MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

(Deemed to be University under section 3 of the UGC Act, 1956)

Centre for Distance and Online Education
CURRICULUM

(MASTER OF COMPUTER APPLICATIONS)

ONLINE DEGREE PROGRAMME

BATCH: 2023- 25

PREAMBLE

The program MCA is adapted to an outcome based education system which would enable the students to acquire the capabilities to meet the demands of society and industry at regional, national and global level. The Program Education Objectives (PEOs) of MCA are consistent with the Vision and Mission of the Department as well as the University, and aim to produce globally successful IT professionals who are empowered to contribute to nation building through sound knowledge, technical skills and research aptitude. The POs and PSOs address the PEOs and aim to produce innovators, IT professionals, entrepreneurs and technocrats with high professional and social ethics.

The curriculum exhibits the requisite balance among the fundamental, core and elective subjects. This is to create a MCA student talent pool that can serve the IT technological needs of the software industry. Many courses are meant to meet the IT technological needs such as Big Data Analytics, Python Programming, R Programming, Network Security and Cryptography, Android Application Development, Mobile Computing and Database Administration etc. .

The curriculum includes courses focusing on employability, entrepreneurship and skill development which map strongly with the PO defining demonstration of technical knowledge and engagement in independent and life-long learning. Examples of such courses are Analytics of Business Strategy, Managing Sales Process and so on.

Certain courses are meant to create awareness about the environment and sustainability and inculcate professional ethics, meeting the requisites of POs defining these characteristic such as Employability Skills Enhancement etc.

The design of curriculum is done in accordance with the predetermined Program Education Objectives. The syllabus content of each course is meticulously created to develop thorough understanding and gain in-depth knowledge in the subject. A number of theory courses are accompanied with laboratory courses to inculcate the practical skills. In order to ensure the effectiveness of teaching-learning process and true implementation of the curriculum, the course outcomes of each course are developed to meet the program outcomes and program specific outcomes, which are also reflected in the Course Articulation Matrix. Course outcome and program outcome attainment is measured through direct and indirect tools including internal assessments, assignments, end semester examinations, dissertations and projects etc.

Although the curriculum had been designed after thorough deliberations involving experts from academia and industry, and considering the feedbacks obtained from various stakeholders, there is always a scope of regular revision and updation of the syllabus keeping in view the changing needs of the industry and society. Thus a well-articulated process is followed to revise the curriculum from time to time. The process begins with obtaining feedbacks from various stakeholders i.e. students, faculty, alumni, parents and industry experts. The feedbacks are analyzed and relevant suggestions are incorporated in the curriculum through a Curriculum revision workshop under the supervision of Departmental Academic Committee (DAC).The revised curriculum is scrutinized by the Board of Studies (BOS) and suggestions of the BOS are also incorporated. The revised curriculum is then placed before the Board of Faculty for consideration which is further reviewed and approved by the Academic Council.

INDEX

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH & STUDIES
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Centre for Distance and Online Education

VISION

Through online education, Manav Rachna stands tall to bring the most efficacious environment for providing higher quality academic and research oriented education to the aspirants. Manav Rachna Online Education facilitate the goal of increasing access to enduring learning prospects to students and providing opportunities to make efficient use of scarce resources in light of the new economic realities of higher education.

MISSION

To provide an exclusive learning environment to students with flexible and meticulous online learning opportunities that will guide students to acquire the knowledge and skills as per the requirements of society at large. The aim of Manav Rachna Online Education is:

- To develop emerging skills through online learning methodologies to pursue their Academic and Professional goals.
- To impart profound knowledge and understanding of conceptual aspects of multidisciplinary learning.

ABOUT THE DEPARTMENT

Department of Computer Applications is one of the oldest departments of the university engaged in teaching and research in computer applications. Currently, it is offering BCA, B.Sc (IT) and MCA programmes with latest, industry-ready curriculum which is being kept regularly updated in the light of latest developments in the IT industry. There is great thrust on practical applications. We provide a highly interactive learning environment so that the students get a full feel of the subject and get fully involved in the acquisition of computer skills. Students are encouraged in innovative and critical thinking in various computer languages, platforms and protocols. They are exposed to live industry projects to enable them to gain insights into the working of the industry.

PROGRAM EDUCATION OBJECTIVES (PEOs)

The objective of the programme is to develop students to work in fields of Computer Applications in various sectors together with internet technologies, e-business applications etc. The MCA program is focused on exposing students to business application areas. The program provides a strong foundation with an integrated understanding of Information Technology based applications. The program is designed to impart the concepts, values, challenges, opportunities and latest trends in the field of Computer Science to develop a broad practical understanding of its context, purpose, and underlying functional areas. The MCA programme tends more towards software application development and exposure to the latest software tools and techniques to develop the applications. Following are Program Educational Objectives of MCA:

PEO 1. To prepare graduates who will be successful professionals in industry, government, academia, research, entrepreneurial pursuit and consulting firms in the field of Computer Applications.

PEO 2. To provide students a solid foundation in computing fundamentals and techniques required to solve related problems and also to pursue higher studies and research.

PEO 3. To inculcate students in professional and ethical attitude, effective communication skills, multidisciplinary approach and an ability to relate computing issues to broader social context.

PEO 4. To provide students an academic environment for excellence, leadership and continuous learning, on technology and trends needed for a successful career.

PROGRAM SPECIFIC OBJECTIVES & PROGRAM OUTCOMES

PROGRAM SPECIFIC OBJECTIVES (PSO):

When the PEO's are achieved, the post graduates will be:

PSO 1. Ability to pursue careers in IT industry/ consultancy/ research and development, teaching and allied areas related to computer science.

PSO 2. Comprehend, explore and build up computer programs in the areas allied to Algorithms, System Software, Multimedia, Web Design and Big Data Analytics for efficient design of computer-based systems of varying complexity.

PROGRAM OUTCOMES (POs)

Programme outcomes are attributes of the graduates from the programme that are indicative of the graduates' ability and competence to work as an IT professional upon graduation. Program Outcomes are statements that describe what students are expected to do now or do by the time of post graduation. They must relate to knowledge and skills that the students acquire from the programme. The achievement of all outcomes indicates that the student is well prepared to achieve the program educational objectives down the road. The department of Computer Applications has following PO's.

PO1. Computational Knowledge: Understand and apply mathematical foundation, computing and domain knowledge for the conceptualization of computing models from defined problems.

PO2. Problem Analysis: Ability to identify, critically analyze and formulate complex computing problems using fundamentals of computer science and application domains.

PO3. Design / Development of Solutions: Ability to transform complex business scenarios and contemporary issues into problems, investigate, understand and propose integrated solutions using emerging technologies

PO4. Conduct Investigations of Complex Computing Problems: Ability to devise and conduct experiments, interpret data and provide well informed conclusions.

PO5. Modern Tool Usage: Ability to select modern computing tools, skills and techniques necessary for innovative software solutions

PO6. Professional Ethics: Ability to apply and commit professional ethics and cyber regulations in a global economic environment.

PO7. **Life-long Learning**: Recognize the need for and develop the ability to engage in continuous learning as a Computing professional.

PO8. Project Management and Finance: Ability to understand, management and computing principles with computing knowledge to manage projects in multidisciplinary environments.

PO9. Communication Efficacy: Communicate effectively with the computing community as well as society by being able to comprehend effective documentations and presentations.

PO10. **Societal & Environmental Concern:** Ability to recognize economical, environmental, social, health, legal, ethical issues involved in the use of computer technology and other consequential responsibilities relevant to professional practice.

PO11. Individual & Team Work: Ability to work as a member or leader in diverse teams in multidisciplinary environment.

PO12. Innovation and Entrepreneurship: Identify opportunities, entrepreneurship vision and use of innovative ideas to create value and wealth for the betterment of the individual and society.

MAPPING OF PEOs WITH POs and PSOs

Program Outcome(PO)/ Program Specific Outcome (PSO)		PEOs that are attained through concerned PO
PO1	Computational Knowledge: Understand and apply mathematical foundation, computing and domain knowledge for the conceptualization of computing models from defined problems.	**1,2**
PO2	Problem Analysis: Ability to identify, critically analyze and formulate complex computing problems using fundamentals of computer science and application domains.	**1,2**
PO3	Design / Development of Solutions: Ability to transform complex business scenarios and contemporary issues into problems, investigate, understand and propose integrated solutions using emerging technologies..	**1,2,3**
PO4	Conduct Investigations of Complex Computing Problems: Ability to devise and conduct experiments, interpret data and provide well informed conclusions.	**2,3**
PO5	Modern Tool Usage: Ability to select modern computing tools, skills and techniques necessary for innovative software solutions	**2**
PO6	Professional Ethics: Ability to apply and commit professional ethics and cyber regulations in a global economic environment.	**3**
PO7	Life-long Learning: Recognize the need for and develop the ability to engage in continuous learning as a Computing professional	**3,4**
PO8	Project Management: Ability to understand management and computing principles with computing knowledge to manage projects in multidisciplinary environments.	**2,3**
PO9	Communication Efficacy: Communicate effectively with the computing community as well as society by being able to comprehend effective documentations and presentations.	**3,4**
PO10	Societal & Environmental Concern: Ability to recognize economical, environmental, social, health, legal, ethical issues involved in the use of computer technology and other consequential responsibilities relevant to professional practice.	**3,4**
PO11	Individual & Team Work: Ability to work as a member or leader in diverse teams in multidisciplinary environment	**3,4**
PO12	Innovation and Entrepreneurship: Identify opportunities, entrepreneurship vision and use of innovative ideas to create value and wealth for the betterment of the individual and society.	**1,3**

PSO1	Ability to pursue careers in IT industry/ consultancy/ research and development, teaching and allied areas related to computer science.	**1,2,4**
PSO2	Comprehend, explore and build up computer programs in the areas allied to Algorithms, System Software, Multimedia, Web Design and Big Data Analytics for efficient design of computer-based systems of varying complexity.	**1,2,3**

SEMESTER SYSTEM AND CHOICE BASED CREDIT SYSTEM

Credit based system of study and student's performance/progress is measured by the number of credits that he/she has earned, i.e. completed satisfactorily. Based on the course credits and grade obtained by the student, grade point average is calculated

(a) Course credits assignment

Each course has a certain number of credits assigned to it depending upon its duration in periods for lecture, tutorial and laboratory/clinical practice in a week. A few courses/activities are without credit (s) and are referred to as Audit Pass Courses (APC) but are mandatory to pass as a partial fulfilment of award of degree.

(b)Earning of credits

At the end of every course, a letter "Grade" shall be awarded in each course for which a student has registered. On obtaining a minimum Pass Grade, student shall accumulate the course credits as Earned Credits. A student's performance shall be measured by the number of credits that he/she has earned and by the weighted grade point average. Grades obtained in the audit courses shall not be counted for computation of grade point average, however shall be mandatory to pass as a partial fulfilment of award of degree.

For Award of Degree of a programme **Masters of Computer Applications**, he/she has to earn minimum **80 credits** during the 2 year duration of the programme **in 4 semesters.**

The total credits required to be earned have been further classified under two baskets of courses: "Compulsory Courses Basket", and "Elective Courses Basket". The **total 64 credits** required to be earned under **"Compulsory Courses Basket"** and **16 credits** under **"Elective Courses Basket".**

All courses under "Compulsory Courses Basket", are required to be qualified and cleared/pass by each and every students enrolled under the programme and are semester-wise listed in the study scheme along with credits assigned to each course.

Under Elective Courses Basket, there will be three types of courses:

- Semester-wise courses offered by the department itself
- Open/Inter-disciplinary courses offered at the Institute/University level notified from the office of Dean-Academics.
- Massive Open Online Courses (MOOCs) available on SWAYAM Platform or any other platform as recommended by UGC/AICTE and notified from the office of Dean-Academics.

Each course shall have credits assigned to it. Student shall be required to register courses every semester for as many courses/credits specified under "Elective Courses Basket" depending upon his/her interest, capability/pace of learning and availability of time slot (without any clash in time table) so as to earn all required total credits under the "Elective Courses Basket" during the entire programme duration.

However, for registration of courses [including courses under "Compulsory Courses Basket", "Elective Courses Basket" and Previous Semester Courses (wherein he/she was declared in-eligible on the basis of attendance or he/she could not clear the course within permissible given chances)], if any, the maximum limit in a semester shall be 30 credits.

MCA STUDY SCHEME (FOR 2023-25 Batch)
Semester-I

Course Type	Course Name	Course Code	Internal marks	External marks	Total	Credits
Core	Research Innovation Catalyst-I	OMCA-RIC-I	100	-	100	0.5
Core	Linear Algebra & Statistical Techniques	OMCA-DS-110	30	70	100	3
Core	Data Structures	OMCA-DS-111	30	70	100	3
Core	Object oriented programming in Java	OMCA-DS-112	30	70	100	3
Core	Python Programming	OMCA-DS-113	30	70	100	2
Core	Data Structures Lab	OMCA-DS-161	30	70	100	1
Core	Object oriented programming in Java Lab	OMCA-DS-162	30	70	100	1
Core	Python Programming Lab	OMCA-DS-163	30	70	100	1
Domain Elective	Elective-I		30	70	100	2
Domain Elective	Elective-II		30	70	100	2
Core	Placement Competency Enhancement -I	OCDC 511	30	70	100	2
Bridge	Fundamentals of Computer Programming	OMCA-DS-001	30	70	100	Audit Pass
Bridge	Elements of Mathematics	OMCA-DS-002	30	70	100	Audit Pass
Total Credits						20.5

	General	Cloud Computing	Artificial Intelligence	Cyber Security	FSD	Mobile Computing	Multimedia
ELECTIVE-I	MATLAB (OMCA-DS-115)	Azure Fundamentals (OMCA-CC-001)	Concepts of AI & Machine Learning. (OMCA-AI-001)	Network Security (OMCA-CS-001)	Gaming Technology – I (OMCA-FSD-001)	Mobile Computing Basics (OMCA-MC-001)	Digital methods I: Photoshop, Illustrator (OMCA-MM-001)
	Soft Programming (OMCA-DS-116)	*Fundamentals of Cloud Computing (OMCA-CC-002)*	Probabilistic Reasoning (OMCA-AI-002)	*Cyber Security (OMCA-CS-002)*	Advanced Web Technologies. (OMCA-FSD-002)	Mobile Software Technologies. (OMCA-MC-002)	**Animation Fundamentals** (OMCA-MM-002)
		IoT	**Data Science**	**Block Chain**	**DevOps**	**Networking**	**Gaming with AR VR**
ELECTIVE-II	*Basics of E-Commerce (OMCA-DS-117)*	IoT Basics and Technology (OMCA-IOT-001)	Probability and Statistics (OMCA-DaS-001)	Introduction to block chain (OMCA-BC-001)	DevOps Essentials (OMCA-DO-001)	Fundamentals of Computer Networks (OMCA-CN-001)	Augmented Reality Foundations (OMCA-AR-001)
	Introduction to Open Source Software and Open Standards (OMCA-DS-118)	Hardware Architectures (OMCA-IOT-002)	Introduction to Data Science (OMCA-DaS-002)	Block chain implementation and applications (OMCA-BC-002)	AWS Services (OMCA-DO-002)	Routing Protocols and Architectures (OMCA-CN-002)	Animation and Rendering Techniques (OMCA-AR-002)

Semester-II

Course Type	Course Name	Course Code	Internal marks	External marks	Total	Credits
Core	Research Innovation Catalyst-II	OMCA-RIC-II	100	-	100	0.5
Core	Data Communications	OMCA-DS-210	30	70	100	3
Core	Analysis & Design of Algorithm	OMCA-DS-211	30	70	100	3
Core	Introduction to Artificial Intelligence	OMCA-DS-212	30	70	100	3
Core	Vocational Training/ Project	OMCA-DS-213	30	70	100	2
Core	R Programming Lab	OMCA-DS-263	30	70	100	1
Core	Android Application Development Lab	OMCA-DS-264	30	70	100	1
Fundamentals	Placement Competency Enhancement-II	OCDC 512	30	70	100	2
Domain Elective	Elective-III		30	70	100	2
Domain Elective	**Elective-IV**		30	70	100	2
Total Credits						19.5

	General	Cloud Computing	Artificial Intelligence	Cyber Security	FSD	Mobile Computing	Multimedia
Elective-III	Computer Graphics (OMCA-DS-214)	Cloud Computing Platforms (OMCA-CC-003)	Supervised Learning (OMCA-AI-003)	Cryptographic (OMCA-CS-003)	Gaming Technology -II (OMCA-FSD-003)	Autmotive Computing (OMCA-MC-003)	Compositing and Visual Effect (OMCA-MM-003)
	Web Applications Development using PHP (OMCA-DS-215)	Programming with AWS (OMCA-CC-004)	Text Mining (OMCA-AI-004)	Ethical Hacking. (OMCA-CS-004)	Angular (OMCA-FSD-004)	Mobile games (OMCA-MC-004)	Modelling & Texturing (OMCA-MM-004)
		IoT	**Data Science**	**Block Chain**	**DevOps**	**Networking**	**Gaming with AR VR**
Elective-IV	Advance Database Systems (OMCA-DS-216)	Communication technologies in IoT (OMCA-IOT-003)	Data Analytics & Visualization using Excel (OMCA-DaS-003)	**Blockchain architecture** (OMCA-BC-003)	DevOps Software Engineering (OMCA-DO-003)	Network Protocols (OMCA-CN-003)	3D Models for Augmented and Virtual Reality (OMCA-AR-003)
	Social Network Analytics (OMCA-DS-217)	Software & Programming in IoT (OMCA-IOT-004)	Data Analytics & Visualization using Python (OMCA-DaS-004)	Blockchain and smart contracts (OMCA-BC-004)	Continouos integration & Version Control (OMCA-DO-004)	TCP/IP (OMCA-CN-004)	VR and 360 Video Production (OMCA-AR-004)

Semester-III

Course Type	Course Name	Course Code	Internal marks	External marks	Total	Credits
Core	Research Innovation Catalyst-III	OMCA-RIC-III	100	-	100	1
Core	Data Mining and warehousing	OMCA-DS-310	30	70	100	3
Core	Software Engineering & Testing	OMCA-DS-311	30	70	100	3
Core	Operations Research	OMCA-DS-312	30	70	100	3
Core	Big Data Analytics	OMCA-DS-314	30	70	100	2
Domain Elective	**Elective-V**		30	70	100	2
Domain Elective	**Elective-VI**		30	70	100	2
Core	Data Mining Lab	OMCA-DS-360	30	70	100	1
Core	Big Data Analytics Lab	OMCA-DS-364	30	70	100	1
Total Credits						18

	General	**Cloud Computing**	**Artificial Intelligence**	**Cyber Security**	**FSD**	**Mobile Computing**	**Multimedia**
Elective-V	Automata Theory (OMCA-DS-316)	Cloud Data Storage & Management (OMCA-CC-005)	Unsupervised Learning (OMCA-AI-005)	Cyber Forensics (OMCA-CS-005)	Agile Methodologies and DevOps (OMCA-FSD-005)	Smart Energy (OMCA-MC-005)	Multimedia in Acting and Choreography (OMCA-MM-005)
	Compiler Design (OMCA-DS-317)	Programming with GAE (OMCA-CC-006)	IoT with machine Learning (OMCA-AI-006)	Web Application Security (OMCA-CS-006)	Automated Testing Using Selenium. (OMCA-FSD-006)	Logistics (OMCA-MC-006)	Digital Character Animation (OMCA-MM-006)
	General	**IoT**	**Data Science**	**Block Chain**	**DevOps**	**Networking**	**Gaming with AR VR**
Elective-VI	Multimedia and its tools (OMCA-DS-318)	Sensors, Actuators and Signal Processing (OMCA-IOT-005)	SQL for Data Science (OMCA-DaS-005)	Applications of Blockchain (OMCA-BC-005)	Containerization with Docker (OMCA-DO-005)	Advanced Computer Network (OMCA-CN-005)	Game Design Fundamentals (OMCA-AR-005)
	Software Project Management (OMCA-DS-319)	Data Management in IoT (OMCA-IOT-006)	Time series Analytics-I (OMCA-DaS-006)	Smart Contract Application & Development (OMCA-BC-006)	Advanced DevOps Tools (OMCA-DO-006)	Network Management (OMCA-CN-006)	Immersive Technology and Media (AR/VR) (OMCA-AR-006)

Semester-IV

Course Type	Course Name	Course Code	Internal marks	External marks	Total	Credits
Core	Introduction to .NET	OMCA-DS-410	30	70	100	3
Core	Advanced Java	OMCA-DS-411	30	70	100	3
Core	Introduction to .NET Lab	OMCA-DS-460	30	70	100	2
Core	Advanced Java Lab	OMCA-DS-461	30	70	100	1
Domain Elective	**Elective-VII**		30	70	100	2
Domain Elective	**Elective-VIII**		30	70	100	2
Core	Project	OMCA-DS-462	30	70	100	5
OR						
Core	Major Project	OMCA-DS-463	30	70	100	18
Total Credits						18

	General	Cloud Computing	Artificial Intelligence	Cyber Security	FSD	Mobile Computing	Multimedia
Elective-V	Digital Image Processing (OMCA-DS-412)	Cloud Security Management (OMCA-CC-007)	Neural Networks and Deep Learning (OMCA-AI-007)	Cyber Laws (OMCA-CS-007)	React JS (OMCA-FSD-007)	Ambient Assisted Living/Mobile Health (OMCA-MC-007)	Multimedia in Media Production (OMCA-MM-007)
	Software API processes (OMCA-DS-413)	Ethics and standard of cloud. (OMCA-CC-008)	Machine Learning and Pattern Recognition (OMCA-AI-008)	Information Security (OMCA-CS-008)	Cloud Security (OMCA-FSD-008)	Mobile Infotainment (OMCA-MC-008)	Multimedia Security (OMCA-MM-008)
	General	**IoT**	**Data Science**	**Block Chain**	**DevOps**	**Networking**	**Gaming with AR VR**
Elective-VI	Intelligent Decision Support System (OMCA-DS-414)	IoT Security Management (OMCA-IOT-007)	Statistical methods in Decision making (OMCA-DaS-007)	Spring framework (OMCA-BC-007)	Web Application on Cloud (OMCA-DO-007)	Next Generation Networking. (OMCA-CN-007)	Virtual Reality: Interface, Application and Design (OMCA-AR-007)
	Simulation Modelling (OMCA-DS-415)	IoT Applications (OMCA-IOT-008)	Time series Analytics-II (OMCA-DaS-008)	Cryptography Algorithms (OMCA-BC-008)	DevOps Project Management (OMCA-DO-008)	Wireless Networking (OMCA-CN-008)	Interactive Application Development. (OMCA-AR-008)

Note: For Successful completion of the OMCA degree, the students need to earn the credits as per the following:

(a) For Major Project : 64 credits of compulsory courses and at least 16 of Elective Courses.
(b) For Semester Option: 60 credits of compulsory courses and at least 20 of Elective Courses

SEMESTER-I

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH & STUDIES

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OMCA-RIC-I: RESEARCH INNOVATION CATALYST-I

Periods/week	Credits	Max. Marks: 100
T: 1	0.5	Continuous Evaluation: 100
		End Semester Examination: Nil

Pre-requisites: Basic knowledge of Research and Innovation
Course Type: Research & Training
Course Outcomes:
OMCA-RIC.I.1. The students will be able to understand what is Research and Innovation.
OMCA-RIC.I.2. To be in a position to describe the process and the procedure to carry out research/ innovation
OMCA-RIC.I.3. To understand the research documentation that is needed for, journals publication, conferences etc.
OMCA-RIC.I.4. To understand and adopt the ethical practice in the research / Innovation activities.
OMCA-RIC.I.5. To comprehend the benefits obtained by means of systematic research/ Innovation
OMCA-RIC.I.6. To inculcate Team building and collaborative approach.

Unit 1: What is Research?

1.1 Capturing the current research/ Innovation trends
1.2 Insight about scientific research/ Innovation performed by renowned experts in the related field.
1.3 Exploration and excavation of in-house and commercially available facilities
1.4 Model design about framing the research/ Innovation question – A motivational Approach
1.5 Do's and Don'ts pertaining to research/ Innovation

Unit 2: Insight about Scientific Documentation

2.1 Different types of Journals/Conferences
2.2 Different components of a research paper
2.3 Indexing of Journals
2.4 Parameters involved in publication
2.5 Scientific/technical writing and ethical practice

Unit 3: Understanding the Literature Survey (LS)

3.1 Finding research papers related to a topic
3.2 Understanding the different aspects of Literature search and Databases.
3.3 Usage of different sources like Google scholar, WoS, PubMed, Scopus, ABDC, EBSCO etc.
3.4 Exploration of online library-Deepdyve for research/ Innovation.
3.5 Usage of scholarly networking sites like Research Gate, Mendeley, Academia.edu etc.
3.6 Demo sessions on the usage of above mentioned sources

Unit 4: Implementation of Process

4.1 Understanding and selection of the research/ Innovation theme.
4.2 Finding out the specific research/ Innovation problem in the relevant area
4.3 Seeking information through published work w.r.t the problem
4.4 Reading & categorizing the downloaded/referred papers or articles and structuring of the idea.

Unit 5: Report Writing and Presentation skill Development

5.1 Report making on the surveyed literature to cater the basic idea of the author/ inventor
5.2 Compiling and analyzing the published results to justify and understand the proposed ideas
5.3 Usage of MS-PowerPoint and other technical resources for the presentation
5.4 Development of presentation skills and group addressing

References:

1. http://nptel.ac.in/courses/121106007/
2. http://public.wsu.edu/~taflinge/research.html

Evaluation Criteria: The following evaluation parameters shall be considered for internal assessment by both research coordinators and faculty coordinator or research mentors:-

Criteria	Evaluation parameters	Weightage (Marks)	
Online and offline Attendance	· Percentage of classes attended by the students	3+2	5
Group participation and response of the students to a given task	· Judge individual student in the group · Meeting timelines as per lesson plan	5 10	15
Selection of research/ Innovation topics and Literature Survey	· Student interaction with faculty mentors · Relevance of the topic · Usage of Scientific Literature Databases. e.g., Scopus/ Web of Science/ etc. · Scientific/Technical writing · Number of relevant papers referred for the given topic	3 2 1 2 2	10
Presentation and Report Making	· Report structure and Slide sequence, · Contribution of individual group member towards the presentation and report · Reference listing · Plagiarism/Authenticity of the report	5 5 5 5	20

Course Articulation Matrix:

CO Statement (XX-300)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
OMCA-RIC.I.1	√	√	√	√	√	√			√		√		√	√
OMCA-RIC.I.2			√	√	√				√				√	√
OMCA-RIC.I.3		√		√					√	√			√	√
OMCA-RIC.I.4								√					√	√
OMCA-RIC.I.5	√					√	√					√	√	√
OMCA-RIC.I.6	√	√							√			√	√	√

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OMCA-DS-110: LINEAR ALGEBRA AND STATISTICAL TECHNIQUES

Periods/week	Credits	Max. Marks: 100
L: 4 T: 0	3	Continuous Evaluation: 30
Duration of Examination: 3 Hrs		End Semester Examination: 70

Pre-Requisite: Knowledge of basic mathematics
Course Type: Fundamentals

Course Outcomes: At the end of the course the student will be able to:

OMCA-DS-110.1. Learn the concepts and methods of Linear Algebra.
OMCA-DS-110.2. Interpret the ability to solve problems using Linear Algebra.
OMCA-DS-110.3. Relate Linear Algebra to other domains of study.
OMCA-DS-110.4. Examine the impact of Skewness and outliers on the various statistical interpretations.
OMCA-DS-110.5. Apply various types of statistical tools & Linear Programming in research & real-timeproblems.

PART-A

Unit 1: Linear Algebra

1.1 Concepts of Groups
1.2 Concepts of Ring and Fields
1.3 Vector Space
1.4 Linear Transformations
1.5 Linear Algebra
1.6 Matrix of Linear Transformation
1.7 Inverse of Matrix
1.8 Rank of Matrix

Unit 2: Linear Equations

2.1 Solution of System of Linear Equations
2.2 Homogeneous Linear Equations
2.3 Non-Homogeneous Linear Equations
2.4 Consistency theorem.

Unit 3: Eigen Values & Triangularization

3.1 Characteristic roots and Vectors
3.2 Clayey-Hamilton Theorem
3.3 Minimal Polynomial of a Matrix
3.4 Orthogonal Matrices
3.5 Normal and Unitary Matrices
3.6 Diagonalization of a Matrix.

PART-B

Unit 4: Elements of Statistics

4.1 Measures of Central Tendency
4.2 Measures of Variations Covariance
4.3 Correlation and Coefficient of Correlation
4.4 Regression
4.5 Regression lines
4.6 Probability
4.7 Binomial Distribution
4.8 Poisson Distribution
4.9 Normal Distribution
4.10 Fitting of Normal distribution to given data

Unit 5: Sampling

5.1 Concept of Sampling
5.2 Level of Significance
5.3 Critical Region
5.4 Test of Significance for large Samples
5.5 Sampling with small Samples
5.6 $\chi 2$ - Distribution

Unit 6: Linear Programming & Transportation

6.1 Linear Programming
6.2 Graphical Method to solve LPP
6.3 Simplex Method
6.4 Artificial variables and degeneracy in Simplex Method
6.4 Transportation Problems and their optimal basic solutions
6.5 Unbalanced Transportation Problems.

Suggested Readings:

1. Babu Ram, 2014, Engineering Mathematics, Volume II, Pearson Education
2. Glyn James, 2010, Advanced Modern Engineering Mathematics, Pearson Education
3. Bruce Cooperstein, 2015, Advanced Linear Algebra, Chapman and Hall Publication.
4. Kaare Brandt Petersen, 2012, Michael Syskind Pedersen, The Matrix Cookbook, Technical University of Denmark.

Note: Only latest editions of the books are recommended.

Instructions for paper setting: Seven questions are to be set in total. First question will be multiple choice covering entire syllabus and will be compulsory to attempt and will be of 18 marks. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 13 marks.

Evaluation Policy:

The evaluation will include two types of assessments:

(i) Continuous or formative assessments (in the form of end semester examination or term examination. Weightage of assessments are as follows:

For continuous or Formative assessment (in semester): Maximum 30 percent. The categorization for the same is:

MCQs	30%
Subjective (Short/Long)	40%
Discussion/Presentation	15%
Projects/Group Activities etc	15%

(ii) For Summative assessment (End Semester Examination or End-Term Examination):
Minimum: 70 percent. Categorization for the same is:
Objective Type Questions: 30%
Short/Long Questions: 70%

Assessment Tools:
Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
OMCA-DS-110.1	1		1	2	2		3						3	1
OMCA-DS-110.2	1	1	2	3	1		2						3	1
OMCA-DS-110.3	1	2	2	1	2								2	1
OMCA-DS-110.4	1	1	2	1	1		3						1	2
OMCA-DS-110.5	1	1	2	1			2	3					2	2

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH & STUDIES
(Deemed to be University under section 3 of the UGC Act 1956)

OMCA-DS-111: DATA STRUCTURES

Periods/week	Credits	Max. Marks: 100
L: 3 T: 0	3	Continuous Evaluation: 30
Duration of Examination: 3 Hrs		End Semester Examination: 70

Pre-Requisite: Basic concepts of C Programming
Course Type: Core

Course Outcomes: At the end of the course, the student will be able to:

OMCA-DS-111.1. Describe the concept to evaluate asymptotic performance of algorithms.
OMCA-DS-111.2. Develop skills to design and analyze simple linear and non-linear data structures.
OMCA-DS-111.3. Apply for solving problem like traversing, searching, sorting, insertion and deletion of data.
OMCA-DS-111.4. Demonstrate linear and non-linear data structures in real life problems.
OMCA-DS-111.5 Solve the problems related to File organization, Hashing and Collision Resolution Techniques.

PART-A

UNIT 1: Introduction to Data Structures

1.1 Concepts and definitions of basic data structure
1.2 Top Down and Bottom up Approaches
1.3 Big "O" Notations
1.4 Time and Space Complexity of algorithms
1.5 Types of data Structures
1.6 Concept of Garbage Collection and Memory Allocation
1.7 Array: Representation of one and multidimensional arrays in memory
1.8 Array Operations
1.9 Sparse matrices: representation
1.10 Searching Techniques: Linear Search; Binary search
1.11 Sorting Techniques: Internal and External Sorting Techniques.

Unit 2: Stacks and Queues

2.1 Stacks: Representation
2.2 Operations of Stack
2.3 Applications of Stack (Tower of hanoi algorithm and evaluation of arithmetic expression)
2.4Queues: Representation
2.5 Operations of queue
2.6 Types of Queue
2.7 Applications of Queue

Unit 3: Introduction to Linked List

3.1 Linked List: Representation
3.2 Operations of Linear Linked List
3.3 Applications of Linear Linked List
3.4 Circular Linked List and its operations
3.5 Double Linked List and operations

PART-B

Unit 4: Trees

4.1 Trees Terminology
4.2 Representing a general tree
4.3 Types of Tree
4.4 Binary Tree: Memory representation
4.5 Binary tree Construction
4.6 Traversing of Binary Tree

4.7 Convert general tree into binary tree
4.8 Threaded Binary tree
4.9 Binary Search Tree: Searching and inserting in BST; Deleting in a BST; Applications of BST
4.10 B tree and its operations
4.11 B+ trees
4.12 AVL trees and its operations

Unit 5: Graph Theory

5.1 Graphs: Terms related with Graphs
5.2Types of Graphs
5.3 Sequential and Linked Representation of Graphs
5.4 Traversing a Graph: BFS; DFS
5.5 Minimum Spanning Tree
5.6 Graph Operations
5.7 Shortest path Algorithms: Dijkstra's and Warshall's Algorithm

Unit 6: File Organization

6.1 Introduction to File Organization
6.2 File attributes and operations
6.3 Fixed and Variable Length Record
6.4 Hashing Techniques
6.5 Collision Resolution Techniques

Suggested Readings:

1. Seymour Lipschutz, 2014, Data Structures, McGraw Hill
2. Tenenbaum, 2006, Data Structures using C & C++, Prentice-Hall
3. Yashwant Kanetkar, 2008, Data Structures Through C, BPB Publications

Note: Only latest editions of the books are recommended.

Software required/ Weblinks:

Turbo C
https://www.tutorialspoint.com/data_structures_algorithms/index.htm (Last visited Date: 21 February, 2024)
http://toolsqa.com/data-structures-tutorial/ (Last visited Date: 21 February, 2024)

Instructions for paper setting: Seven questions are to be set in total. First question will be multiple choice covering entire syllabus and will be compulsory to attempt and will be of 18 marks. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 13 marks.

Evaluation Policy:

The evaluation will include two types of assessments:

(iii) Continuous or formative assessments (in the form of end semester examination or term examination. Weightage of assessments are as follows:

For continuous or Formative assessment (in semester): Maximum 30 percent. The categorization for the same is:

MCQs	30%
Subjective (Short/Long)	40%
Discussion/Presentation	15%
Projects/Group Activities etc	15%

(iv) For Summative assessment (End Semester Examination or End-Term Examination):

Minimum: 70 percent. Categorization for the same is:

Objective Type Questions:	30%
Short/Long Questions:	70%

Assessment Tools:

Assignment/Tutorials
Sessional tests

Surprise questions during lectures/Class Performance
Term end examination

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO 4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
OMCA-DS-111.1	1	1	2	2	3		3	2					3	3
OMCA-DS-111.2	1	1	1	1	1		2	2			3		3	3
OMCA-DS-111.3	1	1	1	1	2		2	2			3		2	3
OMCA-DS-111.4	1	1	1	1	1		2	1			3		2	2
OMCA-DS-111.5	1	1	1	1			2	2					1	2

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH & STUDIES
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OMCA-DS-112: OBJECT ORIENTED PROGRAMMING IN JAVA

Periods/week	Credits	Max. Marks: 100
L: 3	3	Continuous Evaluation: 30
Duration of Examination: 3 Hrs		End Semester Examination: 70

Pre-Requisite: Knowledge of C++ Programming
Course Type: Core

OMCA-DS-112.1. Understand the Object-oriented concepts of modern programming language.
OMCA-DS-112.2. Identify classes, objects, functions and relationships among them needed for a specific problem.
OMCA-DS-112.3. Use Java in a variety of technologies and on different platforms.
OMCA-DS-112.4. Demonstrate the concepts of Polymorphism and Inheritance.
OMCA-DS-112.5. Design solutions of basic problems using Object-oriented approach.
OMCA-DS-112.6. Develop GUI based application using AWT.

PART-A

UNIT 1: Introduction and Fundamentals of Java

1.1 History of Java; Java essentials
1.2 Java Virtual Machine
1.3 Java Features
1.4 Differences between Java and C++
1.5 Java and Internet; Java Program Structure
1.6 Java Environment
1.7 Keywords; Constants and Variables
1.8 Primitive Data Types
1.9 Type Conversion and Casting; Operators
1.10 Decision Making Statements
1.11 Repetitive Statements

UNIT 2: Introducing Classes, Arrays and Inheritance

2.1 Concepts of Array
2.2 One Dimensional Array & Two-dimensional Array
2.3 Class fundamentals; Method declaration; declaring objects
2.4 Constructors: Parameterized Constructors; Constructor Overloading
2.5 Static members, this keyword
2.6 Garbage Collection
2.7 Concepts of Inheritance
2.8 Types of Inheritance in Java; deriving classes using extends keyword
2.9 Overriding Methods: Super keyword, Final keyword
2.10 Abstract Classes; Shadowing vs overriding

UNIT 3: Interfaces and Packages

3.1 Interfaces: Defining, extending and implementing interfaces
3.2 Accessing interface variables
3.3 Introduction to Java API packages
3.4 Defining a Package
3.5 Package as Access Protection
3.6 Importing packages

PART-B

UNIT 4: Exception Handling and Multithreaded programming

4.1 Concepts of Exception
4.2 Exception Types; checked and Unchecked Exception
4.3 Exception handling techniques: try..catch; throw, throws, finally
4.4 Multiple catch statements; creating your own exceptions

4.5 Concepts of Thread
4.6 Creating a thread
4.7 Thread Life-Cycle
4.8 Thread Priorities
4.9 Synchronizing Threads

UNIT 5: Applet Programming and Introduction to Event Handling

5.1 Two types of Applets: Applet & Application
5.2 Applet Life Cycle
5.3 How to run an applet?
5.4 Passing parameters to Applet
5.5 Introduction to Event Handling
5.6 Delegation Event Model, Sources of events, Event Listeners

UNIT 6: AWT and Introduction to JDBC

6.1 Introduction to AWT
6.2 Components and Containers
6.3 AWT Controls
6.4 Introduction to JDBC: Load the driver; establish connection; create statement; execute query; iterate result set, transactions

Suggested Readings:

1. Joshua Bloch, 2018, Effective Java, Pearson Education.
2. E Balagurusamy, 2006, Programming with Java, Tata McGraw Hill.
3. Schildt Herbert, 2011, Java: The Complete Reference, Tata McGraw Hill.
4. Bruce Eckel, 2008, Thinking in Java, Pearson Education

Note: Only latest editions of the books are recommended.

Software required/Web links:

JDK 1.8
https://www.tutorialspoint.com/java/index.htm (Last visited Date: 21 February, 2024)
https://www.javatpoint.com/java-tutorial (Last visited Date: 21 February, 2024)

Instructions for paper setting: Seven questions are to be set in total. First question will be multiple choice covering entire syllabus and will be compulsory to attempt and will be of 18 marks. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 13 marks.

Evaluation Policy:

The evaluation will include two types of assessments:

(v) Continuous or formative assessments (in the form of end semester examination or term examination. Weightage of assessments are as follows:

For continuous or Formative assessment (in semester): Maximum 30 percent. The categorization for the same is:

MCQs	30%
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Discussion/Presentation	15%
Projects/Group Activities etc	15%

(vi) For Summative assessment (End Semester Examination or End-Term Examination):

Minimum: 70 percent. Categorization for the same is:

Objective Type Questions:	30%
Short/Long Questions:	70%

Assessment Tools:
Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO 4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
OMCA-DS-112.1	2	2		3	1								2	3
OMCA-DS-112.2	2	1		3	2									3
OMCA-DS-112.3	2	2	1	3				1						3
OMCA-DS-112.4	3	3	1	2				1					2	2
OMCA-DS-112.5	2	2	1	2				1			3			3
OMCA-DS-112.6	3	2	1	2			1							3

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH & STUDIES

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OMCA-DS-113: PYTHON PROGRAMMING

Periods/week	Credits	Max. Marks: 100
L: 2	2	Continuous Evaluation: 30
Duration of Examination: 3 Hrs		End Semester Examination: 70

Pre-Requisite: Knowledge of Programming Languages
Course Type: Core

Course Outcomes: At the end of the course, students will be able to

OMCA-DS-113.1. Define the methodology and procedures related to python programming
OMCA-DS-113 2. Demonstrate the concepts of control structures in Python.
OMCA-DS-113.3. Use Python data structures to solve complex problems.
OMCA-DS-113.4. Illustrate the use of various python libraries and functions.
OMCA-DS-113.5. Apply the concepts of file handling and regular expression using packages.

PART –A

UNIT 1: Fundamentals of Python with Operators & Data Types
1.1 Need of Python Programming
1.2 Installation and Working with Python
1.3 Variables, Data Types & Keywords
1.4 Input-Output, Indentation and comments
1.5 Python basic Operators
1.6 Declaring and using Numeric data types: int, float, complex
1.7 Using string data type and string operations
1.8 Defining list and list slicing
1.9 Use of Tuple data type
1.10 Introduction to Dictionaries

UNIT 2: Python Program Flow Control
2.1 Conditional blocks using if, else and Nested If-else
2.2 Simple For loops in python
2.3 For loop using ranges, string, list and dictionaries
2.4 Use of while loops in python
2.5 Loop manipulation using pass, continue, break and else
2.6 Programming using Python conditional and loops block

Unit 3: Python Strings, List and Dictionary Manipulations
3.1 Building blocks of python programs
3.2 Understanding string inbuilt methods
3.3 List manipulation using inbuilt methods
3.4 Tuple manipulation using inbuilt methods
3.5 Dictionary manipulation
3.6 Programming using string, list and dictionary in build functions

PART-B

UNIT 4: Python Functions, Modules & Packages
4.1 Organizing python codes using functions
4.2 Organizing python projects into modules
4.3 Importing own module as well as external modules
4.4 Understanding Packages
4.5 Powerful Lambda function in python

4.6 Programming using functions, modules and external packages

UNIT 5: Exception Handling & File Handling

5.1 Basics of Exception
5.2 Exception Handling
5.3 Try, Finally & Except clause
5.4 Multiple Except Blocks
5.5 Built-in & User Defined Exceptions
5.6 Safe guarding file operation using exception handling
5.7 Handling and helping developer with error code
5.8 Opening & Closing Files
5.9 Understanding read functions, read (), readline() and readlines()
5.10 Understanding write functions, write () and writelines()
5.11 File Positions & Directory Methods

UNIT 6: Graphical User Interfaces

6.1 Behavior of terminal based programs and GUI-based programs
6.2 Coding simple GUI-based programs & other useful GUI resources.
6.3 Using the tkinter Module
6.4 Display text with Label Widgets
6.5 Organizing Widgets with Frames
6.6 Button Widgets and Info Dialog Boxes
6.7 Getting Input with Entry Widget & Using Labels as Output Fields
6.8 Radio Buttons, Check Buttons.
6.9 Simple Graphics and Image Processing: Overview of Turtle Graphics
6.10 Two dimensional Shapes, Colors and RBG System, Image Processing.

Suggested Readings:

1. Allen B. Downey, 2015, "Think Python: How to Think Like a Computer Scientist", 2nd Edition, Green Tea Press.
2. Charles Dierbach, 2013, "Introduction to Computer Science Using Python", 1st Edition, Wiley India Pvt Ltd.
3. Wesley J Chun, 2015, "Core Python Applications Programming", 3rd Edition, Pearson Education India, 2015.
4. Roberto Tamassia, Michael H Goldwasser, Michael T Goodrich, 2016, "Data Structures and Algorithms in Python", 1st Edition, Wiley India Pvt Ltd.
5. Reema Thareja, 2017, "Python Programming using problem solving approach", Oxford University press.
6. Charles R. Severance, 2017, "Python for Everybody: Exploring Data Using Python 3", 1st Edition, Shroff Publishers.

Note: Only latest editions of the books are recommended

Software required/ Web links:

Python 3.6.4
https://www.tutorialspoint.com/python/index.htm (Last visited Date: 21 February, 2024)
https://www.programiz.com/python-programming/first-program (Last visited Date: 21 February, 2024)

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Evaluation Policy:

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MCQs 30%
Subjective (Short/Long) 40%
Discussion/Presentation 15%
Projects/Group Activities etc 15%

(viii) For Summative assessment (End Semester Examination or End-Term Examination):
Minimum: 70 percent. Categorization for the same is:
Objective Type Questions: 30%
Short/Long Questions: 70%

Assessment Tools:
Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO 4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
OMCA-DS-113.1	3	2	1			2							2	2
OMCA-DS-113.2		1		1			1	1	1	2			1	1
OMCA-DS-113.3		3							1				1	3
OMCA-DS-113.4		3						1					1	3
OMCA-DS-113.5		3	3	2	2	1	1	1		1			2	3

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH & STUDIES
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OMCA-DS-161: DATA STRUCTURES LAB

Periods/week	Credits	Max. Marks: 100
P: 2 T: 0	1	Continuous Evaluation: 30
Duration of Examination: 3 Hrs		End Semester Examination: 70

Co-Requisite: Knowledge of basic C Programming
Course Type: Core

Course Outcomes: At the end of the course the student will be able to:

OMCA-DS-161.1 Analyze the asymptotic performance of various algorithms
OMCA-DS-161.2 Design and implement various algorithms with use of arrays, records, linked structures, stacks, queues, trees, and graphs
OMCA-DS-161.3 Demonstrate different methods for traversing trees.
OMCA-DS-161.4 Compare alternative implementations of data structures with respect to performance.
OMCA-DS-161.5 Design and develop non-linear data structure like Trees and Graphs.

List of Experiments:
1. Write a program in C to insert a new element in the list.
2. Write a program in C to delete a new element in the list.
3. Write a program in C to find the sum and subtraction of two matrices.
4. Write a program in C to find the product of two matrices.
5. Write a program in C to find the transpose of a matrix.
6. Write a program in C to sort the list using Bubble Sort.
7. Write a program in C to sort the list using Quick Sort.
8. Write a program in C to sort the list using Insertion Sort.
9. Write a program in C to sort the list using Merge Sort.
10. Write a program in C to sort the list using Heap Sort.
11. Write a program in C to search the element using Linear Search
12. Write a program in C to search the element using Binary Search.
13. Write a program in C to perform all operations of stack using array.
14. Write a program in C to perform all operations of queue using array.
15. Write a program in C to perform all operations of stack using Linked List.
16. Write a program in C to perform all operations of queue using Linked List.
17. Write a program in C to perform all operations of circular queue.
18. Write a program in C to perform insertion operation of linked list.
19. Write a program in C to perform deletion operation of linked list.
20. Write a program in C to perform insertion operation of circular linked list.
21. Write a program in C to perform deletion operation of circular linked list.
22. Write a program in C to perform insertion operation of double linked list.
23. Write a program in C to perform deletion operation of double linked list.
24. Write a program in C to perform traversal of the linked list.
25. Write a program in C to perform insertion operation in Binary Tree.
26. Write a program in C to perform deletion operation in Binary Tree.
27. Write a program in C to perform tree traversal methods.
28. Write a program in C to perform insertion and deletion in Binary Search Tree.

Suggested Readings:

1. Seymour Lipschutz, 2014, Data Structures, McGraw Hill
2. Tenenbaum, 2006, Data Structures using C & C++, Prentice-Hall
3. Yashwant Kanetkar, 2008, Data Structures Through C, BPB Publications

Note: Only latest editions of the books are recommended.

Software required/Web links:

Turbo C++

https://www.tutorialspoint.com/data_structures_algorithms (Last visited Date: 21 February, 2024)

https://www.includehelp.com/data-structure-tutorial (Last visited Date: 21 February, 2024)

Distribution of Continuous Evaluation Table:

Viva-I	30%
Viva-II	30%
File/ Records	20%
Class performance	10%
Attendance	10%

Assessment Tools:

Experiments in lab

File work/Class Performance

Viva (Question and answers in lab)

End Term Practical Exam

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO 4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
OMCA-DS-161.1	1	1	1		2		2						2	3
OMCA-DS-161.2	1	1	1				2						3	3
OMCA-DS-161.3	1	1	2	2	1		1	2					1	2
OMCA-DS-161.4	1	1	2	2	1		2	2				3	2	2
OMCA-DS-161.5	1	1	1	1	2		2	3				3	2	1

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH & STUDIES
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OMCA-DS-162: OBJECT ORIENTED PROGRAMMING IN JAVA LAB

Periods/week	Credits	Max. Marks	: 100
P: 2 T: 0	1	Continuous Evaluation	: 30
Duration of Examination: 3 Hrs		End Semester Examination	: 70

Co-Requisite: Knowledge of Java Programming
Course Type: Core

Course Outcomes: At the end of the course, the student will be able to:

OMCA-DS-162.1. Solve basic problems using concepts of object-oriented programming.
OMCA-DS-162.2. Implement solutions to complex problems using Control Structures, string manipulation and functions.
OMCA-DS-162.3. Propose the use of techniques (inheritance, polymorphism) by implementing them in the Java programming language to solve the given problem
OMCA-DS-162.4. Develop a full-fledged responsive GUI Application using Java AWT and event handling framework.

List of Practical :

1. Write a Java Program to find the Area of circle.
2. Write a program to find sum and reverse of three digit number.
3. Write a program to swap two numbers without using third variable.
4. Write a program to find simple interest.
5. Write a program to find list of prime numbers.
6. Write a program to find sequence of n numbers which are divisible by 3 and 5 both.
7. Write a program to find the roots of a Quadratic Equation.
8. Write a program to find the factorial of n Number.
9. Write a program to find the sequence of Fibonacci series up to n terms.
10. Write a program to check whether given number is palindrome or not.
11. Write a program to find HCF of two numbers.
12. Write a Java Program that will display the sum of 1+1/2+1/3…..+1/n.
13. Write a Java Program that will print the following outputs:

```
1                    1                $
22                  2 2               $$
333                3 3  3              $$$
4444              4 4  4   4           $$$$
55555           5 5   5  5   5         $$$$$
4444
333
22
1
```

14. Write a Java Program to find product of two matrices.
15. Write a Java Program to find sum and subtraction of two matrices.
16. Write a Java Program to sort the list in ascending Order.
17. Write a Java Program to convert decimal into binary number.
18. Write a Java Program to find largest and smallest of n numbers.
19. Write a java program which shows the application of constructors.
20. Write a java program to find the electricity bill using inheritance. The details are as follow:

Units	**Bill Rate**
1-100	Rs 2 per unit
101-300	Rs 5 per unit
301-500	Rs 6 per unit
Above 500	Rs 8 per unit

21. Write a java program to find the result sheet of a student using Interfaces. The details are as follow:

Marks	**Grade**

>90	Excellent
>60 and <=90	Good
Below 60	Average

The format of output is as follow:
Marks of subject 1
Marks of Subject 2
Marks of subject 3
Marks obtained
Total Marks
%Age

22. Write a java program which shows importing of classes from other packages.
23. Write a java program which creates threads using the thread class.
24. Write a java program which use try and catch for exception handling.
25. Write a java program which use multiple catch blocks.
26. Write a java program which shows throwing our own exception.
27. Write a program to handle Labels and Buttons using AWT Controls.
28. Write a program to handle Check Boxes using AWT Controls
29. Write a program to handle Lists and Scroll Bars using AWT Controls
30. Make a mini project based on above mentioned list of practical. Suggested mini projects are:
    a) Java Application World: A Java Application World software where user can use applications developed in Java such as calculator, notepad+, puzzle game, ip finder, word count tool, source code generator, picture puzzle game, tic tac toe game and exam system.
    b) Connect Globe: It provides a common platform to share the common people experiences, information's and harassments all over the world and people can discuss on any topic created by only registered user. Moreover, he/she can give the advice on any topic or report.

Suggested Readings:

1. Joshua Bloch, 2018, Effective Java, Pearson Education.
2. E Balagurusamy, 2006, Programming with Java, Tata McGraw Hill.
3. Schildt Herbert, 2011, Java: The Complete Reference, Tata McGraw Hill.
4. Bruce Eckel, 2008, Thinking in Java, Pearson Education

Software required/Weblinks :

JDK 1.8
https://www.tutorialspoint.com/java/index.htm (Last visited Date: 21 February, 2024)
https://www.javatpoint.com/java-tutorial (Last visited Date: 21 February, 2024)

Distribution of Continuous Evaluation Table:

Viva-I	30%
Viva-II	30%
File/ Records	20%
Class performance	10%
Attendance	10%

Assessment Tools:

Experiments in lab
File work/Class Performance
Viva (Question and answers in lab)
End Term Practical Exam

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO 4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
OMCA-DS-162.1	3				1	1	2						1	2
OMCA-DS-162.2		2	2		2	2	2				2		3	3
OMCA-DS-162.3	2	2		1		1	1	1	1		2		2	3
OMCA-DS-162.4	2	2				1	1	1	1		1	1	3	

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH & STUDIES
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OMCA-DS-163 : PYTHON PROGRAMMING LAB

Periods/week	Credits	Max. Marks : 100
P: 2	1	Continuous Evaluation : 30
Duration of Examination: 2 Hrs		End Semester Examination: 70

Co-Requisite: Knowledge of Programming concepts
Course Type: Core

Course Outcomes: At the end of the course, students will be able to
OMCA-DS-163.1. Develop programs using basics of Python.
OMCA-DS-163.2. Use Python data structures to solve complex problems.
OMCA-DS-163.3. Demonstrate the concepts of control structures in Python.
OMCA-DS-163.4. Apply the concepts of file handling and regular expression using packages.
OMCA-DS-163.5. Develop applications using python programming language.

List of Practical:

Topics to be covered: Installation and Working with Python, Setting up path & Running Python Scripts, Variables & Data Types, Keywords, Input-Output, Indentation

1. Write a Python program to display the current date and time.
2. Write a Python program which accepts the radius of a circle from the user and compute the area
3. Write a Python program which accepts the user's first and last name and print them in reverse order with a space between them.
4. Write a Python program that accepts an integer (n) and computes the value of n+nn+nnn
5. Write a Python program to print the calendar of a given month and year.
6. Write a Python program to calculate number of days between two dates.
   Sample dates : (2014, 7, 2), (2014, 7, 11)
   Expected output : 9 days
7. Create a program that asks the user to enter their name and their age. Print out a message addressed to them that tells them the year that they will turn 100 years old.
8. Ask the user for a number. Depending on whether the number is even or odd, print out an appropriate message to the user. Hint: how does an even / odd number react differently when divided by 2?

Topics to be covered: Python basic Operators, Declaring and using Numeric data types: int, float complex, Using string data type and string operations, Defining list and list slicing, Use of Tuple data type, Introduction to Dictionaries, Understanding string inbuilt methods, List manipulation using inbuilt methods, Dictionary manipulation, Programming using string, list and dictionary in build functions

9. Write a Python program which accepts a sequence of comma-separated numbers from user and generate a list and a tuple with those numbers.
10. Write a Python program to calculate the sum of three given numbers, if the values are equal then return thrice of their sum.
11. Write a Python program to test whether a passed letter is a vowel or not
12. Take a list, say for example this one:
    a = [1, 1, 2, 3, 5, 8, 13, 21, 34, 55, 89]
    and write a program that prints out all the elements of the list that are less than 5.

Extras:

a) Instead of printing the elements one by one, make a new list that has all the elements less than 5 from this list in it and print out this new list.
b) Write this in one line of Python.
c) Ask the user for a number and return a list that contains only elements from the original list a that are smaller than that number given by the user.

13. Create a program that asks the user for a number and then prints out a list of all the divisors of that number. (If you don't know what a divisor is, it is a number that divides evenly into another number. For example, 13 is a divisor of 26 because 26 / 13 has no remainder.)
14. Take two lists, say for example these two:
    a = [1, 1, 2, 3, 5, 8, 13, 21, 34, 55, 89]
    b = [1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13]
    and write a program that returns a list that contains only the elements that are common between the lists (without duplicates). Make sure your program works on two lists of different sizes.
15. Ask the user for a string and print out whether this string is a palindrome or not. (A palindrome is a string that reads the same forwards and backwards.)
16. Let's say I give you a list saved in a variable: a = [1, 4, 9, 16, 25, 36, 49, 64, 81, 100]. Write one line of Python that takes this list a and makes a new list that has only the even elements of this list in it.

Topics to be covered: Conditional blocks using if, else and Nested If-else, Simple For loops in python, For loop using ranges, string, list and dictionaries, Use of while loops in python, Loop manipulation using pass, continue, break and else, Programming using Python conditional and loops block

17. Generate a random number between 1 and 9 (including 1 and 9). Ask the user to guess the number, then tell them whether they guessed too low, too high, or exactly right. (*Hint: remember to use the user input lessons from the very* first exercise)
18. Ask the user for a number and determine whether the number is prime or not. (For those who have forgotten, a prime number is a number that has no divisors.).
19. Write a program (function!) that takes a list and returns a new list that contains all the elements of the first list minus all the duplicates.
20. Write a function that takes an ordered list of numbers (a list where the elements are in order from smallest to largest) and another number. The function decides whether or not the given number is inside the list and returns (then prints) an appropriate boolean.
21. Implement a function that takes as input three variables, and returns the largest of the three. Do this without using the Python max() function!
22. Make a mini project based on concepts above list of practical. Suggested mini projects are:
    a) Write a password generator in Python. Be creative with how you generate passwords - strong passwords have a mix of lowercase letters, uppercase letters, numbers, and symbols. The passwords should be random, generating a new password every time the user asks for a new password. Include your run-time code in a main method.
    b) Make a two-player Rock-Paper-Scissors game. (Hint: Ask for player plays (using input), compare them, print out a message of congratulations to the winner, and ask if the players want to start a new game)
    Remember the rules:
    - Rock beats scissors
    - Scissors beats paper
    - Paper beats rock

Topics to be covered: Basics of Exception, Exception Handling, Except clause, Try, finally clause, User Defined Exceptions, Safe guarding file operation using exception handling, Handling and helping developer with error code, Understanding read functions, read (), readline() and readlines(), Understanding write functions, write () and writelines()

23. Python program to perform read and write operations on a file.
24. Python program to copy the contents of a file to another file.
25. Python program to count frequency of characters in a given file.
26. Python program to print each line of a file in reverse order.
27. Python program to compute the number of characters, words and lines in a file.
28. Write a program that prompts the user to enter his name. The program then greets the person with his name. But if the person's name is 'Rahul' and exception is thrown and he is asked to quit the program.
29. Write a program that accepts date of birth along with the other personal details of a person. Throw an exception if an invalid date is entered.
30. Write a Regular Expression to represent all 10 digit mobile numbers. Rules: 1. Every number should contains exactly 10 digits. 2. The first digit should be 7 or 8 or 9 Write a Python Program to check whether the given number is valid mobile number or not?

31. A spell checker can be a helpful tool for people who struggle to spell words correctly. In this exercise, you will write a program that reads a file and displays all of the words in it that are misspelled. Misspelled words will be identified by checking each word in the file against a list of known words. Any words in the user's file that do not appear in the list of known words will be reported as spelling mistakes. The user will provide the name of the file to check for spelling mistakes as a command line parameter. Your program should display an appropriate error message if the command line parameter is missing. An error message should also be displayed if your program is unable to open the user's file. Words followed by a comma, period or other punctuation mark are not reported as spelling mistakes. Ignore the capitalization of the words when checking their spelling.

Suggested Readings:

1. Allen B . Downey, Think Python, 2016, How to Think Like a Computer Scientist, Shroff/O'Reilly Publishers
2. Guido van Rossum and Fred L. Drake Jr, 2011, An Introduction to Python – Revised and updated for Python 3.2, Network Theory Ltd.
3. Robert Sedge wick, Kevin Wayne, Robert Dondero, 2015, Introduction to Programming in Python: An Inter-disciplinary Approach, Pearson India Education Services Pvt. Ltd.
4. Python Programming using problem solving approach, 2019, Reema Thareja, Oxford University Press.

Note: Only latest editions of the books are recommended

Software required/ Web links:

Python 3.6.4
https://www.tutorialspoint.com/python/index.htm (Last visited Date: 21 February, 2024)
https://www.programiz.com/python-programming/first-program (Last visited Date: 21 February, 2024)

Distribution of Continuous Evaluation Table:

Viva-I	30%
Viva-II	30%
File/ Records	20%
Class performance	10%
Attendance	10%

Assessment Tools:

Experiments in lab
File work/Class Performance
Viva (Question and answers in lab)
End Term Practical Exam

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO 4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
OMCA-DS-163.1	3						3						1	2
OMCA-DS-163.2	2	3					3						2	3
OMCA-DS-163.3			2				3						1	3
OMCA-DS-163.4		2	2		2		3						2	1
OMCA-DS-163.5	2	2	2		2		3						3	2

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH & STUDIES

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OMCA-DS-115: MATLAB

Periods/week Credits — Max Marks: 100
L: 2 T: 0 2 — Continuous Evaluation: 30
Duration of Examination: 3 Hrs — End Semester Examination: 70

Pre-Requisite: Knowledge of basic Programming concepts
Course Type: Domain Elective

Course Outcomes: At the end of the course, students will be able to

OMCA-DS-115.1. To learn features of MATLAB as a programming tool.
OMCA-DS-115.2. To promote new teaching model that will help to develop programming skills and technique to solve mathematical problems.
OMCA-DS-115.3. To understand MATLAB graphic feature and its applications.
OMCA-DS-115.4. Interpret and visualize simple mathematical functions and operations thereon using plots/display
OMCA-DS-115.5. To use MATLAB as a simulation tool.

PART -A

UNIT 1: Introduction to MATLAB

1.1 The MATLAB Environment
1.2 MATLAB Basics – Variables, Numbers, Operators, Expressions, Input and output.
1.3 Working in the Command Window
1.4 Vectors, Arrays – Matrices
1.5 EXAMPLES OF MATLAB APPLICATIONS

UNIT 2: MATLAB Arrays

2.1 Creating a one-dimensional array (vector)
2.2 Creating a two-dimensional array (matrix)
2.3 Array addressing
2.4 Using a colon: in addressing arrays
2.5 Adding elements to existing variables
2.6 Deleting elements
2.7 Strings and strings as variables
2.8 Built-in Functions
2.9 User defined Functions

UNIT 3: Graphics with MATLAB

3.1 Files and File Management – Import/Export
3.2 Basic 2D, 3D plots
3.3 Plot commands: pplot, fplot
3.4 Plots with error bars
3.5 Plots with special graphics
3.6 Histograms
3.7 Polar plots
3.8 Plotting multiple plots on the same page

PART-B

UNIT 4: MATLAB Functions

4.1 Built-in Function
4.2 User defined Function
4.3 Creating a function file
4.4 Structure of a function file
4.5 Saving a function file

UNIT 5: Programming with MATLAB

5.1 Relational and Logical Operators
5.2 Conditional Statements, Loops
5.3 Switch Case Statement
5.4 Break and continue Command
5.5 MATLAB Programs – Programming and Debugging.
5.6 Applications of MATLAB Programming.

UNIT 6 : Mathematical Computing with MATLAB

6.1 Algebraic equations
6.2 Basic Symbolic Calculus
6.3 Differential equations
6.4 Integration
6.5 Numerical Techniques and Transforms

Suggested Readings:

1. Brian R. Hunt, Ronald L. Lipsman, Jonathan M. Rosenberg, 2006, "A Guide to MATLAB – for Beginners and Experienced Users", 2nd Ed., Cambridge University Press.
2. Stephen J. Chapman, 2009, "Essentials of MATLAB Programming", 2nd Ed., Cengage Learning.
3. David McMahon, 2007, "MATLAB Demystified", The McGraw-Hill Companies.
4. Holly Moore, 2012, "MATLAB® for Engineers", 3rd Ed., Pearson Education, Inc..
5. David M. Smith, 2010, "Engineering computation with MATLAB", 2nd Ed., Pearson Education, Inc..

Note: Only latest editions of the books are recommended.

Software required/ Web links:

MATLAB 2022a
https://www.mathworks.com/help/matlab/getting-started-with-matlab.html?s_tid=CRUX_lftnav (Last visited Date: 21 February, 2024)

Instructions for paper setting: Seven questions are to be set in total. First question will be multiple choice covering entire syllabus and will be compulsory to attempt and will be of 18 marks. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 13 marks.

Evaluation Policy:

The evaluation will include two types of assessments:

(ix) Continuous or formative assessments (in the form of end semester examination or term examination. Weightage of assessments are as follows:

For continuous or Formative assessment (in semester): Maximum 30 percent. The categorization for the same is:

MCQs	30%
Subjective (Short/Long)	40%
Discussion/Presentation	15%
Projects/Group Activities etc	15%

(x) For Summative assessment (End Semester Examination or End-Term Examination):

Minimum: 70 percent. Categorization for the same is:

Objective Type Questions:	30%
Short/Long Questions:	70%

Assessments Tools:
Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term and examination

COURSE ARTICULATION MATRIX:

	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2
OMCA-DS-115.1	2	3	3	3	3	2	3				2	3	3	3
OMCA-DS-115.2	3	2	3	2	2	1	2			2	2	3	2	3
OMCA-DS-115.3	3	3	3	3	3	1	3		2		2	2	3	3
OMCA-DS-115.4	3	2	2	3	1		2		1			3	2	3
OMCA-DS-115.5	3	3	3	3	2	1	3	2				3	3	3

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH & STUDIES
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OMCA-DS-116: SOFT PROGRAMMING

Periods/week	Credits	Max. Marks	: 100
L: 2 T: 0	2	Continuous Evaluation	: 30
Duration of Examination: 3 Hrs.		End Semester Examination	: 70

Pre-Requisite: Basic of AI
Course Type: Domain Elective

Course Outcomes: At the end of the course the student will be able to:

OMCA-DS-116.1. Learn soft computing techniques and their applications.
OMCA-DS-116.2. Analyze various neural network architectures.
OMCA-DS-116.3. Define the fuzzy systems.
OMCA-DS-116.4. Understand the genetic algorithm concepts and their applications.
OMCA-DS-116.5. Identify and select a suitable Soft Computing technology to solve the problem
OMCA-DS-116.6. Construct a solution and implement a Soft Computing solution.

PART- A

Unit 1: Introduction:

1.1 What is Soft Computing
1.2 Difference between Hard and Soft
1.3 Computing
1.4 Requirement of Soft computing
1.5 Major Areas of Soft Computing
1.6 Applications of Soft

Unit 2: Neural Networks:

1.1 What is Neural Network
1.2 Learning rules and various activation functions
1.3 Single layer Perceptron
1.4 Back Propagation networks
1.5 Architecture of Backpropagation (BP)
1.6 Networks, Backpropagation Learning,
1.7 Variation of Standard
1.8 Back propagation Neural Network,
1.9 Introduction to Associative Memory,

Unit 3: Fuzzy Systems:

1.1 Fuzzy Set theory
1.2 3.2 Fuzzy versus Crisp set
1.3 Fuzzy Relation
1.4 Fuzzification
1.5 Minmax Composition
1.6 Defuzzification Method,
1.7 Fuzzy Logic
1.8 Fuzzy Rule based systems
1.9 Predicate logic
1.10 Fuzzy Decision Making

PART-B

Unit 4: Genetic Algorithm:

4.1 History of Genetic Algorithms (GA)
4.2 Working Principle
4.3 Various Encoding methods
4.4 Fitness function
4.5 GA Operators- Reproduction
4.6 Crossover, Mutation
4.7 Convergence of GA
4.8 Bit wise operation in GA
4.9 Multi-level Optimization.

Unit 5: Hybrid Systems:

5.1 Sequential Hybrid Systems
5.2 Auxiliary Hybrid Systems
5.3 Embedded Hybrid Systems
5.4 Neuro-Fuzzy Hybrid Systems
5.5 Neuro-Genetic Hybrid Systems
5.6 Fuzzy-Genetic Hybrid Systems.

Unit 6: Fuzzy Backpropagation Networks:

6.1 LR type Fuzzy numbers
6.2 Fuzzy Neuron
6.3 Fuzzy BP Architecture
6.4 Learning in Fuzzy BP
6.5 Application of Fuzzy BP Networks

Suggested Readings:

1. S.Rajasekaran, G. A. Vijayalakshmi, 2013, Neural Networks, Fuzzy Logic and Genetic Algorithms: Synthesis & Applications, , PHI.
2. E. Goldberg, 1989, Genetic Algorithms: Search and Optimization, Addison Wesley.
3. Chin Teng Lin, C. S. George Lee, 1996, Neuro-Fuzzy Systems, PHI.

Note: Only latest editions of the books are recommended.

Software required/ Web links:

1. https://www.cet.edu.in/noticefiles/274_soft%20computing%20LECTURE%20NOTES.pdf (Last Visited Date: 22 February, 2024)
2. http://lancet.mit.edu/ga/dist/galibdoc.pdf (Last Visited Date:22 February, 2024)

Instructions for paper setting: Seven questions are to be set in total. First question will be multiple choice covering entire syllabus and will be compulsory to attempt and will be of 18 marks. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 13 marks.

Evaluation Policy:

The evaluation will include two types of assessments:

(xi) Continuous or formative assessments (in the form of end semester examination or term examination. Weightage of assessments are as follows:

For continuous or Formative assessment (in semester): Maximum 30 percent. The categorization for the same is:

MCQs	30%
Subjective (Short/Long)	40%
Discussion/Presentation	15%
Projects/Group Activities etc	15%

(xii) For Summative assessment (End Semester Examination or End-Term Examination):
Minimum: 70 percent. Categorization for the same is:

Objective Type Questions: 30%
Short/Long Questions: 70%

Assessment Tools:
Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO 4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
OMCA-DS-116.1	2	1		2			2						3	3
OMCA-DS-116.2	1	3	1	1			2						2	2
OMCA-DS-116.3	1	2	1	1			2						2	3
OMCA-DS-116.4	1	2	2	3	2		1						3	2
OMCA-DS-116.5	2	1	1	3	2		2						2	2
OMCA-DS-116.6	1	1	1		2	2	2						2	2

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OMCA-CC-001: Azure Fundamentals

Periods/week	Credits	Max. Mark: 100
L: 2 T: 0	2	Continuous Evaluation: 30
Duration of Examination: 3 Hrs		End Semester Examination: 70

Pre-Requisite: NA

Course Type: Domain Specific

Course Outcomes: At the end of the course the student will be able to:

OMCA-CC-001.1 Be familiar with the general cloud technology concepts
OMCA-CC-001.2 Build knowledge of Azure services and Azure workloads.
OMCA-CC-001.3 Detail knowledge of security and privacy in Azure, Azure pricing and support.
OMCA-CC-001.4 Develop capability to build the application support, and application development

PART- A

Unit 1: Cloud Fundamentals
1.1 Introduction to cloud computing
1.2 Describe the benefits of using cloud services
1.3 Describe cloud service types
1.4 Identify appropriate use cases for each cloud service (IaaS, PaaS, SaaS)

Unit 2: Introduction to Azure
2.1 Introduction to Azure
2.2 Tour of Azure Portal
2.3 Create a Virtual Machine
2.4 Creating Resources in azure
2.5 Configure IIS

Unit 3: Describe Azure architecture and Services
3.1 Describe the core architectural components of Azure
3.2 Describe Azure compute
3.3 networking service
3.4 Describe Azure storage services

PART- B

Unit 4: Describe Azure management and governance
4.1 Describe Azure identity
4.2 Azure access, and security
4.3 Azure advanced Thread Protection
4.4 Describe features and tools in Azure for governance and compliance
4.5 Describe features and tools for managing and deploying Azure resources

Unit 5: Control Azure Resources
5.1 Describe monitoring tools in Azure
5.2 Principles of resource group
5.3 Tagging to resources
5.4 Azure policies
5.5 Secure resources in azure

Unit 6: Azure Cost and Optimisation spending

6.1 Factors effecting cost
6.2 Azure Price Calculator
6.3 Estimate total cot with TCO calculator
6.4 Save infrastructure & licensing cost
6.5 Service life cycle public and private

Suggested Books:

1. James Boyce, Microsoft Certified Azure Fundamentals Study Guide: Exam AZ-900
2. Jim Cheshire**,** Exam Ref AZ-900 Microsoft Azure Fundamentals
3. Eri, Cloud Computing-Concepts, Technology & Architecture: Pearson Publication

Note: Only latest editions of the books are recommended.

Web links:

- AZ-900 Exam Study Guide (microsoft.com) (last visited date: 22 February 2024)
- https://infrastructuremap.microsoft.com/explore (last visited date: 22 February 2024)
- Microsoft Certified: Azure Fundamentals - Certifications | Microsoft Learn (last visited date: 22 February 2024)

Instructions for paper setting: Seven questions are to be set in total. First question will be multiple choice covering entire syllabus and will be compulsory to attempt and will be of 18 marks. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 13 marks.

Evaluation Policy:

The evaluation will include two types of assessments:

(xiii) Continuous or formative assessments (in the form of end semester examination or term examination. Weightage of assessments are as follows:

For continuous or Formative assessment (in semester): Maximum 30 percent. The categorization for the same is:

MCQs	30%
Subjective (Short/Long)	40%
Discussion/Presentation	15%
Projects/Group Activities etc	15%

(xiv) For Summative assessment (End Semester Examination or End-Term Examination):

Minimum: 70 percent. Categorization for the same is:

Objective Type Questions:	30%
Short/Long Questions:	70%

Assessment Tools:

Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
OMCA-CC-001.1	2	3	2	2	2	1					1			1
OMCA-CC-001.2	2	3			2							1		2
OMCA-CC-001.3	2	2	2	3	2	2	1						1	1
OMCA-CC-001.4		3		2	2									1

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OMCA-CC-002: FUNDAMENTALS OF CLOUD COMPUTING

Periods/week	Credits	Max. Marks : 100
L: 2 T: 0	2	Continuous Evaluation: 30
Duration of Examination: 3 Hrs		End Semester Examination: 70

Pre-Requisite: Knowledge of Data Communication & Networking
Course Type: Domain Elective

Course Outcomes: At the end of the course the student will be able to:

OMCA-CC-002.1 Define cloud computing and memorize the different cloud services and deployment models.
OMCA-CC-002.2 Describe importance of virtualization along with their respective technology.
OMCA-CC-002.3 Use and examine different cloud computing services.
OMCA-CC-002.4 Analyze and compare various different cloud computing platforms such as AWS, Microsoft Azure.
OMCA-CC-002.5 Design different cloud computing business applications with appropriate security mechanism.

PART -A

UNIT 1: Introduction to Cloud Computing
- 1.1 Definition of Cloud Computing
- 1.2 Origin and Influences
- 1.3 Basic Concepts of Clouds: Virtualization and Abstraction
- 1.4 Cloud Characteristics
- 1.5 Challenges and Risks
- 1.6 Applications of Cloud Computing

UNIT 2: Cloud Computing Architecture
- 2.1 Cloud Models: Deployment models, Service Models
- 2.2 Cloud reference model (Architecture, Infrastructure, Platform, and Software)
- 2.3 Cloud types (Public, Private, Hybrid & Community clouds) with examples
- 2.4 Exploring cloud computing status; Connecting to cloud
- 2.5 Cloud Computing Technologies: Elasticity, Load Balancing
- 2.6 Open Challenges

UNIT 3: Cloud Delivery Models
- 3.1 IaaS (IaaS workloads, Pods, Aggregation & Silos);
- 3.2 PaaS (Application development, Using PaaS application framework)
- 3.3 SaaS (Characteristics, Open SaaS & SOA)
- 3.4 IDaaS
- 3.5 Comparing Cloud Delivery Models
- 3.6 Combining Cloud Delivery Models

PART-B

UNIT 4: Cloud Security and Trust Management
- 4.1 An Introduction to the Idea of Data Security
- 4.2 Cloud Security Threats
- 4.3 The Current State of Data Security in the Cloud CryptDb
- 4.4 Onion Encryption layers and Homomorphic Encryption
- 4.5 Trust, Reputation and Security Management

UNIT 5: Cloud Platforms in Industry
- 5.1 Amazon Web Services
- 5.2 Google AppEngine
- 5.3 Microsoft Azure

5.4 Manjra Soft Aneka
5.5 Hadoop

Unit 6: Cloud Applications

6.1 Scientific Applications
6.2 Business Applications
6.3 Consumer Applications
6.4 Third Party Cloud Services
6.5 Case Study related to cloud environment

Suggested Readings:

1. B Rajkumar, V Christian and S. Thamarai Selvi, 2013, Mastering Cloud Computing, TMH Education
2. B Sosinky, 2010, Cloud Computing Bible, Wiley
3. K Jamsa, 2012, Cloud Computing: SaaS, Paas, Iaas, Virtualization, Business Models & More, Jones & Bartlett Learning.
4. K Saurabh, 2012, Cloud Computing, Wiley.
5. Erl, 2013, Cloud Computing-Concepts, Technology & Architecture, Pearson Publication.

Note: Only latest editions of the books are recommended.

Web links:

https://www.tutorialspoint.com/cloud_computing/cloud_computing_evolution.htm (Last visited Date: 21 February, 2024)
http://www.motc.gov.qa/sites/default/files/cloud_computing_ebook.pdf (Last visited Date: 21 February, 2024)
http://eddiejackson.net/web_documents/The_Definitive_Guide_to_Cloud_Computing.pdf (Last visited Date: 21 February, 2024)
https://ptgmedia.pearsoncmg.com/images/9780133387520/samplepages/0133387526.pdf (Last visited Date: 23/02/24)
http://www.buyya.com/MasteringClouds/ToC-Preface-TMH.pdf(Last visited Date: 21 February, 2024)

Instructions for paper setting: Seven questions are to be set in total. First question will be multiple choice covering entire syllabus and will be compulsory to attempt and will be of 18 marks. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 13 marks.

Evaluation Policy:

The evaluation will include two types of assessments:

(xv) Continuous or formative assessments (in the form of end semester examination or term examination. Weightage of assessments are as follows:

For continuous or Formative assessment (in semester): Maximum 30 percent. The categorization for the same is:

MCQs	30%
Subjective (Short/Long)	40%
Discussion/Presentation	15%
Projects/Group Activities etc	15%

(xvi) For Summative assessment (End Semester Examination or End-Term Examination):

Minimum: 70 percent. Categorization for the same is:

Objective Type Questions:	30%
Short/Long Questions:	70%

Assessment Tools:

Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO 4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
OMCA-CC-002.1	2		1	1			2						3	3
OMCA-CC-002.2	1	3	1		1		1						2	2
OMCA-CC-002.3	1	2	2	2		2	1						2	3
OMCA-CC-002.4	1	2	2	2	3	2	1						3	2
OMCA-CC-002.5	2	3	2	2		2	2	1					2	2

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH & STUDIES
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OMCA-AI-001: CONCEPTS OF AI & MACHINE LEARNING

Periods/week Credits
L: 2 T: 0 2
Duration of Examination: 3 Hrs.

Max. Marks : 100
Continuous Evaluation : 30
End Semester Examination : 70

Pre-Requisite: Basic of computing.
Course Type: Domain Elective

Course Outcomes: At the end of the course the student will be able to:

OMCA-AI-001.1 Develop a good understanding of fundamental principles of machine learning.
OMCA-AI-001.2 Understand various Modelling Techniques.
OMCA-AI-001.3 Learn to use machine learning operations for classification and regression.
OMCA-AI-001.4 Analyze the concepts of neural networks for learning linear and non-linear activation functions..
OMCA-AI-001.5 Characterize the machine learning algorithms as supervised and unsupervised learning.

PART- A

Unit 1: Introduction:

1.1 Foundations and approaches of AI
1.2 Problem solving in Artificial Intelligence and current trends
1.3 Introduction: Machine learning, Terminologies in machine learning
1.4 Types of machine learning: supervised, unsupervised, semi-supervised learning
1.5 Discriminative Models: Least Square Regression
1.6 B Gradient Descent Algorithm, Univariate and Multivariate Linear Regression

Unit 2: Modelling technique:

2.1 Prediction Modeling
2.2 Probabilistic interpretation, Regularization,
2.3 Logistic regression, multi class classification
2.4 Support Vector Machines- Large margin classifiers
2.5 Nonlinear SVM,
2.6 Kernel functions, SMO algorithm

Unit 3: ML Operations

3.1 Dimensionality Reduction Subset Selection
3.2 Shrinkage Methods

3.3 Principle Components Regression Linear Classification
3.4 Logistic Regression
3.5 Linear Discriminant Analysis Optimization
3.6 Classification-Separating Hyperplanes Classification

PART-B

Unit 4: Neural Networks:

4.1 Artificial Neural Networks (Early models, Back Propagation, Initialization, Training & Validation) Parameter Estimation (Maximum Likelihood Estimation, Bayesian Parameter Estimation)
4.2 Decision Trees Evaluation Measures
4.3 Hypothesis Testing Ensemble Methods
4.4 Graphical Models

Unit 5: Unsupervised Learning:

5.1 Clustering, Gaussian Mixture Models
5.2 Spectral Clustering Ensemble Methods Learning Theory
5.3 Reinforcement Learning
5.4 Dimensionality Reduction
5.5 Principal Component Analysis (PCA),

Unit 6: Supervise Learning:

6.1 Generative models : Linear Discriminative Analysis,
6.2 Na¨ıve Bayes classifier
6.3 Decision trees
6.4 Ensemble models – Bagging and Boosting.

Suggested Readings:

1. Ethem Alpaydin,2020, Introduction to Machine Learning, Prentice Hall of India.
2. Tom Mitchell, 2019,Machine Learning, McGraw Hill Education.
3. Stephen Marsland, 2020, Machine Learning: An Algorithmic Perspective, Chapman and Hall/CRC
4. Christpher M. Bishop, 2017, Pattern Recognition and Machine Learning, Springer

Note: Only latest editions of the books are recommended.

Software required/ Web links:

1. Web Links: https://www.ibm.com/topics/machine-learning (Last Visited Date: 21st February, 2024)
2. Web Links: https://www.spiceworks.com/tech/artificial-intelligence/articles/what-is-ml/ (Last Visited Date: 21st February, 2024)

Instructions for paper setting: Seven questions are to be set in total. First question will be multiple choice covering entire syllabus and will be compulsory to attempt and will be of 18 marks. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 13 marks.

Evaluation Policy:

The evaluation will include two types of assessments:

(xvii) Continuous or formative assessments (in the form of end semester examination or term examination. Weightage of assessments are as follows:

For continuous or Formative assessment (in semester): Maximum 30 percent. The categorization for the same is:

MCQs	30%
Subjective (Short/Long)	40%
Discussion/Presentation	15%
Projects/Group Activities etc	15%

(xviii) For Summative assessment (End Semester Examination or End-Term Examination):

Minimum: 70 percent. Categorization for the same is:

Objective Type Questions:	30%

Short/Long Questions: 70%

Assessment Tools:
Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
OMCA-AI-001	2	1		2			2						3	3
OMCA-AI-001	1	3	1	1			2						2	2
OMCA-AI-001	1	2	1	1			2						2	3
OMCA-AI-001	1	2	2	3	2		1						3	2
OMCA-AI-001	2	1	1	3	2		2						2	2
OMCA-AI-001	1	1	1		2	2	2						2	2

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OMCA-AI-002: PROBABILISTIC REASONING

Periods/week	Credits		Max. Marks	: 100
L: 2	T: 0	2	Continuous Evaluation	: 30
Duration of Examination: 3 Hrs.			End Semester Examination	: 70

Pre-Requisite: Python Programming
Course Type: Domain Elective

Course Outcomes: At the end of the course the student will be able to:

OMCA-AI-002.1 The basic principles of probability and random variables.
OMCA-AI-002.2 The skills of extracting probabilistic models from the data with the help of continuous probability distributions and Gaussian approach.
OMCA-AI-002.3 The estimation statistics and decision-making techniques, algorithms which plays vital role in data mining.
OMCA-AI-002.4 Demonstrate advanced knowledge of decision theory for formal computation and its relationship to languages
OMCA-AI-002.5 The Bayesian process of inference in probabilistic reasoning system.

PART- A

Unit 1: Matrix Decomposition and Dimension Reduction Algorithms:

1.1 Principal Component Analysis- Population Principal Components
1.2 sample principal coefficients
1.3 covariance matrix of data set
1.4 Dimensionality reduction
1.5 Singular value decomposition
1.6 Gram Schmidt process

Unit 2: Continuous Distributions and Gaussian Models:

2.1 Continuous distributions: normal distribution-MGF
2.2 cumulant generating function
2.3 skewness kurtosis
2.4 exponential distribution-memory less property
2.5 Gaussian distribution.

Unit 3: Maximum Likelihood Parameter Estimation:

3.1 Maximum likelihood estimate (MLE) - log-likelihood function-Binomial Poisson
3.2 Cramer-Rao Lower Bound (CRLB) and applications
3.3 minimum variance unbiased estimator (MVUE).

PART-B

Unit 4: Decision Theory

4.1 Decision functions, basic concept
4.2 The loss functions
4.3 minimax, expected utility principle
4.4 point estimation and interval estimation
4.5 the Neyman-Pearson lemma as a decision theoretic result
4.6 mixture models and the EM algorithm.

Unit 5: Bayesian Methods for Inference and Information Theory:

1.1 Deriving the likelihood function

1.2 Bayes' rule
1.3 Statistical tests and Bayesian model comparison
1.4 Bit, Surprisal, Entropy, Source coding theorem
1.5 Joint entropy, Conditional entropy
1.6 Kullback-Leibler divergence.

Unit 6: Markov networks:

6.1 Representation (potentials)
6.2 Independence and conditional independence
6.3 Trees
6.4 Boltzmann machines
6.5 Conditional Markov random fields
6.6 Inference in Markov networks

Suggested Readings:

1. S. C. Gupta, V. K. Kapoor,2016, "Fundamentals of Mathematical Statistics", S. Chand & Co.
2. Giovanni Parmigiani, Lurdes Inou, 2009, "Decision Theory Principles and Approaches", Wiley Publication.
3. I.T. Jolliffe, 2002, "Principal Component Analysis", Second Edition, Springer publications.
4. Richard Arnold Johnson, Irwin Miller, John E. Freund, 2013, "Probability and Statistics for Engineers", Prentice Hall.
5. B. S. Grewal, 2012, "Higher Engineering Mathematics", Khanna Publishers.

Note: Only latest editions of the books are recommended.

Software required/ Web links:

1. https://mbb-team.github.io/VBA-toolbox/wiki/Bayesian-modelling-introduction/ (Last Visited Date: 23rd February, 2024)
2. https://www.coursehero.com/sitemap/schools/2655-University-of-Edinburgh/courses/1641949-INFORMATICPMR/# (Last Visited Date:23rd February, 2024)
3. 8.2.6-FromBNtoMN.ppt (buffalo.edu) (Last Visited Date:23rd February, 2024)
4. http://www.cs.toronto.edu/~yangxu/information-theory-v3.pdf (Last Visited Date: 23rd February, 2024)
5. http://www.stat.cmu.edu/~larry/=sml/Bayes.pdf (Last Visited Date: 23rd February, 2024)

Instructions for paper setting: Seven questions are to be set in total. First question will be multiple choice covering entire syllabus and will be compulsory to attempt and will be of 18 marks. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 13 marks.

Evaluation Policy:

The evaluation will include two types of assessments:

(xix) Continuous or formative assessments (in the form of end semester examination or term examination. Weightage of assessments are as follows:

For continuous or Formative assessment (in semester): Maximum 30 percent. The categorization for the same is:

MCQs	30%
Subjective (Short/Long)	40%
Discussion/Presentation	15%
Projects/Group Activities etc	15%

(xx) For Summative assessment (End Semester Examination or End-Term Examination):

Minimum: 70 percent. Categorization for the same is:

Objective Type Questions:	30%
Short/Long Questions:	70%

Assessment Tools:

Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
OMCA-AI-002	2	1		2			2						3	3
OMCA-AI-002	1	3	1	1			2						2	2
OMCA-AI-002	1	2	1	1			2						2	3
OMCA-AI-002	1	2	2	3	2		1						3	2
OMCA-AI-002	2	1	1	3	2		2						2	2
OMCA-AI-002	1	1	1		2	2	2						2	2

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH & STUDIES
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OMCA-CS-001: NETWORK SECURITY

Periods/week Credits	Max. Marks: 100
L:2 T: 0 2	Continuous Evaluation: 30
Duration of Examination: 3 Hrs	End Semester Examination : 70

Pre-Requisite: Introduction to Network and Security
Course Type: Domain Elective

Course Outcomes: At the end of the course the student will be able to:
OMCA-CS-001.1 Analyze the basic concepts of network security.
OMCA-CS-001.2 Recognize various security threats, their harm, strategies and tactics to protect the networks.
OMCA-CS-001.3 Explore various aspects of network security and access control mechanism.
OMCA-CS-001.4 Network Security Policy Design and Implementation.
OMCA-CS-001.5 Secure Firewall Configuration and Management.

PART-A

Unit–I: Fundamentals of Network & Protocol

1.1 Computer Network and Defense Fundamental
1.2 Understanding computer network, Describing OSI and TCP/IP network Model
1.3 Comparing OSI and TCP/IP network Models,
1.4 Understanding different types of networks,
1.5 Describing various network topologies,
1.6 Understanding various network components,
1.7 Explaining various protocols in TCP/IP protocol stack,
1.8 Explaining IP addressing concept,
1.9 Understanding Computer Network Defense (CND).

Unit-II: Vulnerabilities, Attacks and Threats

2.1 Network Security Threats,
2.2 Vulnerabilities, and Attacks,
2.3 Understanding threat, attack, and vulnerability,
2.4 Discussing network security concerns,
2.5 Reasons behind network security concerns,
2.6 Effect of network security breach on business continuity,
2.7 Understanding different types of network threats,
2.8 Understanding different types of network security vulnerabilities,
2.9 Understanding different types of network attacks, Describing various network attacks

Unit-III: Network Security & Authentication

3.1 Network Security Controls,
3.2 Protocols, and Devices,
3.3 Understanding fundamental elements of network security,
3.4 Explaining network access control mechanism,
3.5 Understanding different types of access controls,
3.6 Explaining network Authentication, Authorization and Auditing (AAA) mechanism,
3.7 Explaining network data encryption mechanism,
3.8 Describing Public Key Infrastructure (PKI), Describing various network security protocols,
3.9 Describing various network security devices

PART-B

Unit-IV: Security Policies

4.1 Network Security Policy Design and Implementation,
4.2 Understanding security policy,
4.3 Need of security policies,
4.4 Describing the hierarchy of security policy,
4.5 Describing the characteristics of a good security policy,
4.6 Describing typical content of security policy,
4.7 Understanding policy statement,
4.8 Describing steps for creating and implementing security policy, Designing of security policy.

Unit-V: Firewall and Technologies

1.1 Secure Firewall Configuration and Management,
1.2 Understanding firewalls,
1.3 Understanding firewall security concerns,
1.4 Describing various firewall technologies,
1.5 Describing firewall topologies,
1.6 Appropriate selection of firewall topologies,
1.7 Designing and configuring firewall ruleset,
1.8 Implementation of firewall policies,
1.9 Explaining the deployment and implementation of firewall,
1.10 Factors to considers before purchasing any firewall solution.

Unit-VI: VPN

6.1 Secure IDS and VPN Configuration and Management,
6.2 Understanding different types of intrusions and their indications,
6.3 Understanding IDPS, Importance of implementing IDPS,
6.4 Describing role of IDPS in network defense,
6.5 Describing functions, components, and working of IDPS, Secure VPN Configuration and Management,
6.6 Understanding Virtual Private Network (VPN) and its working,
6.7 Importance of establishing VPN, Describing various VPN components,
6.8 Describing implementation of VPN concentrators and its functions.

Suggested Readings:

1. W. Stallings, 2005, Cryptography and Network Security Principles and Practices, Prentice-Hall
2. J. Piwprzyk, T. Hardjono, 2003, Fundamentals of Computer Security, Springer
3. Roberta Bragg, Mark Rhodes, 2017, Network security, The Complete Reference, Tata McGraw-Hill

Web links:

https://www.tutorialspoint.com/ Network security/index.htm (Last visited Date: 21 February, 2024)

Instructions for paper setting: Seven questions are to be set in total. First question will be multiple choice covering entire syllabus and will be compulsory to attempt and will be of 18 marks. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 13 marks.

Evaluation Policy:

The evaluation will include two types of assessments:

(xxi) Continuous or formative assessments (in the form of end semester examination or term examination. Weightage of assessments are as follows:

For continuous or Formative assessment (in semester): Maximum 30 percent. The categorization for the same is:

MCQs	30%
Subjective (Short/Long)	40%
Discussion/Presentation	15%

Projects/Group Activities etc 15%

(xxii) For Summative assessment (End Semester Examination or End-Term Examination):
Minimum: 70 percent. Categorization for the same is:
Objective Type Questions: 30%
Short/Long Questions: 70%

Assessment Tools:

Assignment / Tutorials

Surprise questions during lectures/Class

PerformanceTerm end examination

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO 4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
OMCA-CS-001.1	2					1	2	1					3	3
OMCA-CS-001.2	1	3	1		3		1						2	2
OMCA-CS-001.3			2	2		3	1							
OMCA-CS-001.4	1	2					1						1	1
OMCA-CS-001.5	2	3	1	3		1	3	1					2	2

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH & STUDIES
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OMCA-CS-002: CYBER SECURITY

Periods/week	Credits	Max. Marks : 100
L: 2 T: 0	2	Continuous Evaluation: 30
Duration of Examination: 3 Hrs		End Semester Examination: 70

Pre-Requisite: NA
Course Type: Domain Elective

Course Outcomes: At the end of the course, the student will be able to:
OMCA-CS-002.1. Understand basic concepts and issues related to Cyber Security.
OMCA-CS-002.2. Distinguish various tools used in Cyber Security.
OMCA-CS-002.3. Identify various mechanisms to protect themselves from various security threats on the internet.
OMCA-CS-002.4. Use security tools to enhance system security.
OMCA-CS-002.5. Apply precautionary measures such as firewalls, digital certificates, to stay safe online.

PART-A

UNIT 1: Introduction to cyber security

1.1 Cyber Crimes
1.2 Types of Cybercrime
1.3 Cyberspace and Criminal Behavior
1.4 Digital Forensics
1.5 Contemporary Crimes
1.6 Indian IT ACT 2000

UNIT 2: Web Application Tools

2.1 Scanning for web vulnerability
2.2 Hyper Text Transfer Protocol utility
2.3 Application Inspection Tools
2.4 Password Cracking
2.5 Brute Force Tools – John the ripper and Hydra

UNIT 3: Network Defense Tools

3.1 Working of Firewall
3.2 Packet characteristics to filter
3.3 Network address translation
3.4 Virtual Private Network
3.5 Linux Firewall
3.6 Windows Firewall

PART-B

UNIT 4: Cryptography

4.2 Ciphers and Secret Message
4.3 Security Attacks and Services
4.3 Mathematical Tools for Cryptography
4.4 Theory of Block Cipher Design
4.5 Cipher Network Structures

UNIT 5: Digital Signatures, Certificates, and Standards

5.1 Digital Signature Standard and Authentication (DSS and DSA)
5.2 Public key Infrastructure
5.3 Digital Certificates
5.4 Basics of Public Key Cryptography Standards (PKCS)
5.5 Internet Protocol and Web Security Protocols

UNIT 6: Introduction to Cyber Crime Investigation

6.1 Password Cracking
6.2 Keyloggers and Spyware
6.3 Trojan and backdoors
6.4 SQL Injection
6.5 Buffer Overflow
6.6 Attack on wireless Networks
6.7 Website Attacks

Suggested Readings:

1. J. Piwprzyk, T. Hardjono, 2003, Fundamentals of Computer Security, Springer
2. Nina Godbole, Sunit Belpure, 2011, Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives, Publication Wiley
3. Mike Shema, 2014, Anti-Hacker Tool Kit, McGraw Hill
4. W. Stallings, 2005, Cryptography and Network Security Principles and Practices, Prentice-Hall

Note: Only latest editions of the books are recommended.
Software required/ Web links:

https://www.w3schools.com/cybersecurity/ (Last Visited Date: 22nd February, 2024)

Instructions for paper setting: Seven questions are to be set in total. First question will be conceptual covering entire syllabus and will be compulsory to attempt. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 14 marks.

Evaluation Policy:

The evaluation will include two types of assessments:

(xxiii) Continuous or formative assessments (in the form of end semester examination or term examination. Weightage of assessments are as follows:

For continuous or Formative assessment (in semester): Maximum 30 percent. The categorization for the same is:

MCQs	30%
Subjective (Short/Long)	40%
Discussion/Presentation	15%
Projects/Group Activities etc	15%

(xxiv) For Summative assessment (End Semester Examination or End-Term Examination):

Minimum: 70 percent. Categorization for the same is:

Objective Type Questions:	30%
Short/Long Questions:	70%

Assessment Tools:

Assignment / Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO 4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
OMCA-CS-002.1	2		1	1			2						3	3
OMCA-CS-002.2	1	3	1		1		1						2	2
OMCA-CS-002.3			2	2		2	1							
OMCA-CS-002.4	1	2					1							
OMCA-CS-002.5	2	3	2	2		2	2	1					2	2

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES
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NAAC 'A++' Grade University

OMCA-FSD-001: GAMING TECHNOLOGY - I

Periods/week	Credits	Max. Marks: 100
L :2 T: 0	2	Continuous Evaluation: 30
Duration of Exam: 3 Hrs		End Sem Examination: 70

Pre-requisites: Basic knowledge of computer graphics and gaming
Course Type: Program Elective

Course Outcomes: The students would be able:
OMCA-FSD-001.1. To learn Game Essentials, Types of Games, Stages of Design process.
OMCA-FSD-001.2. To understand requirements of designing a game.
OMCA-FSD-001.3. To learn how a concept turns into a game, and game world
OMCA-FSD-001.4. To create a expressive play, characters in the game
OMCA-FSD-001.5. To understand what a storytelling is, various components of storytelling
OMCA-FSD-001.6. To learn general principles of level design and design issues of online gaming

Unit 1: Games and Video Games

1.1 What Is a Game?
1.2 Conventional Games Versus Video Games,
1.3 Games for Entertainment,
1.4 Serious Games Designing and Developing Games: An Approach to the Task,
1.5 Key Components of Video Games & The Structure of a Video Game
1.6 Stages of the Design Process, Game Design Team Roles, Game Design Documents,
1.7 The Anatomy of a Game Designer

Unit 2: Genres of Game

2.1 What Is a Genre?
2.2 The Classic Game Genres
2.3 Understanding Your Player: Vanden Berghe's Five Domains of Play,
2.4 Demographic Categories, Gamer Dedication,
2.5 The Dangers of Binary Thinking
2.6 Understanding Your Machine: Home Game Consoles, Personal Computers, Portable Devices Other Devices

Unit 3: Game Concepts

3.1 Getting an Idea
3.2 From Idea to Game Concept
3.3 Game Worlds: What Is a Game World?
3.4 The Purposes of a Game World
3.5 The Dimensions of a Game World
3.6 Realism

Unit 4: Creative and Expressive Play

4.1 Self-Defining Play, Creative Play, Other Forms of Expression,
4.2 Game Modifications Character Development: The Goals of Character Design,
4.3 The Relationship Between Player and Avatar,
4.4 Visual Appearances, Character Depth, Audio Design

Unit 5 Storytelling

5.1 Why Put Stories in Games?
5.2 Key Concepts,
5.3 The Storytelling Engine
5.4 Linear Stories, Nonlinear Stories, Granularity,

5.5 Mechanisms for Advancing the Plot, Emotional Limits of Interactive Stories,
5.6 Scripted Conversations and Dialogue Trees,
5.7 When to Write the Story, Other Considerations

Unit 6: General Principles of Level Design

6.1 What Is Level Design?
6.2 Key Design Principles, Layouts,
6.3 Expanding on the Principles of Level Design,
6.4 The Level Design Process, Pitfalls of Level Design Design
6.5 Issues for Online Gaming: What Are Online Games? Advantages of Online Games,
6.6 Disadvantages of Online Games, Design Issues,
6.7 Technical Security, Persistent Worlds, Social Problems

Suggested Books:

1. Rob Miles, Introduction to Programming Through Game Development Using Microsoft XNA Game Studio, Academic Edition, Microsoft Press.
2. Finney, Kenneth C, Advanced 3D game programming all in one, First edition, Course Technology Press.
3. Michael Chung, Game Programming Paradigms, Pocket Gems.
4. La Mothe, André, Tricks of the Windows game programming gurus, Second Edition, Sams Publishing.

Note: Only latest editions of the books are recommended.

Software required/ Web links:

1. https://developer.mozilla.org/en-US/docs/Games/Tutorials Last Visited Date: 22-02-2024
2. https://gamedevacademy.org/how-to-make-a-game/ Last Visited Date:22-02-2024

Instructions for paper setting: Seven questions are to be set in total. First question will be multiple choice covering entire syllabus and will be compulsory to attempt and will be of 18 marks. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 13 marks.

Evaluation Policy:

The evaluation will include two types of assessments:

(xxv) Continuous or formative assessments (in the form of end semester examination or term examination. Weightage of assessments are as follows:

For continuous or Formative assessment (in semester): Maximum 30 percent. The categorization for the same is:

MCQs	30%
Subjective (Short/Long)	40%
Discussion/Presentation	15%
Projects/Group Activities etc	15%

(xxvi) For Summative assessment (End Semester Examination or End-Term Examination):

Minimum: 70 percent. Categorization for the same is:

Objective Type Questions:	30%
Short/Long Questions:	70%

Assessment Tools:

Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

COURSE ARTICULATION MATRIX:

CO Statement	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
OMCA-FSD-001.1	3	2	2	1	2	2	1	1	1	2	2	2	2	1
OMCA-FSD-001.2	3	3	2	2	2	2	1	1	2	2	2	2	2	1
OMCA-FSD-001.3	3	2	2	2	2	2	2	1	2	2	2	2	2	2

OMCA-FSD-001.4	3	3	2	2	2	2	2	1	2	2	2	2	2	3
OMCA-FSD-001.5	3	2	2	2	2	2	2	1	1	2	2	2	2	3
OMCA-FSD-001.6	3	3	2	3	2	2	2	1	2	3	3	1	2	3

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OMCA-FSD-002: ADVANCED WEB TECHNOLOGIES

Periods/week	Credits	Max. Marks: 100
L: 2 T: 0	2	Continuous Evaluation : 30
Duration of Examination: 3 Hrs		End Semester Examination : 70

Pre-Requisite: Web Development concepts
Course Type: Domain Elective

Course Outcomes: At the end of the course, the students will be able to
OMCA-FSD-002.1 Create UI applications using C#
OMCA-FSD-002.2 Design and develop secure web applications using asp.net according to industry standards
OMCA-FSD-002.3 Define and create custom web services
OMCA-FSD-002.4 Apply the concept of Servlet and its life cycle to create web application.
OMCA-FSD-002.5 Build Database connection for the web applications.

PART-A

Unit: 1. Introduction to Dot Net and C#
1.1 Introduction: Visual Studio, Visual Studio IDE, Development Environment Setup,
1.2 .NET Overview, CLR, Assemblies (monolithic vs. component-based applications), Execution Model,
1.3 Client-Side vs. Server-Side Programming, Debugging using Visual Studio,
1.4 Creating Different types of Projects in Visual Studio(Web, Desktop, Library),
1.5 Variables, Constants, Strings, Data Types, Arrays Different Types of Arrays and Operations on Arrays,
1.6 Decision statements, Loop statements, Exception Handling using try – catch –finally, Name Space

Unit 2. OOP C#
2.1 Classes and Objects Instance Variables, Methods, Constructors, Properties,
2.2 Access Specifiers, Static members and methods
2.3 Inheritance Levels of Inheritance, Constructor and Inheritance, Polymorphism,
2.4 Interfaces, Abstract classes, Delegates, Indexers, Sealed Classes,
2.5 Exception handling Collections and Generics Bounded and Unbounded Collections,
2.6 Generic Programming, Generic classes, Functions, Constraints on Generic Programming

Unit 3. Databases and C#
3.1 File Handling Text Files,
3.2 Binary Files, String Processing, Serialization and Deserialization
3.3 ADO.Net Connected and Disconnected,
3.4 Architecture of ADO. Net, Commands, Datasets, Data Readers, Data Adapters,
3.5 Working with Stored Procedures LINQ and the ADO.NET Entity Framework LINQ Introduction,
3.6 Mapping Your Data Model to an Object Model, Introducing Query Syntax 08

PART-B

Unit 4. Asp.Net Web Applications
4.1 Inheriting an Interface, Windows Forms ,
4.3 MsgBox, DialogBox, Handling Mouse and Keyboard Events
4.3 Basic Control Programming for following controls , Button , Label, Textbox,Rich Textbox, RadioButton , Checkbox, List Box, Checked List Box,Tree View, Picture Box, Tab Control

Unit 5. Data and State Management in ASP.NET
5.1 ASP.NET Websites with Themes
5.2 Master Pages, Data Source Controls,
5.3 Data Bound Controls,
5.4 ASP.NET State Management-Client Side and Server Side. ASP.NET and AJAX 10

Unit 6. Web Services
6.1 XML, Web Services Architecture, UDDI, SOAP and its Format,

6.2 WSDL, Create and Consuming XML Web Service Simple and Databases,
6.3 WCF- Architecture, End Points, Types of Contracts,
6.4 Web Applications and Security

Suggested Readings:

1. Ajit Singh, 2022, Advanced Web Technologies 2022, Amazon Digital Services LLC – Kdp
2. A B Nimbalkar, 2017, Advanced Web Technologies, Nirali Prakashan

Web Links:

1. https://www.scribd.com/document/501648827/Advance-Web-technology (Last Visited Date: 22nd February, 2024)

Instructions for paper setting: Seven questions are to be set in total. First question will be multiple choice covering entire syllabus and will be compulsory to attempt and will be of 18 marks. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 13 marks.

Evaluation Policy:

The evaluation will include two types of assessments:

(xxvii) Continuous or formative assessments (in the form of end semester examination or term examination. Weightage of assessments are as follows:

For continuous or Formative assessment (in semester): Maximum 30 percent. The categorization for the same is:

MCQs	30%
Subjective (Short/Long)	40%
Discussion/Presentation	15%
Projects/Group Activities etc	15%

(xxviii) For Summative assessment (End Semester Examination or End-Term Examination):

Minimum: 70 percent. Categorization for the same is:

Objective Type Questions:	30%
Short/Long Questions:	70%

Assessment Tools:

Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
OMCA-FSD-002.1	3	3	2	2	3		3						3	1
OMCA-FSD-002.2	1	1	2	3	1		2						3	1
OMCA-FSD-002.3	1	2	2	1	2								2	1
OMCA-FSD-002.4	1	1	2	1	1		3						1	2
OMCA-FSD-002.5	1	1	2	1			2	3					2	2

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH & STUDIES
(Deemed to be University under section 3 of the UGC Act 1956)

OMCA-MC-001: MOBILE COMPUTING BASICS

Periods/week	Credits	Max. Marks : 100
L: 2 T: 0	2	Continuous Evaluation: 30
Duration of Examination: 3 Hrs		End Semester Examination: 70

Pre-Requisite: Knowledge of Computer Networks
Course Type: Domain Elective

Course Outcomes: At the end of the course the student will be able to:
OMCA-MC-001.1 Define the concept of wireless communication & design of various cellular systems.
OMCA-MC-001.2 Describe working principle of wireless LAN and its standards.
OMCA-MC-001.3 Explain various techniques of multiple user access to scarce radio spectrum resources.
OMCA-MC-001.4 Compare different protocols for mobile adhoc networks
OMCA-MC-001.5 Analyze the working of the GPS system and the concept of location-based routing.
OMCA-MC-001.6 Design applications based on emerging technologies like Bluetooth, RFID, WI-MAX and Mobile IP.

PART -A

Unit 1: Introduction to Mobile Computing
1.1 Mobile computing features & characteristics
1.2 Issues in mobile computing
1.3 Novel applications
1.4 Limitations and architecture
1.5 Cellular concept
1.6 Air-interface
1.7 Channel structure
1.8 Channel allocation in cellular systems
1.9 GSM Architecture, GSM entities, call routing in GSM, CDMA
1.10 GPRS network architecture, network operations, data services, limitations, applications

Unit 2: Wireless LAN
2.1 IEEE 802.11 standards
2.2 Wireless LAN advantages and applications
2.3 Wireless LAN Architecture
2.4 Mobility in Wireless LAN
2.5 Security in Wireless LAN
2.6 WIFI versus 3G

Unit-3: Wireless Application Protocol (WAP)
3.1 Wireless Application Architecture
3.2 Wireless Application protocol Stack
3.3 Wireless Application environment
3.4 Wireless Application push architecture
3.5 Wireless Application push framework
3.6 Wireless session protocol
3.7 Wireless transmission protocol
3.8 WAP gateways and Applications

PART -B

Unit 4: Mobile Adhoc Network
4.1 Introduction to Adhoc networks
4.2 Definition to Adhoc networks
4.3 Characteristics to Adhoc networks
4.4 Applications to Adhoc networks
4.5 Adhoc mobility model: indoor & outdoor models
4.6 Security issues in Adhoc networks

Unit 5: Routing Protocols in Reference to Mobile Computing
5.1 Routing Protocols
5.2 Design issues
5.3 Goals & classification
5.4 Proactive versus reactive routing
5.5 Problems with Message Routing in Wireless Ad-hoc Mobile Networks
5.6 Routing scheme based on signal strength
5.7 Dynamic State Routing (DSR)
5.8 Route Maintenance and Routing error
5.9 Fisheye Routing (FSR)
5.10 Ad-hoc on Demand Distance Vector (ADDV)

Unit 6: **Emerging Technologies & Mobile IP**
6.1 Bluetooth protocol stack
6.2 Bluetooth security
6.3 Bluetooth application model
6.4 RFID, RFID tags, Application areas
6.5 WIMAX Architecture and applications
6.6 Mobile IP Goals
6.7 Assumptions & requirement agent discovery
6.8 Registration
6.9 Tunneling
6.10 Optimizations
6.11 Reverse tunneling

Suggested Readings:
1. Ashoke K Talukder and Roopa R Yavagal, 2006, Mobile Computing-Technology; Applications and Service Creation, Tata McGraw-Hill.
2. Jochen Schiller, 2004, Mobile Communications, Pearson Education.
3. UME Hansmann, Ltthar Merk, Martin-S-Nickous, Thomas Stohe, 2006, Principles of Mobile Computing, Springer International.

Note: Only latest editions of the books are recommended.

Web links:
https://www.tutorialspoint.com/mobile_computing/mobile_computing_evolution.htm (Last visited Date: 21 February, 2024)
https://sgar91.files.wordpress.com/2011/10/mobile_communications_schiller_2e.pdf (Last visited Date: 21 February, 2024)
http://freeofread.com/download/mobile-computing-talukdar/ (last visited date: 22 February 2024)

Instructions for paper setting: Seven questions are to be set in total. First question will be multiple choice covering entire syllabus and will be compulsory to attempt and will be of 18 marks. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 13 marks.

Evaluation Policy:
The evaluation will include two types of assessments:
(xxix) Continuous or formative assessments (in the form of end semester examination or term examination. Weightage of assessments are as follows:

For continuous or Formative assessment (in semester): Maximum 30 percent. The categorization for the same is:

MCQs	30%
Subjective (Short/Long)	40%
Discussion/Presentation	15%
Projects/Group Activities etc	15%

(xxx) For Summative assessment (End Semester Examination or End-Term Examination):
Minimum: 70 percent. Categorization for the same is:

Objective Type Questions: 30%
Short/Long Questions: 70%

Assessment Tools:
Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO 4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
OMCA-MC-001.1	2		1	1			2						3	3
OMCA-MC-001.2	1	3	1		1		1						2	2
OMCA-MC-001.3	1	2	2	2		2	1						2	3
OMCA-MC-001.4	1	2	2	2	3	2	1						3	2
OMCA-MC-001.5	2	3	2	2		2	2	1					2	2
OMCA-MC-001.6	3	2	2	1		1	2						2	2

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH & STUDIES
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OMCA-MC-002: MOBILE SOFTWARE TECHNOLOGIES

Periods/week	Credits	Max. Marks: 100
L: 2 T: 0	2	Continuous Evaluation: 30
Duration of Examination: 3 Hrs		End Semester Examination: 70

Pre-Requisite: Knowledge of Java and OS
Course Type: Domain Elective

Course Outcomes: At the end of the course the student will be able to:

OMCA-MC-002.1 Install and configure Android application development tools.
OMCA-MC-002.2 Design and develop user Interfaces for the Android platform.
OMCA-MC-002.3 Save state information across important operating system events.
OMCA-MC-002.4 Apply Java programming concepts to Android application development.
OMCA-MC-002.5 Design solutions using approaches that integrate ethical, social, legal, and economic responsibilities.

PART -A

Unit 1: Introduction
1.1 Introduction to Mobile Computing
1.2 Introduction to Android Development Environment
1.3 Mobile Software Engineering
1.4 Frameworks and Tools
1.5 Generic UI Development
1.6 Android User

Unit 2: User Interfaces
2.1 VUIs and Mobile Apps
2.2 Text-to-Speech Techniques
2.3 Designing the Right UI
2.4 Multichannel and Multimodal UIs
2.5 Intents and Services
2.6 Android Intents and Services
2.7 Characteristics of Mobile Applications

Unit-3: Storing and Retrieving Data
3.1 Synchronization and Replication of Mobile Data
3.2 Getting the Model Right
3.3 Android Storing and Retrieving Data
3.4 Working with a Content Provider

PART -B

Unit 4: Communications Via Network and the Web
4.1 State Machine
4.2 Correct Communications Model
4.3 Android Networking and Web
4.4 Deciding Scope of an App
4.5 Wireless Connectivity and Mobile Apps
4.6 Android Telephony

Unit 5: Notifications, Alarms and Graphics
5.1 Performance and Memory Management
5.2 Android Notifications and Alarms
5.3 Performance and Multithreading
5.4 Graphics and UI Performance
5.5 Android Graphics

Unit 6: **Putting It All Together (as time allows)**

6.1 Packaging and Deploying
6.2 Performance Best Practices
6.3 Android Field Service App
6.4 Active Transactions
6.5 More on Security
6.6 Hacking Android

Suggested Readings:

1. Virat V Giri, Sagar Chavan and Ashwinin Mane, 2023, Mobile Application Development, Tech Knowledge Publications
2. Michael Burton, 2022, Android App Development, Wiley.
3. UME Hansmann, Ltthar Merk, Martin-S-Nickous, Thomas Stohe, 2006, Principles of Mobile Computing, Springer International.

Note: Only latest editions of the books are recommended.

Web links:

https://www.javatpoint.com/android-tutorial (Last visited Date: 21 February, 2024)
https://www.w3schools.com/appml/ (Last visited Date: 21 February, 2024)

Instructions for paper setting: Seven questions are to be set in total. First question will be multiple choice covering entire syllabus and will be compulsory to attempt and will be of 18 marks. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 13 marks.

Evaluation Policy:

The evaluation will include two types of assessments:

(xxxi) Continuous or formative assessments (in the form of end semester examination or term examination. Weightage of assessments are as follows:

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MCQs	30%
Subjective (Short/Long)	40%
Discussion/Presentation	15%
Projects/Group Activities etc	15%

(xxxii) For Summative assessment (End Semester Examination or End-Term Examination):

Minimum: 70 percent. Categorization for the same is:

Objective Type Questions:	30%
Short/Long Questions:	70%

Assessment Tools:

Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO 4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
OMCA-MC-002.1	2		1	1			2						3	3
OMCA-MC-002.2	1	3	1		1		1						2	2
OMCA-MC-002.3	1	2	2	2		2	1						2	3
OMCA-MC-002.4	1	2	2	2	3	2	1						3	2

OMCA-MC-002.5	2	3	2	2		2	2	1					2	2
OMCA-MC-002.6	3	2	2	1		1	2						2	2

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH & STUDIES
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OMCA-MM-001: DIGITAL METHODS I: PHOTOSHOP, ILLUSTRATOR

Periods/week	Credits	Max. Marks: 100
L: 2 T: 0	2	Continuous Evaluation: 30
Duration of Examination: 3 Hrs		End Semester Examination: 70

Pre-Requisite: Knowledge of basics of Computer Graphics and Multimedia.
Course Type: Domain Elective

Course Outcomes: At the end of the course, the student will be able to:

OMCA-MM-001.1 Develop critical and creative thinking skills and perceptual awareness necessary for understanding and producing designs using specific design programs.
OMCA-MM-001.2 Understand and apply media, technology, and processes.
OMCA-MM-001.3 Organize the components of a work into a cohesive whole through knowledge of organizational principles of design and art elements.
OMCA-MM-001.4 Evaluate a range of subject matter and ideas to communicate intended meaning in designs through innovative methods.
OMCA-MM-001.5 Reflect upon and assess the characteristics and merits of their work and perceive connections between digital media and other disciplines.

PART- A

UNIT I: Getting Acquainted with Photoshop
1.1 PS environment, Various tools of PS
1.2 colour palette,
1.3 Basic Image Manipulation - Scanning images, editing their resolution and size
1.4 Bitmap and vector images, creating new images, and placing files
1.5 Painting Tools, brush tools, pencils, erasers, magic erasers, blending modes,
1.6 Brush Settings, brush palette and use the brushes of various sizes, shapes, and tips, along with other features of brushes.

UNIT II: Manipulating Images
2.1 Locking layers, linking and stacking layers, creating layer sets, and other important functions in layers
2.2 Making Selections- the lasso, marquee, magic wand, and other tools
2.3 Filling and Stroking- paint bucket tool, gradient editor, pattern maker, and other filling and stroking tools
2.4 Advanced Layers - layer styles, masking layers, creating knockouts
2.5 Text - enter, edit, select, and apply effects to text in an image
2.6 Using Channels and Masking - channels, masks, spot colours, alpha channels, and channels palette through this mobile.

UNIT III: Excelling Photoshop
3.1 Using Adobe Bridge.
3.2 Basic Photo Corrections- Retouching, straightening, cropping, and other basic correction techniques.
3.3 Retouching and Repairing - clone stamp tool to retouch and repair the damaged images
3.4 Creating Links within an Image - use slicing, jumping, and other actions to insert links within an image
3.5 Creating Rollover Web Visuals - rollover states, and how to create them
3.6 Animating GIF Images for the Web - to create and manipulate GIFs and use vector masks and other tools to edit them.

Part B

UNIT IV: INTRODUCTION TO ILLUSTRATOR
4.1 Straight Lines
4.2 Using the Pen Tool
4.3 Adjusting the Workspace

4.4 Arranging Objects Color Fills
4.5 Curves Drawing Curves (Pen Tool)
4.6 Anchor Points and Direction Points, Default Fill and Stroke

UNIT V
5.1 No Smoking Sign, Fill and Stroke
5.2 Basic Shape Tools, Grouping Objects Layers Panel
5.3 Working with Templates, Live Trace and Live Paint Tracing, Hand-Drawn Images
5.4 Coloring Live Paint Objects Brushes Flare Tool
5.5 Compound Paths Group Selection Tool
5.6 Mask Till You Drop Clipping Masks (Shapes), Blob Brush Tool Eraser Tool Reflect Tool Masking with Type Type Tool Clipping Masks (Editable Type) Filling Text with a Photo Placing Linked Images

UNIT VI: BUILDING YOUR GAME
6.1 Blend Tool Blending Options, Wavy Line Blend Blending Lines Reflect Tool Rotate Tool Juggling Colors and Gradients Dashed Lines and Stroke Options
6.2 Saving Colors as Swatches Blending Modes C Gradient Tool Saving Gradient Swatches Combining Shapes with the Pathfinder Merging Paths (Pathfinder)
6.3 Transparency Options Grouping Objects
6.4 Working with Type Text and Character Options Adding a Drop Cap Type on a Path Text Wrap Fill Text with a Pattern Stylin' Effects
6.5 Using the Appearance Panel Transparency Blending Modes Drop Shadows Arrowheads Appearance
6.6 Graphic Styles Graphic Styles Appearance Panel Multiple Fills Auto-sizing Text Boxes

Suggested Readings:

1. Adobe Photoshop CC Classroom in a Book, 2018, Andrew Faulkner, Conrad Chavez, Pearson.

Note: Only latest editions of the books are recommended.

Weblinks:
https://www.creativelive.com/class/adobe-illustrator-cc-the-complete-guide-jason-hoppe (Last Visited Date: 22-02-2024)

Instructions for paper setting: Seven questions are to be set in total. First question will be multiple choice covering entire syllabus and will be compulsory to attempt and will be of 18 marks. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 13 marks.

Evaluation Policy:
The evaluation will include two types of assessments:

(xxxiii) Continuous or formative assessments (in the form of end semester examination or term examination. Weightage of assessments are as follows:

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MCQs	30%
Subjective (Short/Long)	40%
Discussion/Presentation	15%
Projects/Group Activities etc	15%

(xxxiv) For Summative assessment (End Semester Examination or End-Term Examination):
Minimum: 70 percent. Categorization for the same is:

Objective Type Questions:	30%
Short/Long Questions:	70%

Assessment Tools:
Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO 5	PO 6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
OMCA-MM-001.1					1	1	1		1	1	1		1	1
OMCA-MM-001.2					1	1	1		1	1	1		1	1
OMCA-MM-001.3					1	1	1		1	1	1		1	1
OMCA-MM-001.4					1	1	1		1	1	1		1	1
OMCA-MM-001.5					1	1	1		1	1	1		1	1

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES
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OMCA-MM-002: ANIMATION FUNDAMENTALS

Periods/week	Credits	Max. Marks: 100
L :2 T: 0	2.0	Continuous Evaluation: 30
Duration of Exam: 3 Hrs		End Semester Examination: 70

Pre-Requisite: Basic Knowledge of computers is required
Course Type: Domain Elective

Course Outcomes: Students will be able to –

OMCA-MM-002.1. Understand the basic concept of computer graphics, Graphic devices, Graphics APIs, Graphics Pipeline, Open Source 3D computer graphics software/tools.

OMCA-MM-002.2 Describe and identify the concept of Typography, Typesetting, Handwriting & Calligraphy, Graffiti, Architectural lettering.

OMCA-MM-002.3. Apply the concept of Color theory, Color wheel, Color systems, page Layout, User interface design

OMCA-MM-002.4. Analyze the Blender open source tool to design the Graphics and Animation.

OMCA-MM-002.5. Evaluate the GIMP and Movie sandbox open source tool to design the Graphics and Animation.

OMCA-MM-002.6. Create different open source tools to design the Graphics and Animation.

PART- A

Unit-1: Introduction to Computer Graphics and Animation

1.1 Introduction, History of computer graphics
1.2 Graphics Design overview, Types of computer graphics
1.3 2D & 3D computer graphics, Graphics areas, Graphic devices
1.4 Display techniques.
1.4 Major applications, Graphics APIs, Graphics Pipeline
1.5 Graphics transformation.
1.6 Open source 2D & 3D computer graphics software/tools,
1.7 2D/3D Graphics Primitives

Unit-2: Introduction to Typography

2.1 Introduction to typography, History of Typography
2.2 History of computer Typefaces, Typesetting, Type design
2.3 The Anatomy of a Typeface, Classifying Types
2.4 Type Families
2.5 Handwriting & Calligraphy, Graffiti
2.6 Architectural lettering, Typography today

Unit -3: Colors, Page Layout

3.1 Introduction to Colors
3.2 Color theory
3.3 Three groups of colors, Color wheel
3.4 Color systems
3.5 Introduction to polygon filling.
3.6 Filling algorithms (Boundary fill, Flood fill & Scan line algorithms)
3.6 Introduction to Page Layout, front end versus back end
3.7 User interface design
3.8 Functionality requirements gathering
3.9 Information Architecture
3.10 Prototyping, Usability testing

PART- B

Unit -4: Blender

4.1 Introduction to Blender
4.2 rendering and Animation Basics (Blender Specific)
4.3 Installing Blender, Working with Blender
4.4 Blender Interface
4.5 Basic Blender Commands,
4.6 The Blender 3D view: Modeling, Material & Texture and Lights
4.7 Working with layers
4.8 Rendering, Character modeling
4.9 Animation, Blender in the Media
4.10 Blender when compared to other 3D Animation software.

Unit -5: GIMP

5.1 Introduction to GIMP
5.2 Features and capabilities
5.3 Basic concepts of GIMP
5.4 GIMP user interface,
5.5 Layer Groups

Unit- 6: Movie Sandbox

6.1 Introduction to Movie sandbox
6.2 Minimum system requirements
6.3 Movie using Movie sandbox, Nodes
6.4 Cameras in Movies sandbox
6.5 Recent development, Conclusion, Comparison

Suggested Books:

1. Roland Hess, 2010, Blender Foundations - The essential Guide to learning Blender 2.6, Routledge.
2. Steve Roberts, 2011, Character Animation Fundamentals - Developing skills for 2D and 3D Character animation, Routledge.

Software required/Weblinks:

http://en.wikipedia.org/wiki/Color Last Visited Date:22.02.2024
http://en.wikipedia.org/wiki/Blender_(software) Last Visited Date:22.02.2024
http://www.mopi.nl/blogo/ Last Visited Date:22.02.2024
http://www.blender.org/blenderorg/blender-foundation/history/ Last Visited Date:22.02.2024
http://www.blender.org/BL/ Last Visited Date:22.02.2024
http://www.blender.org/development/release-logs/blender-248/ Last Visited Date:22.02.2024
http://www.gimp.org/ Last Visited Date:22.02.2024
http://www.gimp.org/features/ Last Visited Date:22.02.2024
http://www.moviesandbox.net/ Last Visited Date:22.02.2024
http://wiki.moviesandbox.net/index.php?title=Main_Page Last Visited Date:22.02.2024

Instructions for paper setting: Seven questions are to be set in total. First question will be multiple choice covering entire syllabus and will be compulsory to attempt and will be of 18 marks. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 13 marks.

Evaluation Policy:

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MCQs	30%

Subjective (Short/Long) 40%
Discussion/Presentation 15%
Projects/Group Activities etc 15%

(xxxvi) For Summative assessment (End Semester Examination or End-Term Examination):
Minimum: 70 percent. Categorization for the same is:
Objective Type Questions: 30%
Short/Long Questions: 70%

Assessment Tools:
Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
End Semester Examination

COURSE ARTICULATION MATRIX:

CO Statement	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
OMCA-MM-002.1	-	1	-	2	3	-	-	-	-	-	-	-	-	1
OMCA-MM-002.2	-	1	-	2	3	-	-	-	-	-	-	-	-	1
OMCA-MM-002.3	-	1	2	-	-	-	-	-	-	-	-	-	-	-
OMCA-MM-002.4	-	-	-	2	3	-	-	-	-	-	-	-	2	-
OMCA-MM-002.5	-	-	-	2	-	-	-	-	-	-	-	-	2	-
OMCA-MM-002.6	-	-	-	2	3	-	-	-	-	-	-	-	3	-

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH & STUDIES
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OMCA-DS-117: BASICS OF E-COMMERCE

Periods/week Credits
L: 2 T: 0 2
Duration of Examination: 3 Hrs

Max. Marks : 100
Continuous Evaluation : 30
End Semester Examination: 70

Pre-Requisite: Knowledge of Internet
Course Type: Domain Elective

Course Outcomes: At the end of the course the student will be able to:

OMCA-DS-117. 1: Understand the fundamentals and importance of E-Commerce.
OMCA-DS-117.2: Classify trading relationships including Business to Consumer, Business-to-Business, Inter-organization.
OMCA-DS-117.3: Interpret the key features of Internet, Intranets and Extranets by demonstrating their relation with each other.
OMCA-DS-117.4: Analyze the major security challenges in using and making On-line transactions.
OMCA-DS-117.5: Examine the legal issues and Privacy in E-Commerce.
OMCA-DS-117..6: Design an embedded system by exploring marketing strategies and using IOT based applications.

PART-A

Unit 1: Introduction to E-Commerce
1.1 Introduction to E-Commerce
1.2 Main activities of E-Commerce
1.3 Goals of E-Commerce
1.4 Technical Components of E-Commerce
1.5 Advantages and disadvantages of E-Commerce
1.6 Scope of E-Commerce
1.7 Electronic Commerce Applications
1.8 Electronic Commerce and Electronic Business

Unit 2: Evolution of Internet
2.1 Domain Names and Internet Organization
2.2 Types of Network
2.3 Internet Service Provider
2.4 World Wide Web
2.5 Benefits of creating a Website
2.6 Registering a Domain Name
2.7 Web promotion
2.8 Shopping Bots

Unit 3: Internet Security
3.1 Secure Transaction
3.2 Computer Monitoring
3.3 Privacy on Internet
3.4 Corporate Email privacy
3.5 Computer Crime(Laws , Types of Crimes)
3.6 Threats and Attacks on Computer System
3.7 Software Packages for privacy
3.8 Hacking
3.9 Computer Virus
3.10 Encryption and Decryption
3.11 Public Key Encryption
3.12 Authorization and Authentication

3.13 Firewall
3.14 Digital Signature

PART-B

Unit 4: Internet, Extranet and Electronic Data Exchange
4.1 Definition of Internet
4.2 Advantages and Disadvantages of the Internet
4.3 Component of Internet Information technology structure
4.4 Development of Intranet
4.5 Extranet and Intranet Difference
4.6 Role of Internet in B2B Application
4.7 Concepts of EDI and its Limitation
4.8 EDI model
4.9 Applications of EDI

Unit 5: Planning for E-Commerce and EPS
5.1 Introduction
5.2 Types of Electronic Payment System
5.3 Payment Types
5.4 Electronic Cash
5.5 Linking objectives to business strategies
5.6 Strategies for developing electronic commerce web sites
5.7: Case study on Flip Kart, Amazon and Wall Mart

Unit 6: Internet Marketing and E –Governance for India
6.1 Concept of online shopping
6.2 Internet business
6.3 Internet marketing techniques
6.4 The E-cycle of Internet marketing
6.5 Personalization e-commerce
6.6 Indian customer
6.7 Service center
6.8 Imports
6.9 Exports

Suggested Readings:

1. Kamlesh K Bajaj, Debjani Nag, 2005, E-Commerce-Cutting Edge of Business, Tata McGraw Hill.
2. J Christopher Westland, Theodre H K Clark, 2001, Global Electronic Commerce-Theory and case studies, University Press.
3. G.S.V Muthy, 2019, E-Commerce Concepts, Models, Strategies, Himalaya Publications.
4. Chan, 2001, E-Commerce, Fundamentals and Applications, Wiley Publications.

Note: Only latest editions of the books are recommended.

Web Links:
https://www.tutorialspoint.com/e_commerce (Last visited Date: 21 February, 2024)
https://www.bestcourse4u.com › What is e-commerce (Last visited Date: 21 February, 2024)
https://ecommerceguide.com/guides (Last visited Date: 21 February, 2024)

Instructions for paper setting: Seven questions are to be set in total. First question will be multiple choice covering entire syllabus and will be compulsory to attempt and will be of 18 marks. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 13 marks.

Evaluation Policy:
The evaluation will include two types of assessments:
(xxxvii) Continuous or formative assessments (in the form of end semester examination or term examination. Weightage of assessments are as follows:

For continuous or Formative assessment (in semester): Maximum 30 percent. The categorization for the same is:

MCQs	30%
Subjective (Short/Long)	40%
Discussion/Presentation	15%
Projects/Group Activities etc	15%

(xxxviii) For Summative assessment (End Semester Examination or End-Term Examination):
Minimum: 70 percent. Categorization for the same is:

Objective Type Questions:	30%
Short/Long Questions:	70%

Assessment Tools:
Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
OMCA-DS-117.1			1		2	3	1	1	1				1	1
OMCA-DS-117.2		1	1		2	2	1			2		1	1	
OMCA-DS-117.3		1	1	1	1	2	1		1	1			1	1
OMCA-DS-117.4		1			1	2	1			1	2		1	1
OMCA-DS-117.5		1	1		1	2	1			1	1		1	
OMCA-DS-117.6	1	1			1	2	1	1		1	1	1	3	3

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH & STUDIES
(Deemed to be University under section 3 of the UGC Act 1956)

OMCA-DS-118: INTRODUCTION TO OPEN SOURCE SOFTWARE AND OPEN STANDARDS

Periods/week	Credits	Max. Marks : 100
L: 2 T: 0	2	Continuous Evaluation: 30
Duration of Examination: 2 Hrs		End Semester Examination:70

Prerequisite: Basic knowledge of open-source software and World Wide Web is essential.

Course Outcomes:
OMCA-DS-118.1 Gain knowledge of Open Standards including evolution of open standards.
OMCA-DS-118.2 Gain knowledge about the standard setters with clear differentiation between De Jure and De facto standard setters.
OMCA-DS-118.3 Gain knowledge about the adoption of open standards along with case studies.
OMCA-DS-118.4 Gain knowledge of open-source software including operating system LINUX and graphical user interface etc.
OMCA-DS-118.5 Gain knowledge about the evolution and benefits of open source and how to contribute to open-source projects.

Part A

Unit-1: Introduction to Standards
1.1 Introduction to Standards
1.2 Types of Standards: Open Standard, Closed Standard Summary and examples
1.3 Evolution of Standards
1.4 Life Cycle
1.5 Importance of Standards
1.6 Benefits of Open Standards

Unit-2: The Standard Setters
2.1 Standard Organizations
2.2 De Jure standard setters - International Organization for Standardization, International Electro technical Commission, International Telecommunication Union, ASEAN, Bureau of Indian Standards
2.3 De Facto Standard Setters -Bluetooth Special Interest group, USB Implementers forum; Testing and certification, Summary
2.4 Introduction, Drivers for adoption - Network effects, Lower costs, Impending benefits
2.5 Adoption methods and Process - Degree of association, Methods, process
2.6 Examples of Open Standards adoption in the world - SCOSTA, Web Standards
2.7 Adoption barriers, Early adopters

Unit-3: Adoption of Open Standards
3.1 Introduction; Drivers of Adoption
3.2 Adoption Methods and Process
3.3 Examples of Open Standard Adoptions in the World
3.4 Adoption Barriers; Early adopters
3.5 Open Standards Case Study 1 - Transfer Account Procedure (TAP)
3.6 Open Standards Case Study 2 - Open Document Format (ODF)
3.7 Major Principles of Open Standards - Openness, Consensus, Due Process, Open IPR, Open World, Open Access, Open meetings, Ongoing support, Open interfaces, Open use

Part B

Unit 4: Introduction to Open Source
4.1 Introduction to Open Source Software
4.2 History of Open Source Software
4.3 Initiation of Open Source project start
4.4 Open Source Software examples: The Origins, The GNU projects

4.5 The Operating System GNU/Linux, The Graphical User Interface KDE/GNOME, Apache Web Server, Application Software
4.6 Strengths and Advantages of Open Source Software - Network effects, Lower cost, Availability, Maintainability
4.7 Drivers for Adoption - Lower cost of ownership, Quality, Innovation reuse, Technical competence; Open Source Software Assessment
4.8 Examples of Open Source Adoption in the World, Open Source Challenges

Unit 5: History of Open Source
5.1 History, evolution and benefits of Open Source
5.2 History of Open Source - Evolution of UNIX
5.3 GNU General Public License - Genesis of GNU, Copyleft- All Rights reserved
5.4 Benefits of Open Source. Open Source Initiative (OSI)
5.5 Open Source definition; Free Software foundation
5.6 Open Source development process – Call for Contributions, MythBuster
5.7 Brook's law; Open Source Community
5.8 Apache Web Server; Apache Software Foundation (ASF); How to contribute to Open source projects?

Unit-6: Adoption of Open Source
6.1 Introduction; Drivers for Open Source adoption
6.2 Adoption Methods and Process
6.3 Examples of Open Standard Adoptions in the World
6.4 Open Source Challenges; Introduction
6.5 Open Standards Case Study 1 - Mozilla
6.6 Open Standards Case Study 2 – Linux

Suggested Books:
1. Huibert Vries, Henk Vries , Ilan Oshri, 2008, Standards-Battles in Open Source Software, Springer, 2008.

Weblinks:
1. http://www.oasis-open.org/org. (Last visited Date: 21 February, 2024)
2. http://www.odfalliance.org/ (Last visited Date: 21 February, 2024)
3. http://www.iso.org.(Last visited Date: 21 February, 2024)

Instructions for paper setting: Seven questions are to be set in total. First question will be multiple choice covering entire syllabus and will be compulsory to attempt and will be of 18 marks. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 13 marks.

Evaluation Policy:
The evaluation will include two types of assessments:

(xxxix) Continuous or formative assessments (in the form of end semester examination or term examination. Weightage of assessments are as follows:

For continuous or Formative assessment (in semester): Maximum 30 percent. The categorization for the same is:

MCQs	30%
Subjective (Short/Long)	40%
Discussion/Presentation	15%
Projects/Group Activities etc	15%

(xl) For Summative assessment (End Semester Examination or End-Term Examination):
Minimum: 70 percent. Categorization for the same is:

Objective Type Questions:	30%
Short/Long Questions:	70%

Assessment Tools:
Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO 4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
OMCA-DS-118.1	2	2											3	3
OMCA-DS-118.2					1	1	1						2	2
OMCA-DS-118.3				2		2							2	3
OMCA-DS-118.4	1	2	2		3			3	2		2		3	2
OMCA-DS-118.5	2	3	2			2							2	2

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH & STUDIES
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OMCA-IOT-001: IOT BASICS AND TECHNOLOGY

Periods/week	Credits	Max. Marks : 100
L: 2 T: 0	2	Continuous Evaluation : 30
Duration of Examination: 3 Hrs		End Semester Examination: 70

Pre-Requisite: Knowledge of Basics of Electronics & Networking
Course Type: Domain Elective

Course Outcomes: At the end of the course the student will be able to:

OMCA-IOT-001.1. Interpret the vision of IoT & explain in a concise manner how Internet of Things work
OMCA-IOT-001.2. Understand the basics of IoT networking, communication protocols, & sensor networks
OMCA-IOT-001.3. Use & application of wireless technologies and mobile networks for Internet of Things
OMCA-IOT-001.4. Compare and contrast the use of devices, gateways and data management in IoT
OMCA-IOT-001.5. Interfacing of sensing devices & implementation of IoT using Arduino & Raspberry Pi
OMCA-IOT-001.6. Illustrate the applications of IoT in industrial automation, connected vehicles, fog computing and identify real world design constraints.

PART-A

Unit 1: Introduction to IoT
1.1 Definition, characteristics, key applications, evolution, IoT enablers
1.2 connectivity layers
1.3 addressing & network configurations
1.4 Sensors & Actuators
1.5 Sensing: Sensors, Features, Types, Classes, Transducers
1.6 Actuation: Actuators, Features, Types, Classes

Unit 2: Basics of IoT Networking
2.1 IoT components
2.2 inter-dependencies,
2.3 Convergence of domain
2.4 functional components of IoT
2.5 IoT implementation
2.6 IoT categories
2.7 SoA, gateways
2.8 key technologies of IoT,
2.9 IoT challenges
2.10 IoT networking protocols: MQTT, CoAP, XMPP, AMQP

Unit 3: Connectivity Technologies
3.1 Introduction, working principles & features of key communication protocols
3.2 IEEE 802.15.4 (WPAN)
3.3 Zigbee
3.4 6LoWPAN
3.5 Bluetooth
3.6 NFC, RFID
3.7 WirelessHART, Z-wave,

PART-B

Unit 4: Sensor Networks
4.1 Wireless sensor networks
4.2 key features, characteristics,

4.3 applications, layers
4.4 sensor nodes, features & challenges
4.5 Sensor web, routing, object detections & tracking
4.6 Stationery & mobile WSN
4.7 UAVs & FANETs
4.8 Machine-to-Machine communication

Unit 5: Arduino Basics
5.1 Overview of microcontrollers & embedded systems
5.2 Ardunio key features, board types & specifications
5.3 Arduino Uno- pin configuration & architecture
5.4 Arduino IDE: setup & sketch structures
5.5 Operators, control statement, strings, loops, arrays, function libraries
5.6 Sample sketches & application examples
5.7 Interfacing of various types of sensors & actuators with Arduino board

Unit 6: **Introduction to Raspberry Pi & IoT Applications**
6.1 Raspberry Pi: Key features & specifications,
6.2 architecture, board types
6.3 Operating system, basic setup of Raspberry Pi
6.4 Implementation of IoT with Raspberry Pi, examples
6.5 Introduction to SDN, Cloud & Fog computing
6.6 Smart Cities, Smart Homes, Connected vehicles, Smart grids
6.7 Introduction to Industrial IoT (IIoT)

Suggested Readings:

1. Vijay Madisetti and Arshdeep Bahga, 2014, "Internet of Things (A Hands-on-Approach)", 1st Edition, VPT.
2. Pethuru Raj and Anupama C. Raman, 2017, "The Internet of Things: Enabling Technologies, Platforms, and Use Cases",CRC Press.
3. Francis daCosta, 2013, "Rethinking the Internet of Things: A Scalable Approach to Connecting Everything", 1st Edition, Apress Publications.
4. Cuno Pfister, 2011, "Getting Started with the Internet of Things", O"Reilly Media.
5. Jan Holler, Vlasios Tsiatsis, Catherine Mulligan, Stefan Avesand, Stamatis Karnouskos, David Boyle, 2014, "From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence", Academic Press.

Note: Only latest editions of the books are recommended.

Web Links:
https://www.edx.org/learn/iot-internet-of-things (Last visited Date: 21 February, 2024)
https://nptel.ac.in/courses/106105166/# (Last visited Date: 21 February, 2024)
https://geekflare.com/internet-of-things-iot-learning-resources/ (Last visited Date: 21 February, 2024)
https://onlinecourses.nptel.ac.in/noc22_cs53/preview (Last visited Date: 21 February, 2024)
https://www.techtarget.com/iotagenda/definition/Internet-of-Things-IoT (Last visited Date: 21 February, 2024)

Instructions for paper setting: Seven questions are to be set in total. First question will be multiple choice covering entire syllabus and will be compulsory to attempt and will be of 18 marks. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 13 marks.

Evaluation Policy:
The evaluation will include two types of assessments:

(xli) Continuous or formative assessments (in the form of end semester examination or term examination. Weightage of assessments are as follows:

For continuous or Formative assessment (in semester): Maximum 30 percent. The categorization for the same is:

MCQs	30%
Subjective (Short/Long)	40%
Discussion/Presentation	15%
Projects/Group Activities etc	15%

(xlii) For Summative assessment (End Semester Examination or End-Term Examination):
Minimum: 70 percent. Categorization for the same is:
Objective Type Questions: 30%
Short/Long Questions: 70%

Assessment Tools:
Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO 5	PO 6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
OMCA-IOT-001.1	1		1	1	2		2						2	1
OMCA-IOT-001.2	1	1	2	3	1		2						3	2
OMCA-IOT-001.3	2	2	1	1	2								2	1
OMCA-IOT-001.4	1	2	2	1	1		2						1	2
OMCA-IOT-001.5	1	1	2	1			2	3					2	2
OMCA-IOT-001.6	1	1	2	1	1		2	2				3	1	1

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH & STUDIES
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OMCA-IOT-002: HARDWARE ARCHITECTURES

Periods/week	Credits	Max. Marks: 100
L: 2 T: 0	2	Continuous Evaluation: 30
Duration of Examination: 3 Hrs		End Semester Examination: 70

Pre-Requisite: Basic concepts of C Programming
Course Type: Domain Elective

Course Outcomes: At the end of the course, the student will be able to:

OMCA-IOT-002.1. Learn the functional block diagram of a single bus architecture of a computer.
OMCA-IOT-002.2. Describe the function of the instruction execution cycle, RTL interpretation of instructions, addressing modes, instruction set.
OMCA-IOT-002.3. Demonstrate assembly language program for specified microprocessor for computing 16-bit multiplication, division and I/O device interface (ADC, Control circuit, serial port communication).
OMCA-IOT-002.4. Categorize & describe the process for Concurrent access to memory and cache coherency in Parallel Processors.
OMCA-IOT-002.5. Compare different CPU organizations and instructions and will be able to design a memory module and able to analyse its operation by interfacing with the CPU.
OMCA-IOT-002.6. Appraise CPU performance, and apply design techniques to enhance performance using pipelining, parallelism and RISC methodology.

PART-A

Unit 1: Functional blocks of a computer
1.1 Functional blocks of a computer: CPU, memory, input-output subsystems, control unit.
1.2 Instruction set architecture of a CPU – registers, instruction execution cycle.
1.3 RTL interpretation of instructions, addressing modes, instruction set.
1.4 Case study – instruction sets of some common CPUs.
1.5 Case study –on Intel i-series processors.
1.6 Case study –on mobile processors.

Unit 2: Data representation
2.1 Signed number representation,
2.2 Fixed and floating point representations, character representation.
2.3 Computer arithmetic – integer addition and subtraction,
2.4 Ripple carry adder, carry look-ahead adder, etc.
2.5 Multiplication – shift-and add, both multiplier, carry save multiplier, etc.
2.6 Division restoring and non-restoring techniques, floating point arithmetic.

Unit 3: Microprocessor architecture, CPU control unit and Memory system design
3.1 Introduction to x86 architecture.
3.2 CPU control unit design: hardwired and micro-programmed design approaches.
3.3 Case study – design of a simple hypothetical CPU.
3.4 Memory system design: semiconductor memory technologies,
3.5 Memory organization.

PART-B

Unit 4: Peripheral devices and their characteristics
4.1 Peripheral devices and their characteristics: Input-output subsystems
4.2 Peripheral devices and their characteristics: I/O device interface
4.3 I/O transfers – program controlled,
4.4 Interrupt driven and DMA,
4.5 Privileged and non-privileged instructions, software interrupts and exceptions.

4.6 Programs and processes – role of interrupts in process state transitions
4.7 I/O device interfaces – SCII, USB.

Unit 5: Pipelining and parallel processing
5.1 Pipelining: Basic concepts of pipelining,
5.2 Throughput and speedup,
5.3 Pipeline hazards.
5.2 Parallel Processors: Introduction to parallel processors.
5.3 Concurrent access to memory and cache coherency.

Unit 6: Memory organization
6.1 Memory organization: Memory interleaving,
6.2 Memory organization: concept of hierarchical memory organization
6.3 Cache memory, cache size vs. block size,
6.4 Mapping functions
6.5 Replacement algorithms,
6.6 Write policies.

Suggested Books:

1. David A. Patterson and John L. Hennessy, 2013, "Computer Organization and Design: The Hardware/Software Interface", Elsevier.
2. Carl Hamache, 2022, "Computer Organization and Embedded Systems", McGraw Hill Higher Education.
3. John P. Hayes, 1998, "Computer Architecture and Organization", McGraw-Hill.
4. William Stallings, 2016, "Computer Organization and Architecture: Designing for Performance", Pearson Education.

Note: Only latest editions of the books are recommended.

Web Links:
https://www.edrawsoft.com/article/computer-architecture.html (Last visited Date: 21 February, 2024)

Instructions for paper setting: Seven questions are to be set in total. First question will be multiple choice covering entire syllabus and will be compulsory to attempt and will be of 18 marks. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 13 marks.

Evaluation Policy:
The evaluation will include two types of assessments:

(xliii) Continuous or formative assessments (in the form of end semester examination or term examination. Weightage of assessments are as follows:

For continuous or Formative assessment (in semester): Maximum 30 percent. The categorization for the same is:

MCQs	30%
Subjective (Short/Long)	40%
Discussion/Presentation	15%
Projects/Group Activities etc	15%

(xliv) For Summative assessment (End Semester Examination or End-Term Examination):
Minimum: 70 percent. Categorization for the same is:

Objective Type Questions:	30%
Short/Long Questions:	70%

Assessment Tools:
Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
End Semester Examination

Course Articulation Matrix:

CO Statement	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2
OMCA-IOT-002.1	2			1						1		2	-	2
OMCA-IOT-002.2	3	3			2	1	2			2			2	2
OMCA-IOT-002.3		3	3	2				1	1					2
OMCA-IOT-002.4	2	3		2		2			1	1		3	2	2
OMCA-IOT-002.5	3			2	1	-	2	1	2			3		2
OMCA-IOT-002.6	3			2	2			2	2	2	2	-	3	3

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH & STUDIES
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OMCA-DaS-001: PROBABILITY AND STATISTICS

Periods/week	Credits	Max. Marks: 100
L: 2 T: 0	2	Continuous Evaluation: 30
Duration of Examination: 3 Hrs		End Semester Examination: 70

Pre-Requisite: Knowledge of basic mathematics
Course Type: Domain Elective

Course Outcomes: At the end of the course the student will be able to:

OMCA-Das-001.1. Learn the language and core concepts of probability theory
OMCA-DaS-001.2. Interpret the ability to solve problems based on basic principles of statistical inference.
OMCA-DaS-001.3. Relate Statistical Techniques in other domains of study.
OMCA-DaS-001.4. Examine the impact of Skewness and outliers on the various statistical interpretations.
OMCA-DaS-001.5. Develop critical reasoning by studying statistical concepts
OMCA-DaS-001.6. Apply various types of statistical tools & Linear Programming in research & real-time problems.

PART - A

Unit 1: Introduction to Probability
1.1 Counting
1.2 Random variables,
1.3 Distributions
1.4 Quartiles
1.5 Mean Variance
1.6 Types of Probability

Unit 2: Laws of Probability
2.1 Sum of all probabilities
2.2 Addition of probabilities,
2.3 Multiplication of probabilities,
2.4 Complementary events

Unit 3: Conditional Probability
3.1 Conditional probability,
3.2 Bayes' theorem,
3.3 Base rate fallacy
3.4 Joint distributions,
3.5 covariance, correlation, independence
3.6 Central limit theorem

PART-B

Unit 4: Elements of Statistics

4.1 Measures of Central Tendency
4.2 Measures of Variations Covariance
4.3 Correlation and Coefficient of Correlation
4.4 Regression
4.5 Regression lines

Unit 5: Probability Distribution

5.1 Basic Concepts of Probability Distributions
5.2 Binomial Distribution
5.3 Poisson Distribution
5.4 Normal Distribution
5.5 Fitting of Normal distribution to Data

Unit 6: Sampling and Statistical Test

6.1 Concept of Sampling
6.2 Level of Significance
6.3 Critical Region
6.4 Test of Significance for large Samples
6.5 Sampling with small Samples
6.6 $\chi 2$ - Distribution

Suggested Readings:

1. Babu Ram, 2014, Engineering Mathematics, Volume II, Pearson Education
2. Glyn James, 2010, Advanced Modern Engineering Mathematics, Pearson Education
3. Bruce Cooperstein, 2015, Advanced Linear Algebra, Chapman and Hall Publication.
4. Kaare Brandt Petersen, 2012, Michael Syskind Pedersen, The Matrix Cookbook, Technical University of Denmark.

Note: Only latest editions of the books are recommended.

Instructions for paper setting: Seven questions are to be set in total. First question will be multiple choice covering entire syllabus and will be compulsory to attempt and will be of 18 marks. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 13 marks.

Evaluation Policy:

The evaluation will include two types of assessments:

(xlv) Continuous or formative assessments (in the form of end semester examination or term examination. Weightage of assessments are as follows:

For continuous or Formative assessment (in semester): Maximum 30 percent. The categorization for the same is:

MCQs	30%
Subjective (Short/Long)	40%
Discussion/Presentation	15%
Projects/Group Activities etc	15%

(xlvi) For Summative assessment (End Semester Examination or End-Term Examination):

Minimum: 70 percent. Categorization for the same is:

Objective Type Questions:	30%
Short/Long Questions:	70%

Assessment Tools:
Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
OMCA-Das-001.1	1		1	1	2		3						2	3
OMCA-DaS-001.2	1	1	2	3	1		2						3	3
OMCA-DaS-001.3	1	2	0	1	2								3	1
OMCA-DaS-001.4	1		2	1	1		3						1	3
OMCA-DaS-001.5	1	2		1			2	3					1	2

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES
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NAAC 'A++' Grade University

OMCA-DaS-002: INTRODUCTION TO DATA SCIENCE

Periods/week	Credits	
L :2 T: 0	2.0	Max. Marks: 100
		Continuous Evaluation: 30
Duration of Exam: 3 Hrs		End Semester Examination: 70

Pre-Requisite: Basic Knowledge of Mathematics and Python
Course Type: Domain Elective

Course Outcomes: Students will be able to –

OMCA-Das-002.1 Demonstrate proficiency with statistical analysis of data.
OMCA-Das-002.2 Execute statistical analyses with professional statistical software.
OMCA-Das-002.3. Apply data science concepts and methods to solve problems in real-world contexts and will communicate these solutions effectively.
OMCA-Das-002.4. ability to build and assess data-based models.

PART–A

UNIT 1: Introduction to Data Science
1.1 Introduction to Data Science
1.2 Understanding Data: Definition and Types
1.3 Importance and Applications of Data Science
1.4 Key Components of Data Science
1.5 Data Science vs. Data Analytics

UNIT 2: Languages of Data Science I
2.1 Introduction to Python for Data Science
2.2 Packages and APIs for Data Science
2.3 Working with Datasets and Models
2.4 Popular Data Science Libraries: NumPy, Pandas, and Scikit-learn

UNIT 3: Languages of Data Science II
3.1 Introduction to R
3.2 Exploring RStudio for Data Science
3.3 Data Science Workflow: Jupyter Notebooks and Version Control with Git

PART –B

UNIT 4: Data Exploration and Preprocessing
4.1 Understanding Data: Types and Sources
4.2 Data Cleaning Techniques: Handling Missing Data, Outliers, and Inconsistencies
4.3 Data Transformation and Feature Engineering

UNIT 5: Data Analysis and Modeling
5.1 Introduction to Statistical Analysis
5.3 Statistical Measures: Central Tendency, Variability, and Correlation
5.3 Visualization Techniques and Tools: Matplotlib, Seaborn, and Tableau
5.4 Data Visualization Techniques: Plotting, charts, graphs

UNIT 6: Data Ethics and Privacy

6.1 Ethical considerations in data science
6.2 Privacy issues in data science
6.3 Anonymization, data anonymization techniques, and data protection regulation
6.4 Introduction to responsible data science practices and guidelines

Suggested Readings:

1. Peter Bruce, 2020, Practical Statistics for Data Scientists, 2e: 50+ Essential Concepts Using R and Python, O'Reilly
2. Andrew Park, 2020, Data Science for Beginners

Note: Only latest editions of the books are recommended.

Web Links:

- https://www.w3schools.com/datascience/ (last visited date: 22 February 2024)
- https://www.javatpoint.com/data-science (last visited date: 22 February 2024)

Instructions for paper setting: Seven questions are to be set in total. First question will be multiple choice covering entire syllabus and will be compulsory to attempt and will be of 18 marks. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 13 marks.

Evaluation Policy:

The evaluation will include two types of assessments:

(xlvii) Continuous or formative assessments (in the form of end semester examination or term examination. Weightage of assessments are as follows:

For continuous or Formative assessment (in semester): Maximum 30 percent. The categorization for the same is:

MCQs	30%
Subjective (Short/Long)	40%
Discussion/Presentation	15%
Projects/Group Activities etc	15%

(xlviii) For Summative assessment (End Semester Examination or End-Term Examination):
Minimum: 70 percent. Categorization for the same is:

Objective Type Questions:	30%
Short/Long Questions:	70%

Assessment Tools:

Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO 5	PO 6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
OMCA-DaS-002.1	2	2		3	2		2					1		1
OMCA-DaS-002.2	2	1	2	1	1		1						3	2
OMCA-DaS-002.3	2		1	1	2							1		2
OMCA-DaS-002.4	1	2	2	3	1		2						1	2

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH & STUDIES
(Deemed to be University under section 3 of the UGC Act 1956)

OMCA-BC-001: INTRODUCTION TO BLOCKCHAIN

Periods/week	Credits	Max. Marks: 100
L: 2 T: 0	2	Continuous Evaluation : 30
Duration of Examination: 3 Hrs		End Semester Examination : 70

Pre-Requisite: Fundamentals of Cybersecurity
Course Type: Domain Elective

Course Outcomes: At the end of the course, the student will be able to:
OMCA-BC-001.1. Understand the concepts of Blockchain
OMCA-BC-001.2. Know about usage of the protocols
OMCA-BC-001.3. Understand the hyper ledger fabric
OMCA-BC-001.4. Learn the implementation of the blockchain
OMCA-BC-001.5. Learn about application of Blockchain in Financial Systems
OMCA-BC-001.6. Learn about application of Blockchain in Trade and Supply

PART-A

Unit 1: Introduction to Blockchain
1.1 Distributed Ledgers
1.2 Design Primitives
1.3 Security issues

Unit 2: Understanding BlockChain
2.1 Consensus
2.2 Permissions
2.3 Privacy

Unit 3: Protocols in Blockchain
3.1 Consensus protocols
3.2 Proof of Work (PoW)
3.3 Scalability aspects of Blockchain consensus protocols
3.4 Permissioned Blockchains: Design goals
3.5 Consensus protocols for Permissioned Blockchains

PART-B

Unit 4: Hyperledger
1.1 Decomposing the consensus
1.2 Hyperledger fabric components
1.3 Design and Implementation of Hyperledger Fabric
1.4 fabric SDK and Front End
1.5 Hyperledger composer tool

Unit 5: Applications
5.1 Blockchain in Financial Software and Systems (FSS):
(i) Settlements (ii) KYC (iii) Capital markets (iv) Insurance

Unit 6: Applications-II
6.1 Blockchain in trade / supply chain: (i) Provenance of goods, visibility, trade/supply cian finance, invoice management discounting, etc. Date and time strings

Suggested Readings:
1. Andreas Antonopoulos, 2017, Mastering Bitcoin: Unlocking Digital Cryptocurrencies, Shroff/ O'Reilly.
2. Melanie Swa, 2015, Blockchain, O'Reilly

Note: Only latest editions of the books are recommended.

WebLinks:
https://www.redbooks.ibm.com/Redbooks.nsf/RedbookAbstracts/crse0401.html (Last visited date: 23rd February, 2024)

Instructions for paper setting: Seven questions are to be set in total. First question will be multiple choice covering entire syllabus and will be compulsory to attempt and will be of 18 marks. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 13 marks.

Evaluation Policy:

The evaluation will include two types of assessments:

(xlix) Continuous or formative assessments (in the form of end semester examination or term examination. Weightage of assessments are as follows:

For continuous or Formative assessment (in semester): Maximum 30 percent. The categorization for the same is:

MCQs	30%
Subjective (Short/Long)	40%
Discussion/Presentation	15%
Projects/Group Activities etc	15%

(l) For Summative assessment (End Semester Examination or End-Term Examination):

Minimum: 70 percent. Categorization for the same is:

Objective Type Questions:	30%
Short/Long Questions:	70%

Assessment Tools:
Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
OMCA-BC-001.1	2		1	2	1		2			1			3	1
OMCA-BC-001.2	1			1			3	1		1	2	1	2	
OMCA-BC-001.3	2		2		1	1			1		2		2	
OMCA-BC-001.4	1		1	2			3	1	3		2		3	2

OMCA-BC-001.5		1	1		2		3	1			2		1	
OMCA-BC-001.6	2		3		1		3		2		3		1	3

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH & STUDIES
(Deemed to be University under section 3 of the UGC Act 1956)

OMCA-BC-002: BLOCK CHAIN IMPLEMENTATION & APPLICATIONS

Periods/week	Credits	Max. Marks: 100
L: 2 T:	2	Continuous Evaluation : 30
Duration of Examination: 3 Hrs		End Semester Examination : 70

Pre-Requisite: Blockchain

Course Type: Domain Elective

Course Outcomes: At the end of the course the student will be able to:

OMCA-BC-002.1. Contentedly discuss and describe the history, types and applications of Blockchain
OMCA-BC-002.2. Gain familiarity with cryptography and Consensus algorithms.
OMCA-BC-002.3. Create and deploy projects using Web3j.
OMCA-BC-002.4. Implement an ICO on Ethereum and design blockchain based application with Swarm & IPFS.

PART-A

Unit 1: Introduction to Blockchain

1.1 Distributed DBMS
1.2 Limitations of Distributed DBMS
1.3 Introduction to Block chain – History, Definition, Distributed Ledger
1.4 Blockchain Categories – Public, Private, Consortium

Unit 2: Blockchain Architecture

1.1 Blockchain Network and Nodes, Peer-to-Peer Network
1.2 Mining Mechanism
1.3 Generic elements of Blockchain
1.4 Features of Blockchain
1.5 Types of Blockchain.

Unit 3: Blockchain Architecture

3.1 Operation of Bitcoin Blockchain
3.2 Blockchain Architecture – Block, Hash, Distributer P2P
3.3 Structure of Blockchain- Consensus mechanism: Proof of Work (PoW), Proof of Stake (PoS), Byzantine Fault Tolerance (BFT), Proof of Authority (PoA) and Proof of Elapsed Time (PoET)

PART-B

Unit 4: Blockchain Futures System

1.1 Project presentation
1.2 Futures smart contract: Blockchain
1.3 Oracles- Web3j: Setting up the Web3J- Installing web3j
1.4 Wallet creation
1.5 Java client: The wrapper generator
1.6 Initializing web3j- Setting up Ethereum accounts
1.7 Deploying the contract Aliases and pre-qualifier

Unit 5: Blockchains in Business and creating

1.1 Public versus private and permissioned versus permission less blockchains
5.2 Privacy and anonymity in Ethereum-
1.2 The Ethereum Enterprise Alliance Blockchain as-a-Service- Initial Coin Offering (ICO)

1.3 Project setup for ICO implementation- Token contracts-
1.4 Token sale contracts-Contract security and testing the code. Date and time strings

Unit 6: Distributed Storage IPFS and Swarm

6.1 Ethereum Virtual Machine- Swarm
6.2 IPFS: Installing IPFS
6.3 Hosting our frontend: Serving your frontend using IFPS
6.4 Serving your frontend using Swarm
6.5 IPFS file uploader project: Project setup the web page

Suggested Readings:

1. Imran Bashir, 2018,"Mastering Blockchain: Distributed Ledger Technology, decentralization, and smart contracts explained", 2nd Edition, Packt Publishing Ltd.
2. Bellaj Badr, Richard Horrocks, Xun (Brian) Wu, 2018, "Blockchain By Example: A developer's guide to creating decentralized applications using Bitcoin, Ethereum, and Hyperledger", Packt Publishing Limited.
3. Andreas M. Antonopoulos, 2015, "Mastering Bitcoin: Unlocking Digital Cryptocurrencies", O'Reilly Media Inc.
4. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller and Steven Goldfeder, 2016, "Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction", Princeton University Press.

Note: Only latest editions of the books are recommended.

Weblinks

- https://www.ibm.com/products/blockchain-platform-hyperledger-fabric (last visited date: 22 February 2024)
- https://www.oracle.com/in/blockchain/ (last visited date: 22 February 2024)

Instructions for paper setting: Seven questions are to be set in total. First question will be multiple choice covering entire syllabus and will be compulsory to attempt and will be of 18 marks. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 13 marks.

Evaluation Policy:

The evaluation will include two types of assessments:

(Ii) Continuous or formative assessments (in the form of end semester examination or term examination. Weightage of assessments are as follows:

For continuous or Formative assessment (in semester): Maximum 30 percent. The categorization for the same is:

MCQs	30%
Subjective (Short/Long)	40%
Discussion/Presentation	15%
Projects/Group Activities etc	15%

(Iii) For Summative assessment (End Semester Examination or End-Term Examination):

Minimum: 70 percent. Categorization for the same is:

Objective Type Questions:	30%
Short/Long Questions:	70%

Assessment Tools:

Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

COURSE ARTICULATION MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
OMCA-BC-002.1	1		1	2	2		3						3	1
OMCA-BC-002.2	1	1	2	3	1		2						3	1
OMCA-BC-002.3	1	2	2	1	2								2	1
OMCA-BC-002.4	1	1	2	1	1		3						1	2

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH & STUDIES
(Deemed to be University under section 3 of the UGC Act 1956)

OMCA-DO-001: DEVOPS ESSENTIALS

Periods/week Credits
L: 2 T: 0 P:0
Duration of Examination: 3 Hrs

Max. Marks : 100
Continuous Evaluation : 30
End Semester Examination : 70

Pre-Requisite: Knowledge of Linux operating system and command-line interface.

Course Type: Domain Elective

Course Outcomes: At the end of the course the student will be able to:

OMCA-DO-001.1. Define discuss the key concepts and principles of DevOps.
OMCA-DO-001.2. Learning the basics of Git, version control, and repositories..
OMCA-DO-001.3. Utilize Jenkins for automation and continuous integration to streamline software development processes
OMCA-DO-001.4. Understanding the concept of treating infrastructure as code.
OMCA-DO-001.5. Learning Docker fundamentals, containers, and images.
OMCA-DO-001.6. Exploring monitoring and Implementing effective logging practices for troubleshooting.

PART-A

UNIT 1: Introduction to DevOps
1.1 Introduction to DevOps and its importance in software development
1.2 DevOps Principles
1.3 DevOps Benefits
1.4 DevOps Culture
1.5 DevOps Tools
1.6 DevOps Processes

UNIT 2: Source Control Management with Git
2.1 Introduction to Git
2.2 Git Fundamentals
2.3 Git Workflow
2.4 Git Collaboration
2.5 Git Integration

UNIT 3: Continuous Integration & Delivery with Jenkins
3.1 Introduction to continuous integration
3.2 Setting up Jenkins for continuous integration
3.3 Building and testing code with Jenkins
3.4 Jenkins Installation and Configuration
3.3 Introduction to continuous delivery
3.4 Setting up Jenkins for continuous delivery
3.5 Deploying code with Jenkins Jobs

PART-B

UNIT 4: Infrastructure as Code with Terraform
4.1 Introduction to infrastructure as code
4.2 Understanding Terra form and its features
4.3 Deploying infrastructure with Terraform
4.4 Introduction to configuration management
4.5 Understanding Ansible and its features
4.6 Configuring servers with Ansible

UNIT 5: Containerization with Docker
5.1 Introduction to containerization
5.2 Understanding Docker and its features
5.3 Building and deploying containers with Docker Functions of Transport Layer
5.4 Introduction to container orchestration
5.5 Understanding Kubernetes and its features
5.6 Deploying and managing applications with Kubernetes

UNIT 6 : Monitoring and Logging
6.1 Introduction to monitoring and logging
6.2 Understanding monitoring tools such as Prometheus and Grafana
6.3 Configuring logging with tools such as ELK stack Logical link Control (LLC)
6.4 Understanding cloud services and its role in DevOps
6.5 Deploying and managing applications in cloud environment
6.6 Understanding the DevOps culture and collaboration
6.7 Implementing DevOps culture in organizations

Suggested Readings:
1. Gene Kim, Jez Humble, Patrick Debois, and John Willis, 2019, The DevOps Handbook: How to Create World-Class Agility, Reliability, and Security in Technology Organizations, Revolution press.
2. Jez Humble and David Farley, 2018, Continuous Delivery: Reliable Software Releases through Build, Test, and Deployment Automation, Addison Welsey.
Note: Only latest editions of the books are recommended.
Weblinks:
https://www.tutorialspoint.com/market/course/industrial_engineering_operations_research/index.jsp (Last Visited Date: 21st February, 2024)

Instructions for paper setting: Seven questions are to be set in total. First question will be multiple choice covering entire syllabus and will be compulsory to attempt and will be of 18 marks. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 13 marks.

Evaluation Policy:
The evaluation will include two types of assessments:

(liii) Continuous or formative assessments (in the form of end semester examination or term examination. Weightage of assessments are as follows:

For continuous or Formative assessment (in semester): Maximum 30 percent. The categorization for the same is:

MCQs	30%
Subjective (Short/Long)	40%
Discussion/Presentation	15%
Projects/Group Activities etc	15%

(liv) For Summative assessment (End Semester Examination or End-Term Examination):
Minimum: 70 percent. Categorization for the same is:

Objective Type Questions:	30%
Short/Long Questions:	70%

Assessment Tools:
Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
OMCA-DO-001.1	3	1		1	2			1			1		1	
OMCA-DO-001.2		3			2							1	2	2
OMCA-DO-001.3			3		2		2			1			2	1
OMCA-DO-001.4		3			2						1		1	
OMCA-DO-001.5	1			3		2							2	2
OMCA-DO-001.6	3		3					2					2	2

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH & STUDIES
(Deemed to be University under section 3 of the UGC Act 1956)

OMCA-DO-002: AWS SERVICES

Periods/week	Credits	Max. Marks: 100
L: 2 T: 0	2	Continuous Evaluation: 30
Duration of Examination: 3 Hrs		End Semester Examination: 70

Pre-Requisite: Knowledge of Computer Network

Course Type: Domain Elective

Course Outcomes: At the end of the course the student will be able to:

OMCA-DO-002.1. Identify and understand the concept of AWS

OMCA-DO-002.2. Understand the concept of cloud storage over the traditional storage

OMCA-DO-002.3. Analyse the concept of a Virtual private cloud

OMCA-DO-002.4. Apply the concept of configuring Auto Scaling for real Application Infrastructure

OMCA-DO-002.5. Configure the Relational database services (RDS) and Application Services and identify the Security & Identity Services

PART-A

Unit 1: Introduction and getting started with AWS

1.1 Introduction to Cloud Computing
1.2 Different AWS projects and services
1.3 Setting up of the AWS account
1.4 AWS Global Infrastructure and its benefits
1.5 EC2 instances, Features of Amazon EC2
1.6 Different EC2 Instance purchasing options and placement groups

Unit 2: Amazon EC2 and Simple Storage Services

2.1 Amazon AMI
2.2 AMI creation, security groups, key pairs
2.3 Traditional storage tiers, Disadvantages of traditional storage over cloud
2.4 AWS storage options: EBS, S3 & Glacier
2.5 AWS Connecting Storage: Snowball & Storage Gateway

Unit 3: Virtual Private Cloud & Direct Connect

3.1 Subnet and Subnet Mask
3.2 VPC and its benefits
3.3 Default and Non-default VPC
3.4 Components of VPC
3.5 Direct Connect

PART -B

Unit 4: Elastic Load Balancing & Auto Scaling

4.1 Components and types of load balancing
4.2 Auto scaling and its benefits
4.3 Dynamic Scaling
4.4 Lifecycle of auto-scaling
4.5 Components and policies of auto-scaling

Unit 5: Relational database services (RDS) and Application Services

5.1 Introduction to RDS
5.2 Different database services of AWS: Amazon RDS, DynamoBD, RedShift, ElastiCache
5.3 Configuring the database
5.4 Configuring backups
5.5 Connecting to Database
5.6 AWS Application Services: SQS, SNS, SES
5.7 AWS Compute Services: Lambda and Elastic Beanstalk

Unit 6: Security & Identity Services

6.1 Benefits, features and components of OpsWorks
6.2 Benefits of Chef, Cookbook, Recipes
6.3 OpsWorks lifecycle events
6.4 Security and identity services
6.5 IAM and KMS

Suggested Readings:

1. Mark Wilkins, 2019, Learning Amazon Web Services (AWS): A Hands-On Guide to the Fundamentals of AWS Cloud Addison-Wesley Professional.
2. Andreas Wittig and Michael Wittig, 2018, Amazon Web Services in Action, Manning.
3. Albert Anthony, 2017, Mastering AWS Security, Packet Publishing.

Note: Only latest editions of the books are recommended.

WebLinks:

1. https://www.guru99.com/what-is-aws.html (Last Visited Date:Date: 22nd February, 2024)

Instructions for paper setting: Seven questions are to be set in total. First question will be multiple choice covering entire syllabus and will be compulsory to attempt and will be of 18 marks. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 13 marks.

Evaluation Policy:

The evaluation will include two types of assessments:

(lv) Continuous or formative assessments (in the form of end semester examination or term examination. Weightage of assessments are as follows:

For continuous or Formative assessment (in semester): Maximum 30 percent. The categorization for the same is:

MCQs	30%
Subjective (Short/Long)	40%
Discussion/Presentation	15%
Projects/Group Activities etc	15%

(lvi) For Summative assessment (End Semester Examination or End-Term Examination):

Minimum: 70 percent. Categorization for the same is:

Objective Type Questions:	30%
Short/Long Questions:	70%

Assessment Tools:

Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
OMCA-DO-002.1	1		1	2	2		2						3	1
OMCA-DO-002.2	1	1	2	3	1		2						3	1
OMCA-DO-002.3	1	2	1	1	2								2	1
OMCA-DO-002.4	1	1		1	1		3						1	2
OMCA-DO-002.5	1	1	2	1			2	1					2	2

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES
(Deemed to be University under section 3 of the UGC Act 1956)
NAAC 'A++' Grade University

OMCA-CN-001: FUNDAMENTALS OF COMPUTER NETWORKS

Periods/week Credits
L :2 T: 0 2.0

Max. Marks: 100
Continuous Evaluation: 30
End Semester Examination: 70

Duration of Exam: 3 Hrs

Pre-Requisite: Basic Knowledge of Animation is required
Course Type: Domain Elective

Course Outcomes: Students will be able to –

OMCA-CN-001.1. Explain basic concepts, OSI reference model, services and role of each layer of OSI model.
OMCA-CN-001.2 Describe and assign the IP addresses.
OMCA-CN-001.3. Understand the various protocols in Wireless Networking
OMCA-CN-001.4. Design and implement the utilities in TCP/IP Networking.

PART –A

UNIT 1: Introduction to Networking & OSI Model

1.1Why use networks
1.2Types of Networks
1.3 How networks are used?
1.4 OSI Model
1.5 Applying the OSI Model
1.6 IEEE Networking Specifications
1.7 Transmission Basics
1.8 Common Media Characteristics

UNIT 2: TCP/IP and Ethernet Standards

1.1 Characteristic of TCP/IP
1.2 The TCP/IP Model
1.3 IPv4 Addressing
1.4 IPv6 Addressing
2.1 Assigning IP addresses
2.2 Host Name and DNS
2.3 Ethernet Standards
2.4 Network Hardware: (Switches, Routers, Gateways, Hub, Cables)

UNIT 3: Wide Area Network & Wireless Networking

3.1 WAN Essentials
3.2 WAN Topologies
3.3 Wireless Spectrum
3.4 Wireless Transmission
3.5 WLAN Architecture
3.6 802.11 WLANs
3.7Wireless WANs

PART – B

UNIT 4: Designing and Implementing TCP/IP Networking

1.1 Designing TCP/IP based Networks
1.2 TCP/IP Mail Services
1.3 TCP/IP Utilities
1.4 Implementing TCP/IP in the Command Line

UNIT 5: Virtual Networks and Network Security

1.1 Virtual Networks and VLANs
1.2 Remote Access
1.3 VPNs
1.4 Network Security & Security Risks
1.5 Encryption
1.6 Wireless Network Security

UNIT 6: Troubleshoot Network, Network Protocols and Management

6.1 Troubleshooting Methodology
6.2 Troubleshooting Tools
6.3 Fundamentals of Network Management
6.4 Network Protocols
6.1 Fault and Performance Management

Suggested Readings:

1. Tamara Dean, 2010, Network+ Guide to Networks, 7th Edition. Course Technology - Cengage Learning
2. Don Anderson, Jay Trodden, 2003, Hyper Transport System Architecture: MindShare, Inc, Addison-Wesely Professional
3. Charles E. Spurgeon, 2014, Ethernet: The Definitive Guide, O'Reilly Media Inc.
4. Jenna Matthews, 2005, Computer Networking: Internet Protocols in Action, John Wiley & Sons
5. Tanenbaum, A.S., 2010, Computer Networks: Prentice Hall

Note: Only latest editions of the books are recommended.

Web Links:

https://www.javatpoint.com/computer-network-tutorial (last visited date: 22 February 2024)
https://www.tutorialspoint.com/computer_fundamentals/computer_networking.htm(last visited date: 22 February 2024)

Instructions for paper setting: Seven questions are to be set in total. First question will be multiple choice covering entire syllabus and will be compulsory to attempt and will be of 18 marks. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 13 marks.

Evaluation Policy:

The evaluation will include two types of assessments:

(lvii) Continuous or formative assessments (in the form of end semester examination or term examination. Weightage of assessments are as follows:

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Discussion/Presentation	15%
Projects/Group Activities etc	15%

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Short/Long Questions:	70%

Assessment Tools:

Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO 5	PO 6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
OMCA-CN-001.1	2	2		3	2		2					1		1
OMCA-CN-001.2	2	1	2	1	1		1						3	2
OMCA-CN-001.3	2		1	1	2							1		2
OMCA-CN-001.4	1	2	2	3	1		2						1	2

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH & STUDIES

(Deemed to be University under section 3 of the UGC Act 1956)

OMCA-CN-002: ROUTING PROTOCOLS AND ARCHITECTURES

Periods/week	Credits	Max. Marks: 100
L: 2	2	Continuous Evaluation: 30
Duration of Examination: 3 Hrs		End Semester Examination: 70

Pre-Requisite: Fundamentals of Computer Networks
Course Type: Domain Specific

Course Outcomes: At the end of the course, students will be able to
OMCA-CN-002.1. Understand basic concept of Routing in Computer Networks.
OMCA-CN-002.2. Explore various Routing Protocols and their Characterstics.
OMCA-CN-002.3. Understand the concept of Routing Algorithm and Apply different routing protocols over network layer and transport layer.
OMCA-CN-002.4. Analyze different routing protocols requires to be configured in real routers along with the framework of the concerned routing algorithms.
OMCA-CN-002.5. Understanding next generation routing algorithms in the domain of wireless networking.

PART –A

UNIT 1: Network Routing: Basics and Foundations
1.1 An Introduction to Routing Algorithms
1.2 Types of routers
1.3 Functions of Router
1.4 Router architectures
1.5 Routing tables
1.6 Static Routing and Dynamic Routing

UNIT 2: Routing Algorithms
2.1 The Optimality Principle
2.2 Unicast & Multicast Routing
2.2 Shortest Path Routing
2.3 Flooding
2.4 Distance Vector Routing & Link State Routing
2.5 Hierarchical Routing
2.6 Broadcast Routing
2.7 Routing for Mobile Hosts
2.8 k Shortest Paths Algorithm

Unit 3: Network Layer Routing
3.1 The IP Protocol
3.2 IP Addresses
3.3 Internet Control Protocols
3.4 Routing Information Protocol
3.5 OSPF-The Interior Gateway Routing Protocol
3.6 BGP-The Exterior Gateway Routing Protocol
3.7 Internet Multicasting
3.8 Mobile IP & IPv6

PART-B

UNIT 4: Internet Transport Protocols
4.1 Transmission Control Protocol
4.2 User Datagram Protocol
4.3 Internet Protocol

4.4 TCP Congestion Control
4.5 Stream Control Transmission Protocol
4.6 Wireless TCP & UDP
4.7 Transactional TCP.

UNIT 5: Next Generation Routing
5.1 Background of QoS and QoS Routing
5.2 QoS Attribues
5.3 Traffic Engineering
5.4 Extension to Routing Protocols
5.5 Multiprotocol Label Switching (MPLS),
5.6 Generalized MPLS
5.7 MPLS Virtual Private Networks

UNIT 6: Wireless Routing Protocols
6.1 Routing in cellular radio mobile communication networks
6.2 Packet radio Routing Internet based mobile ad-hoc networking
6.3 Wireless Networks Routing Algorithms
6.4 Destination sequenced Distance Vector(DSDV)
6.5 Dynamic source Routing (DSR)
6.6 Ad-hoc On demand Distance Vector(AODV)
6.7 Temporarily Ordered Routing algorithm (TORA)

Suggested Readings:

1. B. Forouzan, 2017, Data Communication and Networking, Tata McGraw Hill.
2. A.S. Tanenbaum,2016, Computer networks, Prentice Hall.
3. Tomasi Wayne, 2007, Introduction to Data Communication & Networking, Pearson Education
4. Uyless Black, 1993, Protocol Standards and Interfaces, Computer networks, Black, Prentice Hall Education

Note: Only latest editions of the books are recommended.

Weblinks:

https://www.smartzworld.com/notes/computer-network-cn-notes-pdf (last visited date: 22 February 2024)
https://www.tutorialspoint.com (last visited date: 22 February 2024)
www.tutorialspoint.com/listtutorials/networking/1 Last Visited Date:23.02.2024

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Evaluation Policy:

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(lix) Continuous or formative assessments (in the form of end semester examination or term examination. Weightage of assessments are as follows:

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Discussion/Presentation	15%
Projects/Group Activities etc	15%

(lx) For Summative assessment (End Semester Examination or End-Term Examination):

Minimum: 70 percent. Categorization for the same is:

Objective Type Questions:	30%
Short/Long Questions:	70%

Assessment Tools:
Assignment/Tutorials
Sessional tests

Surprise questions during lectures/Class Performance
Term end examination

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
OMCA-CN-002.1		2		1		1	3						2	1
OMCA-CN-002.2	2	2	2				3			1			3	2
OMCA-CN-002.3		3		1			2						2	
OMCA-CN-002.4	2	3			1		2		1		1		1	2
OMCA-CN-002.5	2	1	1		2		3			1				

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH & STUDIES

(Deemed to be University under section 3 of the UGC Act 1956)

OMCA-AR-001: AUGMENTED REALITY FOUNDATIONS

Periods/week	Credits	Max. Marks : 100
L: 2 T: 0	2	Continuous Evaluation : 30
Duration of Examination: 3 Hrs		End Semester Examination: 70

Pre-Requisite: Nil
Course Type: Domain Elective

Course Outcomes: At the end of the course the student will be able to:
OMCA-AR-001.1. Historical and modern overviews and perspectives of Augmented Reality
OMCA-AR-001.2. Understand the technologies, components and hardware needed for AR
OMCA-AR-001.3. Implement the AR and hand-on preparation
OMCA-AR-001.4. Impart the importance of augmented reality with real-time examples
OMCA-AR-001.5. Gain knowledge of software tools required for AR
OMCA-AR-001.6. Understand the applications of AR and VR

PART-A

Unit 1: Introduction to Augmented Reality

1.1 History of Augmented reality and characteristics
1.2 Difference between Augmented Reality and Virtual Reality
1.3 AR technological components
1.4 Technologies used in AR
1.5 Feature Extraction
1.6 Hardware components- AR devices
1.7 Importance of AR - Real world uses of AR
1.8 AR types – Software tools available for AR

Unit 2: Technologies needed for Augmented Reality

1.9 Hardware technology
1.10 virtual scenes
1.11 3D objects
1.12 AR components – Display, HMD, Eyeglasses, Contact Lenses
1.13 AR powered devices
1.14 AR application development drawbacks
1.15 Compatibility and Performance
1.16 R libraries
1.17 Motion tracking, Environmental understanding
1.18 Anchors

Unit 3: Technology Integration and Implementation of AR

3.1 Technology use and integration in industrial settings
3.2 Assistive training
3.3 Planning and administration for implementation
3.4 AR implications
3.5 Practical data – AR labs
3.6 Platforms to form AR content
3.7 Coordinated utilization of AR applications
3.8 Hands-on preparation

PART-B

Unit 4: Augmented Reality and Virtual Reality for Micro Learning

4.1 Micro learning techniques
4.2 Utilizing VR for learning
4.3 VR for Practical online assessment

4.4 VR infographics, Virtual case considerations
4.5 Utilizing AR for learning, Accessible learning, sensible data
4.6 Elevated learner engagement
4.7 VR technology – Components, Hardware, applications

Unit 5: Tools for Augmented Reality
5.1 Tools available for Augmented Reality and Recognition
5.2 Software Tools – Google Poly, Unity
5.3 Software approaches-recognition types
5.4 Native software solutions – ARKit, ARCore
5.5 software development kit
5.6 Cloud services

Unit 6: **Applications of Augmented Reality**
6. 1 AR business applications
6. 2 weather prediction
6. 3 market prediction
6. 4 smart cities
6. 5 AR application for Education
6. 6 AR application for Healthcare sector, Agriculture, Civil Engineering, Architecture, Archaeology, Crime and Security, Games, IoT
6. 7 Use cases- Social Media, Gaming, Education, Healthcare, Shopping and Business

Suggested Readings:

1. Schmalstieg D, and Hollerer T.,2016, Augmented Reality: Principles & Practice, Pearson Education India.
2. Coiffet, P., Burdea, G. C., 2003, "Virtual Reality Technology," Wiley-IEEE Press.
3. Kaliraj, P., Devi, T., 2021, Innovating with Augmented Reality: Applications in Education and Industry, CRC Press, Taylor & Francis Group, Boca Raton.
4. Craig, A. B.,2013, "Understanding Augmented Reality, Concepts and Applications," Morgan Kaufmann.

Note: Only latest editions of the books are recommended.

Web Links:
https://gamedevacademy.org/best-ar-tutorials/ (last visited date: 22 February 2024)
https://www.geeksforgeeks.org/basics-augmented-reality/ (last visited date: 22 February 2024)
https://www.simplilearn.com/tutorials/artificial-intelligence-tutorial/all-about-augmented-reality (last visited date: 22 February 2024)
https://www.youtube.com/watch?v=WzfDo2Wpxks (last visited date: 22 February 2024)

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Assessment Tools:
Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO 5	PO 6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
OMCA-AR-001.1	2	2		3	2		2					1		1
OMCA-AR-001.2	2	1	2	1	1		1						3	2
OMCA-AR-001.3	2		1	1	2							1		2
OMCA-AR-001.4	1	2	2	3	1		2						1	2
OMCA-AR-001.5		1	2	1			2	3				1	2	3
OMCA-AR-001.6	1	1	1	1	1		2	2				2	1	1

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES
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NAAC 'A++' Grade University

OMCA-AR-002: ANIMATION & RENDERING TECHNIQUES

Periods/week Credits
L :2 T: 0 2.0

Max. Marks: 100
Continuous Evaluation: 30
Duration of Exam: 3 Hrs
End Semester Examination: 70

Pre-Requisite: Basic Knowledge of Animation is required
Course Type: Domain Elective

Course Outcomes: Students will be able to –

OMCA-AR-002.1. Understand the basic concept of computer graphics, Graphic devices, Graphics APIs, Graphics Pipeline, open-source 3D computer graphics software/tools.
OMCA-AR-002.2 Describe and identify the concept of Character setup.
OMCA-AR-002.3. Apply the concept of 3D Muscle system in Animation
OMCA-AR-002.4. Analyze the Surfacing concept and its practical usage in Animation.
OMCA-AR-002.5. Evaluate the role of 3D Lighting to design the Graphics and Animation.
OMCA-AR-002.6. Create different Animations using different tools and Rendering

PART- A

Unit-1: Introduction to Computer Graphics and Animation

1.1 Introduction, History of computer graphics
1.2 Graphics Design overview, Types of computer graphics
1.3 2D & 3D computer graphics, Graphics areas, Graphic devices
1.4 Display techniques.
1.4 Major applications, Graphics APIs, Graphics Pipeline
1.5 Graphics transformation.
1.6 Open source 2D & 3D computer graphics software/tools,
1.7 2D/3D Graphics Primitives

Unit-2: Introduction to Character setup

2.1 Riggers role & Criteria for a good rig
2.2 Joints and skeletons, Creating skeleton hierarchy, Constraints
2.3 Forward (FK) and Inverse kinematics (IK), FK, IK joint structures
2.4 Animation controllers, Blend shapes, Clusters, Biped Rig- Analyzing reference
2.5 Anatomy of human body, Bone placements, Setting up Torso, Biped Arms, Fingers, Legs/Foot controls, Skinning,
2.6 Facial Rig- Anatomy of a face, The Facial Action Coding System(FACS), Mouth shapes, Phonemes, Animation controllers for Face, Character GUI.

Unit-3: Introduction to 3D Muscle system

3.1 Components of Muscle, Capsules, Spline based muscle system,
3.2 Stretch based muscle systems, Muscle Objects and skins,
3.3 Assigning weights to Muscle skin, Muscle Builder,
3.4 Muscle Parameters, Custom muscle systems,
3.5 Wrinkles, fold, jiggle, Slide, Collide, Muscle control.

PART- B

Unit -4: Surfacing

4.1 Lofting, Surface, Extruded Surface, Planar Surface, Beveled Surface,
4.2 Boundary Surface – Combining Techniques
4.3 Surface History – Modeling with Deformers
4.4 Editing NURBS Surfaces – Using NURBS Surfacing to Create Polygons
4.5 Converting NURBS to Polygons Patch Modeling – Using Artisan to Sculpt NURBS.
4.6 Modeling with Deformers
4.7 Subdivisions Surfaces: The Lattice – Creating a Base Poly Model, Modeling and Animations, Interiors - More complex UV mapping, Programmatic movement.

Unit -5: 3D Lighting

5.1 Directional lights
5.2 Spot lights,
5.3 Types of lights in 3D space,
5.4 Light attributes,
5.5 3 Point lighting, 2 Point lighting,
5.6 Shadows, photo real environmental lighting

Unit- 6: Rendering

6.1 3D rendering
6.2 Advance lighting effects,
6.3 Shading material for objects: Anisotropic, Blinn, Lambert, Pong, Pong E, Layer Shader, Ocean Shader, Hair tube shader, Ramp shader, Shading Map,
6.4 Surface shader, Refining shading materials, Mental ray rendering and Toon shade rendering.
6.5 IPR rendering, Software, Hardware rendering, Batch rendering,
6.6 Creating various output as per the end user requirements and maintaining the resolution.

Suggested Books:

1. Graphics and Animation Tools, IBM ICE Publication.
2. Roland Hess, Blender Foundations - The essential Guide to learning Blender 2.6
3. Steve Roberts, Character Animation Fundamentals - Developing skills for 2D and 3D Character animation.

Software required/Weblinks:

http://www.blender.org Last Visited Date:22-02-2024
http://www.gimp.org/ Last Visited Date: 22-02-2024
http://www.moviesandbox.net/ Last Visited Date: 22-02-2024

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Short/Long Questions:	70%

Assessment Tools:

Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
End Semester Examination

COURSE ARTICULATION MATRIX:

CO Statement	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
OMCA-AR-002.1	-	1	-	2	3	-	-	-	-	-	-	-	-	1
OMCA-AR-002.2	-	1	-	2	3	-	-	-	-	-	-	-	-	1
OMCA-AR-002.3	-	1	2	-	-	-	-	-	-	-	-	-	-	-
OMCA-AR-002.4	-	-	-	2	3	-	-	-	-	-	-	-	2	-
OMCA-AR-002.5	-	-	-	2	-	-	-	-	-	-	-	-	2	-
OMCA-AR-002.6	-	-	-	2	3	-	-	-	-	-	-	-	3	-

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OCDC-511: PLACEMENT COMPETENCY ENHANCEMENT-I

L	T	P	Credits	
4			2	

Total Marks: 100
Continuous Evaluation: 30
Duration of Examination: 2 Hrs
End Semester Examination: 70

Course Outcomes: At the end of the course,

OCDC-511.1: Students will be able to enhance and expand word knowledge by fostering word consciousness.
OCDC-511.2: Students will be able to construct simple and complex sentences accurately and develop reading skills & build verbal reasoning skills.
OCDC-511.3: Students will be able to enhance their effectiveness and behave professionally
OCDC-511.4: Students will be able to enhance their ability to ace interviews,
OCDC-511.5: Students will be able to analyze various forms of data and solve complex problems based on arithmetic reasoning.
OCDC-511.6: Students will be able to apply short tricks on complex problems of the number system.

PART – A (VERBAL ABILITY)

Unit 1: Communication Accuracy

1.1 Relevance of Verbal Ability and preparatory guidelines
1.2 Functional Grammar – Subject Verb Agreement
1.3 Tenses – Perfect, Simple, Continuous
1.4 Common Errors and rectification, Idioms and Phrases
1.5 Word Power Building Skills - Root word technique, antonyms, synonyms, verbal analogies

Unit 2: Reading & Writing Skills

2.1 Objectives of Reading, Definition & Types of Reading & Importance of Reading
2.2 Reading Techniques: SQ3R, Active Reading, Detailed, Speed Reading
2.3 Practice Exercises: Short & Medium Passages
2.4 Sentences, Phrases, Types of Sentences, Parts of Sentences
2.5 Paragraph Writing: Construction, Linkage & Cohesion
2.6 Email writing using given phrases

PART – B (INTERVIEW ENHANCEMENT)

Unit 3: Personal Effectiveness

3.1 Communication Enhancement
3.2 Goal Setting
3.3 Professionalism - Integrity, Workplace ethics
3.4 Teamwork & Leadership
3.5 Time Management

Unit 4: Interview Prep-1

4.1 Developing the employability mindset, Researching the employer
4.2 Preparing for Self -Introduction
4.3 Drafting Cover letters / Emails
4.4 Dressing Dos & Don'ts
4.5 Acing the interview
4.6 Group Discussion
4.7 Resume

PART – C (APTITUDE)

Unit 5: Arithmetic

- 5.1 Numbers
- 5.2 Percentages
- 5.3 Profit and Loss
- 5.4 Simple Interest & Compound Interest
- 5.5 Ratio & Proportion
- 5.6 Partnership
- 5.7 Time Speed & Distance

Unit 6: Reasoning

- 6.1 Blood Relation
- 6.2 Coding Decoding
- 6.3 Direction Sense

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES
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OMCA-DS-001: Fundamentals of Computer Programming

Periods/week Credits
L: 2 T: 0P :0 Audit Pass
Duration of Examination: 3 Hrs

Max. Marks: 100
Continuous Evaluation: 30
End Semester Examination: 70

Pre-Requisite: None
Course Type: Bridge

Course Outcomes: At the end of the course, students will be able to
OMCA-DS-001.1 Understand the structured programming designs and the basic elements of Computer Programming
OMCA-DS-001.2 Describe and differentiate various types of Open Source Software
OMCA-DS-001.3. Construct program code using simple and nested selection/decision control structure to make decision.
OMCA-DS-001.4. Use pre& post tested loop/repetitive control structure while writing program code to process same sequence of tasks/activities.
OMCA-DS-001.5. Apply various open source tools for improving development efficiency.

PART - A

UNIT 1: Introduction to Programming
1.1 History of Programming,
1.2 Difference b/w Programming Languages
1.3 System Development Life Cycle
1.4 Introduction to OOP
1.5 Introduction to Python : Installation, Python IDE
1.6 Syntax Rules and Basic Program
1.7 Numbers and Math Functions

UNIT 2:Programming Standards
2.1Flow Chart
2.2Pseudo Code and Hierarchy Chart
2.3 Syntax Errors
2.4 Logical Errors and Runtime Errors
2.5 Detailed Working of a Compiler
2.6 Difference Between Compiler and Interpreter.

UNIT 3: Programming Controls
3.1 Controls and Properties
3.2 Variables and Arithmetic Operations
3.3 Writing Program that Handle a Control Events
3.4 Strings
3.5 Data type conversions
3.6 Built –in functions

PART - B

UNIT 4: Introduction to Open Source
4.1. Why open source, What is Open Source, Open Source Principles
4.2. Software License provider, Free Software Vs Open Source Software
4.3. Open Source Standards, Methodologies, Philosophy

4.4. Case Studies: Apache, Linux ,Mozilla Firefox

UNIT 5: Open Source Programming Languages

5.1. Various Open Source Programming Languages.
5.2. Programming Language Case Study: Python, Java, PHP
5.3. Open Source vs Closed Source Programming.
5.4. Server Side vs Client Side Programming.
5.5. Front-End and Back-End

UNIT 6: Open Source Programming Tools

6.1. Starting and Maintaining an Open Source Project
6.2. Open Source Ethics.
6.3. Open Source IDE's and Editors (Eclipse, Atom, Sublime Text).
6.4. Source Code Management (Git)
6.5. Open Source Project Repositories(GitHub, SourceForge, Google Code etc.)

Suggested Readings:

1. E. Balaguruswami, 2016, Programming in ANSI 'C', Tata McGraw- Hill, 7th Edition
2. Ashok Kamthane, 2006, Programming with ANSI and TURBO C, Pearson
3. Karl Fogel, 2005, Producing Open Source Software, Oreilly Media
4. Mark Pilgrim, 2004, Dive into Python, Apress Publications

Note: Only latest editions of the books are recommended.

Software required/ Web links:

Turbo C
Python 3.x
https://www.tutorialspoint.com/cprogramming/index.htm (last visited date: 22 February 2024)
https://www.cprogramming.com/tutorial/c-tutorial.html (last visited date: 22 February 2024)

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Surprise questions during lectures/Class Performance
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OMCA-DS-001.1	1				2	1	3	2	1	-			2	1
OMCA-DS-001.2		3	2	1			3			3		1		3
OMCA-DS-001.3	1	3	2	2	2				1				2	1
OMCA-DS-001.4	2	1		1	2							1	2	2
OMCA-DS-001.5	1	1	2		2	1				2			2	2

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

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OMCA-DS-002: ELEMENTS OF MATHEMATICS

Periods/week	Credits	Max. Marks : 100
L: 2	Audit Pass	Continuous Evaluation : 30
Duration of Examination: 3 Hrs		End Semester Examination : 70

Pre-Requisite: None
Course Type: Fundamental

Course Outcomes: At the end of the course the student will be able to:

OMCA-DS-002.1. Understand the concept of matrices and various operations performed on matrices
OMCA-DS-002.2. Learn basic concepts of probability
OMCA-DS-002.3. Use different types of functions
OMCA-DS-002.4. Develop the concept of Set, Relations and Function
OMCA-DS-002.5. Apply mathematics in real life.

PART-A

UNIT 1: Set Theory
1.1 Elements of set methods of describing a set
1.2 Types of Set
1.3 Venn diagram
1.4 Difference of a set
1.5 Union intersection and difference of set duality and applications
1.6 Partitioning of a set

UNIT 2:Relation and Function
2.1 Definition of Relation
2.2 Application of relation
2.3 Definition of function
2.4 Cartesian product
2.5 Concepts of domain, co-domain and range
2.6 Application on domain and range

UNIT 3: Matrices and Determinants
3.1 Matrices
3.2 Types of matrices
3.3 Operation on matrices
3.4 Scalar multiplication and multiplication of matrices
3.5 Determinant
3.6 Inverse of matrices
3.7 Cramer's Rule

PART- B

UNIT 4: Binomial and Permutations, Combinations
4.1 Definition and basics of binominal theorem
4.2 Positive index

4.3 Applications of binomial theorem (Only positive index)
4.4 Basics of Permutations and Combinations

UNIT5: Co-ordinate Geometry

5.1 Quadrant Planes
5.2 Distance Formula
5.3 Section Formula
5.4 Bisection Formula,
5.5 Slope
5.6 Equations of straight Line
5.7 Angle between two lines.

UNIT6: Probability

6.1 Basics of Probability
6.2 Addition Theorem on Probability
6.3 Conditional Probability
6.4 Multiplication Theorem on Probability
6.5 Independent Events
6.6 Baye's Theorem

Suggested Readings:

1. Dr. Babu Ram, 2010, Discrete Mathematics, Pearson Publication
2. Schaum Series ,2007, Discrete Mathematics, Tata McGraw Hill
3. Dr. Delip Kumar,2016, Elements of Mathematics, Jeevan Sons Publications.

Note: Only latest editions of the books are recommended.

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Sessional tests
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OMCA-DS-002.1	1		1	2	2		3						3	1
OMCA-DS-002.2	1	1	2	3	1		2						3	1
OMCA-DS-002.3	1	2	2	1	2								2	1
OMCA-DS-002.4	1	1	2	1	1		3						1	2
OMCA-DS-002.5	1	1	2	1			2	3					2	2

SEMESTER-II

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH & STUDIES
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OMCA-RIC-II: Research and Innovation Catalyst-II

Periods/week	Credits	Max. Marks	: 100
T: 1	0.5	Continuous Evaluation	: 100

Pre-requisites: Research and Innovation Catalyst-I
Course Type: Research & Training
Course Outcomes: The students will be able
OMCA-RIC-II.1. To critically evaluate the work done by various researchers relevant to the research topic
OMCA-RIC-II.2. To integrate the relevant theory and practices followed in a logical way and draw appropriate Conclusions
OMCA-RIC-II.3. To understand the research methodologies/approaches/techniques used in research/ Innovation domains
OMCA-RIC-II.4. To structure and organize the collected information or findings through an appropriate abstract, headings, reference citations and smooth transitions between sections
OMCA-RIC-II.5. To learn the structuring of the paper/ concept in the form of Power Point Presentation
OMCA-RIC-II.6. To adapt working with group members and outside world.

Unit 1: Literature Survey (LS)
1.1 Collection of research papers related to previously identified gap/problem
1.2 Comprehend and arrange the literature based on the idea framed
1.3 Presenting the collected data and inferring it with the further scope of expansion

Unit 2: Structuring of Review Paper
2.1 Analysis of different approach/methodology adopted by various researchers
2.2 Listing out the components of the paper w.r.t the problem
2.3 Identification of suitable Journal or Conference
2.4 Formatting/Styling the paper according to the respective template

Unit 3: Presenting the findings
3.1 Structuring and preparation of PPT
3.2 Mock presentation
3.3 Review on presentation skills and content delivered both
3.4 Incorporating the review comments in the slides

References:

1. http://www.sciencedirect.com/
2. https://www.ncbi.nlm.nih.gov/pubmed
3. https://www.elsevier.com/books-and-journals
4. https://www.plos.org/
5. https://www.deepdyve.com/
6. http://ieeexplore.ieee.org/Xplore/home.jsp
7. https://www.researchgate.net/
8. https://www.science.gov/
9. https://scholar.google.co.in/
10. http://www.popsci.com/

Evaluation Criteria: The following evaluation parameters shall be considered for internal assessment by both research coordinators and faculty coordinator or research mentors:-

Criteria	Evaluation parameters	Weightage (Marks)	
Online and offline Attendance	· Percentage of classes attended by the students	3+2	5
Group participation and response of the students to a given task	· Judge individual student in the group · Meeting timelines as per lesson plan	5 10	15
Literature Survey	· Usage of Scientific Literature Databases. e.g., Scopus/ Web of Science/ etc. · Number of relevant papers referred for the given topic · Summarizing the referred paper · Plagiarism/Authenticity · Reference listing	2 4 4 3 2	15
Structuring and presentation	· Paper structuring and presentation · Group presentation with individual contribution · Target journal, Impact factor/ Topic centered Journal · Students response towards comments by research/faculty mentors	7 2 1 5	15

Course Articulation Matrix:

CO Statement (XX-400)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
OMCA-RIC-II.1	√	√		√									√	√	√	√
OMCA-RIC-II.2	√			√		√				√			√	√	√	√
OMCA-RIC-II.3	√			√		√				√			√	√	√	√
OMCA-RIC-II.4		√		√		√		√		√			√	√	√	√
OMCA-RIC-II.5																
OMCA-RIC-II.6																

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH & STUDIES

(Deemed to be University under section 3 of the UGC Act 1956)

OMCA-DS-210: DATA COMMUNICATIONS

Periods/week Credits
L: 3 T: 0 P:0
Duration of Exam: 3 Hrs

Max. Marks: 100
Continuous Evaluation: 30
End Semester Examination: 70

Pre-Requisite: Knowledge of Computer Networks
Course Type: Core

Course Outcomes: At the end of the course the student will be able to:

OMCA-DS-210.1. Understand the principles of data communication and transmission.
OMCA-DS-210.2. Define signals and explore their characteristics.
OMCA-DS-210.3. Grasp the concepts related to transmission media.
OMCA-DS-210.4. Apply hardware and software solutions to enhance network efficiency
OMCA-DS-210.5.Analyze network security needs, potential errors, and methods for error control.

PART-A

UNIT 1: Basic Concepts of Data Communication
1.1 Introduction to data communication
1.2 Components of data communication
1.3 Advantages and applications of Networking
1.4 Network Topologies
1.5 Network Protocols
1.6 Connection –oriented and Connection-less Services
1.7 Modes of data transmission

UNIT 2: Signals and Transmission Media
2.1 Signal and data
2.2 Channel Characteristics
2.3 Encoding and Modulation Techniques
2.4 Transmission Media: Guided Media (Twisted Pair, Co-axial cable, Optical Fiber), Unguided Media (Radio, Microwave, Satellite)
2.5 Transmission Impairments
2.6 Multiplexing (Frequency Division Multiplexing, Time Division Multiplexing, Wavelength Division Multiplexing)
2.7 Switching (Circuit Switching, Packet Switching, Message Switching)

UNIT 3: System Architecture and Layered Protocol Models
3.5 Protocol hierarchies
3.6 Layered Architecture
3.3 ISO OSI Reference Model
3.4 TCP/IP Model

PART-B

UNIT 4: Data link Layer
4.1 Functions of Data Link Layer
4.1 Framing of data
4.2 Flow Control
4.3 Error control
4.4 High Level Data Link Control (HDLC)
4.5 Error detection Techniques (VRC,LRC, CRC, Checksum)

4.6 Error Correction Techniques (Single Bit Error Correction, Hamming Code and Burst Error Correction)
4.7 Carrier Sense Multiple Access with Collision Detection (CSMA/CD)

UNIT 5: Transport Layer
5.1 Functions of Transport Layer
5.2 TCP and UDP
5.3 Routing Algorithms (Static Routing Algorithms: Shortest Path Routing, Dynamic Routing: Distance Vector Routing, Link State Routing)
5.4 Congestion control (Congestion Avoidance, Discarding and Leaky Bucket Algorithm)
5.5 Fault handling
5.6 Access control

UNIT 6: IEEE Standards, Protocols & Addressing
6.1 Logical link Control (LLC)
6.2 IEEE Standard 802.3(Ethernet)
6.3 IEEE Standard 802.4 (Token Bus)
6.4 IEEE Standard 802.5 (Token Ring)
6.5 X.25
6.6 Frame Relay
6.7 Asynchronous Transfer Mode (ATM)
6.8 IPv4 & IPv6

Suggested Readings:
1. B. Forouzan, 2001, Data Communication and Networking, Tata McGraw Hill.
2. A.S. Tanenbaum, 1994, Computer networks, Prentice Hall.
3. Tomasi Wayne, 2004, Introduction to Data Communication & Networking, Pearson Education
4. Uyless Black, 1994, Computer networks: Protocol Standards and Interfaces, Prentice Hall Education

Note: Only latest editions of the books are recommended.

Weblinks:
https://www.smartzworld.com/notes/computer-network-cn-notes-pdf (Last visited date: 23/02/2024)
https://www.tutorialspoint.com/data_communication_computer_network/index.htm (last visited date: 22 February 2024)
https://archive.nptel.ac.in/courses/106/105/106105080/ (last visited date: 22 February 2024)

Instructions for paper setting: Seven questions are to be set in total. First question will be multiple choice covering entire syllabus and will be compulsory to attempt and will be of 18 marks. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three fromeach part. Each question will be of 13 marks.

Evaluation Policy:
The evaluation will include two types of assessments:
(lxix) Continuous or formative assessments (in the form of end semester examination or term examination. Weightage of assessments are as follows:

For continuous or Formative assessment (in semester): Maximum 30 percent. The categorization for the same is:

MCQs	30%
Subjective (Short/Long)	40%
Discussion/Presentation	15%
Projects/Group Activities etc	15%

(lxx) For Summative assessment (End Semester Examination or End-Term Examination):

Minimum: 70 percent. Categorization for the same is:

Objective Type Questions:	30%
Short/Long Questions:	70%

Assessment Tools:

Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

COURSE ARTICULATION MATRIX:

	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO 2
OMCA-DS-210.1		2	3		2	1	1					1		3
OMCA-DS-210.2		2	2				1						2	3
OMCA-DS-210.3		2	2	2			1						3	2
OMCA-DS-210.4	2						2						2	2
OMCA-DS-210.5		1	2		2		1						2	3
OMCA-DS-210.6	2		3	1	3				1	3	3	1	3	3
OMCA-DS-210.7	2		2		2	1	3		2	1	3	3	1	1

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH & STUDIES

(Deemed to be University under section 3 of the UGC Act 1956)

OMCA-DS-211: ANALYSIS & DESIGN OF ALGORITHM

Periods/week Credits
L: 3 T: 0 3
Duration of Examination: 3 Hrs

Marks : 100
Continuous Evaluation : 30
End Semester Examination : 70

Pre-Requisite: Knowledge of C Programming and Data
Course Type: Core

Course Outcomes: At the end of the course, students will be able to:

OMCA-DS-211.1. Learn the basics of various computer algorithms.
OMCA-DS-211.2. Understand the algorithm in terms of time and space complexity and to apply Divide & Conquer approach.
OMCA-DS-211.3. Apply Greedy method to solve critical problems.
OMCA-DS-211.4. Analyze algorithms for finding optimal solution using Dynamic Programming methods.
OMCA-DS-211.5. Evaluate programming problems using the Backtracking method.
OMCA-DS-211.6. Design the deterministic and non-deterministic polynomial time algorithms.

PART-A

UNIT 1: Introduction to Algorithm

1.1 Algorithm analysis
1.2 Problem solving approach
1.3 Asymptotic analysis
1.4 Analysis of Non-recursive and Recursive Algorithm
1.5 Sets and disjoint sets union

UNIT 2: Divide and Conquer approach

2.1 Introduction to Divide and Conquer approach
2.2 Binary search
2.3 Merge sort
2.4 Quick sort
2.5 Selection sort\
2.6 Stassen's matrix multiplication algorithms

UNIT 3: Greedy Method

3.1 Introduction to Greedy Method
3.2 Knapsack problem
3.3 Job sequencing with dead lines
3.4 Minimum Spanning Trees: Kruskal and Prim's method
3.5 Single source shortest paths (Dijesktra's algorithm).

PART-B

UNIT 4: Dynamic Programming

1.1 General method
1.2 Optimal binary search trees
1.3 0/1 knapsack
1.4 Traveling salesperson problem

UNIT 5: Backtracking

1.1 General Method
1.2 queen's problem
1.3 Graph colouring
1.4 Hamiltonian cycles
1.5 Introduction to Branch and Bound approach
1.6 0/1 knapsack
1.7 Traveling salesperson problem.

UNIT 6: Problem Classes

6.1Polynomial and Non Polynomial classes
6.2 NP-hard and NP-complete
6.3 Deterministic and non-deterministic polynomial time algorithms,
6.4 Cook's theorem
6.5 NP scheduling problems.

Suggested Readings:

Ellis Horowitz and Sartaj Sahni, 2008, Fundamentals of Computer Algorithms, Computer Science Press.
Aho A.V. Hopcroft J.E, 1974, The Design and Analysis of Computer Algorithm, Addison Wesley.
Thomas H. Coreman, 2009, Introduction to Algorithm, McGraw-Hill

Note: Only latest editions of the books are recommended.

Software required/ Web links:

Dev C/ Turbo C++
https://www.tutorialspoint.com/design_and_analysis_of_algorithms/
(Last Visited Date: 22nd February, 2024)
(https://www.youtube.com/watch?v=1PI58Q3Ne2w (Last Visited Date: 22nd February, 2024)

Instructions for paper setting: Seven questions are to be set in total. First question will be multiple choice covering entire syllabus and will be compulsory to attempt and will be of 18 marks. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three fromeach part. Each question will be of 13 marks.

Evaluation Policy:

The evaluation will include two types of assessments:

(lxxi) Continuous or formative assessments (in the form of end semester examination or term examination. Weightage of assessments are as follows:

For continuous or Formative assessment (in semester): Maximum 30 percent. The categorization for the same is:

MCQs	30%
Subjective (Short/Long)	40%
Discussion/Presentation	15%
Projects/Group Activities etc	15%

(lxxii) For Summative assessment (End Semester Examination or End-Term Examination):
Minimum: 70 percent. Categorization for the same is:

Objective Type Questions:	30%
Short/Long Questions:	70%

Assessment Tools:
Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

COURSE ARTICULATION MATRIX

	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2
OMCA-DS-211.1	3	3	3	3	1		3				2	3	3	3
OMCA-DS-211.2	3	3	3	2	2		2				2	3	3	3
OMCA-DS-211.3	3	3	3	3	3		3				2	3	3	3
OMCA-DS-211.4	3	3	3	2	1		2				2	3	3	3
OMCA-DS-211.5	3	3	3	3	3		3	2			2	3	3	3
OMCA-DS-211.6	1	2	1	2	1		2				2	3	1	2

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH & STUDIES

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OMCA-DS-212: INTRODUCTION TO ARTIFICIAL INTELLIGENCE

Periods/week	Credits	Max. Marks : 100
L: 3 T: 0	3	Continuous Evaluation : 30
Duration of Examination: 3 Hrs		End Semester Examination : 70

Pre-Requisite: Basics of Data Structure
Course Type: Core

Course Outcomes: At the end of the course, the student will be able to:
OMCA-DS-212.1. Understand the fundamental concepts of Artificial Intelligence.
OMCA-DS-212.2. Interpret the problem as a state space, graph, design heuristics and select amongst different search or game-based techniques to solve them.
OMCA-DS-212.3. Apply knowledge representation, reasoning, and machine learning techniques to real-world problems
OMCA-DS-212.4. Examine various AI search algorithms
OMCA-DS-212.5. Assess critically the Artificial Intelligence techniques presented and apply them to real world problems

PART-A

Unit 1: Introduction to Artificial Intelligence
1.1 Foundations, scope, problems, characteristics, examples and approaches of AI
1.2 Application Areas of Artificial Intelligence
1.3 Problem solving in Artificial Intelligence: Tic-Tac-Toe, Water Jug problem
1.4 Current trends in Intelligent Systems
1.5 AI application to robotics
1.6 Goal driven Learning agents
1.7 Programming Languages of Artificial Intelligence

Unit 2: Problem Solving Concepts and AI Search Techniques
2.1 Problem Solving Concepts and Methods
2.2Types of Search techniques: Uninformed (Blind) and Informed (Informed) techniques
2.3 Blind search techniques: Breadth-First search and Depth- First search methods
2.4 Heuristic search techniques
2.5 Best First search, Means-ends Analysis Technique
2.6 Problem reduction, Constraint satisfaction

Unit 3: Knowledge Representation
3.1 Foundations of knowledge representation and reasoning
3.2 Prepositional and Predicate logic
3.3 Syntax and Semantics for first order logic
3.4 Resolution and Unification
3.5 Knowledge representation schemes: semantic nets, frames.

PART-B

Unit 4: Reasoning and Game Playing
4.1 Reasoning about Knowledge, Default Reasoning
4.2 Reasoning with uncertain knowledge
4.3 Probability Based Reasoning

4.4 Reasoning Using Certainty Factors; Bayes Theorem
4.5 Fuzzy Based Reasoning Systems
4.6 Games playing: Minimax algorithm, Tic-Tac-Toe

Unit 5: Expert Systems & Natural Language Processing
5.1 Expert system: Definition and applications
5.2 Characteristics of expert system
5.3 Basic components & architecture of expert systems
5.4 Introduction to Natural Language Processing (NLP)
5.5 Parsing techniques

Unit 6: Machine Learning and Neural Networks
6.1 Introduction to Machine Learning
6.2 Learning techniques
6.3 Applications of Machine Learning
6.4 Introduction to Neural Network
6.5 Artificial and Biological Neurons
6.6 Classifications of Neural Network

Suggested Readings:

1. Pradhan Manaswini, 2023, Fundamentals of Artificial Intelligence and Machine Learning:DPS Publishing House
2. Russel and Norwig, 2022, Artificial Intelligence: A Modern Approach,Pearson Education.
3. George F. Luger, 2022, Artificial Intelligence, Pearson Education.

Note: Only latest editions of the books are

Recommended. Web links:

http://www.vssut.ac.in/lecture_notes/lecture1428643004.pdf (Last visited date: 22.2.24)
https://epub.uni-regensburg.de/13629/1/ubr06078_ocr.pdf (Last visited date: 22.2.24)

Instructions for paper setting: Seven questions are to be set in total. First question will be multiple choice covering entire syllabus and will be compulsory to attempt and will be of 18 marks. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three fromeach part. Each question will be of 13 marks.

Evaluation Policy:

The evaluation will include two types of assessments:

(lxxiii) Continuous or formative assessments (in the form of end semester examination or term examination. Weightage of assessments are as follows:

For continuous or Formative assessment (in semester): Maximum 30 percent. The categorization for the same is:

MCQs	30%
Subjective (Short/Long)	40%
Discussion/Presentation	15%
Projects/Group Activities etc	15%

(lxxiv) For Summative assessment (End Semester Examination or End-Term Examination):
Minimum: 70 percent. Categorization for the same is:

Objective Type Questions:	30%
Short/Long Questions:	70%

Assessment Tools

Assignment/ Tutorials
Sessional Tests
Surprise questions during lectures/Class Performance
Term end examination

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
OMCA-DS-212.1	2	2	2	2		2							1	1
OMCA-DS-212.2	1	3	1	3		2								1
OMCA-DS-212.3	3	2		2		1							2	2
OMCA-DS-212.4	1		2			3							2	
OMCA-DS-212.5	3	3		2		3							3	1

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH & STUDIES

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OMCA-DS-213: VOCATIONAL TRAINING

Periods/week Credits	Max. Marks: 100
4 Weeks 2	Continuous Evaluation: 100
Duration of Examination: 2 Hrs	End Semester Examination: ---

Course Outcomes: At the end of the course, students will be able to

OMCA-DS-213.1 Describe the Systems Development Life Cycle (SDLC).
OMCA-DS-213.2 Construct and evaluate data flow diagrams.
OMCA-DS-213.3 Design and evaluate system outputs
OMCA-DS-213.4 Construct and evaluate entity-relationship (ER) diagrams for real projects
OMCA-DS-213.5 Determine the various test cases and analyze the results.
OMCA-DS-213.6 Develop soft-skills including writing formal reports and delivering oral presentations.

Internship experience provides the student with an opportunity to enhance the knowledge in their respective subject areas. This training provides insight to understand the actual behaviour of the industry able to develop a greater understanding about the career option. Each of the students is required to develop a mini project during his/ her one month internship. Evaluation will be done by the respective mentors. Internal assessment will be done on the basis of following criteria:

1. Presentation - 30 marks
2. Viva - 50 marks
3. Thesis/Project report - 20 marks.

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH & STUDIES

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OMCA-DS-263: R PROGRAMMING LAB

Periods/week	Credits	Max. Marks : 100
L: 0 P: 2	1	Continuous Evaluation: 30
Duration of Examination: 2 Hrs		End Semester Examination : 70

Co-Requisite: Programming in C language
Course Type: Core

Course Outcomes: At the end of the course the student will be able to:

OMCA-DS-263.1. Understand how to setup R environment and R Console.
OMCA-DS-263.2. Demonstrate different data structures (vectors, lists, matrices, data frames) in R.
OMCA-DS-263.3. Analyze the various data sets in R programming (importing and exporting of data).
OMCA-DS-263.4. Assess the data manipulation technique using R programming
OMCA-DS-263.5. Develop an application in R using a built-in database.

List of Experiments:-

Activity 1: Concept: Overview of R Console,R script,R Environment and Graphical Output.

1) Installation and Environmental setup in R studio.
2) Introduction to data types and scripts of R.

Activity 2:Introduction to Arrays & Vectors

3) Implement recursive functions using R tool.
4) Create and modify matrix using c function (c()) in R tool.
5) Create a list using List() and perform List Slicing operation in R tool.
6) Create three vectors x,y,z with integers and each vector has 3 elements. Combine the three vectors to become a 3×3 matrix A where each column represents a vector. Change the row names to a,b,c.
7) Create a vector with 12 integers. Convert the vector to a 4*3 matrix B using matrix(). Please change the column names to x, y, z and row names to a, b, c, d.
8) Create the vector of for (1.2.3,…19.20,19,18,…2,1)
9) Create a vextor of values of
   $e^x\cos(x)$ at x= 3,3.1,3.2……,6 ;
10) Create a character vector with length of number-of-rows-of-iris-dataset, such that, each element gets a character value – "greater than 5" if the corresponding 'Sepal.Length' > 5, else it should get "lesser than 5".Impletement it using For Loop.

Activity 3:List and Data Frames in R

11) Create a data frame in R and perform various operations.
12) Implement Linear Model Formula using 100 variables in R.
13) Write a program to expand data frame in R.
14) With the dataframes created from code below, perform the various merge operations.

```
set.seed(100)
Df1 <- iris[sample(1:nrow(iris), 10), c(1,2,3,5)]
Df2 <- iris[sample(1:nrow(iris), 10), c(1,2,4,5) ]
# induce NAs
Df1 <- Df1[sample(1:nrow(Df1), 3), 4]
Df2 <- Df2[sample(1:nrow(Df1), 3), 4]
```

Activity 4: Data Analysis in R(Importing and exporting of data)

15) Generate Exploratory Analysis of Big Mart Data Set.
16) Generate Exploratory Analysis of Train Data Set.

17)Show graphical representation of Big Mart Data set using Univariate Analysis and Bivariate Analysis.
18) Show graphical representation of Train Data Set using Univariate Analysis and Bivariate Analysis.

.

Activity 5: Data Manipulation in R.

19) Calculate the count of Outlet Indentifiers,Item Identifiers and Outlet years of Big mart Data Set.
20) Calculate the count of Outlet Identifiers, Item Identifiers and Outlet years of Big mart Data Set.

Note: Faculty can suggest more practical assignment and projects as per the need.

Suggested Readings:

1. Garrett Grolemund, 2014, Hands on Programming with R
2. Mark Gardener, 2013, Beginning R: The Statistical Programming Language

Note: Only latest editions of the books are recommended.

Software required:

R Studio

Distribution of Continuous Evaluation Table:

Viva-I	30%
Viva-II	30%
File/ Records	20%
Class performance	10%
Attendance	10%

Assessment Tools:

Experiments in lab
File work/Class Performance
Viva (Question and answers in lab)
End Term Practical Exam

COURSE ARTICULATION MATRIX:

	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2
OMCA-DS-263.1	1	1	1	1	2								3	3
OMCA-DS-263.2	2	2	1	1	2								3	3
OMCA-DS-263.3	3	3	2	2	2								3	3
OMCA-DS-263.4	3	2	2	3	2								3	3
OMCA-DS-263.5	1	2	3	3	2						2		3	3

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH & STUDIES
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OMCA-DS-264: ANDROID APPLICATION DEVELOPMENT LAB

Periods/week	Credits	Max. Marks: 100
P: 2 T: 0	1	Continuous Evaluation: 30
Duration of Examination: 2 Hrs		End Semester Examination: 70

Co-Requisite: Knowledge of Java.
Course Type: Core

Course Outcomes: At the end of the course the student will be able to:
OMCA-DS-264.1 Describe the application lifecycle, intents, and activities.
OMCA-DS-264.2 Create mobile applications on the Android Platform.
OMCA-DS-264.3 Create mobile applications involving data storage in SQLite Database.
OMCA-DS-264.4 Deploy and maintain the Android Application.
OMCA-DS-264.5 Students should be able to debug and test Android apps using Android Studio's built-in tools and techniques.

Concepts & List of Experiments:

Activity 1:
Create an application that takes the name from a text box and shows hello message along with the name entered in text box, when the user clicks the OK button.

Activity 2:
Create a screen that has input boxes for User Name, Password, Address, Gender (radio buttons for male and female), Age (numeric), Date of Birth (Date Picket), State (Spinner) and a Submit button. On clicking the submit button, print all the data below the Submit Button. Use

1. Linear Layout
2. Relative Layout and
3. Grid Layout or Table Layout.

Activity 3:
Develop an application that shows names as a list and on selecting a name it should show the details of the candidate on the next screen with a Back button. If the screen is rotated to landscape mode (width greater than height), then the screen should show list on left fragment and details on right fragment instead of second screen with back button. Use Fragment transactions and Rotation event listener.

Activity 4:
Develop an application that uses a menu with 3 options for dialing a number, opening a website and to send an SMS. On selecting an option, the appropriate action should be invoked using intents.

Activity 5:
Develop an application that inserts some notifications into Notification area and whenever a notification is inserted, it should show a toast with details of the notification.

Activity 6:
Create an application that uses a text file to store user names and passwords (tab separated fields and one record per line) When the user submits a login name and password through a screen, the details should be verified with the text file data and if they match, show a dialog saying that login is successful. Otherwise, show the dialog with Login Failed message.

Activity 7:

1. Create a user registration application that stores the user details in a database table.
2. Create a database and a user table where the details of login names and passwords are stored. Insert some names and passwords initially. Now the login details entered by the user should be verified with the database and an appropriate dialog should be shown to the user.

Activity 8:
Create an admin application for the user table, which shows all records as a list and the admin can select any record for edit or modify. The results should be reflected in the table.

Activity 9:
Create an alarm that rings every Sunday at 8:00 AM. Modify it to use a time picker to set alarm time.

Activity 10:
Develop an application that shows the current locations latitude and longitude continuously as the device is moving (tracking)

Recommended Small Projects:
a) Create an accident alert app.
b) Create a diet planner app
c) Create an application for budget management of your family.
d) Create an application to stimulate calculator
e) Create an application to simulate Notepad
f) Create an application for Women Protection System

Note: Faculty can suggest more practical assignment and projects as per the need.

Suggested Readings:

1. Reto Meier, 2010, Professional Android
2. Application Development 2. Marko Gargenta, 2014, Learning Android
3. Lauren Darcey, 2010, Sams Teach Yourself Android Application Development in 24 Hours

Software required/ Web links:
Android Studio 3.x
Android SDK
https://developer.android.com/guide/ (Last Visited Date: 23rd February, 2024)
https://www.javatpoint.com/android-tutorial (Last Visited Date: 23rd February, 2024)
https://hackr.io/tutorials/learn-android-development (Last Visited Date: 23rd February, 2024)

Distribution of Continuous Evaluation Table:

Viva-I	30%
Viva-II	30%
File/ Records	20%
Class performance	10%
Attendance	10%

Assessment Tools:
Experiments in lab
File work/Class
Performance Viva (Question and answers in lab)
End Term Practical Exam

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
OMCA-DS-264.1	2	3	2		3								2	3
OMCA-DS-264.2	2	3			3									
OMCA-DS-264.3	1	3	2		3									
OMCA-DS-264.4	2	3	2	2	3		1	1	1		1	2	2	3
OMCA-DS-264.5	1		2	2	2			1				2	2	3

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH & STUDIES
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OCDC 512: Placement Competency Enhancement-II

Periods/week	Credits	Max. Marks: 100
L: 0 T: 4	2	Continuous Evaluation: 30
Duration of Examination: 3 Hrs		End Semester Examination: 70

Pre-requisite: None
Course Type: Elective
Course Outcomes: At the end of the course the student will be able to:
OCDC-512.1: Enhance their ability to write, read, comprehend and communicate effectively to increase the productivity of business.
OCDC-512.2: Get proficient in resume building and drafting effective cover letters.
OCDC-512.3: Enhance professionalism and display positive attitude throughput
OCDC-512.4: Enhance their placement prospects and manage interviews effectively.
OCDC-512.5: Recognize problem based on Modern Mathematics and Algebra
OCDC-512.6: Calculate solution to logical reasoning.

Part - A (VERBAL ABILITY)

Unit 1: Word Order and Sentence Construction

1.1 One Word Substitution
1.2 Ordering of Words
1.3 Sentence Improvement, ordering of sentences
1.4 Spotting Errors
1.5 Change of Voice/ Direct & Indirect speech

Unit 2: Reading Comprehension & Reasoning

2.1 Strategic Reading, Eliminating Poor Reading Habits
2.2 Techniques to increase speed reading, comprehension and recall
2.3 Solving Sample RC Passages
2.4 Cloze Test
2.5 Para Jumbles

PART – B (INTERVIEW ENHANCEMENT)

Unit 3: Professional Behavior

3.1. Showcasing Professional Attitude in an interview
3.2. Rejection Analysis in an interview
3.3. What not to do in an interview

Unit 4: Interviews Prep- II

4.1. Interview readiness tip to toe.
4.2. Body Language in interviews
4.3. Resume Check
4.4. Answering Difficult Questions in an Interview
4.5 Mock Interviews
4.6 Researching the Employer

PART – C (APTITUDE)

Unit 5: Arithmetic -II

5.1 Average
5.2 Time & Work
5.3 Mixture & Allegation
5.4 Data Interpretation

Unit 6 : Advanced Aptitude

6.1 Permutation & Combination
6.2 Probability
6.3 Syllogism
6.4 Data Sufficiency

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH & STUDIES

(Deemed to be University under section 3 of the UGC Act 1956)

OMCA-DS-214: COMPUTER GRAPHICS

Periods/week	Credits	Max. Marks : 100
L: 2 T: 0	2	Continuous Evaluation : 30
Duration of Examination: 3 Hrs		End Semester Examination : 70

Pre-requisite: None
Course Type: Domain Elective

Course Outcomes: At the end of the course the student will be able to:
OMCA-DS-214.1: Describe the basic concepts of computer graphics and its applications in day to day life.
OMCA-DS-214.2: Summarize and interpret the various categories of graphics algorithms.
OMCA-DS-214.3: Apply various scan conversion algorithms on real life problems.
OMCA-DS-214.4: Apply effective editing by using different transformations on 2D and 3D objects.
OMCA-DS-214.5: Categorize the different object shapes and their detection methods in 2D and 3D viewing.
OMCA-DS-214.6: Demonstrate practical applications on computer graphics to continue professional development.

PART-A

UNIT 1: Introduction to Computer Graphics
1.1 Basic concepts of Computer Graphics
1.2 Computer graphics hardware, Software and Standards
1.3 User Interface: Console User Interface (CUI) and Graphical User Interface (GUI)
1.4 Application of Computer Graphics
1.5 Input – Output Devices
1.6 Cathode Ray Tube
1.7 Color Monitors
1.8 Flat Panel Devices
1.9 Direct View Storage Tube
1.10 Frame Buffer
1.11 Display Processor

UNIT 2: Scan Conversion
2.1 Scan Conversion of Point, Line, and Circle
2.2 Line Drawing Algorithm: Slope Intercept, DDA and Bresenham's
2.3 Circle Drawing Algorithm s: Mid Point, Bresenham's
2.4 Ellipse Drawing Algorithm
2.5 Antialiasing

UNIT 3: Curve drawing and Polygon filling Algorithms
3.1 Introduction to Curve Hierarchy
3.1 Bezier Curve
3.2 B-spline Curve
3.3 Area Fill Attributes: Fill style, Pattern Fill, Soft fills
3.4 Solid Modelling Techniques: Sweep Representation, Constructive Solid Geometry, Octtree, BSP Tree
3.4 Filling of Curved Boundary: Boundary fill algorithm, Flood fill algorithm.
3.5 Character Generation

PART-B

UNIT 4: Transformation & Projection
4.1 Two Dimensional and Three-Dimensional graphics concepts
4.2 Introduction to basic Matrix Operation
4.3 2-D transformation: Translation; Scaling; Rotation; Reflection, Shearing.
4.4 Composite transformations
4.5 3-D Transformation: Translation; Scaling; Rotation.
4.6 Numerical Implementation of 2D and 3D Transformation

4.7 Introduction to Projection
4.8 Types of projections : Parallel & Perspective

UNIT 5: Clipping
5.1 Introduction to Window and Viewport
5.2 Viewing pipeline
5.3 Viewing Coordinate Reference Frame
5.4 Window to Viewport mapping
5.5 Introduction to Clipping
5.6 Point Clipping Algorithm
5.7 Line Clipping Algorithms: Cohen Sutherland, Liang Barsky
5.8 Polygon Clipping Algorithm: Sutherland-Hodgeman, Weiler Antherton

UNIT 6: Visible Surface Detection Methods
6.1 Concept of Hidden Line & Surfaces
6.2 Classification of Visible Surface Detection Algorithm
6.3 Back Face Detection
6.4 Depth Buffer Method
6.5 Depth Sorting Method
6.6 Wireframe Methods
6.7 Visibility Detection Functions

Suggested Readings:

1. D Hearn & P M Baker, 2002, Computer Graphics, Prentice Hall
2. J D Foley & A Van Dam, 1983, Fundamentals of interactive Computer Graphics, Addition Wesley
3 Schaum Series, 2004, Computer Graphics, Tata McGraw Hill
4 Pradeep K. Bhatia, 2013, Computer Graphics, I.K. International

Note: Only latest editions of the books are recommended.

Web Links:
https://www.javatpoint.com/computer-graphics-tutorial (last visited date: 23 February 2024)

Note: Only latest editions of the books are recommended.
Instructions for paper setting: Seven questions are to be set in total. First question will be multiple choice covering entire syllabus and will be compulsory to attempt and will be of 18 marks. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 13 marks.

Evaluation Policy:
The evaluation will include two types of assessments:

(lxxv) Continuous or formative assessments (in the form of end semester examination or term examination. Weightage of assessments are as follows:

For continuous or Formative assessment (in semester): Maximum 30 percent. The categorization for the same is:

MCQs	30%
Subjective (Short/Long)	40%
Discussion/Presentation	15%
Projects/Group Activities etc	15%

(lxxvi) For Summative assessment (End Semester Examination or End-Term Examination):
Minimum: 70 percent. Categorization for the same is:

Objective Type Questions:	30%
Short/Long Questions:	70%

Assessment Tools:
Assignment/Tutorials

Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO 5	PO 6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
OMCA-DS-214.1		2				1	2	1	1	1	1		2	2
OMCA-DS-214.2	2		1			1	2	1	1	1	2		1	1
OMCA-DS-214.3	2		1			1	2	1	1	1	2		1	3
OMCA-DS-214.4	2		1			1	2	1	1	1	2		1	3
OMCA-DS-214.5	2	2		2	2	1	2	2	2	1	2		2	2
OMCA-DS-214.6	2					1	1	1	1	1	1	2	2	3

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH & STUDIES

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OMCA-DS-215: WEB APPLICATIONS DEVELOPMENT USING PHP

Periods/week	Credits	Max. Marks: 100
L: 2	2	Continuous Evaluation: 30
Duration of Examination: 3 Hrs		End Semester Examination: 70

Pre-Requisite: Knowledge of Programming Languages and Database Management System
Course Type: Domain Specific

Course Outcomes: At the end of the course, students will be able to
OMCA-DS-215.1. Learn basics of Web Programming.
OMCA-DS-215 2. Understand the concepts of different frameworks for website designing.
OMCA-DS-215.3. Apply different tools and run commands for developing interactive website.
OMCA-DS-215.4. Analyze the interface and make connectivity with database.
OMCA-DS-215.5. Create and design website using PHP and MySql.

PART –A

UNIT 1: HTML Basics
1.1 Principals involved in developing website
1.2 Five golden rules of web designing
1.3 Web Standards
1.4 Introduction to HTML
1.5 Basic Structure of HTML document
1.6 HTML Tags
1.7 Content layout and presentation
1.8 Working with images
1.9 Working with Lists
1.10 Table Handling
1.11 Frame Design
1.12 Form Design

UNIT 2: Introduction to Cascading Style Sheets and JavaScript
2.1 Introduction to Cascading Style Sheet
2.2 CSS Properties
2.3 Internal Style sheets
2.4 External Style sheets
2.5 Inline Style sheets
2.6 CSS ID and Class
2.7 Introduction to JavaScript: Document Object Model
2.8 JavaScript identifiers
2.9 JavaScript Operators
2.10 Control & Looping structure
2.11 Creating Dialog Boxes

Unit 3: Hypertext Preprocessor (PHP) Concepts
3.1 Introduction to PHP
3.2 PHP history and importance
3.3 Variables and Constants in PHP
3.4 Data types in PHP
3.5 Operators in PHP
3.6 Conditional statements
3.7 Loops
3.8 Date and Time and Image uploading in PHP
3.9 Creating and accessing string
3.10 String functions

3.11 Working with PHP forms: Get and Post methods
3.12 Form Validation
3.13 Session Handling

PART-B

UNIT 4: Working with Arrays and Files
4.1 Concept of Arrays
4.2 Types of Arrays: Index based arrays and Associative Arrays
4.3 Accessing Arrays
4.4 Single dimensional Arrays
4.5 Multidimensional array
4.6 Opening and Closing of File
4.7 Introduction to Objects
4.8 Copying, renaming and deleting of file
4.9 Working with directories
4.10 Building text editor
4.11 File uploading and downloading

UNIT 5: Object Oriented Programming in PHP
5.1 Declaring a class
5.2 The new keyword and constructor
5.3 Destructor
5.4 Access method and properties using $this variable
5.5 Public, private, protected properties and methods
5.6 Inheritance
5.7 Polymorphism
5.8 Exception Handling: Understanding Exception and error
5.9 Try, catch, and throw

UNIT 6: Connection with MySql Database and Introduction to Frameworks
6.1 Introduction to MySQL
6.2 Performing basic database operation (DML): Insert, Delete, Update, Select from PHP Scripts
6.3 Executing parameterized query
6.4 Joins: Cross joins, Inner joins, Outer Joins, Self joins
6.5 Storing and retrieving data from MySQL DB using PHP based forms
6.6 Sending Email using PHP form
6.7 Introduction to Frameworks (Word Press)

Suggested Readings:

1. Ivan Bayross, 2010, HTML, DHTML, PERL, CGI, BPB Publications.
2. Mike McGrath, 2012, PHP and MySQL, Tata McGraw Hill
3. Lynn Beighley, 2008, Head First PHP & MySQL, O'Reilly Media
4. W.Jason Gilmore, 2010, Beginning PHP and MySQL from Novice to Professional, Apress.
5. Luke Welling Laura Thomson, 2016, PHP and MySql web Development, Addison-Wesley Professional

Note: Only latest editions of the books are recommended

Software required/ Web links:
Web Server: Apache HTTP Server 2.2
Database Server: MySql Server 5.0
https://www.phptpoint.com/software-requirement/ (last visited date: 22 February 2024)
https://www.javatpoint.com/php-tutorial (last visited date: 22 February 2024)

Instructions for paper setting: Seven questions are to be set in total. First question will be multiple choice covering entire syllabus and will be compulsory to attempt and will be of 18 marks. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 13 marks.

Evaluation Policy:

The evaluation will include two types of assessments:

(lxxvii) Continuous or formative assessments (in the form of end semester examination or term examination. Weightage of assessments are as follows:

For continuous or Formative assessment (in semester): Maximum 30 percent. The categorization for the same is:

MCQs	30%
Subjective (Short/Long)	40%
Discussion/Presentation	15%
Projects/Group Activities etc	15%

(lxxviii) For Summative assessment (End Semester Examination or End-Term Examination):

Minimum: 70 percent. Categorization for the same is:

Objective Type Questions:	30%
Short/Long Questions:	70%

Assessment Tools:

Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO 4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
OMCA-DS-215.1	3	2	1			2							2	2
OMCA-DS-215.2		1		1			1	1	1	2			1	1
OMCA-DS-215.3		3							1				1	3
OMCA-DS-215.4		3						1					1	3
OMCA-DS-215.5		3	3	2	2	1	1	1		1			2	3

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH & STUDIES

(Deemed to be University under section 3 of the UGC Act 1956)

OMCA-CC-003: CLOUD COMPUTING PLATFORMS

Periods/week Credits	Max Marks : 100
L: 2 T: 0 2	Continuous Evaluation: 30
Duration of Examination: 3 Hrs	End Semester Examination : 70

Pre-Requisite: Knowledge of Cloud
Course Type: Core

Course Outcomes: At the end of the course, students will be able to

OMCA-CC-003.1 Understand the core concepts of cloud computing.
OMCA-CC-003.2 Evaluate and differentiate between major cloud computing platforms.
OMCA-CC-003.3 Deploy, manage, and optimize resources on various cloud platforms.
OMCA-CC-003.4 Develop cloud-native applications tailored to specific cloud services.
OMCA-CC-003.5 Analyze real-world use cases and business scenarios for selecting cloud platforms.

PART -A

UNIT 1: Basic concepts

1.1 Business case for implementing cloud application,
1.2 Requirements collection for cloud application development,
1.3 Cloud service models and deployment models,
1.4 Open challenges in Cloud Computing: Cloud inter-operability and standards, scalability and fault tolerance, security, trust and privacy.

UNIT 2: Application development framework

2.1 Accessing the clouds: Web application vs Cloud Application,
2.2 Frameworks: Model View Controller (MVC), Struts, Spring.
2.3 Cloud platforms in Industry – Google App Engine, Microsoft Azure, Open shift, Cloud Foundry

UNIT 3: Cloud service delivery environment and API

1.1 Storing objects in the Cloud,
1.2 Session management,
1.3 Working with third party APIs: Overview of interconnectivity in Cloud ecosystems.
1.4 Facebook API, Twitter API, Google API.

PART-B

UNIT 4: Cloud applications

4.1 Amazon Simple Notification Service (Amazon SNS),
4.2 Multi-player online game hosting on cloud resources
4.3 Building content delivery networks using clouds

UNIT 5: Managing the data in cloud

1.1 Securing data in the cloud, ACL, OAuth, OpenID, XACML,
1.2 Securing data for transport in the cloud,
1.3 Scalability of applications and cloud services.

UNIT 6: Automation and provisioning tool

6.1 Puppet and Chef – steps for automation: Introduction,
6.2 Files and packages,
6.3 Services and subscriptions, exec and notify, facts,
6.4 Conditional statements and logging

Suggested Readings:

1. Rajkumar Buyya, Christian Vecchiola, S Thamarai Selvi, 2013, "Mastering cloud computing", Tata McGraw Hill Education Private Limited.
2. Anthony T.Velte, Toby J. Velte, Robert Elsenpeter, 2010, "Cloud Computing a Practical Approach", Tata McGraw-HILL.
3. James Loope, 2011, "Managing Infrastructure with puppet", O'REILLY.

Note: Only latest editions of the books are recommended.

Web Links:

1. https://cloud.google.com/appengine/docs (last visited date: 22 February 2024)
2. https://www.chef.io/solutions/cloud-management (last visited date: 22 February 2024)
3. https://aws.amazon.com/documentation(last visited date: 22 February 2024)

Instructions for paper setting: Seven questions are to be set in total. First question will be multiple choice covering entire syllabus and will be compulsory to attempt and will be of 18 marks. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 13 marks.

Evaluation Policy:

The evaluation will include two types of assessments:

(lxxix) Continuous or formative assessments (in the form of end semester examination or term examination. Weightage of assessments are as follows:

For continuous or Formative assessment (in semester): Maximum 30 percent. The categorization for the same is:

MCQs	30%
Subjective (Short/Long)	40%
Discussion/Presentation	15%
Projects/Group Activities etc	15%

(lxxx) For Summative assessment (End Semester Examination or End-Term Examination):

Minimum: 70 percent. Categorization for the same is:

Objective Type Questions:	30%
Short/Long Questions:	70%

Assessment Tools:

Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

Course Articulation Matrix:

	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
OMCA-CC-003.1	1	2	3	3	1		3				2	2	2	1
OMCA-CC-003.2	2	2	3	2	3		2	2			3	3	3	1
OMCA-CC-003.3	2	3	3	3	3		3	2	2		2	3	3	2
OMCA-CC-003.4	3	3	3	2	1		2		2		1	3	1	3
OMCA-CC-003.5	2	3	3	3	3		3	2			1	3	2	2

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES
(Deemed to be University under section 3 of the UGC Act 1956)

OMCA-CC-004: PROGRAMMING WITH AWS

Periods/week	Credits	
L :2 T: 0	2.0	Max. Marks: 100
		Continuous Evaluation: 30
Duration of Exam: 3 Hrs		End Semester Examination: 70

Pre-Requisite:
Course Type: Domain Elective

Course Outcomes: Students will be able to –

OMCA-CC-004.1 Design the overall networking environment for servers.
OMCA-CC-004.2 Deploy, Manage and Scale applications using container orchestration service.
OMCA-CC-004.3 Monitor Server Resources and Account activities.
OMCA-CC-004.4 Setup Database Engines and Secure Servers and Services.

PART –A

UNIT 1: Fundamentals of AWS Cloud Computing
- 1.1 Introduction to Cloud Computing
- 1.2 Cloud Environment Architecture
- 1.3 Cloud Computing Models
- 1.4 Introduction to Amazon Web Services
- 1.5 AWS Global Infrastructure

UNIT 2: Elastic Compute Cloud
- 2.1 Launching our first EC2 instance
- 2.2 EC2 instance types & Pricing Models
- 2.3 Creating AMI and Image Templates
- 2.4 Understanding Security Groups - a Server-side Firewall

UNIT 3: Virtual Private Cloud
- 3.1 Introduction to Network Switches & Virtual Private Cloud
- 3.2 VPC & Subnets
- 3.3 Private and Public Subnets
- 3.4 Internet Gateways, VPC Peering & NAT Gateways
- 3.5 VPN Setup

PART–B

UNIT 4: Storage
- 4.1 Introduction to Block & Object storage mechanism
- 4.2 Introduction to Elastic Block Store – EBS
- 4.3 EBS Snapshots
- 4.4 Introduction to Simple Storage Service (S3)
- 4.5 Features of S3

UNIT 5: Elastic Load Balancers and Elasticity
- 5.1 Understanding High Availability Configuration
- 5.2 ELB Configuration with Classic and Application Load Balancers
- 5.3 Auto Scaling

UNIT 6: AWS ECS
- 6.1 Getting Started with Containerization
- 6.2 ECS Services and Tasks
- 6.3 Load Balancing in ECS
- 6.4 ECS Scaling

Suggested Readings:

4. Rajkumar Buyya, Christian Vecchiola, S Thamarai Selvi, 2013, "Mastering cloud computing", Tata McGraw Hill Education Private Limited.
5. Anthony T.Velte, Toby J. Velte, Robert Elsenpeter, 2010, "Cloud Computing a Practical Approach", Tata McGraw-HILL.
6. James Loope, 2011, "Managing Infrastructure with puppet", O'REILLY.

Note: Only latest editions of the books are recommended.

Web Links:

4. https://cloud.google.com/appengine/docs (last visited date: 22 February 2024)
5. https://www.chef.io/solutions/cloud-management (last visited date: 22 February 2024)
6. https://aws.amazon.com/documentation(last visited date: 22 February 2024)

Instructions for paper setting: Seven questions are to be set in total. First question will be multiple choice covering entire syllabus and will be compulsory to attempt and will be of 18 marks. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 13 marks.

Evaluation Policy:

The evaluation will include two types of assessments:

(lxxxi) Continuous or formative assessments (in the form of end semester examination or term examination. Weightage of assessments are as follows:

For continuous or Formative assessment (in semester): Maximum 30 percent. The categorization for the same is:

MCQs	30%
Subjective (Short/Long)	40%
Discussion/Presentation	15%
Projects/Group Activities etc	15%

(lxxxii) For Summative assessment (End Semester Examination or End-Term Examination):
Minimum: 70 percent. Categorization for the same is:

Objective Type Questions:	30%
Short/Long Questions:	70%

Assessment Tools:

Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

Course Articulation Matrix:

	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
OMCA-CC-004.1	1	1	1	1	1		3				2		2	1
OMCA-CC-004.2	3	2	2	2	3		2	3				3		1
OMCA-CC-004.3	2	1	2	3	3		3	3	2				3	
OMCA-CC-004.4	3	1	3	1	1		1		2					2

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES
(Deemed to be University under section 3 of the UGC Act 1956)
NAAC 'A++' Grade University

OMCA-AI-003: SUPERVISED LEARNING

Periods/week Credits
L :2 T: 0 2.0

Max. Marks: 100
Continuous Evaluation: 30
Duration of Exam: 3 Hrs
End Semester Examination: 70

Pre-Requisite: Basic Knowledge of Data Mining

Course Outcomes: Students will be able to –

OMCA-AI-003.1 Understand how to select an appropriate supervised machine learning method for a given scenario and dataset.
OMCA-AI-003.2 Understand the tradeoffs inherent in different machine learning methods: speed, accuracy, complexity of hypothesis space, etc.
OMCA-AI-003.3. Increase awareness of issues of algorithmic bias, transparency, fairness in supervised machine learning applications.

PART –A

UNIT 1: Introduction to Supervised Learning
1.1 Introduction to Data Science
1.2 What is Data?
1.3 Importance and applications of Data Science
1.4 Key Components of Data Science: Data Collection, Cleaning, Analysis and visualization
1.5 Difference between Data Science and Data Analytics

UNIT 2: Linear Regression
2.1 Regression basics: Relationship between attributes using Covariance and Correlation
2.2 Relationship between multiple variables: Regression (Linear, Multivariate) in prediction.
2.3 Residual Analysis
2.4 Identifying significant features, feature reduction using AIC, multi-collinearity
2.5 Non-normality and Heteroscedasticity
2.6 Hypothesis testing of Regression Model
2.7 Confidence intervals of Slope

UNIT 3: Multiple Linear Regression
3.1 Polynomial Regression
3.2 Regularization methods
3.3 Lasso, Ridge and Elastic nets
3.4 Categorical Variables in Regression

PART – B

UNIT 4: Non-Linear Regression
4.1 Logit function and interpretation
4.2 Types of error measures (ROCR)
4.3 Logistic Regression in classification

UNIT 5: Classification
5.1 Basic Concepts
5.2 Decision Tree Induction
5.3 Bayes Classification Methods
5.4 Introducing Ensemble methods
5.5 Support Vector Machine

UNIT 6: Clustering
6.1 Distance measures
6.2 Different clustering methods (Distance, Density, Hierarchical)
6.3 Iterative distance-based clustering;
6.4 Dealing with continuous, categorical values in K-Means
6.5 Constructing a hierarchical cluster

Suggested Readings:
1. Peter Bruce, 2020, Practical Statistics for Data Scientists, 2e: 50+ Essential Concepts Using R and Python, O'Reilly
1. Andrew Park, 2020, Data Science for Beginners
Note: Only latest editions of the books are recommended.

Web Links:
https://www.w3schools.com/datascience/ (Last visited date: 22 February 2024)
https://www.javatpoint.com/data-science (Last visited date: 22 February 2024)

Instructions for paper setting: Seven questions are to be set in total. First question will be multiple choice covering entire syllabus and will be compulsory to attempt and will be of 18 marks. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 13 marks.

Evaluation Policy:
The evaluation will include two types of assessments:
(lxxxiii) Continuous or formative assessments (in the form of end semester examination or term examination. Weightage of assessments are as follows:

For continuous or Formative assessment (in semester): Maximum 30 percent. The categorization for the same is:

MCQs	30%
Subjective (Short/Long)	40%
Discussion/Presentation	15%
Projects/Group Activities etc	15%

(lxxxiv) For Summative assessment (End Semester Examination or End-Term Examination):
Minimum: 70 percent. Categorization for the same is:

Objective Type Questions:	30%
Short/Long Questions:	70%

Assessment Tools:
Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO 5	PO 6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
OMCA-AI-003.1	2	2		3	2		2					1	2	3
OMCA-AI-003.2	2	2	3	1	2		1						3	2
OMCA-AI-003.3	2		1	2	2							2		1

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH & STUDIES

(Deemed to be University under section 3 of the UGC Act 1956)

OMCA-AI-004: TEXT MINING

Periods/week	Credits	Max. Marks: 100
L: 2 T: 0	2	Continuous Evaluation: 30
Duration of Examination: 3 Hrs		End Semester Examination: 70

Pre-Requisite: Data structure, algorithms & programming language (Java/Python)
Course Type: Domain Elective

Course Outcomes: At the end of the course the student will be able to:
OMCA-AI-004.1. Understand basic concepts and theories of text mining and utilize computational tools and methods for text mining
OMCA-AI-004.2. Learn the fundamentals of natural language processing & tools
OMCA-AI-004.3. Classify text and design associated algorithms
OMCA-AI-004.4. Understand the concept text clustering & text modelling
OMCA-AI-004.5. Know the concepts of social media & network analysis
OMCA-AI-004.6. Analyze sentiments problems and emotions detection approaches

PART-A

Unit 1: Natural language processing
1.1 Basic techniques in natural language processing
1.2 Tokenization (bag-of-words and n-gram models)
1.3 Stop words and punctuation, Stemming and lemmatization,
1.4 Part-of-speech tagging, chunking,
1.5 Regular expressions, Named entity recognition.
1.6 Public NLP toolkits such as NLTK and SpaCy

Unit 2: Text classification
2.1 The Vector Space Model and tf-idf weighting, representing unstructured text documents with appropriate format
2.2 Feature selection and text categorization algorithms
2.3 Naive Bayes, k-Nearest Neighbor (kNN),
2.4 Logistic Regression,
2.5 Support Vector Machines and Decision Trees.
2.6 Evaluation of text classification: precision and recall, confusion matrix, F-score

Unit 3: Text clustering & Topic Modelling
3.1 Clustering algorithms,
3.2 Connectivity-based clustering (hierarchical clustering)
3.3 Centroid-based clustering (k-means clustering)
3.4 Evaluation of text clustering: purity and Rand index
3.5 Concept of topic modelling
3.6 Topic models—Probabilistic Latent Semantic Indexing (pLSI) and Latent Dirichlet Allocation (LDA)
3.7 Document summarization

PART-B

Unit 4: Social-Media and Network analysis
1.1 Characteristic of social network, inter-connectivity
1.2 Google's winning algorithm PageRank
1.3 social influence analysis and social media analysis

Unit 5: Sentiment analysis
5.1 Definition of the sentiment analysis problem
5.2 Differences between sentiment analysis and emotion detection
5.3 sentiment polarity prediction, mining and aspect identification

5.4 Lexicon-based approaches to sentiment analysis
5.5 Key approaches to exploit dictionaries, ontologies,
5.6 specialized corpora for detecting the sentiment polarity in texts
5.7 Machine learning approaches to sentiment analysis
5.8 Overview of neural network architectures for sentiment analysis

Unit 6: **Affect and emotion detection**
6.1 Survey and definition of affect and emotion detection in texts
6.2 Differences between the tasks of detection of sentiment, feelings, emotions, and opinion
6.3 Modeling language of emotions using neural networks and statistical language model
6.4 Multimodal approaches to emotion detection
6.5 Exploitation of multimodal data (e.g., face and body language in video and audio recordings) to detect language of emotions

Suggested Readings:

1. Charu C. Aggarwal and Cheng Xiang Zhai, 2012, "Mining Text Data", Springer
2. Dan Jurafsky and James H Martin, 2000, "Speech & Language Processing", Pearson Education India
3. Christopher D. Manning, Prabhakar Raghavan, and Hinrich Schuetze, 2007, "Introduction to Information Retrieval", Cambridge University Press
4. Liu, B., 2012, Sentiment analysis and opinion mining. Synthesis lectures on human language technologies, 5(1), 1-167.
5. Munezero, M. D., Montero, C. S., Sutinen, E., & Pajunen, J., 2014, Are they different? Affect, feeling, emotion, sentiment, and opinion detection in text. IEEE transactions on affective computing
6. Calvo, R. A., & D'Mello, S., 2010, Affect detection: An interdisciplinary review of models, methods, and their applications. IEEE Transactions on affective computing

Note: Only latest editions of the books are recommended.

Web links:
1. https://www.educba.com/text-mining/ (Last visited Date: 22/2/2024)

Instructions for paper setting: Seven questions are to be set in total. First question will be multiple choice covering entire syllabus and will be compulsory to attempt and will be of 18 marks. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 13 marks.

Evaluation Policy:
The evaluation will include two types of assessments:
(lxxxv) Continuous or formative assessments (in the form of end semester examination or term examination. Weightage of assessments are as follows:

For continuous or Formative assessment (in semester): Maximum 30 percent. The categorization for the same is:

MCQs	30%
Subjective (Short/Long)	40%
Discussion/Presentation	15%
Projects/Group Activities etc	15%

(lxxxvi) For Summative assessment (End Semester Examination or End-Term Examination):
Minimum: 70 percent. Categorization for the same is:

Objective Type Questions:	30%
Short/Long Questions:	70%

Assessment Tools:
Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO 5	PO 6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
OMCA-AI-004.1		1	3	1	1		1					1	2	2
OMCA-AI-004.2	2		2	2	1		1						3	2
OMCA-AI-004.3	2	1	1	1	2		3					1	2	2
OMCA-AI-004.4		2	2	3	1		2						2	2
OMCA-AI-004.5	2		3	2			2	3				3	2	3
OMCA-AI-004.6	1	1	1	1	1		2	2				2	1	1

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH & STUDIES
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OMCA-CS-003: CRYPTOGRAPHIC

Periods/week	Credits	Max. Marks: 100
L: 2 T: 0	2	Continuous Evaluation: 30
Duration of Examination: 3 Hrs		End Semester Examination: 70

Pre-Requisite: Basic knowledge of Information Security
Course Type: Domain Elective
Course Outcomes: At the end of the course the student will be able to:
OMCA-CS-003.1 Understand basic cryptographic algorithms, message and web authentication and security issues.
OMCA-CS-003.2 Identify information system requirements for both of them such as client and server.
OMCA-CS-003.3 Understand the current legal issues towards information security.
OMCA-CS-003.4 Understand the authentication process and algorithm towards information security.
OMCA-CS-003.5 Understand the security algorithm towards information security.

PART-A

UNIT 1: Introduction:
1.1 Security Attacks
1.2 Security Services
1.3 Integrity check
1.5 Digital Signature
1.5 Authentication

Unit 2: Secret Key Cryptography:
2.1 Block Encryption
2.2 DES rounds
2.3 S-Boxes IDEA
2.4 Uses of Secret key Cryptography
2.5 ECB, CBC, OFB, CFB
2.6 Multiple encryptions DES

Unit 3: Hash Functions and Message Digests
3.1 Length of hash, uses
3.2 Algorithms (MD2, MD4, MD5, SHS)
3.3 MD2: Algorithm (Padding, checksum, passes.)
3.4 MD4 and 5: algorithm (padding, stages, digest computation.)
3.5 SHS: Overview, padding, stages

PART-B

Unit 4: Public key Cryptography:
4.1 Algorithms
4.2 Modular arithmetic (addition, multiplication, inverse, and exponentiation)
4.3 RSA: generating keys, encryption and decryption
4.4 PKCS
4.5 Diffie-Hellman
4.6 El-Gamal signatures
4.7 DSS

4.8 Zero-knowledge signatures

UNIT 5: Authentication:

5.1 Password Based, Address Based, Cryptographic Authentication

5.3 Passwords in distributed systems, on-line vs offline guessing

5.3 Cryptographic Authentication: passwords as keys, protocols, KDC's Certification Revocation, Interdomain, groups, delegation

5.4 Authentication of People: Verification techniques, passwords, length of passwords, password distribution, smart cards, biometrics

UNIT 6: Security Policies and Security Handshake Pitfalls:

6.1 Security policy
6.2 High and low level policy
6.3 Protocol problems, assumptions
6.4 Shared secret protocols, public key protocols
6.5 Mutual authentication, reflection attacks
6.6 Session keys, one-and two-way public key based authentication

Suggested Readings:

1. Atul Kahate, 2017, Cryptography and Network Security, McGraw Hill.
2. Kaufman, C., Perlman, R., and Speciner, M., 2002, Network Security, Private Communication in a public world, Prentice Hall PTR.
3. Stallings, W., 2003, Cryptography and Network Security: Principles and Practice, 3rd ed., Prentice Hall PTR.
4. Stallings, W., 2000, Network security Essentials: Applications and standards, Prentice Hall.
5. Behrouz A Forouzan, 2007, Cryptography and Network Security; McGraw Hill.

Note: Only latest editions of the books are recommended.

Web Links:

1. https://www.mygreatlearning.com/blog/cryptography-tutorial/ (last visited date: 22 February 2024)

Instructions for paper setting: Seven questions are to be set in total. First question will be multiple choice covering entire syllabus and will be compulsory to attempt and will be of 18 marks. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 13 marks.

Evaluation Policy:

The evaluation will include two types of assessments:

(lxxxvii) Continuous or formative assessments (in the form of end semester examination or term examination. Weightage of assessments are as follows:

For continuous or Formative assessment (in semester): Maximum 30 percent. The categorization for the same is:

MCQs	30%
Subjective (Short/Long)	40%
Discussion/Presentation	15%
Projects/Group Activities etc	15%

(lxxxviii) For Summative assessment (End Semester Examination or End-Term Examination): Minimum: 70 percent. Categorization for the same is:

Objective Type Questions:	30%
Short/Long Questions:	70%

Assessment Tools:

Assignment/Tutorials

Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO 5	PO 6	PO 7	PO8	PO9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2
OMCA-CS-003.1	3	1	2	2	3		3						3	2
OMCA-CS-003.2	2	2	2	3	1		2						3	2
OMCA-CS-003.3	1	1	2	1	2								2	1
OMCA-CS-003.4	2	1	2	1	1		3						1	2
OMCA-CS-003.5	1	1	2	1			2	3					2	2

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH & STUDIES
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OMCA-CS-004: ETHICAL HACKING

Periods/week	Credits	Max. Marks: 100
L: 2 T: 0	2	Continuous Evaluation: 30
Duration of Examination: 3 Hrs		End Semester Examination: 70

Pre-Requisite: Basic knowledge of Information Security
Course Type: Domain Elective
Course Outcome: At the end of the course the student will be able to:
OMCA-CS-004.1 Understand about Ethical hacking and penetration testing.
OMCA-CS-004.2 Solve various types of attacks, security threats and vulnerabilities present in the computer system.
OMCA-CS-004.3 Examine how social engineering can be done by an attacker to gain access to useful & sensitive information about confidential data.
OMCA-CS-004.4 Understands cryptography, and the basics of web application attacks.
OMCA-CS-004.5 Implement tools, techniques and ethical issues likely to face the domain of ethical hacking and ethical responsibilities.

Part-A

Unit 1:
- 1.1 Introduction, What is Ethical Hacking,
- 1.2 What are the different types of hackers, Five phases of hacking,
- 1.3 Scope of Ethical Hacking, Brush up Linux, Brush up networking
- 1.4 Information Gathering: Passive Information Gathering, Active Information Gathering

Unit 2:
- 2.1 Scanning
- 2.2 System Hacking: Introduction to Metasploit Framework,
- 2.3 Exploit MS17-010 Vulnerability,
- 2.4 Reverse TCP Connection

Unit 3:
- 1.1 Privileged Escalation using post exploit bypassuac and getsystem,
- 1.2 Reverse connection in different network using port forwarding
- **1.3** Android hacking using reverse TCP connection

Part-B

Unit 4:
- **4.1** Show software based vulnerabilities (Badblue/iceblaster)

Unit 5:
- **5.1** Introduction to Active Directory
- **5.2** Explain OU, DC, TREE, FOREST,
- **5.3** Explain LDAP, Explain how AD works,
- **5.4** Explain smb share Explain SPN

Unit 6:
- **6.1** Introduction to Kerberos, Explain how Kerberos works (Authentication Server, Ticket Granting Server, TGT
- 6.2 Explain Kerberoasting attack, Mention, ASREPROASTING, Golden Ticket.
- 6.3 Cryptography: Symmetric Encryption Algorithm, Asymmetric Encryption Algorithm,
- 6.4 Hash Algorithm, Steganography, Prevention

Suggested Readings:
1. Jon Erickson, 2008, Hacking: The art of Exploitation, No Starch Press.

2. Peter Kim, 2013, The Hacker Playbook 2, Syngress

Note: Only latest editions of the books are recommended.

Web Links:
1. https://www.javatpoint.com/ethical-hacking (Last Visited Date: 22nd February, 2024)

Instructions for paper setting: Seven questions are to be set in total. First question will be multiple choice covering entire syllabus and will be compulsory to attempt and will be of 18 marks. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 13 marks.

Evaluation Policy:
The evaluation will include two types of assessments:
(lxxxix) Continuous or formative assessments (in the form of end semester examination or term examination. Weightage of assessments are as follows:

For continuous or Formative assessment (in semester): Maximum 30 percent. The categorization for the same is:

MCQs	30%
Subjective (Short/Long)	40%
Discussion/Presentation	15%
Projects/Group Activities etc	15%

(xc) For Summative assessment (End Semester Examination or End-Term Examination):
Minimum: 70 percent. Categorization for the same is:

Objective Type Questions:	30%
Short/Long Questions:	70%

Assessment Tools:
Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
OMCA-CS-004	1	2	2		3		3						3	1
OMCA-CS-004	2	3	1		2		2							
OMCA-CS-004	1	3	2	1	2								2	2
OMCA-CS-004	1			1	2		3						2	2
OMCA-CS-004		1	2	1			2	3	2				2	2

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OMCA-FSD-003: GAMING TECHNOLOGY-II

Periods/week Credits	Max. Marks : 100
L: 2 T: 2	Continuous Evaluation : 30
Duration of Examination: 3 Hrs	End Semester Examination : 70

Pre-Requisite: Knowledge of any Programming Language and fundamentals of Multimedia.
Course Type: Domain Elective

Course Outcomes: At the end of the course, the student will be able to:
OMCA-FSD-003.1. Understand basic principles of Game Design and Game Design Process.
OMCA-FSD-003.2. Understand importance of standards for good quality code and testing
OMCA-FSD-003.3. Basics of display technology, Software Development Kit (SDK), Application Programming Interface (API).
OMCA-FSD-003.4. Understand basic design guidelines for gaming application,
OMCA-FSD-003.5. Industry wide best practices and various ways in game to grabs inputs from various devices.
OMCA-FSD-003.6. Develop a small game based on the learning.

PART- A

UNIT I: INTRODUCTION TO GAMING
1.1 Core Design: What Is a Game?
1.2 Gameplay meaning and creating the Game Specification
1.3 Initial Design: The Beginning.
1.4 Hardware Abstraction.
1.5 The Problem Domain.
1.6 Thinking in Tokens.

UNIT II: TECHNOLOGY
2.1 Use of Technology: The State of the Art.
2.2 Blue-Sky Research.
2.3 Reinventing the Wheel.
2.4 Use of Object Technology, Building Bricks: Reusability in Software
2.5 Initial Architecture Design: The Birth of Architecture.
2.6 The Tier System and Architecture Design.

UNIT III: DEVELOPMENT
3.1 The Development Process.
3.2 Code Quality and Coding Priorities.
3.3 Debugging
3.4 Module Completion.
3.5 The Seven Golden Gambits- The Three Lead Balloons.

Part B

UNIT IV: GAME PROGRAMMING
4.1 Game Programming Technologies
4.2 Display, Mixing 2D and 3D, DirectX,
4.3 User Interface code
4.4 Resource caching
4.5 Main loop.

UNIT V: DESIGN PRACTICES
5.1 Smart & naked pointers
5.2 Correct use of memory
5.3 Game scripting languages

5.4 User focus, Scenarios and Navigation Design
5.5 Screen Design, Prototyping techniques and Wire-Framing
5.6 Understanding the UI Layer and Its Execution Framework

UNIT VI: BUILDING YOUR GAME
6.1 Creating a project, source code repositories and version control,
6.2 Building the game and scripts,
6.3 User interface programming
6.4 input devices: Getting the Device State,
6.5 Working with the Mouse (and Joystick), Keyboard,
6.6 User Interface Components and more Control Properties.

Reference Books:

1. E. N. Barron, Game Theory: An Introduction, Wiley Student Edition.
2. Gary Rosenzweig, ActionScript 3.0 Game Programming University, Pearson Education.
3. Andrew Rollings and Dave Morris, 2003, "Game Architecture and Design", New Riders.
4. Mike McShaffry, "Professional Game Programming", Dreamtech Press.

Web Links:

1. https://www.toptal.com/game/video-game-physics-part-i-an-introduction-to-rigid-body-dynamics Last Visited Date: 22-02-2024
2. https://www.cgspectrum.com/blog/game-design-basics-how-to-start-building-video-games Last Visited Date: 22-02-2024

Instructions for paper setting: Seven questions are to be set in total. First question will be multiple choice covering entire syllabus and will be compulsory to attempt and will be of 18 marks. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 13 marks.

Evaluation Policy:

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(xci) Continuous or formative assessments (in the form of end semester examination or term examination. Weightage of assessments are as follows:

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Discussion/Presentation	15%
Projects/Group Activities etc	15%

(xcii) For Summative assessment (End Semester Examination or End-Term Examination):
Minimum: 70 percent. Categorization for the same is:

Objective Type Questions:	30%
Short/Long Questions:	70%

Assessment Tools:
Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

COURSE ARTICULATION MATRIX:

CO Statement	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
OMCA-FSD-003.1	3	2	2	1	2	2	1	1	1	2	2	2	2	1
OMCA-FSD-003.2	3	3	2	2	2	2	1	1	2	2	2	2	2	1
OMCA-FSD-003.3	3	2	2	2	2	2	2	1	2	2	2	2	2	2
OMCA-FSD-003.4	3	3	2	2	2	2	2	1	2	2	2	2	2	3
OMCA-FSD-003.5	3	2	2	2	2	2	2	1	1	2	2	2	2	3
OMCA-FSD-003.6	3	3	2	3	2	2	2	1	2	3	3	1	2	3

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH & STUDIES
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OMCA-FSD-004: ANGULAR

Periods/week	Credits	Max. Marks: 100
L: 2	2	Continuous Evaluation: 30
Duration of Examination: 3 Hrs		End Semester Examination: 70

Pre-Requisite: Basic Knowledge on HTML, CSS, BOOTSTRAP, JAVASCRIPT
Course Type: Domain Specific

Course Outcomes: At the end of the course, students will be able to
OMCA-FSD-004.1 Define the architecture of Angular application
OMCA-FSD-004.2 Understand the Angular concepts, including components, modules, services, and directives
OMCA-FSD-004.3 Develop modern, complex, responsive and scalable web applications with Angular
OMCA-FSD-004. Create the applications from JavaScript framework

PART-A

Unit-1: Introduction to Angular
1.1. What is Angular
1.2. Difference between Angular 2.0 vs 7.0
1.3. Angular CLI and Troubleshooting
1.4. Node JavaScript Introduction
1.5. Setup a Project
1.6. Setup Node js with angular
1.7. Typescript Introduction
1.8. What is bootstrap
1.9. Create Your Fist App

Unit-2: Modules and Components
2.1. What is Component in Angular js
2.2. What is Module in Angular js
2.3. Create and Start Component
2.4. Why Components are important.
2.5. How we create a component
2.6. Create Component using CLI
2.7. What is nesting Component
2.8. What is Component Template
2.9. Component Styles and Selectors

Unit-3: Data Binding in Angular
3.1. What is Data binding
3.2. Splitting Application into Component
3.3. String Interpolation
3.4. What is Property Binding
3.5. Difference between Property Binding and String Interpolation
3.6. Binding with Custom Events.
3.7. What are Binding Properties and Events
3.8. Two Way binding
3.9. Combine Forms with Data binding
3.10. Custom Properties
3.11. What is Encapsulation
3.12. How to Use Local Reference in Templates Access and DOM
3.13. Component Lifecycle
3.14. What are Hooks in Angular js
3.15. Access Template with Hooks

PART-B

Unit-4: Directives in Angular js
4.1. What are Directives
4.2. Using Output Data Conditionally
4.3. What is ng if and else condition
4.4. Output List
4.5. Styling Element with ngStyle
4.6. How to apply CSS class dynamically with angular js
4.7. How to Create Basic Attribute Directive
4.8. What is Renderer
4.9. What is Host Binding and Host Listener
4.10. Directive Properties

Unit-5: Dependency Injection in Angular js
5.1. What is Dependency Injection
5.2. What are Services
5.3. Logging Service and Injection
5.4. Create Data Service
5.5. Instance of Services
5.6. Insert Service into Services
5.7. How to use service in Cross Component?
5.8. What is Hierarchical Injector

Unit-6: Angular Modules
6.1. What is idea behind Modules
6.2. What is feature Modules and how we create it
6.3. What are App Modules
6.4. Registering Routes in Feature Modules
6.5. What is Shared Module and how we create
6.6. Create the Auth Feature module

Suggested Readings:
1.Aristeidis Bampakos, Mark Thompson, 2021, Angular Projects: Build modern web apps by exploring Angular 12 with 10 different projects and cutting-edge technologies, Packet Publishing Ltd.
2. Muhammad Ahsan Ayaz, 2021, Angular Cookbook: Over 80 actionable recipes every Angular developer should know, Packet Publishing Ltd.

Note: Only latest editions of the books are recommended.

Web Links:
1. https://www.tektutorialshub.com/angular-tutorial/ (last visited date: 22 February 2024)
2. https://angular.io/guide/example-apps-list (last visited date: 22 February 2024)
3. https://www.javatpoint.com/angular-8 (last visited date: 22 February 2024)
4. https://www.w3schools.com/angular/angular_examples.asp (last visited date: 22 February 2024)

Instructions for paper setting: Seven questions are to be set in total. First question will be multiple choice covering entire syllabus and will be compulsory to attempt and will be of 18 marks. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 13 marks.

Evaluation Policy:
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Discussion/Presentation	15%
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Minimum: 70 percent. Categorization for the same is:

Objective Type Questions:	30%
Short/Long Questions:	70%

Assessment Tools:
Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
OMCA-FSD-004.1.	3	2	1			2							1	1
OMCA-FSD-004.2.		1		1			1	1	1	2			3	2
OMCA-FSD-004.3.			3						1					
OMCA-FSD-004.4.		3						1					3	2

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH & STUDIES
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OMCA-MC-003: AUTOMOTIVE COMPUTING

Periods/week	Credits	Max. Marks: 100
L: 2 T: 0	2	Continuous Evaluations: 30
Duration of Examination: 3 Hrs		End Semester Examination: 70

Pre-Requisite: Cloud Computing
Course Type: Domain Elective

Course Outcomes: At the end of the course, the student will be able to:
OMCA-MC-003.1 Demonstrate competency in the use of personal computers and business application software as required by the automotive industry.
OMCA-MC-003.2. Describe data types, basic computer architecture and concepts, systems and components, and OEM/aftermarket automotive computer diagnostic systems.
OMCA-MC-003.3. Demonstrate skills and knowledge of microcontrollers and microcontroller programming, and basic analog and digital signal acquisition and control.
OMCA-MC-003. 4. Demonstrate analytical and critical reasoning skills for problem solving of automotive computing case studies.
OMCA-MC-003.5. Demonstrate basic knowledge of data communications as applied to automotive technology.

PART-A

UNIT 1: Application Software on Personal Computers
1.1. Microsoft Word: Document-creating, Formatting, Finalizing
1.2. Microsoft Excel: Sheet-Creating, Formatting, Finalizing
1.3. Microsoft PowerPoint: Presentation-Creating , Finalizing
1.4. Microsoft Access:Database-Crating, Finalizing
1.5. Robotic systems and devices for health care and medicine
1.6. Technologies to promote a healthy and secure society

UNIT 2: Computer Basics
2.1. Data Types and Structures
2.2. Computer Hardware and Software
2.3. Operating Systems

UNIT 3: Microcontroller Basics
3.1. I/O Signals and Control
3.2. Memory (RAM/ROM/EEPROM)
3.3. Programming

PART-B

UNIT 4: Automotive Computer Diagnostic
4.1. OBD II and CAN Bus
4.2. OEM/Aftermarket Scan

UNIT 5: Automotive Hardware and Computing system
5.1. Introduction to modern hardware and computing systems
5.2. Hypervisor OS
5.3. Telematics Systems
5.4. Infotainment Systems
5.5. Smartphone Apps Integration

UNIT 6: **Automotive Mobile Apps**
6.1. Wireless networking
6.2. Mobile and wearable sensing
6.3. Multi-gigabit wireless networks

6.4. Internet of things

Suggested Readings:

1. Parsons & Oja, 2011, Practical Microsoft Office 2010: Text w/CD, (1st ed.), Cengage.
2. Matthew Gast, 2012, 802.11n: A Survival Guide, O'Reilly Media.
3. Matthew Gast, 2013, 802.11ac: A Survival Guide, O'Reilly Media.

Note: Only latest editions of the books are recommended.

Web links:

- Syllabus - CS 695-002 Wireless and Mobile Computing (gmu.edu)(Last Visited Date: 23rd February, 2024)
- Automotive-embedded-systems.pdf (buffalo.edu).(Last visited Date: 23rd February, 2024)
- Role of Advanced Hardware and Software Platforms in the Automotive Industry (einfochips.com).(Last visited Date: 23rd February, 2024)

Instructions for paper setting: Seven questions are to be set in total. First question will be multiple choice covering entire syllabus and will be compulsory to attempt and will be of 18 marks. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 13 marks.

Evaluation Policy:

The evaluation will include two types of assessments:

(xcv) Continuous or formative assessments (in the form of end semester examination or term examination. Weightage of assessments are as follows:

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MCQs	30%
Subjective (Short/Long)	40%
Discussion/Presentation	15%
Projects/Group Activities etc	15%

(xcvi) For Summative assessment (End Semester Examination or End-Term Examination):
Minimum: 70 percent. Categorization for the same is:

Objective Type Questions:	30%
Short/Long Questions:	70%

Assessment Tools:

Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
OMCA-MC-003.1.	1	1		2			2	3		2		2	3	3
OMCA-MC-003.2	3	3		2			3	3		2		2	2	
OMCA-MC-003.3	1	1	3		2		3	3		2	3		2	1
OMCA-MC-003.4	1	1	1	2	2		2	3			3		1	
OMCA-MC-003.5	1	1		2			3	3		2	3			3

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OMCA-MC-004: MOBILE GAMES

Periods/week	Credits	Max. Marks: 100
L: 2 T: 0	2	Continuous Evaluation: 30
Duration of Examination: 3 Hrs		End Semester Examination: 70

Pre-Requisite: Nil
Course Type: Domain Elective
COURSE OUTCOMES: If you complete the course successfully, you should be able to:
MCA-MC-004.1 Understand the fundamental concepts of game theory.
MCA-MC-004.2 Acquire proficiency in constructing and analyzing mathematical models to represent strategic interactions.
MCA-MC-004.3 Analyze various strategic situations, identify the key players, their preferences, and available choices.
MCA-MC-004.4 Model and analyze a wide range of strategic interactions using game-theoretic frameworks.
MCA-MC-004.5 Will gain insights into decision-making under uncertainty through concepts like probability, risk, and expected utility theory within the framework of game theory

PART-A

Unit 1: Introduction to Game Theory
1.1 Game theory,
1.2 Theory of rational choice,
1.3 Interacting decision makers

Unit 2: Strategic Games and Nash Equilibrium
2.1 Strategic games: examples,
2.2 Nash equilibrium: concept and examples, Best response functions,
2.3 Dominated Actions, Symmetric games and symmetric equilibria,
2.4 Illustrations of Nash Equilibrium,
1.5 Cournot's model of duopoly market

Unit 3: Bertrand's model of duopoly market
1.1 Electoral Competition,
1.2 War of Attrition, Auctions,
1.3 Accident Laws

PART-B

Unit 4: Mixed Strategy Nash Equilibriu
4.1 Introduction, Strategic games with randomisation,
4.2 Mixed strategy Nash equilibrium: concept and examples
4.3 Dominated Actions,
4.4 Formation of Players' beliefs

Unit 5: Extensive Games and Nash Equilibrium
5.1 Introduction to extensive games,
5.2 Strategies and outcomes,
5.3 Nash equilibrium, Subgame perfect Nash equilibrium,
5.4 Backward induction

Unit 6: Illustrations of Extensive Games and Nash Equilibrium
6.1 Stackelberg model of duopoly markets,
6.2 Ultimatum game

Suggested Readings:
1. Osborne, M.J., 2004, An Introduction to Game Theory, Oxford University Press.
2. Mas-Colell, A., M.D. Whinston and J.R. Green, 1995, Microeconomic Theory, Oxford University Press.

Web links:

1. https://www.geeksforgeeks.org/how-to-get-started-with-game-development/amp/ (Last Visited Date: 22nd February, 2024)
2. https://www.munotes.in/sem5techmaxgp.html (Last Visited Date: 22nd February, 2024)

Instructions for paper setting: Seven questions are to be set in total. First question will be multiple choice covering entire syllabus and will be compulsory to attempt and will be of 18 marks. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 13 marks.

Evaluation Policy:

The evaluation will include two types of assessments:

(xcvii) Continuous or formative assessments (in the form of end semester examination or term examination. Weightage of assessments are as follows:

For continuous or Formative assessment (in semester): Maximum 30 percent. The categorization for the same is:

MCQs	30%
Subjective (Short/Long)	40%
Discussion/Presentation	15%
Projects/Group Activities etc	15%

(xcviii) For Summative assessment (End Semester Examination or End-Term Examination): Minimum: 70 percent. Categorization for the same is:

Objective Type Questions:	30%
Short/Long Questions:	70%

Assessment Tools:

- Assignment/Tutorials
- Sessional tests
- Surprise questions during lectures/Class Performance
- Term end examination

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
OMCA-MC-004.1	1	2	2	3	3			2					3	1
OMCA-MC-004.2	1	2	2	3	1				2				3	2
OMCA-MC-004.3	1	3	2	1	2								2	1
OMCA-MC-004.4	1	2	2						3	3			2	1
OMCA-MC-004.5	1	2	1		3	2	2				1	1		

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH & STUDIES
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OMCA-MM-003: COMPOSITING & VISUAL EFFECTS

Periods/week	Credits	Max. Marks : 100
L: 2	2	Continuous Evaluation: 30
Duration of Examination: 3 Hrs		End Semester Examination: 70

Pre-Requisite: Multimedia
Course Type: Doman Elective

Course Outcomes: At the end of the course the student will be able to:
MCA-MM-003.1. Understand the different toolset meant for multimedia
MCA-MM-003.2. Learn processing of 3D images
MCA-MM-003.3. Acquire profound knowledge in photographic applications of 3D images
MCA-MM-003.4. Hands on practice in creating realistic and immersive scenes
MCA-MM-003.5. Optimize the visuals along with the effects using techniques like various multi-pass rendering techniques
MCA-MM-003.6. Create movies, videos and games using creative tools like matting and Chroma Keys

PART-A

UNIT 1: Introduction to Toolsets
1.1 Brief history of compositing and visual effects
1.2 Deconstructing digital images and the rendering process
1.3 Fundamental 3D and digital compositing principles
1.4 Comparing the Nuke and After Effects compositing engines
1.5 Pre-multiplied vs. non-pre-multiplied images Reading

UNIT 2: Photographic applications for 3D
2.1 Deconstructing cameras and the photographic process
2.2 Camerawork fundamentals
2.3 Aspect ratios, standards, focus, and exposure principles
2.4 Shooting and image processing for a background plate
2.5 Discuss perspective and depth cues

UNIT 3: Advanced photographic applications for 3D
3.1 Texture gathering
3.2 Limitations of standard low-dynamic range images
3.3 Shooting and Processing High Dynamic Range Images
3.4 Applications for HDRI in 3D Reading

PART-B

UNIT 4: Compositing 3D with Live Action
4.1 Setup and matching of 3D lighting to a background plate
4.2 Exporting multiple render passes and compositing for shadows
4.3 Image based lighting and reflections
4.4 Realistic materials
4.5 Ideal specifications for diffuse texturing
4.6 Contrasting game asset texturing to cinematic asset texturing

UNIT 5: Multi-pass Rendering
5.1 Using render layers to optimize multi-pass rendering
5.2 Multi layer compositing principles and techniques
5.3 Comparing basic effects and layered composite workflows
5.4 Diffuse, color, shadows, reflections, and occlusion
5.5 Advanced multi-Pass Rendering (specialty layers and channels, Z-Depth vs. Luminance depth, Image bit depth, 8-bit vs. 16 bit vs. floating point)

5.6 Node based compositing principles and techniques
5.7 Color correction and post effects

UNIT 6: Film, Video, Matting, and Chroma Keying
6.1 Deconstructing film, video, and digital video standards
6.2 Aspect ratios, file formats, and frame rates
6.3 Types of mattes and matting techniques
6.4 Chroma Keying , Making and mattes for 2D elements vs. 3D elements
6.5 Rotoscoping and wire removal
6.6 Matting Techniques for Particle Systems

Suggested Readings:

1. Mark Spencer, 2009, Apple Pro Training Series: Motion 4, Peachpit Press.
2. Damian Allen, 2007, Apple Pro Training Series: Motion 3, Peachpit Press.
3. Damian Allen, Brian Connor, 2006, Apple Pro Training Series: Encyclopedia of Visual Effects, Peachpit Press.
4. Jeffrey A. Okun and Susan Zwerman, 2020, The VES Handbook of Visual Effects: Industry Standard VFX Practices and Procedures, Routledge.
5. Bill Byrne, 2009, The Visual Effects Arsenal: VFX Solutions for the Independent Filmmaker, Routledge.

Web Links:
1. VFX Compositing & Visual Effects: After Effects Tutorials | Udemy (Last visited Date: 23-February, 2024)
2. What Is Compositing in Video Editing? A Beginner's Guide - Storyblocks (Last visited Date: 23-February, 2024)

Instructions for paper setting: Seven questions are to be set in total. First question will be multiple choice covering entire syllabus and will be compulsory to attempt and will be of 18 marks. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 13 marks.

Evaluation Policy:
The evaluation will include two types of assessments:
(xcix) Continuous or formative assessments (in the form of end semester examination or term examination. Weightage of assessments are as follows:

For continuous or Formative assessment (in semester): Maximum 30 percent. The categorization for the same is:

MCQs	30%
Subjective (Short/Long)	40%
Discussion/Presentation	15%
Projects/Group Activities etc	15%

(c) For Summative assessment (End Semester Examination or End-Term Examination):
Minimum: 70 percent. Categorization for the same is:

Objective Type Questions:	30%
Short/Long Questions:	70%

Assessment Tools:
Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
MCA-MM-003.1	1	1		2	3		3	2					3	3
MCA-MM-003.2	1	1	1	1	1		2	2			3		3	3
MCA-MM-003.3	1	1		1	2			2			3		2	3
MCA-MM-003.4	1		1		1		2	1			3		2	2
MCA-MM-003.5	1	2	1		2			3			2		2	2
MCA-MM-003.6	2		2				2				3		3	

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OMCA-MM-004: MODELLING & TEXTURING

Periods/week	Credits	Max. Marks: 100
L: 2 T: 0	2	Continuous Evaluation : 30
Duration of Examination: 3 Hrs		End Semester Examination : 70

Pre-Requisite: Multimedia
Course Type: Doman Elective

Course Outcomes: At the end of the course the student will be able to:
MCA-MM-004.1 Understand the structure of modern graphics.
MCA-MM-004.2 Develop and design drawings that demonstrate modelling and design skills.
MCA-MM-004.3 Make use of the key algorithms for modeling and rendering graphical data.
MCA-MM-004.4 Develop, design and problem solving skills with application to computer graphics.
MCA-MM-004.5 Implement various graphical features like clipping, filling etc.

Part-A

Unit 1: Introduction to Media
1.1 Introduction to "Visual Communication" A brief History of animation
1.2 Development throughout the age
1.3 Different types of animation production,
1.4 Introduce the Production Methodology behind Animation film production

- I Pre-Production.
- II Production.
- III Postproduction

Unit 2: Object Modelling
2.1 Making the Object in BLENDER,
2.2 Add 'materials and shading',
2.3 Basics of "TEXTURING,UV Mapping",
2.4 Basics of "LIGHTING",
2.5 Basics of "RENDER ANDCOMPOSITING".

Unit 3: Character Modelling
3.1 Introduce different 'styles of characters used for animation and gaming,
3.2 Create own character,
3.3 Detailed Study on Character Design,
3.4 Clay Modelling methodology.

Part-B

Unit 4: Textures in 3D Model
4.1 Basics of Armature
4.2 3D Model of a proposed Character,
4.3 Experiment special features and mannerisms to character,
4.4 Identify the texture for developed characters, Deals with some procedural Textures

Unit 5: Blender 3D UVW
5.1 Learning Blender 3D UVW Maps and Unwrapping
5.2 A Mesh, lighting to character,
5.3 Compositing and Enhancement Phase.

Unit 6: BG modelling
6.1 Learn basic of "Perspective",
6.2 Environment Modelling,
6.3 develop an atmosphere.

6.4 3D UVW Maps and Unwrapping
6.5 A Mesh More experiments with TEXTURING AND SHADING OF REALISTIC BACK GROUNDS for animation, Practice rendering, compositing.

Suggested Readings:

1. David S. Ebert, F. Kenton Musgrave, Darwyn Peachey, 2003, Texturing and Modeling: A Procedural Approach (The Morgan Kaufmann Series in Computer Graphics, Morgan Kaufmann Publishers In

2. D. S. Ebert, 1998, Texturing and Modeling: A Procedural Approach, 2nd Ed., Academic Press Inc

Web Links:

1. https://www.a23d.co/blog/what-is-3d-texturing/ (Last Visited Date: 23rd February, 2024)

2. https://www.oreilly.com/library/view/3d-animation-essentials/9781118147481/9781118239056c05.xhtml (Last Visited Date: 23rd February, 2024)

Instructions for paper setting: Seven questions are to be set in total. First question will be multiple choice covering entire syllabus and will be compulsory to attempt and will be of 18 marks. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 13 marks.

Evaluation Policy:

The evaluation will include two types of assessments:

(ci) Continuous or formative assessments (in the form of end semester examination or term examination. Weightage of assessments are as follows:

For continuous or Formative assessment (in semester): Maximum 30 percent. The categorization for the same is:

MCQs	30%
Subjective (Short/Long)	40%
Discussion/Presentation	15%
Projects/Group Activities etc	15%

(cii) For Summative assessment (End Semester Examination or End-Term Examination):

Minimum: 70 percent. Categorization for the same is:

Objective Type Questions:	30%
Short/Long Questions:	70%

Assessment Tools:

Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
OMCA-MM-004.1	3	3	2	2	3		3						2	1
OMCA-MM-004.2	1	1	2	2	2		1						3	1
OMCA-MM-004.3	1	2	2	1	2								2	1
OMCA-MM-004.4	1	1	3	2	1		3						1	1

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH & STUDIES

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OMCA-DS-216: ADVANCE DATABASE SYSTEMS

Periods/week Credits — Max. Marks: 100
L: 2 — 2 — Continuous Evaluation: 30
Duration of Examination: 3 Hrs — End Semester Examination: 70

Pre-Requisite: Knowledge of Database Management System
Course Type: Domain Elective

Course Outcomes: At the end of the course, students will be able to:
OMCA-DS-216.1 Understand the concept of Advance Database Base Management System.
OMCA-DS-216.2 Explore the relational databases and its different models.
OMCA-DS-216.3 Apply advance SQL queries and PL/SQL programs.
OMCA-DS-216.4 Analyze the different database security issues.
OMCA-DS-216.5 Create and implement the ER and EER diagrams.

PART -A

UNIT 1: Relational Database Design and Implementation

1.1 Introduction to Relational Database Management System
1.2 Features of Good Relational Database Management System
1.3 Enhanced ER tools
1.4 Converting EER diagram to tables
1.5 Different Table Constraints and Characterization
1.6 Normalization: UNF, 1NF, 2NF, 3NF, EKNF, BCNF, 4NF, ETNF, 5NF, DKNF, 6NF
1.7 Inclusion Dependencies and Template Dependency

UNIT 2: Emerging Database Technologies, Applications and Environments

2.1 Database Concepts and its Architecture
- 2.1.1 Object Oriented Database
- 2.1.2 Object Relational Database
- 2.1.3 Active Database
- 2.1.4 Temporal Database
- 2.1.5 Spatial Database
- 2.1.6 Deductive Database
- 2.1.7 Mobile Database

2.2 Query Processing
2.3 Geographic Information System
2.4 Data Warehousing and Data Mining

UNIT 3: Advance SQL and PL/SQL

3.1 SQL Query Statements
3.2 Advance SQL Queries
3.3 SQL Operations: Selection, Join, Sorting, Grouping
3.4 Transformation of Relational and Logical Operations
3.5 SQL Functions
3.6 Storage and Query Optimization
3.7 Views and Query Processing
3.8 Cursors: Implicit and Explicit
3.9 Database Triggers
3.10 Exception Handling
3.11 Sub Programs: Procedures and Functions

PART-B

UNIT 4: Distributed Databases

4.1 Centralized versus non centralized Database
4.2 Homogeneous and Heterogeneous DDBMS and their comparison
4.3 Functions and Architecture
4.4 Distributed database design, query processing in DDBMS
4.5 Distributed concurrency management, deadlock management
4.6 Concepts of replication servers

UNIT 5: Database Security and Authorization
1.1 Introduction to Database Security
1.2 Problems in Database Security and Conclusions
1.3 Levels of Database Security
1.4 Access Control
1.5 Multilevel Security
1.6 Statistical Database Security
1.7 Examples of E-Security

UNIT 6: Transaction Management and Recovery Process
6.1 Advanced feature of Transactions
6.2 Enhanced Lock Based and timestamp-based Protocols
6.3 Deadlock Handling
6.4 Weak Levels of Consistency
6.6 Recovery and Atomicity
6.7 Recovery with Concurrent Transaction
6.8 Advanced Recovery Techniques
6.9 Remote Backup Systems

Suggested Readings:
1. Elmasri and Navathe, 2016, Fundamentals of Database Systems, Pearson Education
2. Raghu Ramakrishnan, 2003, Database Management Systems, Johannes Gehrke, , McGraw-Hill
3. Korth, Silberchatz, Sudarshan, 2011, Database System Concepts, McGraw-Hill.
4. Peter Rob and Coronel, 2010, Database Systems, Design, Implementation and Management, Thomson Learning.
5. C. J. Date & Longman, 2003, Introduction to Database Systems, Pearson Education

Note: Only latest editions of the books are recommended.

Software required/ Web links:
Oracle 9i or above versions (10g, 11i, 12c)
https://www.geeksforgeeks.org/dbms-concurrency-control-protocols-lock-based-protocol/ (last visited date: 22 February 2024)
https://www.tutorialspoint.com/dbms/dbms_data_recovery.htm (last visited date: 22 February 2024)
https://www.tutorialspoint.com/html/index.htm (last visited date: 22 February 2024)
https://www.w3schools.com/ (last visited date: 22 February 2024)

Instructions for paper setting: Seven questions are to be set in total. First question will be multiple choice covering entire syllabus and will be compulsory to attempt and will be of 18 marks. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 13 marks.

Evaluation Policy:
The evaluation will include two types of assessments:
(ciii) Continuous or formative assessments (in the form of end semester examination or term examination. Weightage of assessments are as follows:

For continuous or Formative assessment (in semester): Maximum 30 percent. The categorization for the same is:

MCQs	30%
Subjective (Short/Long)	40%

Discussion/Presentation 15%
Projects/Group Activities etc 15%

(civ) For Summative assessment (End Semester Examination or End-Term Examination):
Minimum: 70 percent. Categorization for the same is:
Objective Type Questions: 30%
Short/Long Questions: 70%

Assessment Tools:
Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
OMCA-DS-216.1		1	2	3		2		2		3	3		3	2
OMCA-DS-216.2	1	2	2	3	3	3		2	2		3		2	1
OMCA-DS-216.3	1	1	2		2		2		3		2	2	2	2
OMCA-DS-216.4		3	2	3			2			3			2	3
OMCA-DS-216.5	1	1	2		2				2	3			2	1

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH & STUDIES
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OMCA-DS-217: SOCIAL NETWORK ANALYTICS

Periods/week	Credits	Max. Marks: 100
L: 2	2	Continuous Evaluation: 30
Duration of Examination: 3 Hrs		End Semester Examination: 70

Pre-Requisite: Basic Knowledge on C Programming, Sensors, Microcontrollers
Course Type: Domain Elective

Course Outcomes: At the end of the course, students will be able to:
OMCA-DS-217.1. Do Online interactive demonstrations and hands-on analysis of real-world data sets
OMCA-DS-217.2. Analyse the structure and evolution of network
OMCA-DS-217.3 Formulate agent based model which from local behaviour of agent can generate network with diverse global structure.
OMCA-DS-217.4 Know how to conduct computer simulation to analyse properties of such model.

PART-A

Unit-1: Introduction
1.1 Social network data-Formal methods-
1.2 Paths and Connectivity-Graphs to represent social relations-
1.3 Working with network data-
1.4 Network Datasets-Strong and weak ties - Closure, Structural.

Unit-2: Social Influence
2.1 Homophily- Mechanisms Underlying Homophily,
2.2 Selection and Social Influence, Affiliation,
2.3 Tracking Link Formation in On-Line Data,
2.4 Spatial Model of Segregation –
2.5 Positive and Negative Relationships - Structural Balance - Applications of Structural Balance, Weaker Form of Structural Balance.

Unit-3 Information Networks and The World Wide Web
3.1 The Structure of the Web-World Wide Web-
3.2 Information Networks, Hypertext
3.3 Associative Memory- Webas a Directed Graph,
3.4 Bow-Tie Structure of the Web-Link Analysis
3.5 Web Search Searching the Web: Ranking

PART-B

Unit-4: Information Networks and The World Wide Web
4.1 Link Analysis using Hubs and Authorities-
4.2 Page Rank-
4.3 Link Analysis in Modern Web Search, Applications,
4.4 Spectral Analysis, Random Walks, and Web Search.

Unit-5: Social Network Mining
5.1 Clustering of Social Network graphs: Betweenness, Girvan Newman Algorithm-
5.2 Discovery of communities-
5.3 Cliques and Bipartite Graphs-Graph Partitioning Methods-
5.4 Matrices-Eigen values Sim-rank

Unit-6: **Network Dynamics**
6.1 Cascading Behaviour in networks: Diffusion in Networks,
6.2 Modelling Diffusion-Cascades and Cluster,

6.3 Thresholds, Extensions of the Basic Cascade Model-
6.4 Six Degrees of Separation-Structure and Randomness,
6.5 Decentralized Search- Empirical Analysis and Generalized Models-
6.6 Analysis of Decentralized Search.

Suggested Readings:

1. Easley and Kleinberg, 2010, Networks, Crowds, and Markets: Reasoning about a highly connected world, Cambridge Univ. Press.
2. Robert A. Hannemanandc Mark Riddle, 2005, Introduction to social network methods, University of California.
3. Jure Leskovec, Anand Rajaraman, Milliway Labs, Jeffrey D. Ullman, 2014, Mining of Massive Datasets, Cambridge University Press.

Note: Only latest editions of the books are recommended.

Web Links:

https://www.tutorialride.com/big-data-analytics/social-network-analysis.htm (Last visited Date: 23-02-2024)
https://aberdeenstudygroup.github.io/studyGroup/lessons/SG-T21-SocialNetworkAnalysis/SNA_tutorial/ (Last visited Date: 23-02-2024)

Instructions for paper setting: Seven questions are to be set in total. First question will be multiple choice covering entire syllabus and will be compulsory to attempt and will be of 18 marks. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 13 marks.

Evaluation Policy:

The evaluation will include two types of assessments:

(cv) Continuous or formative assessments (in the form of end semester examination or term examination. Weightage of assessments are as follows:

For continuous or Formative assessment (in semester): Maximum 30 percent. The categorization for the same is:

MCQs	30%
Subjective (Short/Long)	40%
Discussion/Presentation	15%
Projects/Group Activities etc	15%

(cvi) For Summative assessment (End Semester Examination or End-Term Examination):
Minimum: 70 percent. Categorization for the same is:

Objective Type Questions:	30%
Short/Long Questions:	70%

Assessment Tools:

Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
OMCA-DS-217.1	3	3			2	2						1		
OMCA-DS-217.2		2	2	3		1		3				2		1
OMCA-DS-217.3	3	2		2	1									
OMCA-DS-217.4	3		2		2	1								

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH & STUDIES
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OMCA-IOT-003: COMMUNICATION TECHNOLOGIES IN IoT

Periods/week	Credits	Max. Marks: 100
L: 2	2	Continuous Evaluation: 30
Duration of Examination: 3 Hrs		End Semester Examination: 70

Pre-Requisite: Basic Knowledge on C Programming, Sensors, Microcontrollers
Course Type: Domain Specific

Course Outcomes: At the end of the course, students will be able to
OMCA-IOT-003.1. Understand the fundamentals of IOTs.
OMCA-IOT-003.2. Know the concept of simulation of IoT environment
OMCA-IOT-003.3. Learn the technologies of Interfacing sensors with IoT Environment
OMCA-IOT-003.4. Be exposed to various Communication protocols in IoT
OMCA-IOT-003.5. Understand application of IoT communication in Cloud Environment

PART-A

Unit-1: Introduction to IOT
1.1. Understanding IoT fundamentals
1.2. IOT Architecture and protocols
1.3. Various Platforms for IoT
1.4. Real time Examples of IoT
1.5. Overview of IoT components and IoT Communication Technologies
1.6. Challenges in IOT

Unit-2: Arduino Simulation Environment
2.1. Arduino Uno Architecture
2.2. Setup the IDE, Writing Arduino Software
2.3. Arduino Libraries
2.4. Basics of Embedded C programming for Arduino
2.5. Interfacing LED, push button and buzzer with Arduino
2.6. Interfacing Arduino with LCD

Unit-3: Sensor & Actuators with Arduino
3.1. Overview of Sensors working
3.2. Analog and Digital Sensors
3.3. Interfacing of Temperature, Humidity, Motion, Light and Gas Sensor with Arduino
3.4. Interfacing of Actuators with Arduino.
3.5. Interfacing of Relay Switch and Servo Motor with Arduino

PART-B

Unit-4: Basic Networking with ESP8266 WiFi module
4.1. Basics of Wireless Networking
4.2. Introduction to ESP8266 Wi-Fi Module
4.3. Various Wi-Fi library
4.4 Web server- introduction, installation, configuration
4.5 Posting sensor(s) data to web server

Unit-5: IoT Protocols
5.1. M2M vs. IOT
5.2. Communication Protocols
5.3. M2M and WSN Protocols

5.4. SCADA and RFID Protocols
5.5. Issues with IoT Standardization
5.6. Unified Data Standards
5.7. Protocols – IEEE802.15.4
5.8. BACNet Protocol

Unit-6 . Cloud Platforms for IOT
6.1. Virtualization concepts and Cloud Architecture
6.2. Cloud computing, benefits
6.3. Cloud services -- SaaS, PaaS, IaaS
6.4. Cloud providers & offerings
6.5. Study of IOT Cloud platforms
6.6. ThingSpeak API and MQTT
6.7. Interfacing ESP8266 with Web services

Suggested Readings:

1. Honbo Zhou, "The Internet of Things in the Cloud: A Middleware Perspective", CRC Press,2012.
2. Dieter Uckelmann, Mark Harrison, Michahelles, Florian (Eds), "Architecting the Internet ofThings", Springer, 2011.
3. David Easley and Jon Kleinberg, "Networks, Crowds, and Markets: Reasoning About a HighlyConnected World", Cambridge University Press, 2010.
4. Olivier Hersent, David Boswarthick, Omar Elloumi , "The Internet of Things – Key applicationsand Protocols", Wiley, 2012.

Note: Only latest editions of the books are recommended.

Web Links:
https://data-flair.training/blogs/iot-technology/ (Last visited Date: 28-02-2024)

Instructions for paper setting: Seven questions are to be set in total. First question will be multiple choice covering entire syllabus and will be compulsory to attempt and will be of 18 marks. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 13 marks.

Evaluation Policy:
The evaluation will include two types of assessments:

(cvii) Continuous or formative assessments (in the form of end semester examination or term examination. Weightage of assessments are as follows:

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MCQs	30%
Subjective (Short/Long)	40%
Discussion/Presentation	15%
Projects/Group Activities etc	15%

(cviii) For Summative assessment (End Semester Examination or End-Term Examination):
Minimum: 70 percent. Categorization for the same is:

Objective Type Questions:	30%
Short/Long Questions:	70%

Assessment Tools:
Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
OMCA-IOT-003.1	3	3			2	2						1		
OMCA-IOT-003.2		2	2	3		1		3				2		1
OMCA-IOT-003.3					1		2			2	3		1	
OMCA-IOT-003.4	1			1					2					2
OMCA-IOT-003.5	1	2	2		2					2			2	2

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH & STUDIES
(Deemed to be University under section 3 of the UGC Act 1956)

OMCA-IoT-004: SOFTWARE & PROGRAMMING IN IoT

Periods/week	Credits	Max. Marks : 100
L: 2	2	Continuous Evaluation: 30
Duration of Examination: 3 Hrs		End Semester Examination: 70

Co-Requisite: Computer networks
Course Type: Domain Elective

Course Outcomes: At the end of the course the student will be able to:
OMCA-IoT-004.1. Able to understand the basic concepts of IoT as well as role in modern day life
OMCA-IoT-004.2. Learn programming on an electronic platform like microcontroller
OMCA-IoT-004.3. Get hands on experience in designing various IoT applications
OMCA-IoT-004.4. Design some IoT based prototypes
OMCA-IoT-004.5. Learn interoperability between various electronic platforms for information exchange

PART-A

UNIT 1: Introduction to IoT
1.1 Understanding the IoT fundamentals
1.2 IoT architecture and protocols
1.3 Various platforms for IoT
1.4 Real time examples of IoT
1.5 Overview of IoT components and IoT communication Technologies
1.6 Challenges in IoT

UNIT 2: Interaction with Arduino
2.1 Arduino Simulation Environment
2.2 Arduino Uno Architecture
2.3 Setup the IDE, Writing Arduino Software
2.4 Arduino Libraries
2.5 Basics of Embedded C programming for Arduino
2.6 Interfacing LED, push button

UNIT 3: Programming with Arduino
3.1 Sensor and Actuators with Arduino
3.2 Overview of Sensors working
3.3 Analog and Digital Sensors
3.4 Interfacing of Temperature, Humidity, Motion, Light and Gas Sensor with Arduino
3.5 Interfacing of Actuators with Arduino.
3.6 Interfacing of Relay Switch and Servo Motor with Arduino

PART-B

UNIT 4: Interaction with Raspberry Pi
4.1 Interfacing Hardware with the Raspberry Pi
4.2 Raspberry Pi Remote Access, operate the Raspberry Pi in "headless mode", Bash Command line, operating Raspberry Pi without needing a GUI interface
4.3 Introduction to Cloud Storage models and communication APIs.
4.4 Web server & cloud for IoT
4.5 Python web application framework
4.6 Designing a RESTful web API via connecting to APIs

UNIT 5: Designing through Raspberry Pi
5.1 IoT Design using Raspberry Pi IoT Applications based on Pi

5.2 LAMP Web-server, GPIO Control over Web Browser
5.3 Creating Custom Web Page for LAMP
5.4 Communicating data using on-board module
5.5 Home automation using Pi, Node-RED, MQTT Protocol
5.6 Using Node-RED Visual Editor on Rpi

UNIT 6: Networking with Arduino & Rasberry Pi

6.1 Basic Networking with ESP8266 WiFi module & Wireless Networking
6.2 Introduction to ESP8266 Wi-Fi Module
6.3 Web server- introduction, installation, configuration
6.4 Posting sensor(s) data to web server 5. Cloud Platforms for IOT
6.5 Virtualization concepts and Cloud Architecture alongwith the benefits of cloud computing
6.6 Cloud services -- SaaS, PaaS, IaaS & Interfacing ESP8266 with Web services

Suggested Readings:

1. Hakima Chaouchi, "The Internet of Things Connecting Objects to the Web, Wiley Publications
2. Olivier Hersent, David Boswarthick, and Omar Elloumi, — "The Internet of Things: Key Applications and Protocols", Wiley Publications
3. Vijay Madisetti and Arshdeep Bahga, 2014, "Internet of Things (A Hands-on-Approach)", VPT.
4. J. Biron and J. Follett, 2016, "Foundational Elements of an IoT Solution", O'Reilly Media.
5. Keysight Technologies, 2016, "The Internet of Things: Enabling Technologies and Solutions for Design and Test", Application Note.
6. Daniel Minoli, 2013, "Building the Internet of Things with IPv6 and MIPv6: The Evolving World of M2M Communications", Willy Publications.
7. Pethuru Raj and Anupama C. Raman, 2017, "The Internet of Things: Enabling Technologies, Platforms, and Use Cases", CRC Press.

Web Links:

Getting Started with Arduino UNO | Arduino.(Last visited date: 23-02-2024)
Design Your Own Raspberry Pi Compute Module PCB : 5 Steps (with Pictures) - Instructables.(Last visited Date: 23-02-2024)
How to Use the ESP8266 for Wireless Communication With Arduino and Raspberry Pi | ESP8266 | Maker Pro.(Last visited Date: 23-02-2024)

Instructions for paper setting: Seven questions are to be set in total. First question will be multiple choice covering entire syllabus and will be compulsory to attempt and will be of 18 marks. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 13 marks.

Evaluation Policy:

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Sessional tests
Surprise questions during lectures/Class Performance
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OMCA-IOT-004.2	1	1	1	1	1		2	2			3		3	3
OMCA-IOT-004.3	1	1		1	2		2	2			3		2	3
OMCA-IOT-004.4	1		1	1	1		2	1			3		2	2
OMCA-IOT-004.5	1		1		1		1	2			2		2	

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH & STUDIES
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OMCA-DaS-003: DATA ANALYTICS AND VSUALIZATION USING EXCEL

Periods/week	Credits	Max. Marks: 100
L: 2 T: 0	2	Continuous Evaluations: 30
Duration of Examination: 3 Hrs		End Semester Examination: 70

Pre-Requisite: Basics of MS-EXCEL
Course Type: Elective
Course Outcomes: At the end of the course, the student will be able to:

OMCA-DaS-003.1. Generate spreadsheets with appropriate formatting, layout, proofing.
OMCA-DaS-003.2. Draw analysis on data using spreadsheets and use interpretation.
OMCA-DaS-003.3. Make meaningful representations of data in the form of charts and pivot tables.
OMCA-DaS-003.4. Develop ability to deal with numerical and quantitative problems in workbooks.
OMCA-DaS-003.5. Effectively use the analytics and visualisation tools in Spreadsheets.

PART-A

UNIT 1: Excel Advanced Technique

1.1. Templates
1.2. Efficiency and Risk (Standard Deviation, Variance, and Coefficient of Variation)
1.3. Data Validation
1.4. Functions and Power functions
1.5. Array Formulae (Frequency Distribution, mode.mult, mode.sngl)
1.6. Tables
1.7. Advanced Range Names
1.8. What–if-analysis: Goal-seek, Data tables, and Scenario Manager
1.9. Data analysis ToolPak: Descriptive Statistics, Moving averages, Histogram, Covariance, correlation, and Regression analysis (only for projection); solver add in.
1.10. Problem Solving using Solver (optimal product mix, workforce scheduling, transportation

UNIT 2: Excel Interactivity and Automation

2.1 Index and Match
2.2 Offset, Dynamic Charting
2.3 Database functions
2.4 Text functions and Error functions: IfError, IsError, Aggregate, Circular Reference, Formula Auditing, Floating-Point Errors
2.5 Form Controls (Button, Combo, Check box, Spinner, List, Option), Visual Basic (only basic).

UNIT 3: Macros and Working with loops

3.1 Recording Macros, Absolute and relative macros, editing macros
3.2 Use of spinner buttons and command buttons; Sub Procedure, Function Procedure (creating New Functions)
3.3 Working with Loops: Do_while loop, For_Next loop; Creating User Forms: Message Box, Input Box; If_Then_Else

PART-B

UNIT 4: Introduction to VBA

4.1 Conditional Formatting
4.2 Charts that Inspire (Waterfall, Column, Line, Combo, Thermometer, Scatter, Histogram)
4.3 Slicers
4.4 Sparklines
4.5 Graphics Tricks and Techniques

4.6 Worksheet Automation using Macros: Absolute and relative macros editing macros
4.7 Creating new functions using macros, Use of spinner buttons and command buttons.

UNIT 5: Data Analysis and Decision-Making

5.1 Working with External Data
5.2 Advanced Uses of PivotTables
5.3 PowerPivot, Reporting with PowerPivot, Power query
5.4 Dashboard, Creating a spreadsheet in the area of: Loan and Lease statement
5.5 Ratio Analysis
5.6 Payroll Accounting
5.7 Capital Budgeting (NPV & IRR)

UNIT 6: **Graphical Representation of Data Analysis**

6.1 Portfolio Management
6.2 Breakeven analysis and Sensitivity analysis
6.3 Operations Management: Constraint, Forecasting & Trend Analysis optimization
6.4 Assignment Problems
6.5 Depreciation Accounting (Single Method)
6.6 Graphical representation of data
6.7 Frequency distribution and its statistical parameters; Correlation and Regression Analysis

Suggested Readings:

1. Data Visualization in Excel: A Guide for Beginners, Intermediates, and Wonks (AK Peters Visualization Series), AK Peters Publication, CRC Press, 2023
2. Michael Alexander, Dick Kusleika, Excel 2019 Power Programming with VBA, Wiley
3. Chandan Sengupta, Financial Analysis and Modelling Using Excel and VBA, Second Edition, Wiley Student Edition.

Note: Only latest editions of the books are recommended.

Web links:

- A Step-by-Step Guide to Advanced Data Visualization (policyviz.com) (Last visited Date: 22-02-2024)
- Excel Data Analysis - Data Visualization (tutorialspoint.com) (Last visited Date: 22-02-2024)
- Data Visualization in Excel - GeeksforGeeks (Last visited Date: 22-02-2024)

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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
OMCA-DaS-003.1	1	1	1	2			2	3				2	3	3
OMCA-DaS-003.2	3	3		2			3	3				2	2	
OMCA-DaS-003.3	1	1	3		2		3	3					2	1
OMCA-DaS-003.4	1	1	1	2	2		2	3					1	
OMCA-DaS-003.5	1	1		2	3		3	3		1	3	3		3

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH & STUDIES
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OMCA-DaS-004: DATA ANALYTICS & VISUALIZATION USING PYTHON

Periods/week	Credits	Max. Marks: 100
L: 2 T: 0	2	Continuous Evaluations : 30
Duration of Examination: 3 Hrs		End Semester Examination: 70

Pre-Requisite: Basics of Python Programming
Course Type: Elective

Course Outcomes: At the end of the course, the student will be able to:
OMCA-DaS-004.1. Generate Python scripts for data analysis with appropriate documentation.
OMCA-DaS-004.2. Apply Python libraries for data analysis and interpretation.
OMCA-DaS-004.3. Create data visualizations using Python libraries such as Matplotlib and Seaborn, and effectively use charts and pivot tables for data representation.
OMCA-DaS-004.4. Analyze and solve numerical and quantitative problems using Python's data analysis and manipulation tools.
OMCA-DaS-004.5. Apply advanced data analytics and visualization techniques to solve real-world problems.

PART-A

UNIT 1: Introduction
- 1.1. Introduction to Data Science
- 1.2. Exploratory Data Analysis and Data Science Process.
- 1.3. Motivation for using Python for Data Analysis,
- 1.4. Introduction of Python shell iPython and Jupyter Notebook.
- 1.5. Essential Python Libraries: NumPy, pandas, matplotlib, SciPy, scikit-learn, statsmodels

UNIT 2: Getting Started with Pandas
- 2.1 Arrays and vectorized computation
- 2.2 Introduction to pandas Data Structures
- 2.3 Essential Functionality
- 2.4 Summarizing and Computing Descriptive Statistics
- 2.5 Data Loading, Storage and File Formats
- 2.6 Reading and Writing Data in Text Format
- 2.7 Web Scraping
- 2.8 Binary Data Formats,
- 2.9 Interacting with Web APIs
- 2.10 Interacting with Databases Data Cleaning and Preparation.
- 2.11 Handling Missing Data,
- 2.12 Data Transformation,
- 2.13 String Manipulation

UNIT 3: Data Wrangling
- 3.1 Hierarchical Indexing,
- 3.2 Combining and Merging Data Sets Reshaping and Pivoting.

PART-B

UNIT 4: Data Visualization matplotlib
- 4.1 Basics of matplotlib,
- 4.2 plotting with pandas and seaborn,
- 4.3 other python visualization tools

UNIT 5: Data Aggregation and Group operations

5.1 Group by Mechanics
5.2 Data aggregation
5.3 General split-apply-combine
5.4 Pivot tables and cross tabulation
5.5 Time Series Data Analysis:
5.6 Date and Time Data Types and Tools
5.7 Time series Basics
5.8 Date Ranges
5.9 Frequencies and Shifting
5.10 Time Zone Handling
5.11 Periods and Periods Arithmetic
5.12 Resampling and Frequency conversion
5.13 Moving Window Functions

UNIT 6: **Advanced Pandas**

6.1 Categorical Data
6.2 Advanced GroupBy Use
6.3 Techniques for Method Chaining

Suggested Readings:

1. Charles Severance, 2022, "Python for Everybody: Exploring Data in Python 3.
McKinney, W., 2017, Python for Data Analysis: Data Wrangling with Pandas, NumPy and IPython. 2nd edition. O'Reilly Media.
2. O'Neil, C., & Schutt, R., 2013, Doing Data Science: Straight Talk from the Frontline O'Reilly Media.

Note: Only latest editions of the books are recommended.

Web links:

- Packages of Data Visualization in Python - Javatpoint (last visited date: 22 February 2024)
- Introduction to Data Visualization in Python (gilberttanner.com) (last visited date: 22 February 2024)
- Data Visualization with Python - GeeksforGeeks (last visited date: 22 February 2024)

Instructions for paper setting: Seven questions are to be set in total. First question will be multiple choice covering entire syllabus and will be compulsory to attempt and will be of 18 marks. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 13 marks.

Evaluation Policy:

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Short/Long Questions:	70%

Assessment Tools:

Assignment/Tutorials

Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
OMCA-DaS-004.1.	1	1		2			2	3				2	3	3
OMCA-DaS-004.2	3	3		2			3	3				2	2	
OMCA-DaS-004.3	1	1	3		2		3	3					2	1
OMCA-DaS-004.4	1	1	1	2	2		2	3					1	
OMCA-DaS-004.5	1	1		2			3	3		2	3			3

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH & STUDIES

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OMCA-BC-003: BLOCKCHAIN ARCHITECTURE

Periods/week	Credits	Max. Marks: 100
L: 2 T: 0	2	Continuous Evaluation : 30
Duration of Examination: 3 Hrs		End Semester Examination : 70

Pre-Requisite: Fundamentals of Blockchain
Course Type: Domain Elective

Course Outcomes: At the end of the course, the student will be able to:

OMCA-BC-003.1. Know about introduction to Blockchain.
OMCA-BC-003.2. Study about consensus protocols.
OMCA-BC-003.3. Understand Hyperledger fabric.
OMCA-BC-003.4. Implement of blockchain in financial software system and trade supply chain.
OMCA-BC-003.5. Design of the use cases.
OMCA-BC-003.6. Design the use cases of blockchain for government.

PART-A

Unit 1: Introduction to Blockchain

1.1 Digital Money to Distributed Ledgers
1.2 Design Primitives: Protocols, Security, Consensus, Permissions, Privacy
1.3 Blockchain Architecture and Design: Basic crypto primitives: Hash, Signature
1.4 Hash chain to Blockchain, Basic consensus mechanisms

Unit 2: Consensus

2.1 Requirements for the consensus protocols
2.2 Proof of Work (PoW)
2.3 Scalability aspects of Blockchain consensus protocols
2.4 Permissioned Blockchains: Design goals
2.5 Consensus protocols for Permissioned Blockchains

Unit 3: Hyperledger Fabric

3.1 Hyperledger Fabric: Decomposing the consensus process
3.2 Hyperledger fabric components
3.3 Chain code Design and Implementation
3.4 Hyperledger Fabric : Beyond Chaincode: Fabric SDK and Front End
3.5 Hyperledger composer tool

PART-B

Unit 4: Implementation

1.1 OOPS concept of Python
1.2 Encryption technique
1.3 Block encryptio
1.4 Interface/ API of Blockchain
1.5 Blockchain implementation using Python/ Java

Unit 5: Use Case

5.1 Use case 1 : Blockchain in Financial Software and Systems (FSS): (i) Settlements, (ii) KYC, (iii) Capital markets.

5.2 case 2: Blockchain in trade/supply chain: (i) Provenance of goods, visibility, trade/supply chain finance, invoice management discounting, etc.

Unit 6: Use Case3

6.1 Blockchain for Government: (i) Digital identity, land records and other kinds of record keeping between governmen entities, (ii) public distribution system social welfare systems

6.2 Blockchain Cryptography

6.3 Privacy and Security on Blockchain

Suggested Readings:

1. Andreas Antonopoulos, 2014, Mastering Bitcoin: Unlocking Digital Cryptocurrencies, O'Reilly Media.
2. Melanie Swa, 2015, Blockchain, O'Reilly.
3. Bob Dill, David Smits, 2017, Zero to Blockchain – An IBM Redbooks course.

Note: Only latest editions of the books are recommended.

Web Links:

https://www.javatpoint.com/blockchain-tutorial (Last visited date: 23rd February, 2024)

Instructions for paper setting: Seven questions are to be set in total. First question will be multiple choice covering entire syllabus and will be compulsory to attempt and will be of 18 marks. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 13 marks.

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Short/Long Questions:	70%

Assessment Tools:

Assignment/Tutorials

Sessional tests

Surprise questions during lectures/Class Performance

Term end examination

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO 5	PO 6	PO 7	PO8	PO9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2

OMCA-BC-003.1	2		1	2	1		2			1			3	1
OMCA-BC-003.2	1			1			3	1		1	2	1	2	
OMCA-BC-003.3	2		2		1	1			1		2		2	
OMCA-BC-003.4	1		1	2			3	1	3		2		3	2
OMCA-BC-003.5		1	2		3		3	1		3			2	
OMCA-BC-003.6	2			3		2		1			2		3	

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES
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OMCA-BC-004: BLOCKCHAIN AND SMART CONTRACTS

Periods/week	Credits	
L :2 T: 0	2.0	Max. Marks: 100
		Continuous Evaluation: 30
Duration of Exam: 3 Hrs		End Semester Examination: 70

Pre-Requisite: Expertise in programming, basic knowledge of computer security, cryptography, networking, concurrent or parallel programming would help a student to understand the topics.

Course Type: Domain Elective

Course Outcomes: Students will be able to –

OMCA-BC-004.1 Make the students familiar with such emerging technologies.
OMCA-BC-004.2 Understand the cryptographic concept behind the Block chain technology.
OMCA-BC-004.3.Developing and deploying smart contracts on blockchain platforms like Ethereum
OMCA-BC-004.4 Understanding of blockchain security principles and best practices for securing smart contracts
OMCA-BC-004.5 How to integrate blockchain technology into traditional web development practices to create decentralized applications.
OMCA-BC-004.6 Understand and learn the use cases and aspects of Block chain with implementation options.

PART –A

UNIT 1: Introduction:

1.1 Course objectives and outcomes
1.2 What is Ethereum? How does Ethereum compare to Bitcoin?
1.3 The Ethereum network and History of Ethereum
1.4 Background Theories: Cryptographic Hash Functions (SHA), Cryptographically Secured, Digital Signatur e, Public Key Cryptography (RSA),
1.5 Chain of Blocks, Merkle Trees, Smart Contract, Centralized Vs. Distributed network. Actors and components in Blockchain solution

UNIT 2: Smart Contracts, Dapps, And DAOs (concepts):

2.1 What are Smart Contracts?
2.2 What is Ethereum Virtual Machine (EVM)?
2.3 What is Decentralized Autonomous Organizations (DAO)?
2.4 Quick Start Overview of Remix using JavaScript VM

UNIT 3: Ethereum Technology Overview

3.1 Architectural Overview
3.2 Ethereum Block chain Platform
3.3 Ethereum Virtual Machine
3.4 Create your private Ethereum block chain
3.5 Download the main Ethereum block chain
3.6 Analyze Ethereum block chain

PART – B

UNIT 4: Introduction to Programming Smart Contracts

4.1 A Simple Smart Contract
4.2 Account Types, Gas, and Transactions

4.3 Contracts
4.4 Accessing Contracts and Transactions
4.5 Developer Tools and Ethereum Tests
4.6 Web3 Base Layer Services

UNIT 5: – Programming Tutorial - Installing, Building, Testing, & Deploying

5.1 Ethereum Nodes
5.2 Building A Private Blockchain Network
5.3 MetaMask Browser Plug In
5.4 Mist Browser
5.5 Ethereum Wallet
5.6 Web3 Ethereum JavaScript API

UNIT 6: Decentralized Apps (Dapps)

6.1 Connecting to the Blockchain and Smart Contract
6.2 Web3js
6.3 Deployment
6.4 Sample Web Pages (HTML/CSS/Javascript)

Suggested Books:

1. Imran Bashir, 2023, Mastering Blockchain, Packt Publishing
2. Matt Zand, 2021, Hands-On Smart Contract Development with Hyperledger Fabric V2, O'Reilly Media

Note: Only latest editions of the books are recommended.

Web links:

https://www.geeksforgeeks.org/smart-contracts-in-blockchain/ (Last Visited Date: 21st February, 2024)
https://www.simplilearn.com/tutorials/aws-tutorial/aws-load-balancer (Last Visited Date: 21st February, 2024)

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Assessment Tools:

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OMCA-BC-004.3			2	1		2	1		2					
OMCA-BC-004.4		2	3	2			2	2			3	2	2	2
OMCA-BC-004.5		2	3	3			2	2			3	2	3	2
OMCA-BC-004.6		2	3	3			2	2				2	3	

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

(Deemed to be University under section 3 of the UGC Act 1956)

OMCA-DO-003: DEVOPS SOFTWARE ENGINEERING

Periods/week Credits — Max. Marks: 100

L: 2 T: 0 2 — Continuous Evaluation: 30

Duration of Examination: 3 Hrs — End Semester Examination: 70

Pre-Requisite: Software Engineering
Course Type: Domain Elective

Course Outcomes: At the end of the course, students will be able to
OMCA-DO-003.1. Apply configuration management to production environments.
OMCA-DO-003.2. Maintain test suites and measure testing quality and coverage
OMCA-DO-003.3. Automatically generate new tests, using feedback-directed random testing, fuzzing, and data-flow analysis
OMCA-DO-003.4. Programmatically measure code quality via static and dynamic code analysis
OMCA-DO-003.5. Describe the principles of DevOps and JIRA tools.
OMCA-DO-003.6. Apply advanced strategies for deployment of software.

PART–A

Unit 1: Introduction to Devops
1.1 What Is Devops
1.2 History of Devops
1.3 DevOps and Software Development Life Cycle
1.4 Agile Model
1.5 Continuous Integration & Deployment

Unit 2: Version Control System
2.1 Purpose of Version Control System
2.2 Types of Version Control System
2.3 Centralized vs Distributed Version Control
2.4 Version Control tools
2.5 Overview of GIT

Unit 3: Introduction to Agile
3.1 Agile methodologies
3.2 Agile Requirements
3.3 Scaled agile frameworks
3.4 Agile forecasting and project Management
3.5 Agile tracking tools

PART -B

Unit 4: Container Orchestration
4.1 Introducing Docker and its technology
4.2 Understanding of Docker images and containers
4.3 Docker Networking
4.4 Docker Swarm
4.5 Kubernetes

4.6 Kubernetes Cluster Architecture

Unit 5: Continuous Integration
5.1 Essentials of Continuous Integration
5.2 Jenkins Creating pipelines
5.3 Jenkins and its architecture
5.4 Jenkins tool Management
5.5 Unit testing, Integration testing, System testing
5.6 Case Study

Unit 6: DevOps on Cloud
6.1 Essentials of Cloud computing
6.2 Cloud and virtualization architecture
6.3 Cloud deployment architecture
6.4 Cloud providers – An overview
6.5 Why we need DevOps on Cloud?

Suggested Readings:

1. Sricharan Vadapalli, 2018, DevOps: Continuous Delivery, Integration, and Deployment with DevOps: Dive, Packt.
2. Thomas Uphill, John Arundel, Neependra Khare, Hideto Saito, Hui-Chuan, 2017, DevOps: Puppet, Docker, and Kubernetes, Packt.
3. Janet Gregory, Lisa Crispin, More Agile Testing: Learning Journeys for the Whole Team, Addison Wesley.

Note: Only latest editions of the books are recommended.

Weblinks:
https://www.guru99.com/what-is-devops.html (Last Visited Date: 22 February,2024)
https://www.geeksforgeeks.org/git-tutorial/ (Last Visited Date: 22 February,2024)
https://www.geeksforgeeks.org/difference-between-software-engineer-and-devops-engineer/
(Last Visited Date: 22 February,2024)

Instructions for paper setting: Seven questions are to be set in total. First question will be multiple choice covering entire syllabus and will be compulsory to attempt and will be of 18 marks. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three fromeach part. Each question will be of 13 marks.

Evaluation Policy:
The evaluation will include two types of assessments:

(cxix) Continuous or formative assessments (in the form of end semester examination or term examination. Weightage of assessments are as follows:

For continuous or Formative assessment (in semester): Maximum 30 percent. The categorization for the same is:

MCQs	30%
Subjective (Short/Long)	40%
Discussion/Presentation	15%
Projects/Group Activities etc	15%

(cxx) For Summative assessment (End Semester Examination or End-Term Examination):
Minimum: 70 percent. Categorization for the same is:

Objective Type Questions:	30%
Short/Long Questions:	70%

Assessment Tools:

Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
OMCA-DO-003.1	3	2	2	3	2	1	2	2			1	3	2	2
OMCA-DO-003.2	3	1	1	3	2	1	2	1			2	3	2	2
OMCA-DO-003.3	3	2	1	3	2	1	1	2			2	3	2	2
OMCA-DO-003.4	2	3	2	3	1	1	2	2			3	3	2	2
OMCA-DO-003.5	1	2	1	2	2	1	2	2			3	3	2	2
OMCA-DO-003.6	3	2		2	2	1	1	2			2	3	2	2

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH & STUDIES

(Deemed to be University under section 3 of the UGC Act 1956)

OMCA-DO-004: CONTINUOUS INTEGRATION & VERSION CONTROL

Periods/week	Credits	Max. Marks: 100
L: 2 T: 0	2	Continuous Evaluation: 30
Duration of Examination: 3 Hrs		End Semester Examination: 70

Pre-Requisite: Knowledge of Software Development
Course Type: Domain Elective

Course Outcomes: At the end of the course the student will be able to:
MCA-DO-004.1 Define the concept of version control.
MCA-DO-004.2 Describe working principles of GIT repository and how to use them in real world projects.
MCA-DO-004.3 Explain workflows and record changes to repository.
MCA-DO-004.4 Make and track changes in a GIT.
MCA-DO-004.5 create a GIT and use it.

PART -A

Unit 1: Introduction to Version Controlling Tool
1.1 Knowing about Version control
1.2 Essentials of GIT in Industry
1.3 How to setup GIT
1.4 Working with various commands in GIT
1.5 Recording Changes to the Repository

Unit 2: Working with GIT
2.1 Viewing the Commit History
2.2 Undoing Things
2.3 Working with Remotes
2.4 Branching and Merging in Git
2.5 GIT workflows
2.6 GIT cheat sheet

Unit-3: Essentials of Continuous Integration (Jenkins)
3.1 Essentials of Continuous Integration
3.2 An example scenario where CI is used
3.3 Know about Jenkins and its architecture in detail
3.4 Jenkins tool Management in detail
3.5 Know about User management in Jenkins
3.6 Authentication
3.7 Authorization

PART-B

Unit 4: Creating jobs and automatic build settings
4.1 What is Jenkins Pipeline?
4.2 Why Pipeline?
4.3 Integration with GIT
4.4 How to enable project-based authorization for a job
4.5 Source code management while creating jobs

Unit 5: Docker

5.1 Real-world Shipping Transportation Challenges
5.2 Introducing Docker and its technology
5.3 Understanding of Docker images and containers
5.4 Working with container
5.5 How to Share and copy a container
5.6 Container Life Cycle
5.7 How to use Base Image and customize
5.8 Creation of Docker File
5.9 How to Publish Image on Docker Hub

Unit 6: **Introduction to Docker Networking**

6.1 Network Types in docker technology
6.2 Docker Container Networking
6.3 Docker Compose – An introduction
6.4 Docker Swarm – An introduction
6.5 Use Docker Compose to create php, wordpress, mysql
6.6 How to Start Containers on a Cluster with Docker Swarm
6.7 Creating and Scaling an application in Docker swarm

Suggested Readings:

1. Scott Chacon and Ben Straub, 2021, Pro GIT Everything you need to know about GIT, Apress
2. Raju Gandhi, 2022, Head First Git: A Learner's Guide to Understanding Git from the Inside Out, Paperback
3. Silverman Richard E., 2020, Git Pocket Guide, O'Reilly

Note: Only latest editions of the books are recommended.

Web links:

https://www.tutorialspoint.com/continuous_integration/continuous_integration_version_control.htm (last visited date: 22 February 2024)
http://www.w3schools.me/devops/devops-tutorial (last visited date: 22 February 2024)

Instructions for paper setting: Seven questions are to be set in total. First question will be multiple choice covering entire syllabus and will be compulsory to attempt and will be of 18 marks. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three fromeach part. Each question will be of 13 marks.

Evaluation Policy:

The evaluation will include two types of assessments:

(cxxi) Continuous or formative assessments (in the form of end semester examination or term examination. Weightage of assessments are as follows:

For continuous or Formative assessment (in semester): Maximum 30 percent. The categorization for the same is:

MCQs	30%
Subjective (Short/Long)	40%
Discussion/Presentation	15%
Projects/Group Activities etc	15%

(cxxii) For Summative assessment (End Semester Examination or End-Term Examination):
Minimum: 70 percent. Categorization for the same is:

Objective Type Questions:	30%

Short/Long Questions: 70%

Assessment Tools:
Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PS O2
OMCA-DO-004.1	2		1	1			2						3	3
OMCA-DO-004.2	1	3	1		1		1						2	2
OMCA-DO-004.3	1	2	2	2		2	1						2	3
OMCA-DO-004.4	1	2	2	2	3	2	1						3	2
OMCA-DO-004.5	2	3	2	2		2	2	1					2	2

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH & STUDIES

(Deemed to be University under section 3 of the UGC Act 1956)

OMCA-CN-003: NETWORK PROTOCOLS

Periods/week	Credits	Max. Marks: 100
L: 2	2	Continuous Evaluation: 30
Duration of Examination: 3 Hrs		End Semester Examination: 70

Pre-Requisite: Data Communication & Networking
Course Type: Domain Specific

Course Outcomes: At the end of the course, students will be able to
OMCA-CN-003.1. Learn basics of Network Protocols.
OMCA-CN-003.2. Understand the concepts of different protocols over Data Link layer and MAC layer.
OMCA-CN-003.3. Classify and utilize the details of IP addresses and the functions of different routing protocols.
OMCA-CN-003.4. Analyze different protocols require to be configured in networks for reliable transmission.
OMCA-CN-003.5. Understand the purpose of application layer services and protocols.

PART –A

UNIT 1: Network Protocols: Basics and Foundations
1.1 Introduction to Network Protocols
1.2 Protocols and Standards
1.3 Protocol Stack Architecture
1.4 Network Protocol Analyzer
1.5 TCP/IP Protocol Suite

UNIT 2: Data Link Layer Protocols
2.1 Utopian Simplex Protocol
2.2 Stop and Wait Protocol for error free and noisy channel
2.3 Sliding window protocol
2.4 SONET
2.5 ADSL

Unit 3: Multiple Access Protocols
3.1 ALOHA
3.2 CSMA Protocols
3.3 Collision free Protocols
3.4 Limited Contention Protocols
3.5 Wireless LAN Protocols

PART-B

UNIT 4: Network Layer Protocols
4.1 Routing Protocols
4.2 Internet Protocol (IPv4 & IPv6)
4.3 Internet Control Protocols (ICMP & IGMP)
4.4 ARP & RARP

UNIT 5: Transport Layer Protocols
5.1 Elements of Transport Protocol
5.2 TCP & UDP

5.3 Real Time Transport Protocol
5.4 Protocol for Long Fat Networks
5.5 Bundle Protocol for Delay Tolerant Networks

UNIT 6: Application Layer Protocols
6.1 HTTP & HTTPs
6.2 SMTP
6.3 FTP
6.4 DNS
6.5 SNMP
6.6 Telnet

Suggested Readings:

1. B. Forouzan, 2017, Data Communication and Networking, Tata McGraw Hill.
2. A.S. Tanenbaum,2016, Computer networks, Prentice Hall.
3. Tomasi Wayne, 2007, Introduction to Data Communication & Networking, Pearson Education
4. 1993, Protocol Standards and Interfaces, Computer networks, Black, Prentice Hall Education

Note: Only latest editions of the books are recommended.

Weblinks:
https://www.smartzworld.com/notes/computer-network-cn-notes-pdf https://www.tutorialspoint.com (last visited date: 22 February 2024)
www.tutorialspoint.com/listtutorials/networking/1 (last visited date: 22 February 2024)

Instructions for paper setting: Seven questions are to be set in total. First question will be multiple choice covering entire syllabus and will be compulsory to attempt and will be of 18 marks. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three fromeach part. Each question will be of 13 marks.

Evaluation Policy:
The evaluation will include two types of assessments:
(cxxiii) Continuous or formative assessments (in the form of end semester examination or term examination. Weightage of assessments are as follows:

For continuous or Formative assessment (in semester): Maximum 30 percent. The categorization for the same is:

MCQs	30%
Subjective (Short/Long)	40%
Discussion/Presentation	15%
Projects/Group Activities etc	15%

(cxxiv) For Summative assessment (End Semester Examination or End-Term Examination):
Minimum: 70 percent. Categorization for the same is:

Objective Type Questions:	30%
Short/Long Questions:	70%

Assessment Tools:
Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
OMCA-CN-003.1		2		1		1	3						2	1
OMCA-CN-003.2	2	2	2				3			1			3	2
OMCA-CN-003.3		3		1			2						2	
OMCA-CN-003.4	2	3			1		2		1		1		1	2
OMCA-CN-003.5	2	1	1		2		3			1				

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH & STUDIES
(Deemed to be University under section 3 of the UGC Act 1956)

OMCA-CN-004: TCP/IP

Periods/week	Credits	Max. Marks: 100
L: 2 T: 0	2	Continuous Evaluation: 30
Duration of Examination: 3 Hrs.		End Semester Examination: 70

Pre-Requisite: Computer Networks
Course Type: Domain Elective

Course Outcomes: At the end of the course the student will be able to:
OMCA-CN-004.1 Summarize basic principles of IPv4 and its Addressing mechanisms.
OMCA-CN-004.2 Understand UDP Services and Applications in Transport Layer.
OMCA-CN-004.3 Describe the services, and features of TCP.
OMCA-CN-004.4 Discuss various Flow, Error and Congestion control mechanisms of TCP.
OMCA-CN-004.5 Understand the Principles of IPv6 Addressing, IPv6 and ICMPv6 Protocols.

PART- A

Unit 1: Introduction to Neural Network

1.1 The OSI Model and the TCP/IP Protocol Suite
1.2 Protocol Layers, The OSI Model, TCP/IP Protocol suite and addressing.
1.3 IPV4 Addresses- Introduction, Classful and Classless Addressing
1.4 Internet Protocol Version4(IPv4) – Datagrams, Fragmentation, Options, Checksum, Security, IP Package.

Unit 2: Learning Networks

2.1 Introduction to the Transport Layer – Transport Layer Services and Protocols.
2.2 User Datagram Protocol (UDP) – Introduction, User Datagram, UDP Services and Applications, UDP Package.

Unit 3: Concepts of Deep Learning

3.1 Transmission Control Protocol – I: TCP Services, Features
3.2 Segment
3.3 TCP Connection
3.4 Windows in TCP.

PART-B

Unit 4 Parameters in Deep Learning

1.1 Transmission Control Protocol – II: Flow Control
1.2 Error Control, Congestion Control,
1.3 TCP Timers, Options and TCP Package.

Unit 5: Algorithms

5.1 IPv6 Addressing – Introduction, Address Space Allocation
5.2 Global Unicast Addresses, Autoconfiguration and Renumbering.
5.3 IPv6 Protocol - Introduction, Packet Format, Transition from IPv4 to IPv6.
5.4 ICMPv6 - Introduction, Error Messages, Informational Messages
5.5 Neighbor Discovery Messages, Group Membership Messages.

Unit 6: Modelling techniques in Neural Networks

2.1 Internet Protocol: IPv4 ☐ IP Datagram Formats

2.2 Data and Fragmentation ☐ Address Masks
2.3 Prefixes☐ and Subnetworks ☐ Network Address Translation (NAT)

Suggested Readings:

1. TCP/IP Protocol Suite, Behrouz A. Forouzan, 4th Edition, Tata McGraw-Hill Edition

Note: Only latest editions of the books are recommended.

Software required/ Web links:

1. http://wwwdb.deis.unibo.it/courses/TW/DOCS/w3schools/website/web_tcpip.asp.html#gsc.tab=0 (last visited date: 22 February 2024)
2. https://www.ibm.com/docs/en/cics-ts/5.3?topic=web-internet-tcpip-http-concepts (last visited date: 22 February 2024)

Instructions for paper setting: Seven questions are to be set in total. First question will be multiple choice covering entire syllabus and will be compulsory to attempt and will be of 18 marks. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three fromeach part. Each question will be of 13 marks.

Evaluation Policy:

The evaluation will include two types of assessments:

(cxxv) Continuous or formative assessments (in the form of end semester examination or term examination. Weightage of assessments are as follows:

For continuous or Formative assessment (in semester): Maximum 30 percent. The categorization for the same is:

MCQs	30%
Subjective (Short/Long)	40%
Discussion/Presentation	15%
Projects/Group Activities etc	15%

(cxxvi) For Summative assessment (End Semester Examination or End-Term Examination):
Minimum: 70 percent. Categorization for the same is:

Objective Type Questions:	30%
Short/Long Questions:	70%

Assessment Tools:

Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO
OMCA-CN-004.1	2	1		2			2						3	3
OMCA-CN-004.2	1	3	1	1			2						2	2
OMCA-CN-004.3	1	2	1	1			2						2	3
OMCA-CN-004.4	1	2	2	3	2		1						3	2
OMCA-CN-004.5	2	1	1	3	2		2						2	2

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH & STUDIES
(Deemed to be University under section 3 of the UGC Act 1956)

OMCA-AR-003: 3-D MODELS FOR AUGUMENTED & VIRTUAL REALITY

Periods/week	Credits	Max. Marks : 100
L: 2 T: 0	2	Continuous Evaluation: 30
Duration of Examination: 3 Hrs		End Semester Examination: 70

Co-Requisite: Computer networks
Course Type: Domain Elective

Course Outcomes: At the end of the course the student will be able to:
OMCA-AR-003.1. Inculcate conceptual knowledge of 3D modeling and VR
OMCA-AR-003.2. Implement workflows to created 3D content from existing as well as future environments
OMCA-AR-003.3. Hands on practice for 3D model creation using SketchUp, CityEngine (theoretical), Unity
OMCA-AR-003.4. Understand the emerging possibilities of environmentally sensed information
OMCA-AR-003.5. Create 3D models and make them accessible in an interactive way through the use of game engines.

PART-A

UNIT 1: Introduction and Overview of 3D Modeling and Virtual Reality
1.1 Distinguishing VR, AR, and MR Systems
1.2 3D Modeling and VR in the Geospatial Sciences
1.3 Applications of 3D Modeling
1.4 An overview of Workflows for 3D Model construction
1.5 Static 3D Modeling, Data-Driven Modeling & Procedural Modelling
1.6 3D and VR Application Building Workflows

UNIT 2: Hands-on Modeling using SketchUp
2.1 Installing SketchUp
2.2 Optimization and Rendering
2.3 Create a building
2.4 SketchUp and Sketchfab

UNIT 3: Introduction to Procedural Modeling & ArcGIS Pro
3.1 Overview of procedural modelling
3.2 Introduction to CityEngine and its CGA shape Grammar
3.3 Create a road map of University park campus
3.4 Symbolizes Layers and Edit features
3.5 Explore Raster and 3D data

PART-B

UNIT 4: 3D Spatial Analysis
4.1 Overview of 3D spatial Analysis
4.2 Flood Analysis
4.3 Sun Shadow Volume Analysis
4.4 Reflection in Spatial Modeling in 3D

.

UNIT 5: UNITY I

5.1 Overview of UNITY 1
5.2 The Unity3D Game Engine
5.3 Unity interface and Basic Unity Concepts
5.4 Walkthrough: Using Unity to Build a Stand-Alone Windows application
5.5 First Game in Unity: Roll-the-Ball

UNIT 6: Unity II

6.1 3D Applications in Unity
6.2 Walkthrough: From SketchUp Model to Unity
6.3 Animations and state change in Unity
6.4 Walkthrough: Creating a camera Animation
6.5 Unity Based VR Applications for mobile devices
6.6 Walkthrough: Creating a 360 degree Movie for Google Cardboard

Suggested Readings:

1. Kelly S. Hale (Editor), Kay M. Stanney, 2014, Handbook of Virtual Environments: Design, Implementation, and Applications, Second Edition (Human Factors and Ergonomics).
2. Michael Madary and Thomas K. Metzinger, 2016, Real Virtuality: A Code of Ethical Conduct. Recommendations for Good Scientific Practice and the Consumers of VR-Technology. Frontiers in Robotics and AI
3. Jason Jerald, 2015, The VR Book: Human-Centered Design for Virtual Reality. Association for Computing Machinery and Morgan & Claypool Publishers.
4. Tony Parisi, 2015, Learning Virtual Reality, O,Reilly.

Note: Only latest editions of the books are recommended

Web Links:

1. How to Create 3D Model for Augmented Reality – 3D-Ace Studio (Last visited: 23-02-2024)
2. How to get started making a video game | Unity (Last visited: 23-02-2024)

Instructions for paper setting: Seven questions are to be set in total. First question will be multiple choice covering entire syllabus and will be compulsory to attempt and will be of 18 marks. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three fromeach part. Each question will be of 13 marks.

Evaluation Policy:

The evaluation will include two types of assessments:

(cxxvii) Continuous or formative assessments (in the form of end semester examination or term examination. Weightage of assessments are as follows:

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MCQs	30%
Subjective (Short/Long)	40%
Discussion/Presentation	15%
Projects/Group Activities etc	15%

(cxxviii) For Summative assessment (End Semester Examination or End-Term Examination):
Minimum: 70 percent. Categorization for the same is:

Objective Type Questions:	30%
Short/Long Questions:	70%

Assessment Tools:

Assignment/Tutorials

Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
OMCA-AR-003.1	1	1	2	2	3		3	2					3	3
OMCA-AR-003.2	1	1	1	1	1		2	2			3		3	3
OMCA-AR-003.3	1	1		1	2		2	2			3		2	3
OMCA-AR-003.4	1		1	1	1		2	1			3		2	2
OMCA-AR-003.5	1	1	1	1			2	2					1	2

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH & STUDIES
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OMCA-AR-004: VR AND 360 VIDEO PRODUCTION

Periods/week	Credits	Max. Marks: 100
L: 2 T: 0	2	Continuous Evaluation: 30
Duration of Examination: 3 Hrs		End Semester Examination: 70

Pre-Requisite: Knowledge of Multimedia
Course Type: Domain Elective

Course Outcomes: At the end of the course the student will be able to:
OMCA-AR-004.1 Describe how VR systems work and list the applications of VR.
OMCA-AR-004.2 Understand the design and implementation of the hardware that enables VR systems to be built.
OMCA-AR-004.3 Understand the system of human vision and its implication on perception and rendering.
OMCA-AR-004.4 Explain the concepts of motion and tracking in VR systems.
OMCA-AR-004.5 Describe the importance of interaction and audio in VR systems.

PART-A

UNIT 1: Introduction to Virtual Reality
1.1 Defining Virtual Reality, History of VR,
1.2 Human Physiology and Perception,
1.3 Key Elements of Virtual Reality Experience,
1.4 Virtual Reality System, Interface to the Virtual World-
1.5 Input & output- Visual, Aural & Haptic Displays, Applications of Virtual Reality.

Unit 2: The Geometry of Virtual Worlds &The Physiology of Human Vision
2.1 Geometric Models,
2.2 Changing Position and Orientation,
2.3 Axis-Angle Representations of Rotation,
2.4 Viewing Transformations,
2.5 Chaining the Transformations,
2.6 Human Eye, eye movements & implications for VR.

Unit 3: Visual Perception & Rendering
1.1 Visual Perception –
1.2 Perception of Depth, Perception of Motion,
1.3 Perception of Color, Combining Sources of Information
1.4 Visual Rendering -Ray Tracing and Shading Models,
1.5 Rasterization, Correcting Optical Distortions,
1.6 Improving Latency and Frame Rates

PART-B

Unit 4: Motion & Tracking
1.1 Motion in Real and Virtual Worlds-
1.2 Velocities and Accelerations, The Vestibular System,
1.3 Physics in the Virtual World, Mismatched Motion and Vection Tracking-
1.4 Tracking 2D & 3D Orientation,
1.5 Tracking Position and Orientation, Tracking Attached Bodies

UNIT 5: Interaction & Audio

5.1 Interaction - Motor Programs and Remapping,
5.2 Locomotion, Manipulation, Social Interaction. Audio –
5.3 The Physics of Sound,
5.4 The Physiology of Human Hearing,
5.5 Auditory Perception, Auditory Rendering.

Unit 6: 360 Video

6.1 What is 360 Video?,
6.2 3-DoF vs 6-DoF, Position and Orientation,
6.3 Agency, Presence, and Immersion,
6.4 Point of View (POV),
6.5 Mono vs. Stereo, Parallax, Equirectangular Projection & Cubemaps,
6.6 Field of View (FOV), Stitch Lines

Suggested Readings:

1. Steven M. LaValle, 2016, Virtual Reality, Cambridge University Press.
2. William R Sherman and Alan B Craig, 2002, Understanding Virtual Reality: Interface, Application and Design, Morgan Kaufmann Publishers.
3. Alan B Craig, William R Sherman and Jeffrey D Will 2009, Developing Virtual Reality Applications: Foundations of Effective Design, , Morgan Kaufmann.
4. Gerard Jounghyun Kim, 2005, "Designing Virtual Systems: The Structured Approach, Springer.
5. Doug A Bowman, Ernest Kuijff, Joseph J LaViola, Jr and Ivan Poupyrev, 2005, "3D User Interfaces, Theory and Practice", Addison Wesley
6. Oliver Bimber and Ramesh Raskar, 2005, "Spatial Augmented Reality: Meging Real and Virtual Worlds, Routledge.
7. Burdea, Grigore C and Philippe Coiffet, 2003, "Virtual Reality Technology", Wiley Interscience.

Note: Only latest editions of the books are recommended.

Web links:

http://lavalle.pl/vr/book.html (last visited date: 22 February 2024)

Instructions for paper setting: Seven questions are to be set in total. First question will be multiple choice covering entire syllabus and will be compulsory to attempt and will be of 18 marks. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three fromeach part. Each question will be of 13 marks.

Evaluation Policy:

The evaluation will include two types of assessments:

(cxxix) Continuous or formative assessments (in the form of end semester examination or term examination. Weightage of assessments are as follows:

For continuous or Formative assessment (in semester): Maximum 30 percent. The categorization for the same is:

MCQs	30%
Subjective (Short/Long)	40%
Discussion/Presentation	15%
Projects/Group Activities etc	15%

(cxxx) For Summative assessment (End Semester Examination or End-Term Examination):
Minimum: 70 percent. Categorization for the same is:

Objective Type Questions:	30%
Short/Long Questions:	70%

Assessment Tools:
Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
OMCA-AR-004.1	3	1	2	2	3		2						3	1
OMCA-AR-004.2	1	1	2	3	1		2						3	1
OMCA-AR-004.3	2	2	2	1	1								2	1
OMCA-AR-004.4	1	1	2	1	1		3						1	2
OMCA-AR-004.5	2	2	2	1			2	3					2	2

SEMESTER -III

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH & STUDIES

(Deemed to be University under section 3 of the UGC Act 1956**)**

OMCA-RIC-III: Research and Innovation Catalyst-III

Periods/week	Credits		
P: 2	1	Max. Marks	: 100
		Continuous Evaluation	: 100

Pre-requisites: Research and Innovation Catalyst-II
Course Type: Research & Training
Course outcomes:
OMCA-RIC-III.1. The students will be able to compare the various research methodologies and thereupon choosing the appropriate one.
OMCA-RIC-III.2. To apply the contextual knowledge in designing and conducting the experiments
OMCA-RIC-III.3. To analyze and interpret the research/ innovation outcomes
OMCA-RIC-III.4. To analyze the further scope of research/ innovation
OMCA-RIC-III.5. To gain hands on experience in techniques/technologies/ case studies etc
OMCA-RIC-III.6. To adapt working with group members in cohesive temperament.

Unit 1: Setting up the simulation/experiment environment

1. Deciding the hypothesis or direction to carry out simulation/experiments / case study
2. Identifying the set of experiments/simulations/ case study for designing the model or analysing the data
3. Finding the resources for performing experiments/simulations / case study
4. Choosing the appropriate research methodology/ business model

Unit 2: Planning of experiments/ case study

1. Formulate experimental procedures and case study approach
2. Procurement of materials and secondary data
3. Modification of the experimental set-up / case study approach, if required

Unit 3: Execution of experiments/simulations/ case study

1. Conduct experiments/ build prototype / case study
2. Tabulating and recording data
3. Analysis and interpretation of the data
4. Interpreting convolution between experimental data and hypothesis/simulation
5. Comparison of the results for discrepancies
6. Listing and analysing the observations to get the further research direction

References:

1. www.originlab.com
2. http://www.cambridgesoft.com/software
3. http://www.synergy.com/
4. www.mathworks.com/products/matlab.html

Evaluation Criteria: The following evaluation parameters shall be considered for internal assessment by both research coordinators and faculty coordinator or research mentors:-

Criteria	Evaluation parameters	Weightage (Marks)	
Online and offline Attendance	· Percentage of classes attended by the students	6+4	10
Group participation	· Judge individual student's participation in the experiments · Proper experimental planning · Collecting evidences substantiating to the experiments · Time bound completion of experiments	10 4 6 10	 30

Execution of experiments	· Finding available resources · Usage of Scientific Literature Databases. e.g., Scopus/ Web of Science/ etc. for theoretical guidance · Understanding the technique/technology used · Analysis and interpretation of results · Percentage of reproducibility	4 4 6 4 6	24
Report and Presentation	· Presentation of slides · Experimental findings and content (Graph, Tables, Diagrams, Real time videos etc.) · Report	12 12 12	36

Course Articulation Matrix:

CO Statement (XX-500)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
OMCA-RIC-III.1		√	√		√	√								
OMCA-RIC-III.2		√		√							√			
OMCA-RIC-III.3	√	√	√	√	√						√			
OMCA-RIC-III.4														
OMCA-RIC-III.5														
OMCA-RIC-III.6														

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH & STUDIES
(Deemed to be University under section 3 of the UGC Act 1956)
OMCA-DS-310: DATA MINING AND WAREHOUSING

Periods/week	Credits	Max. Marks: 100
L: 3 T: 0	3	Continuous Evaluation: 30
Duration of Examination: 3 Hrs		End Semester Examination: 70

Pre-requisite: Knowledge of Data Base Management System
Course Type: Core

Course Objectives: At the end of the course, the student will be able to:

OMCA-DS-310.1. Define the fundamental concepts of Data Warehouse.
OMCA-DS-310.2. Describe the difference between data base management system, data mining and data warehouse.
OMCA-DS-310.3. Demonstrate the architecture of a Data Warehouse
OMCA-DS-310.4 Apply data mining techniques on different kinds of data.
OMCA-DS-310.5. Compare various data mining techniques and their applications.

PART-A

Unit 1: Introduction to Data Warehousing
1.1 Evolution of data warehousing
1.2 Difference between data warehousing and data warehouse
1.3 Data Warehousing characteristics
1.4 Benefits of data warehousing
1.5 Comparison of OLTP and OLAP
1.6 Problems of data warehousing

Unit 2: Data Model
2.1 Data Mart
2.2 Data Cube
2.3 Multidimensional Data Model
2.4 Characteristics of OLAP System
2.5 OLAP operations on MDDM
2.5 Schemas for data model: Star, Snowflake and Fact constellation
2.6 Conversion of schemas using DMQL

Unit 3: Data Warehousing Architecture
3.1 Data Warehouse components
3.2 Three-Tier Data Warehouse architecture
3.3 Types of OLAP Servers
3.4 ROLAP versus MOLAP versus HOLAP
3.5 Distributed and Virtual data warehouse

PART-B

Unit 4: Introduction to Data Mining
4.1 Basic concepts of data mining
4.2 Data mining steps, data mining functionalities
4.3 Architectures of data mining
4.4 Knowledge Discovery in Data mining versus data mining
4.5 Applications of data mining

4.6 Classification of Data Mining Systems
4.7 Data Mining primitives
4.8 Data preprocessing
4.9 Integration of Data Mining System with a Data Warehouse

Unit 5: Data Mining Techniques
5.1 Support and confidence
5.2 Frequent Item set Mining methods
5.3 Multi-Level Association Rules
5.4 Multi-Dimensional Association Rules : Apriori algorithm
5.5 Correlation analysis

Unit 6: Classification and Cluster Analysis
6.1 Difference between Classification and Prediction
6.2Decision Tree Induction
6.3Bayesian Classification
6.4Prediction techniques
6.5Cluster Analysis
6.6Categorization of Clustering Methods
6.7Partitioning Methods
6.8Hierarchical Methods
6.9Data Mining Applications

Suggested Readings:
1. Jawei Han & Micheline Kamber, 2006, Data Mining- Concepts & Techniques, Morgan Kaufmann
2. Berry Michael, Linoff Gordon, 2008, Mastering Data Mining, John Wiley & Sons
3. Pudi Vikram, 2009, Data Mining, Oxford University Press
4. Thareja Reema, 2009, Data Warehousing, Oxford University Press

Note: Only latest editions of the books are recommended.

Weblinks/ Softwares required:
Weka
Tanagra
https://www.javatpoint.com/data-mining (Last Visited Date: 24 February 2024)

Instructions for paper setting: Seven questions are to be set in total. First question will be multiple choice covering entire syllabus and will be compulsory to attempt and will be of 18 marks. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three fromeach part. Each question will be of 13 marks.

Evaluation Policy:
The evaluation will include two types of assessments:
(cxxxi) Continuous or formative assessments (in the form of end semester examination or term examination. Weightage of assessments are as follows:

For continuous or Formative assessment (in semester): Maximum 30 percent. The categorization for the same is:

MCQs	30%
Subjective (Short/Long)	40%
Discussion/Presentation	15%
Projects/Group Activities etc	15%

(cxxxii) For Summative assessment (End Semester Examination or End-Term Examination):
Minimum: 70 percent. Categorization for the same is:
Objective Type Questions: 30%
Short/Long Questions: 70%

Assessment Tools:
Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
OMCA-DS-310.1	1	1	1	1	1								1	1
OMCA-DS-310.2	1	1	1	1	1								1	1
OMCA-DS-310.3	1	1	1	1	1								1	1
OMCA-DS-310.4	2	1	1	1	1								1	1
OMCA-DS-310.5	2	2	2	2	2		2						2	2

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

(Deemed to be University under section 3 of the UGC Act 1956)

OMCA-DS-311: SOFTWARE ENGINEERING & TESTING

Periods/week Credits — Max. Marks: 100
L: 3 T: 0 3 — Continuous Evaluation: 30
Duration of Examination: 3 Hrs — End Semester Examination: 70

Pre-Requisite: Knowledge of fundamentals of computers
Course Type: Core

Course Outcomes: At the end of the course, students will be able to
OMCA-DS-311.1. Understand the requirements for software development and learn the specifications within realistic constraints.
OMCA-DS-311.2. Define various software development life-cycle approaches with risks and benefits of each approach.
OMCA-DS-311.3. Analyze various software design models, design technologies involved in software development.
OMCA-DS-311.4. Select various software testing techniques applicable at the system and organizational level.
OMCA-DS-311.5. Develop the test cases for various software systems.
OMCA-DS-311.6. Assess software quality attributes and to integrate quality control and assurance

PART –A

Unit 1: Introduction to Software Engineering
1.1 The software problem
1.2 Software crisis
1.3 Evolution of software engineering
1.4 Principles of software engineering
1.5 Software development vs. software engineering
1.6 Component based software engineering
1.7 Requirements gathering
1.8 Requirements analysis and specification
1.9 Software process

Unit 2: Software Process Models, Project Metrics & Project Management
2.1 Selection of appropriate process model
2.2 Software process models: Waterfall, Spiral, Prototyping, RAD, Agile methodology
2.3 Software project management concepts
2.4 Project planning and control
2.5 Cost estimation using COCOMO model
2.6 Project scheduling using PERT charts, GANTT charts and WBS
2.7 Software metrics: FP, LOC, FP vs. LOC, Token count
2.8 Object-Oriented metrics

Unit 3: Basic Design Issues
3.1 Introduction to software design
3.2 Design objectives
3.3 Design principles
3.4 Design process
3.5 Modularity
3.6 Cohesion
3.7 Coupling
3.8 Function-Oriented software design with DFD and structure chart
3.9 Object-Oriented design

3.10 User interface design

PART -B

Unit 4: Introduction to Testing & Static Testing Techniques

4.1 Some terms: error, mistakes, bug, fault, failure, defects
4.2 Software testing: introduction and definition
4.3 Testing objectives
4.4 Testing process
4.5 Testing life cycle
4.6 Testing principles
4.7 Software testing team
4.8 Models for software testing
4.9 Test cases designing and writing of test cases: concept & introduction
4.10 Verification & Validation
4.11 Review techniques

Unit 5: Dynamic Testing Techniques & Various Testing Strategies

5.1 Introduction dynamic testing techniques
5.2 Need & advantages
5.3 Functional testing techniques: Equivalence partitioning, BVA, Cause- Effect graphing, Decision table testing
5.4 Structural testing techniques: Coverage testing, Path coverage, Mutation testing
5.5 Unit testing, Integration testing, System testing
5.6 Acceptance testing: Alpha testing & Beta testing
5.7 Usability testing

Unit 6: Types of Testing and Software Quality Assurance

6.1 Regression testing
6.2 Performance testing: load testing & stress testing
6.3 Security testing
6.4 Testing web based Applications
6.5 Definition of quality and factors
6.6 Software quality control
6.7 Software quality assurance Software quality control VS Software quality assurance
6.8 The SEI process Capability Maturity Model (CMM)

Suggested Readings:

1. Software Engineering: K.K. Aggarwal & Yogesh Singh, New Age International.
2. Software Engineering: A practitioner's approach, R. S. Pressman, McGraw Hill
3. Software Engineering: Sommerville, Addison Wesley.

Note: Only latest editions of the books are recommended.

Weblinks:

https://www.geeksforgeeks.org/software-testing-basics/(Last Visited Date: 22nd February, 2024)
https://archive.nptel.ac.in/courses/106/101/106101061/(Last Visited Date: 22nd February, 2024)

Instructions for paper setting: Seven questions are to be set in total. First question will be multiple choice covering entire syllabus and will be compulsory to attempt and will be of 18 marks. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three fromeach part. Each question will be of 13 marks.

Evaluation Policy:

The evaluation will include two types of assessments:

(cxxxiii) Continuous or formative assessments (in the form of end semester examination or term examination. Weightage of assessments are as follows:

For continuous or Formative assessment (in semester): Maximum 30 percent. The categorization for the same is:

MCQs	30%
Subjective (Short/Long)	40%
Discussion/Presentation	15%
Projects/Group Activities etc	15%

(cxxxiv) For Summative assessment (End Semester Examination or End-Term Examination):

Minimum: 70 percent. Categorization for the same is:

Objective Type Questions:	30%
Short/Long Questions:	70%

Assessment Tools:

Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
OMCA-DS-311.1	2	3	2	3	2	1	2	2	3	1	1	3	2	2
OMCA-DS-311.2	2	1	1	3	2	1	2	1	2	1	2	3	2	2
OMCA-DS-311.3	2	2	1	3	2	1	1	2	2	1	2	3	2	2
OMCA-DS-311.4	2	1	2	3	1	1	2	2	2	1	3	3	2	2
OMCA-DS-311.5	1	2	1	2	2	1	2	2	3	1	3	3	2	2
OMCA-DS-311.6	2	1	1	2	2	1	1	3	3	1	3	3	2	2

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH & STUDIES

(Deemed to be University under section 3 of the UGC Act 1956)

OMCA-DS-312: OPERATIONS RESEARCH

Periods/week	Credits	Max. Marks: 100
L: 3 T:	3	Continuous Evaluation: 30
Duration of Examination: 3 Hrs		End Semester Examination: 70

Pre-Requisite: Knowledge of basic mathematics
Course Type: Core

Course Outcomes: At the end of the course, the student will be able to:

MCA-DS-312.1. Understand the mathematical tools that are needed to solve optimization problems.
MCA-DS-312.2. Apply the techniques used in operations research to solve real life problem.
MCA-DS-312.3. Solve a wide range of problems related to network construction through PERT/CPM.
MCA-DS-312.4. Solve specialized linear programming problems like the transportation and assignment Problems.
MCA-DS-312.5. Familiar with the concepts of Game Theory.

PART-A

Unit 1: Operations Research: An Introduction

1.1 Introduction
1.2 Operations Research: Meaning, Nature and Origin
1.3 Operations Research as a Tool in Decision-Making
1.4 Significance of Operations Research
1.5 Methodology of Operations Research

Unit 2: Linear Programming Problem

2.1 Meaning of Linear Programming Problem
2.2 General Form of the Linear Programming Model
2.3 Graphical Solution Method
2.4 Simplex Method
2.5 Linear Programming Using Artificial Variable

Unit 3: Transportation Problem

1.1 Objectives
1.2 Degeneracy in Transportation Problems
1.3 Transportation Algorithm
1.4 Unbalanced and Maximization of Transportation

PART-B

Unit 4: Assignment Problem

4.1 Objectives
4.2 Assignment Problems
4.3 Test for Optimality by using Hungarian Method
4.4 Maximization in Assignment Problems

Unit 5: Network Analysis

5.1 Introduction to Network concept
5.2 Network Analysis and Rules of Network Construction
5.3 Critical Path Method (CPM)

5.4 Programme Evaluation and Review Technique (PERT)
5.5 Comparison and Limitations of PERT and CPM

Unit 6: **Game Theory**

6.1 Introduction to Game Theory
6.2 Basic Terms in Game Theory
6.3 Two-Person Zero-Sum Games
6.4 The Maximin-Minimax Principal
6.5 Dominance Property

Suggested Readings:

1. H.A. Taha, 2003, Operations Research-An introduction, Eighth Edition, Prentice Hall of India.
2. P.K. Gupta and D.S. Hira, 2015, Operations Research, S. Chand & Co
3. S.D. Sharma, 2002, Operation Research, Kedar Nath Ram Nath Publications.
4. J.K. Sharma, 1989, Mathematical Models in Operation Research, Tata McGraw Hill.

Note: Only latest editions of the books are recommended.

Web Links:

https://www.tutorialspoint.com/market/course/industrial_engineering_operations_research/index.jsp (last visited date: 22 February 2024)

Instructions for paper setting: Seven questions are to be set in total. First question will be multiple choice covering entire syllabus and will be compulsory to attempt and will be of 18 marks. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three fromeach part. Each question will be of 13 marks.

Evaluation Policy:

The evaluation will include two types of assessments:

(cxxxv) Continuous or formative assessments (in the form of end semester examination or term examination. Weightage of assessments are as follows:

For continuous or Formative assessment (in semester): Maximum 30 percent. The categorization for the same is:

MCQs	30%
Subjective (Short/Long)	40%
Discussion/Presentation	15%
Projects/Group Activities etc	15%

(cxxxvi) For Summative assessment (End Semester Examination or End-Term Examination):

Minimum: 70 percent. Categorization for the same is:

Objective Type Questions:	30%
Short/Long Questions:	70%

Assessment Tools:

Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO 9	PO10	PO 11	PO12	PS O1	PSO2

MCA-DS-312.1	1		1	2	2		3						3	1
MCA-DS-312.2	1	1	2	3	1		2						3	1
MCA-DS-312.3	1	2	2	1	2								2	1
MCA-DS-312.4	1	1	2	1	1		3						1	2
MCA-DS-312.5	3	3	3	2	2		2						3	2

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH & STUDIES

(Deemed to be University under section 3 of the UGC Act 1956)

OMCA-DS-314: BIG DATA ANALYTICS

Periods/week	Credits		Max. Marks : 100
L: 3	T: 0	3	Continuous Evaluation: 30
Duration of Examination: 3 Hrs			End Semester Examination: 70

Pre-requisite: Knowledge of Database Management System, Data Warehousing, Java or Python
Course Type: Core

Course Outcomes: At the end of the course the student will be able to:
OMCA-DS-314.1 Understand the key concepts of Big data management and its associated applications. .
OMCA-DS-314.2 Explore the need of Big Data to make better business decisions.
OMCA-DS-314.3 Manage big data using NoSQL databases.
OMCA-DS-314.4 Apply Map-Reduce programming using Hadoop and related tools.
OMCA-DS-314.5 Implement the parallel processing framework using Apache Spark.

PART-A

Unit 1: Introduction Data Mining
1.1 Data Mining Functionalities
1.2 Steps in Data Mining Process
1.3 Architecture of A Typical Data Mining Systems
1.4 Classification of Data Mining Systems
1.5 Overview of Data Mining Techniques

Unit 2: Overview of Big Data
2.1 Basics of Big data
2.2 Reasons for using Big data
2.3 Characteristics of Big Data
2.4 Big Data Architecture: Storing, Selecting and Processing of Big Data
2.5 Applications of Big Data
2.6 Cloud and Big Data

Unit 3: Managing Data with NoSQL
3.1 Introduction of NoSQL Database concepts- ACID Vs. BASE, Advantages, Application
3.2 Schema of NoSQL database
3.3 CAP Theorem: Consistency, Availability and Partition Tolerance
3.4 Sharding and Share Nothing Architecture- Feature Based, Key Based and Lookup Table Based
3.5 Distributed and Decentralised NoSQL databases
3.6 High Availability and Fault Tolerance in NoSQL databases
3.7 Comparison of few NoSQL Databases (Cassandra, Mongo, Cloudera, CouchDB, HBase)

PART-B

Unit 4: Introduction to Hadoop Ecosystem
4.1 Problems with traditional large-scale systems
4.2 Hadoop v/s RDBMS
4.3 Hadoop Distributed File System Design and Architecture
4.4 Building Blocks of Hadoop: NameNode, DataNode, Secondary NameNode, JobTracker and Task Tracker
4.5 Map Reduce Framework
4.6 Map Reduce Input and Output Formats

4.7 Introduction to write a MapReduce Program

Unit 5: Querying Big Data with Hive

5.1 Hive Architecture
5.2 Comparison with Traditional Database
5.3 Hive-Data types
5.4 Hive built-in operators and built-in functions
5.5 Hive-Views and Indexes
5.6 Hive QL

Unit 6: Basics of Apache Spark

6.1 Features of Apache Spark
6.2 Hadoop v/s Apache Spark
6.3 Resilient Distributed Dataset (RDD): Introduction of Resilient Distributed Dataset
6.4 Spark RDD operations: RDD Transformation
6.5 Parallel Processing in Spark

Suggested Readings:

1. Tom Plunkett, Brian Macdonald, Oracle Big Data Handbook, Bruce Nelson, Fujitsu
2. Madhu Jagadeesh, Soumendra Mohanty, Harsha Srivatsa, Big Data Imperatives: Enterprise Big Data Warehouse, BI Implementations and Analytics: Apress
3. Frank J. Ohlhorst, Big Data Analytics: Turning Big Data into Big Money, Wiley Publishers
4. Cristian Molaro, Surekha Parekh, Terry Purcell, DB2 11: The Database for Big Data & Analytics, MC Press
5. Mike Frampton, Mastering Apache Spark
6. Edward Capriolo, Dean Wampler, Jason Rutyherglen, O Reilly, Programming Hive

Note: Only latest editions of the books are recommended.

Software required/Weblinks:

http://hadooptutorials.co.in/ (last visited date: 22 February 2024)
https://www.ibm.com/analytics/hadoop/mapreduce (last visited date: 22 February 2024)
https://www.datacamp.com/community/tutorials/apache-spark-tutorial-machine-learning (last visited date: 22 February 2024)
http://hadooptutorial.info/category/hive/ (last visited date: 22 February 2024)

Instructions for paper setting: Seven questions are to be set in total. First question will be multiple choice covering entire syllabus and will be compulsory to attempt and will be of 18 marks. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three fromeach part. Each question will be of 13 marks.

Evaluation Policy:

The evaluation will include two types of assessments:

(cxxxvii) Continuous or formative assessments (in the form of end semester examination or term examination. Weightage of assessments are as follows:

For continuous or Formative assessment (in semester): Maximum 30 percent. The categorization for the same is:

MCQs	30%
Subjective (Short/Long)	40%
Discussion/Presentation	15%
Projects/Group Activities etc	15%

(cxxxviii) For Summative assessment (End Semester Examination or End-Term Examination):
Minimum: 70 percent. Categorization for the same is:

Objective Type Questions: 30%
Short/Long Questions: 70%

Assessment Tools:
Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
OMCA-DS-314.1	1	1	1	1	1		1						1	1
OMCA-DS-314.2	1	1	1	1	1		1						2	2
OMCA-DS-314.3	2	2	3	3	3		3						3	3
OMCA-DS-314.4	3	3	3	3	3		3						3	3
OMCA-DS-314.5	3	3	3	3	3		3						3	3

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES
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OMCA-DS-364: BIG DATA ANALYTICS LAB

Periods/week	Credits	Max. Marks 100
P: 2	1	Continuous Evaluation: 30
Duration of Examination: 3 Hrs		End Semester Examination: 70

Course Type: Core

Course Outcomes: At the end of the course, the student will be able:
OMCA-DS-364.1. To acquire fundamental enabling techniques and scalable algorithms such as NO SQL.
OMCA-DS-364.2. To analyze and integrate machine learning libraries, mathematical and statistical tools with modern technologies like mapreduce.
OMCA-DS-364.3. To solve problems associated with big data characteristics such as high dimensionality, dynamically growing data and in particular scalability issue.
OMCA-DS-364.4. To implement machine learning techniques and computing environment that are suitable for the real time applications such as recommender system.

List of Practicals:

1. Installation of VMWare to setup the Hadoop environment and its ecosystems.
2. Perform setting up and Installing Hadoop in its three operating modes.
   i. Standalone. ii. Pseudo distributed.iii. Fully distributed.
3. Prototype designing
4. Simulation based implementation
5. Use web based tools to monitor your Hadoop setup.
6. Implementing the basic commands of LINUX Operating System – File/Directory creation, deletion, update operations.
7. Implement the following file management tasks in Hadoop:

i. Adding files and directories
ii. Retrieving files
iii. Deleting files
iv. Creating and destroying files

8. Write a Word Count Map Reduce program to understand Map Reduce Paradigm.
9. Optimization of Codes
10. Write a Map Reduce Program to analyse time-temperature statistics and generate report with max/min temperature.
11. Implement Matrix Multiplication with Hadoop Map Reduce
12. Download MongoDB and analyse its client and server working.
13. Create a database in MongoDB and apply CRUD operations.
14. Download Hive.
15. Use Hive to create, alter, and drop databases, tables, views, functions, and indexes .
16. Download Apache Spark, python libraries, open source libraries and implement python programs in spark.
17. How MongoDB associated with other coding languages
18. Android and IoS integrated with Big Data.
19. Implement word count problem using pyspark.

Suggested Readings:

1. Tom Plunkett, Brian Macdonald, Bruce Nelson, Fujitsu,2013, Oracle Big Data Handbook, Oracle Press
2. Madhu Jagadeesh, Soumendra Mohanty, Harsha Srivatsa, 2013, Big Data Imperatives: Enterprise Big Data Warehouse, BI Implementations and Analytics, Apress
3. Frank J. Ohlhorst, 2012, Big Data Analytics: Turning Big Data into Big Money, Wiley Publishers
4. Cristian Molaro, Surekha Parekh, Terry Purcell, 2013, DB2 11: The Database for Big Data & Analytics, MC Press
5. Mike Frampton, 2015, Mastering Apache Spark, PACKT Publishers
6. Edward Capriolo, Dean Wampler, Jason Rutyherglen, 2012, Programming Hive, O Reilly

Software required/weblinks:

http://hadooptutorials.co.in/ (Last Visited Date:22.02.2024)
https://www.ibm.com/analytics/hadoop/mapreduce (Last Visited Date:22.02.2024)
https://www.datacamp.com/community/tutorials/apache-spark-tutorial-machine-learning (Last Visited Date:22.02.2024)
http://hadooptutorial.info/category/hive/ (Last Visited Date:22.02.2024)

Evaluation Policy:

The evaluation will include two types of assessments:

(cxxxix) Continuous or formative assessments (in the form of end semester examination or term examination. Weightage of assessments are as follows:

For continuous or Formative assessment (in semester): Maximum 30 percent. The categorization for the same is:

MCQs	30%
Subjective (Short/Long)	40%
Discussion/Presentation	15%
Projects/Group Activities etc	15%

(cxl) For Summative assessment (End Semester Examination or End-Term Examination):

Minimum: 70 percent. Categorization for the same is:

Objective Type Questions:	30%
Short/Long Questions:	70%

Assessment Tools:

Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
OMCA-DS-364.1	2	2	3	3	3		3						3	3
OMCA-DS-364.2	3	3	3	3	3		3						3	3
OMCA-DS-364.3	3	3	3	3	3		3						3	3
OMCA-DS-364.4	2	3		3	3		2						3	3

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OMCA-DS-360: DATA MINING LAB

Periods/week	Credits	Max. Marks : 100
P:2	1	Continuous Evaluation: 30
Duration of Examination: 3 Hrs		End Semester Examination: 70

Pre-requisite: Knowledge of Database Management System
Course Type: Core

Course Objectives: At the end of the course, the student will be able to:
OMCA-DS-360.1: Explain the concept of loading, preprocessing and analysis of large data sets.
OMCA-DS-360.2: Implement and compare various classification models.
OMCA-DS-360.3: Implement and compare various clustering techniques.
OMCA-DS-360.4: Find association among data and able to explore the ideas.
OMCA-DS-360.5: Work with real datasets from various data repositories.

Program 1: Use Boston House Price Dataset i.e. housing.arff. Apply all preprocessing algorithms and create a version of the initial data set in which the categorical data are converted into numerical data.

Program 2: To implement the following classification algorithms using weather.arff dataset. Perform initial preprocessing and create a version of the initial dataset in which all numeric attributes should be converted to categorical data. Also generate and display the comparison graph for all the above performance parameters through various charts or graphs.

- Decision Tree
- Support Vector Machines
- Logistic Regression
- Bayes networks

Program 3: To implement the following clustering algorithms using bank.arff dataset. Perform initial preprocessing and create a version of the initial data set in which the ID field should be removed and the "children" attribute should be converted to categorical data. Also generate and display the comparison graph for all the above performance parameters through various charts or graphs.

- K-Means
- Expectation Maximization
- Cobweb clustering algorithm
- X-means
- Farthest First.
- Density based spatial clustering structure (OPTICS)

Program 4**:** Use Apriori algorithm to generate association rules for Iris data from the —iris.arff dataset. Perform preprocessing and convert categorical data into numeric attributes and analyze results.

Program 5: Attribute selection crawls through all possible combinations of attributes in the data to decide which of these will best fit the desired calculation, which subset of attributes works best for prediction. Perform the following attribute selection methods:

- Search method: Best-first, forward selection, random, exhaustive, genetic algorithm, ranking algorithm
- Evaluation method: Correlation-based, wrapper, information gain, chi-squared

Suggested Readings:

1. Bostjan Kaluza, 2013, Instant Weka How-to, Packt Publishing
2. Eric Goh, 2019, Learn By Examples - A Quick Guide to Data Mining with Weka and Java using Weka, SVBook Pte. Ltd.
3. Eric Goh**,** 2019, Learn By Examples - A Quick Guide to Data Mining with Rapid miner and Weka, SVBook Pte. Ltd.

Software required/Weblinks:

WEKA 3.8.3
www.cs.wakato.ac.nz (last visited date: 22 February 2024)
http://wekatutorial.com (last visited date: 22 February 2024)
www.tutorialspoint.com (last visited date: 22 February 2024)

Evaluation Policy:

The evaluation will include two types of assessments:

(cxli) Continuous or formative assessments (in the form of end semester examination or term examination. Weightage of assessments are as follows:

For continuous or Formative assessment (in semester): Maximum 30 percent. The categorization for the same is:

MCQs	30%
Subjective (Short/Long)	40%
Discussion/Presentation	15%
Projects/Group Activities etc	15%

(cxlii) For Summative assessment (End Semester Examination or End-Term Examination):

Minimum: 70 percent. Categorization for the same is:

Objective Type Questions:	30%
Short/Long Questions:	70%

Assessment Tools:

Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
OMCA-DS-360.1	1	1	1	3				2			3		1	1
OMCA-DS-360.2	1	2	1	3	2				2		3		2	2
OMCA-DS-360.3	1	2	1		2		3	2				3	2	2
OMCA-DS-360.4	1	2	1		2								2	2
OMCA-DS-360.5	1	2	1	3	2		3						2	2

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OMCA-DS-316: AUTOMATA THEORY

Periods/week	Credits	Max. Marks: 100
L: 2 T: 0	2	Continuous Evaluation : 30
Duration of Examination: 3 Hrs		End Semester Examination : 70

Pre-Requisite: None

Course Type: Domain Elective

Course Outcomes: At the end of the course the student will be able to:
OMCA-DS-316.1 Demonstrate an understanding of abstract models of computing, including deterministic (DFA), non-deterministic (NFA), and Turing (TM) machine models.
OMCA-DS-316.2 Demonstrate an understanding of regular expressions and grammars, including context-free and context-sensitive gram-mars.
OMCA-DS-316.3 Understand the relationships between language classes, including regular, context-free, context-sensitive, recursive, and recursively enumerable languages.
OMCA-DS-316.4 Able to design Turing Machine

PART A

Unit 1: Mathematical Preliminaries
1.1 Sets Relations and Functions
1.2 Graphs and Trees
1.3 Strings and their Properties
1.4 Principle of Induction

Unit 2: Theory of Automata
2.1 Definition of an Automata
2.2 Description of Finite Automata
2.3 Transition Systems
2.4 Properties of Transition Systems
2.5 Properties of Transition Functions
2.6 Acceptability of a finite string by a Finite Automation
2.7 Non Deterministic Finite State Machines
2.8 Equivalence of DFA and NDFA
2.9 Mealy and Moore Models
2.10 Minimization of Finite Automata

Unit 3: Grammar
3.1 Regular Expressions
3.2 Finite Automata and Regular Expressions
3.3 Primitive Recursive Functions
3.4 Recursive Functions
3.5 Chomsky Hierarchy of Languages
3.6 Construction of TM for Simple Problems

PART B

Unit 4: Push Down Automata
4.1 Basic Definitions
4.2 Acceptance by pda
4.3 Ambiguity, Parse Tree Representation of Derivation Trees

4.4 Equivalence of PDA's and Pushdown Automaton (PDA)
4.5 Non-Deterministic Pushdown Automaton (NPDA)

Unit 5: Turing Machines (TM):
5.1 Turing Machine Model
5.2 Representation of Turing Machines
5.3 Language Acceptability by Turing Machines
5.4 Design of Turing Machines
5.5 Standard Turing Machine and its Variations
5.6 Universal Turing Machines
5.7 Models of Computation and Church Turing Thesis

Unit 6: Linear Bound Automata
6.1 Linear Bounded Automata and Languages
6.2 Halting Problem of Turing Machines
6.3 NP Completeness

Suggested Readings:
1. Jeffrey Ullman and John Hopcroft, 2008, Introduction to Automata Theory, Languages, and Computation, 3e, Pearson Education India.
2. K.L.P. Mishra, 2006, Theory of Computer Science: Automata, Languages and Computation, Prentice Hall India Learning Private Limited.
3. John Martin, 2007, Introduction to Languages and the Theory of Computation, McGraw-Hill Higher Education.

Note: Only latest editions of the books are recommended.

Web Links:
https://dblp.org/db/books/collections/P2021.html (last visited date: 22 February 2024)
https://www.tutorialandexample.com/automata-tutorial (last visited date: 22 February 2024)

Instructions for paper setting: Seven questions are to be set in total. First question will be multiple choice covering entire syllabus and will be compulsory to attempt and will be of 18 marks. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three fromeach part. Each question will be of 13 marks.

Evaluation Policy:
The evaluation will include two types of assessments:

(cxliii) Continuous or formative assessments (in the form of end semester examination or term examination. Weightage of assessments are as follows:

For continuous or Formative assessment (in semester): Maximum 30 percent. The categorization for the same is:

MCQs	30%
Subjective (Short/Long)	40%
Discussion/Presentation	15%
Projects/Group Activities etc	15%

(cxliv) For Summative assessment (End Semester Examination or End-Term Examination):
Minimum: 70 percent. Categorization for the same is:

Objective Type Questions:	30%
Short/Long Questions:	70%

Assessment Tools:
Assignment/Tutorials
Sessional tests

Surprise questions during lectures/Class Performance
Term end examination

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
OMCA-DS-316.1	1	1	1	2									2	2
OMCA-DS-316.2	1	1	2	3	1								2	2
OMCA-DS-316.3	1	2	2	1	2		1	1			1	1	2	1
OMCA-DS-316.4	1	2	2	1	2		1	1			1	1	2	1

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OMCA-DS-317: COMPILER DESIGN

Periods/week Credits — Max. Marks: 100
L: 2 T: 0 2.0 — Continuous Evaluation: 30
Duration of Examination: 3 Hrs — End Term Examination: 70

Pre-Requisite: Basic Knowledge of computers
Course Type: Domain Elective

Course Outcomes: Students will be able to-
OMCA-DS-317.1 Describe the different phases of the compilation process
OMCA-DS-317.2 Apply the formal attributed grammars for specifying the syntax and semantics of programming languages.
OMCA-DS-317.3 Design scanner and parser using LEX tool & YACC tool.
OMCA-DS-317.4 Identify different language translators.
OMCA-DS-317.5 Interpret new code optimization techniques to improve the performance of a program in terms of speed & space.
OMCA-DS-317.6 Employ the knowledge of patterns, tokens & regular expressions for solving a problem in the field of data mining.

PART- A

Unit-1: Concept of Programming language
1.1 Syntactic and semantic rules of a Programming language, Characteristics of a good programming language,
1.2 Specification & implementation of elementary data types,
1.3 Declarations, type checking & type conversions.
1.4 Implicit & explicit sequence controls
1.5 Sequence control within expressions,
1.6 Sequence control within statement,
1.7 Subprogram sequence control: simple call return, recursive subprograms,
1.8 Names & referencing environment, static & dynamic scope,
1.9 Local data & local referencing environment,
1.10 Shared data: dynamic & static scope.
1.11 Parameter & parameter transmission schemes.

Unit–2: Lexical Analysis
2.1 Structure of compiler and its different phases,
2.2 Compiler construction tools, Role of lexical analyzer
2.3 Design and Implementation of lexical analyzer,
2.4 Regular expressions, Specification and recognition of tokens.
2.5 A language specifying lexical analyzer: LEX, Finite automata,
2.6 Conversion from regular expression to finite automata, and vice versa,
2.7 Minimizing number of states of DFA, input buffering

Unit-3: Syntax Analysis
3.1. Context free grammars,
3.2. Role of parsers, definition of parsing,
3.3. Types of parsing. Parsing Technique: Top down parsing,
3.4. Predictive parsing
3.5. Operator precedence parsing,
3.6. Top down parsers, LR parsers, SLR
3.7. LALR and Canonical LR parser

PART- B

Unit-4: Syntax Directed Translations

4.1 Syntax directed definition, construction of syntax trees,
4.2 Syntax directed translation scheme,
4.3 Implementation of syntax directed translation.
4.4 Three address code: quadruples, triples and indirect triples,

Unit-5: Symbol Table & Error Detection and Recovery

5.1 Symbol tables and its contents.
5.2 Data structures for symbol tables; trees, arrays,
5.3 linked lists, hash tables.
5.4 Errors, lexical phase error.
5.5 Syntactic phase error, semantic error,
5.6 Error recovery techniques,

Unit-6: Code Optimization & Code Generation

6.1 Code generation, forms of object code,
6.2 Machine dependent code, optimization of intermediate codes,
6.3 Register allocation for temporary and user defined variables,
6.4 Code optimization.

Suggested Books:

1. A. V. AHO, Ravi Sethi & J.D. Ullman; 1998, Compilers Principle, Techniques & Tools, AW.
2. O.G.Kakde, 2015, Compiler Design, 4thEdition, Laxmi Publications
3. Tremblay & Sorenson, NA, 1985, Theory and Practice of Compiler writing, TMH.
4. K L P Mishra, 2006, Theory of computer science: Automata, Languages and computation,3rd edition, PHI

Software required/Weblinks:

C/C++(TurboC/DOS BOX)
www. W3schools.com (last visited date: 22 February 2024)

Instructions for paper setting: Seven questions are to be set in total. First question will be multiple choice covering entire syllabus and will be compulsory to attempt and will be of 18 marks. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three fromeach part. Each question will be of 13 marks.

Evaluation Policy:

The evaluation will include two types of assessments:

(cxlv) Continuous or formative assessments (in the form of end semester examination or term examination. Weightage of assessments are as follows:

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MCQs	30%
Subjective (Short/Long)	40%
Discussion/Presentation	15%
Projects/Group Activities etc	15%

(cxlvi) For Summative assessment (End Semester Examination or End-Term Examination):

Minimum: 70 percent. Categorization for the same is:

Objective Type Questions:	30%
Short/Long Questions:	70%

Assessment Tools:

Assignment/Tutorials

Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

COURSE ARTICULATION MATRIX:

	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO12	PSO 1	PSO2
OMCA-DS-317.1	1	1	2	-	-	-	-	-	-	1	3	3	1	1
OMCA-DS-317.2	2	1	-	-	3	1	-	-	-	2	-	-	1	2
OMCA-DS-317.3	2	-	1	1	3	1	-	-	-	2	-	-	1	2
OMCA-DS-317.4	1	-	-	-	-	-	2	-	-	-	2	2	-	-
OMCA-DS-317.5	1	2	-	1	-	-	-	-	-	-	2	1	-	-
OMCA-DS-317.6		-	3	-	-	-	-	-	-	-	-	2	2	-

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OMCA-CC-005: CLOUD DATA STORAGE AND MANAGEMENT

Periods/week	Credits	Max. Marks: 100
L: 2 T: 0	2	Continuous Evaluation: 30
Duration of Examination: 3 Hrs		End Semester Examination: 70

Pre-Requisite: Basics of Cloud Security
Course Type: Domain Elective

Course Outcomes: At the end of the course, the student will be able to:
OMCA-CC-005.1 Access the advantages and challenges associated with cloud data storage.
OMCA-CC-005.2 Analyze and interpret different cloud security models, emphasizing the shared responsibility model.
OMCA-CC-005.3 Demonstrate proficiency in NAS SAN management, provisioning, and security measures
OMCA-CC-005.4 Access research challenges and opportunities in the field of cloud data storage for future advancements.

PART-A

Unit 1: Introduction to Cloud Data Storage
1.1 Understanding data storage in the cloud
1.2 Cloud Data Security Fundamentals
1.3 Key cloud storage providers
1.4 Cloud storage types (Object, Block, File)
1.5 Advantages and Challenges of Cloud Data Storage

Unit 2: Scalability and flexibility of Cloud Services
2.1 Data accessibility and reliability challenges
2.2 Cloud Data Storage Use Cases (Real-world examples of cloud storage applications, Industry-specific use cases (e.g., healthcare, finance)
2.3 Encryption and decryption
2.4 Authentication and authorization
2.5 Data integrity and confidentiality in the cloud

Unit 3: Storage Area Network (SAN)
1.1 Introduction to Storage Area Networks
1.2 SAN vs. traditional storage architectures
1.3 SAN Architecture and Components
1.4 Host bus adapters (HBAs)
1.5 Storage fabric (switches, directors)
1.6 Storage devices (arrays, disks)
1.7 SAN Protocols, SAN Management and Administration
1.8 Data encryption in SAN environments, Authentication and Authorization in SAN

PART-B

Unit 4: Network Attached Storage (NAS)
4.1 Overview of Network Attached Storage
4.2 Definition and characteristics
4.3 NAS vs. traditional file servers

4.4 NAS Architecture and Components, NAS controllers
4.5 Storage protocols (NFS, CIFS/SMB)
4.6 Redundancy and fault tolerance
4.7 NAS File Systems, File system types (ZFS, NFS, NTFS)

Unit 5: Cloud Data Storage Technologies
5.1 Object Storage in the Cloud
5.2 Characteristics of object storage
5.3 Popular object storage services (e.g., Amazon S3, Azure Blob Storage)
5.4 Cloud Backup and Disaster Recovery
5.5 Backup strategies in the cloud
5.6 Implementing disaster recovery plans in cloud environments
5.7 Hybrid Cloud Storage, Hybrid cloud storage architectures
5.8 Integrating on-premises storage with cloud storage
5.9 Data Migration to the Cloud

Unit 6: Future Directions and Industry Applications
1.1 Trends in Cloud Data Storage
1.2 Edge computing and storage
1.3 Quantum storage
1.4 Serverless storage solutions
1.5 Industry-specific Applications
1.6 Cloud storage in healthcare, finance, e-commerce
1.7 Research Challenges and Opportunities in cloud data storage
1.8 Project Work and Case Studies

Suggested Readings:
1. Rittinghouse, J. W., & Ransome, J. F. , 2016. "Cloud Computing: Implementation, Management, and Security." CRC Press.
2. Choudhary, A., & Mittal, M. , 2017, "Cloud Security: A Comprehensive Guide to Secure Cloud Computing." Wiley.
3. Gibson, G. A., 2018, "Gibson's Learn & Master SAN Storage Book One of Three." HSB Academia Publishing.
4. Rajaraman, V., 2018, "Cloud Storage Forensics." Syngress.

Note: Only latest editions of the books are recommended.

Web Links:
https://www.slideshare.net/DamilolaMosaku1/data-management-in-cloud-computing-trainee (Last Visited Date:23.02.2024)

Instructions for paper setting: Seven questions are to be set in total. First question will be multiple choice covering entire syllabus and will be compulsory to attempt and will be of 18 marks. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three fromeach part. Each question will be of 13 marks.

Evaluation Policy:
The evaluation will include two types of assessments:
(cxlvii) Continuous or formative assessments (in the form of end semester examination or term examination. Weightage of assessments are as follows:

For continuous or Formative assessment (in semester): Maximum 30 percent. The categorization for the same is:

MCQs	30%

Subjective (Short/Long) 40%
Discussion/Presentation 15%
Projects/Group Activities etc 15%

(cxlviii) For Summative assessment (End Semester Examination or End-Term Examination):
Minimum: 70 percent. Categorization for the same is:
Objective Type Questions: 30%
Short/Long Questions: 70%

Assessment Tools:
Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
OMCA-CC-005.1	2	1	1	3	2	2	3						3	2
OMCA-CC-005.2	2	3	2	2	2	1	2						3	2
OMCA-CC-005.3	3	1	2	1	2	1	3						2	1
OMCA-CC-005.4	2	1	3	2	3	3	3						1	2

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OMCA-CC-006: PROGRAMMING WITH GAE

Periods/week Credits	Max. Marks: 100
L: 2 T: 0	Continuous Evaluation: 30
Duration of Examination: 3 Hrs	End Semester Examination: 70

Pre-Requisite: Knowledge of Computer Network
Course Type: Domain Elective

Course Outcomes: At the end of the course the student will be able to:
OMCA-CC-006.1. Understand the fundamentals of cloud computing and its significance in modern computing environments.
OMCA-CC-006.2. Develop web applications using Google App Engine and implement effective handling of HTTP requests and responses.
OMCA-CC-006.3. Design scalable architectures on App Engine, considering factors such as load balancing, autoscaling, and efficient resource usage.
OMCA-CC-006.4. Apply security best practices for Datastore access, handling sensitive information, and implementing HTTPS for secure communication.
OMCA-CC-006.5. Integrate App Engine applications with various Google Cloud Platform services, including Cloud Storage, Pub/Sub, Cloud Endpoints, Cloud Scheduler, Cloud SQL, and Firestore.
OMCA-CC-006.6. Applications and Case studies in context to App Engine

PART-A

Unit 1: Introduction to Google App Engine
1.1 Understanding Google App Engine (GAE)
1.2 App Engine Features and Services
1.3 Setting up a Google Cloud Project for App Engine
1.4 Deploying a Simple Application on App Engine

Unit 2: App Engine Basics and Architecture
2.1 App Engine Application Structure
2.2 Handling HTTP Requests and Responses
2.3 Datastore: Google's NoSQL Database
2.4 Task Queues for Background Processing
2.5 Understanding App Engine Services: Blob store, Images, and Mail

Unit 3: Building Scalable and Efficient Applications
3.1 Designing Scalable Architectures on App Engine
3.2 Managing Data store Entities and Relationships
3.3 Indexing and Querying in Datastore
3.4 Performance Optimization Techniques
3.5 Load Balancing and Auto Scaling Configurations

PART-B

Unit 4: Securing App Engine Applications
4.1 Authentication and Authorization on App Engine
4.2 Securing Datastore Access
4.3 Handling Sensitive Information: Secrets and Configuration
4.4 Implementing HTTPS for Secure Communication
4.5 Monitoring and Logging for Security Auditing

Unit 5: Integration with Other GCP Services

5.1 Integrating with Cloud Storage
5.2 Implementing Google Cloud Endpoints for API Services
5.3 Utilizing Cloud Scheduler for Job Automation
5.4 Interacting with Cloud SQL and Firestore
5.5 Integrating Firebase for Real-time Features

Unit 6: Advanced Topics and Case Studies
6.1 Serverless Computing with Cloud Functions
6.2 Implementing Microservices on App Engine
6.3 Versioning and Rollback Strategies
6.4 Advanced Datastore Concepts: Transactions and Sharding
6.5 Case Studies of Successful App Engine Applications
6.6 Exploring Future Trends in App Engine Development

Suggested Readings:
1. Cloud Computing: Concepts and Practice by Rajkumar Buyya, James Broberg, and Andrzej M. Goscinski
2. "Building Scalable Web Sites" by Cal Henderson
3. "Google Cloud Platform in Action" by Mark Johnson

Note: Only latest editions of the books are recommended.

Web Links:
https://www.geeksforgeeks.org/what-is-google-app-engine-gae/ (Last Visited Date: 26 February 2024)

Instructions for paper setting: Seven questions are to be set in total. First question will be multiple choice covering entire syllabus and will be compulsory to attempt and will be of 18 marks. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three fromeach part. Each question will be of 13 marks.

Evaluation Policy:
The evaluation will include two types of assessments:

(cxlix) Continuous or formative assessments (in the form of end semester examination or term examination. Weightage of assessments are as follows:

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MCQs	30%
Subjective (Short/Long)	40%
Discussion/Presentation	15%
Projects/Group Activities etc	15%

(cl) For Summative assessment (End Semester Examination or End-Term Examination):
Minimum: 70 percent. Categorization for the same is:

Objective Type Questions:	30%
Short/Long Questions:	70%

Assessment Tools:
Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
OMCA-CC-006.1	2	1	1	3	2	2	3						3	2
OMCA-CC-006.2	2	3	2	2	2	1	2						3	2
OMCA-CC-006.3	3	1		1		1	3						2	1
OMCA-CC-006.4	2		3	2			3						1	2
OMCA-CC-006.5			3		3									3
OMCA-CC-006.6	1	3	2		2		3						2	3

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OMCA-AI-005: UNSUPERVISED LEARNING

Periods/week Credits	Max. Marks : 100
L: 2 T: 0 2	Continuous Evaluation : 30
Duration of Examination: 3 Hrs.	End Semester Examination : 70

Pre-Requisite: Basic of Machine Learning.
Course Type: Domain Elective

Course Outcomes: At the end of the course the student will be able to:

OMCA-AI-005.1 Develop a good understanding of Unsupervised learning.
OMCA-AI-005.2 Understanding clustering and clustering algorithms.
OMCA-AI-005.3 learn how to correctly apply, interpret results, and iteratively refine and tune unsupervised machine learning models.
OMCA-AI-005.4 Learn to refine and tune unsupervised machine learning models to solve a diverse set of problems on real-world datasets
OMCA-AI-005.5 Understand the challenges of unsupervised learning.

PART- A

Unit 1: Introduction to Unsupervised Learning
1.1 Introduction to Unsupervised Learning
1.2 Importance of Unsupervised Learning
1.3 Working of Unsupervised Learning Algorithms
1.4 Types of Unsupervised Learning Algorithms

Unit 2: Clustering
2.1 Introduction to Clustering
2.2 Exclusive and Overlapping Clustering
2.3 K-Means Clustering
2.4 Hierarchical Clustering
2.5 Euclidean Distance
2.6 Probabilistic clustering

Unit 3: Association
3.1 Introduction
3.2 Association Rules

3.3 Apriori algorithms

PART-B

Unit 4: Dimensionality Reduction

1.1 PCA (Principal Component Analysis)
1.2 Singular Value decomposition
1.3 Nonlinear and Distance-based dimensionality reduction
1.4 Autoencoders
1.5 Graphical Models

Unit 5: Applications of Unsupervised Learning:

5.1 Apply unsupervised learning techniques to real-world dataset
5.2 Using unsupervised methods to find features for a supervised learning problem
5.3 Using unsupervised learning for data manipulation
5.4 Medical Imaging, Anomaly Detection, Recommendation Engines

Unit 6: Unsupervised vs. Supervise Learning and Semi-supervised Learning

6.1 Unsupervised Learning
6.2 Supervised Learning
6.3 Semi-supervised Learning
6.4 Challenges of Unsupervised Learning

Suggested Readings:

1 Tom Mitchell, 1997, "Machine Learning", McGraw Hill.
2 E. Alpaydin, 2005, "Introduction to Machine Learning", PHI.
3 AurolienGeron, 2017, "Hands-On Machine Learning with Scikit-Learn and TensorFlow, Shroff/O'Reilly".
4 Andreas Muller and Sarah Guido, 2016, "Introduction to Machine Learning with Python: A Guidefor Data Scientists", Shroff/O'Reilly.

Note: Only latest editions of the books are recommended.

Software required/ Web links:

1 https://onlinecourses.nptel.ac.in/noc21_cs85/preview (last visited date: 22 February 2024)
2 https://openlearninglibrary.mit.edu/courses/course-v1:MITx+6.036+1T2019/about (last visited date: 22 February 2024)
3 https://www.udacity.com/course/intro-to-machine-learning--ud120 (last visited date: 22 February 2024)
4 https://cedar.buffalo.edu/~srihari/CSE574/ (last visited date: 22 February 2024)
https://www.cs.utoronto.ca/~fidler/teaching/2015/CSC411.html (last visited date: 22 February 2024)

Instructions for paper setting: Seven questions are to be set in total. First question will be multiple choice covering entire syllabus and will be compulsory to attempt and will be of 18 marks. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three fromeach part. Each question will be of 13 marks.

Evaluation Policy:

The evaluation will include two types of assessments:

(cli) Continuous or formative assessments (in the form of end semester examination or term examination. Weightage of assessments are as follows:

For continuous or Formative assessment (in semester): Maximum 30 percent. The categorization for the same is:

MCQs	30%
Subjective (Short/Long)	40%
Discussion/Presentation	15%
Projects/Group Activities etc	15%

(clii) For Summative assessment (End Semester Examination or End-Term Examination):

Minimum: 70 percent. Categorization for the same is:

Objective Type Questions:	30%
Short/Long Questions:	70%

Assessment Tools:

Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance

Term end examination

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
OMCA-AI-005.1	2	1		2			2						3	3
OMCA-AI-005.2	1	3	1	1			2						2	2
OMCA-AI-005.3	1	2	1	1			2						2	3
OMCA-AI-005.4	1	2	2	3	2		1						3	2
OMCA-AI-005.5	2	1	1	3	2		2						2	2

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH & STUDIES
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OMCA-AI-006: IoT WITH MACHINE LEARNING

Periods/week	Credits	Max. Marks: 100
L: 2 T: 0	2	Continuous Evaluation: 30
Duration of Examination: 3 Hrs.		End Semester Examination: 70

Pre-Requisite: Python Programming
Course Type: Domain Elective

Course Outcomes: At the end of the course the student will be able to:
OMCA-AI-006.1 Understand the basic theory underlying machine learning.
OMCA-AI-006.2 Understand general concepts of Internet of Things and recognize various devices, sensors and applications
OMCA-AI-006.3 Apply machine learning algorithms to solve problems of moderate complexity.
OMCA-AI-006.4 Design, build and integrate IoT platforms, incorporating different types of sensors, actuators and machine learning methods
OMCA-AI-006.5 Read current research papers and understand the issues raised by current research.

PART- A

Unit 1: Introduction to Machine Learning:
1.1 Definition of learning systems
1.2 Goals and applications of machine learning,
1.3 Aspects of developing a learning system: training data, concept representation
1.4 Role of machine intelligence in IoT

Unit 2: Machine Learning Models:
2.1 Bayesian classifiers, Nearest-neighbor classifiers
2.2 Linear and Polynomial classifiers, Random forests
2.3 Decision trees, Support vector machines
2.4 Dimensionality reduction methods K-mean clustering
2.5. Artificial neural networks, Deep neural networks.

Unit 3: Internet of Things:
3.1 Data Analytics, IoT analytics challenges
3.2 IoT data acquisition, Data Exploration and Pre-processing
3.3 IoT technologies, Architecture and Networking protocols,
3.4 IoT Communication Technologies, Devices and Gateways

PART-B

Unit 4 Sensor & Actuators:
4.1 Overview of Sensors working,
4.2 Analog and Digital Sensors, Interfacing of Temperature,
4.3 Humidity, Motion, Light and Gas Sensor with Arduino,
4.4 Interfacing of Actuators with Arduino,
4.5 Interfacing of Relay Switch and Servo Motor with Arduino

Unit 5: Computing framework:
5.1 Fog computing, Edge computing,
5.2 Cloud computing, Characteristics of Cloud Computing
5.3 Driving factors towards cloud, Architecture,
5.4 Role of Networks in Cloud computing, protocols used, Role of Web services,
5.5 Service Models: IaaS, PaaS, SaaS, NaaS,

5.6 Cloud Clients, Deployment Models: Public Clouds, Community Clouds, Hybrid Cloud, Private
5.7 Cloud, Issues in Cloud Computing, Applications, Distributed computing.

Unit 6: Applications of Machine learning in smart cities:
6.1 Use cases - Smart energy, Smart mobility, Smart citizens
6.2 Urban planning, Smart city data characteristics
6.3 Applied machine learning algorithms to Internet of Things use cases.

Suggested Readings:

1. Vijay Madisetti, Arshdeep Bahga, 2014, "Internet of Things: A Hands-on Approach", University Press.
2. C.M. Bishop, 2006, Pattern Recognition and Machine Learning, Springer.
3. J. Watt, R. Borhani and A. K. Katsaggelos, 2016, Machine Learning Refined: Foundations, Algorithms and Applications, Cambridge University Press.
4. Andrew Minteer, 2017, Analytics for the Internet of Things (IoT) Intelligent Analytics for Your Intelligent Devices, Packt Publishing.

Note: Only latest editions of the books are recommended.

Software required/ Web links:

1. http://ciml.info/ Last Visited Date:23.02.2024
2. https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-867-machine-learning-Last Visited Date:23.02.2024
3. https://nptel.ac.in/courses/106/105/106105166/ Last Visited Date:23.02.2024
4. https://nptel.ac.in/courses/106105077 Last Visited Date:23.02.2024

Instructions for paper setting: Seven questions are to be set in total. First question will be multiple choice covering entire syllabus and will be compulsory to attempt and will be of 18 marks. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three fromeach part. Each question will be of 13 marks.

Evaluation Policy:

The evaluation will include two types of assessments:

(cliii) Continuous or formative assessments (in the form of end semester examination or term examination. Weightage of assessments are as follows:

For continuous or Formative assessment (in semester): Maximum 30 percent. The categorization for the same is:

MCQs	30%
Subjective (Short/Long)	40%
Discussion/Presentation	15%
Projects/Group Activities etc	15%

(cliv) For Summative assessment (End Semester Examination or End-Term Examination):

Minimum: 70 percent. Categorization for the same is:

Objective Type Questions:	30%
Short/Long Questions:	70%

Assessment Tools:

Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

COURSE ARTICULATION MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
OMCA-AI-006.1														3
OMCA-AI-006.2	1	3	1	1			2						2	2
OMCA-AI-006.3	1	2	1	1			2						2	3
OMCA-AI-006.4	1	2	2	3	2		1						3	2
OMCA-AI-006.5	2	1	1	3	2		2						2	2

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH & STUDIES
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OMCA-CC-005: CYBER FORENSICS

Periods/week. Credits	Max. Marks: 100
L: 2 T: 0 2	Continuous Evaluation: 30
Duration of Examination: 3 Hrs	End Semester Examination: 70

Pre-Requisite: Knowledge of Computer Network
Course Type: Domain Elective

Course Outcomes: At the end of the course the student will be able to:
OMCA-CS-005.1. Identify the essential and up-to-date concepts, algorithms, protocols, tools, and methodology of Cyber Forensics
OMCA-CS-005.2. To understand the ethics and laws by which cyberspace is governed in our country and worldwide.
OMCA-CS-005.3. Manage and deploy information resources applicable to a particular area of focus in an enterprise setting.
OMCA-CS-005.4. Analyze the report on significant research in information technology and/or the management of information technology resources.
OMCA-CS-005.5. Work with, lead, and manage teams in an enterprise environment to collaboratively arrive at optimal technology solutions.

PART-A

Unit 1: Introduction to Cyber Forensics
1.1 Information Security Investigations
1.2 Corporate Cyber Forensics
1.3 Scientific method in forensic analysis
1.4 Investigating large scale Data breach cases
1.5 Analyzing malicious software
1.6 Types of Computer Forensics Technology,
1.7 Types of Military Computer Forensic Technology
1.8 Types of Law Enforcement: Computer Forensic Technology, Types of Business Computer Forensic Technology
1.9 Specialized Forensics Techniques
1.10 Encryption Methods and Vulnerabilities
1.11 Avoiding Pitfalls with Firewalls Biometric Security Systems

Unit 2: Types of Computer Forensics Systems
2.1 Internet Security Systems
2.2 Intrusion Detection Systems
2.3 Firewall Security Systems
2.4 Storage Area Network Security Systems
2.5 Network Disaster Recovery Systems
2.6 Public Key Infrastructure Systems
2.7 Wireless Network Security Systems
2.8 Satellite Encryption Security Systems
2.9 Instant Messaging (IM) Security Systems,
2.10 Identity Management Security Systems, Identity Theft
2.11 Biometric Security Systems, Router Forensics.
2.12 Cyber forensics tools and case studies.
2.13 Ethical Hacking: Essential Terminology, Windows Hacking, Malware, Scanning, Cracking.

Unit 3: Evidence Collection and Data Seizure

3.1 Need to Collect Evidence
3.2 Collection Options Obstacles
3.3 Types of Evidence, The Rules of Evidence, Volatile Evidence
3.4 General Procedure, Collection and Archiving, Methods of Collection
3.5 Controlling Contamination: The Chain of Custody, Reconstructing the Attack,
3.6 The digital crime scene, Investigating Cybercrime, Investigating Web attacks
3.7 Investigating network Traffic
3.8 Identification of Data: Timekeeping, Forensic Identification and Analysis of Technical Surveillance Devices, Reconstructing Past Events

PART -B

Unit 4: Introduction to Cyber Law

4.1 Understanding cyber space
4.2 Defining cyber law, Scope and jurisprudence
4.3 Concept of jurisprudence
4.4 Overview of Indian legal system
4.5 Introduction to IT Act 2000, Amendment in IT Act.

Unit 5: Cyber Crimes

5.1 Types of cybercrimes –against individuals institution
5.2 States-various offenses and punishments
5.3 Digital signature-concepts
5.4 Certification Authorities and their role
5.5 Creation and authentication of digital signature
5.6 E-contracting –salient features of E-contracts, formation of E-contracts and types
5.7 E-governance, E-governance models
5.8 E-commerce- salient features and advantages

Unit 6: Forensic Tools and Processing of Electronic Evidence

6.1 Introduction to Forensic Tools, Usage of Slack Space, tools for Disk Imaging
6.2 Data Recovery, Vulnerability Assessment Tools, Encase and FTK tools
6.3 Anti Forensics and probable counters, retrieving information
6.4 Process of computer forensics and digital investigations
6.5 Processing of digital evidence, digital images, damaged SIM and data recovery, multimedia evidence,
6.6. Retrieving deleted data: desktops, laptops and mobiles
6.7 Retrieving data from slack space, renamed file, ghosting, compressed file

Suggested Readings:

1. John R. Vacca, 2015, Computer Forensics: Computer Crime Scene Investigation, 2nd Edition, Charles River Media.
2. Ravi Kumar & B Jain,2006, Cyber Forensics - Concepts and Approaches,ICFAI university press
3. Ali Jahangiri, 2009, Live Hacking: The Ultimate Guide to Hacking Techniques & Countermeasures for Ethical Hackers & IT Security Experts.
4. Ec-Council Press, 2010, Computer Forensics: Investigating Network Intrusions and Cyber Crime, Cengage Learning
5. Barkha and U. Rama Mohan, 2017, Cyber Law Crimes, Asia law house.

Note: Only latest editions of the books are recommended.

Web Links:

1. https://www.splunk.com/en_us/blog/learn/cyber-forensics.html (last visited date: 22 February 2024)
2. https://www.educba.com/cyber-forensics/ (last visited date: 22 February 2024)

Instructions for paper setting: Seven questions are to be set in total. First question will be multiple choice covering entire syllabus and will be compulsory to attempt and will be of 18 marks. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 13 marks.

Evaluation Policy:

The evaluation will include two types of assessments:

(clv) Continuous or formative assessments (in the form of end semester examination or term examination. Weightage of assessments are as follows:

For continuous or Formative assessment (in semester): Maximum 30 percent. The categorization for the same is:

MCQs	30%
Subjective (Short/Long)	40%
Discussion/Presentation	15%
Projects/Group Activities etc	15%

(clvi) For Summative assessment (End Semester Examination or End-Term Examination):
Minimum: 70 percent. Categorization for the same is:
Objective Type Questions: 30%
Short/Long Questions: 70%

Assessment Tools:
Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
OMCA-CC-005.1	1		1	2	2		2						3	1
OMCA-CC-005.2	1	1	2		1		2						3	1
OMCA-CC-005.3	1		1	1	2								2	1
OMCA-CC-005.4	1	1			1		2				1	1	1	2
OMCA-CC-005.5	1	1	2	1				1			1	1	1	2

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH & STUDIES
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OMCA-CS-006: WEB APPLICATION SECURITY

Periods/week Credits
L: 2 T: 0 2
Duration of Examination: 3 Hrs

Max. Marks:100
Continuous Evaluation: 30
End Semester Examination: 70

Pre-Requisite: Knowledge of Computer Network
Course Type: Domain Elective

Course Outcomes: At the end of the course, students will be able to
OMCA-CS-006.1 Understand the basics of web application security.
OMCA-CS-006.2 Identify common web application vulnerabilities and attacks.
OMCA-CS-006.3 Implement best practices to mitigate web application security risks.
OMCA-CS-006.4 Understand how to test and secure web applications.
OMCA-CS-006.5 Develop secure web applications.

PART –A

UNIT 1: Introduction to Web Application Security
1.1 Overview of web application security
1.2 Importance of web application security
1.3 Threat modeling Introduction to Internet

UNIT 2: Web Application Architecture
2.1 Understanding web application components
2.2 Server-side vs. client-side programming
2.3 Web application frameworks DNS: Working of DNS

UNIT 3: Common Web Application Vulnerabilities
3.1 Injection attacks (SQL, LDAP, etc.)
3.2 Cross-site scripting (XSS)
3.3 Cross-site request forgery (CSRF)
3.4 Authentication and authorization vulnerabilities

Part B

UNIT 4: Attack Vectors and Countermeasures
4.1 Session hijacking
4.2 Broken access control
4.3 Denial of service (DoS)
4.4 Web application firewalls (WAFs)

Unit 5: Web Application Security Testing
5.1 Vulnerability scanning
5.2 Penetration testing
5.3 Code review
5.4 Threat modeling
5.5 XML injection
5.6 Web Services Description Language (WSDL)
5.7 SOAP and REST

Unit 6: Emerging Trends in Web Application Security
6.1 Mobile web application security
6.2 Cloud-based web application security
6.3 Internet of Things (IoT) security

6.4 Blockchain security Need of Internet of Things

Suggested Readings:

1. Olivier Hersent, 2011, Internet of Things Key Applications and Protocols,, Wiley Publications
2. Pethuru Raj and Anupama C. Raman, 2017, The Internet of Things Enabling Technologies, Platforms and use cases, CRC Press.
3. Harley Hahn, 2002, The Internet Complete Reference, Tata McGraw Hill.

Web Links:

1. https://owasp.org/ (last visited date: 22 February 2024)
2. https://portswigger.net/web-security (last visited date: 22 February 2024)
3. https://web.dev/secure/ (last visited date: 22 February 2024)
4. https://www.sans.org/topic/secure-development/web-application-security (last visited date: 22 February 2024)

Instructions for paper setting: Seven questions are to be set in total. First question will be multiple choice covering entire syllabus and will be compulsory to attempt and will be of 18 marks. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 13 marks.

Evaluation Policy:

The evaluation will include two types of assessments:

(clvii) Continuous or formative assessments (in the form of end semester examination or term examination. Weightage of assessments are as follows:

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MCQs	30%
Subjective (Short/Long)	40%
Discussion/Presentation	15%
Projects/Group Activities etc	15%

(clviii) For Summative assessment (End Semester Examination or End-Term Examination):

Minimum: 70 percent. Categorization for the same is:

Objective Type Questions:	30%
Short/Long Questions:	70%

Assessment Tools:

Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
OMCA-CS-006.1							2	1						
OMCA-CS-006.2		1			2		1	1						
OMCA-CS-006.3				1			1						1	
OMCA-CS-006.4						2	1							
OMCA-CS-006.5	1					1								

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OMCA-FSD-005: AGILE METHODOLOGIES AND DEVOPS

Periods/week	Credits	Max. Marks: 100
L: 2 T: 0	2	Continuous Evaluation: 30
Duration of Examination: 3 Hrs		End Semester Examination: 70

Pre-requisite: Concepts of Software Engineering
Course Type: Doman Elective

Course Outcomes: At the end of the course, the student will be able to:

OMCA-FSD-005.1 Interpret the concept of agile software engineering and its advantages in software development.
OMCA-FSD-005.2 Analyze the core practices behind several specific agile methodologies.
OMCA-FSD-005.3 Identify the roles and responsibilities in agile projects and their difference from projects following traditional methodologies.
OMCA-FSD-005.4 Articulate DevOps engineering and DevOps terminologies to meet the business requirements.
OMCA-FSD-005.5 Articulate continuous integration and continuous deployment pipeline, and automated deployment pipeline.

PART A

UNIT 1: Introduction to Agile

1.1 Need of Agile software development
1.2 Agile context–Manifesto, Principles, Methods, Values, Roles, Artifacts, Stakeholders, and challenges
1.3 Business benefits of software agility.
1.4 Project Planning: Recognizing the structure of an agile team
1.5 Project Design: Fundamentals, Design principles–Single responsibility, Open-closed, Liskov substitution, Dependency-inversion, Interface-segregation

UNIT 2: Agile Methodologies

2.1 Need of Scrum
2.2 Scrum practices –Working of scrum, Project velocity, Burn down chart, Sprint backlog, Sprint planning and retrospective, Daily scrum
2.3 Scrum roles– Product Owner, Scrum Master, Scrum Team
2.4 Extreme Programming- Core principles, values and practices. Kanban, Feature-driven development, Lean software development

UNIT 3: Testing

3.1 The Agile lifecycle and its impact on testing
3.2 Test driven development– Acceptance tests and verifying stories, writing a user acceptance test Developing effective test suites,
3.3 Continuous integration, Code refactoring. Risk based testing, Regression tests, Test automation

PART-B

UNIT 4: Introduction to DevOps

4.1 Continuous Integration and Continuous Deployment
4.2 CI Pipeline, CD Pipeline, CICD
4.3 Components, CICD roles, CICD Cloud, Continuous Integration on SVC, CI Build Cycle, Architecture

Unit 5: Automated Integration

5.1 Automated Integration, Automated Vs Manual CI
5.2 Installation and Configuration of CI Tool
5.3 Creating Jobs, Running the Jobs, Build Deployments
5.4 CI Documentation principles, Documentation of Tool discussed, CD Build Cycle, CD Architecture

UNIT 6: Automated Delivery
6.1 Automated Vs Manual CD
6.2 Continuous Deployment
6.3 Continuous Deployment Requirement
6.4 Continuous Deployment Components
6.5 Continuous Deployment Build Cycle
6.6 Continuous Deployment Architecture
6.7 Automated Continuous deployment: Automated Vs Manual Continuous Deployment
6.8 Continuous Integration Vs Continuous Delivery Vs Continuous Deployment

Suggested Readings:
1. Robert C. Martin, 2002, Agile Software Development, Principles, Patterns and Practices, First International Edition, Prentice Hall.
2. Jim Highsmith, 2009, Agile Project Management: Creating Innovative Products, Second Edition, Addison-Wesley Professional
3. James A. Crowder, Shelli Friess, 2014, Agile Project Management: Managing for Success, Springer
4. Andrew Stellman, Jennifer Greene, 2015, Learning Agile: Understanding Scrum, XP, Lean, and Kanban, O Reilly
5. Sricharan Vadapalli, 2018, DevOps: Continuous Delivery, Integration, and Deployment with DevOps: Dive into the Core DevOps Strategies, Packt
6. Lisa Crispin, Janet Gregory,2010, Agile Testing: A Practical Guide For Testers And Agile Teams, Pearson

Note: Only latest editions of the books are recommended.

Web Links:
1. https://www.javatpoint.com/agile-design (last visited date: 22 February 2024)
2. https://www.slideshare.net/Managewell/design-thinking-and-agile (last visited date: 22 February 2024)

Instructions for paper setting: Seven questions are to be set in total. First question will be multiple choice covering entire syllabus and will be compulsory to attempt and will be of 18 marks. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 13 marks.

Evaluation Policy:

The evaluation will include two types of assessments:

(clix) Continuous or formative assessments (in the form of end semester examination or term examination. Weightage of assessments are as follows:

For continuous or Formative assessment (in semester): Maximum 30 percent. The categorization for the same is:

MCQs	30%
Subjective (Short/Long)	40%
Discussion/Presentation	15%
Projects/Group Activities etc	15%

(clx) For Summative assessment (End Semester Examination or End-Term Examination):

Minimum: 70 percent. Categorization for the same is:

Objective Type Questions:	30%
Short/Long Questions:	70%

Assessment Tools:

Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO 4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
OMCA-FSD-005.1	1	1	2	2	2		2	2				2	3	3
OMCA-FSD-005.2	1	1	2	2	2		2	2				2	3	3
OMCA-FSD-005.3	1	1	2	2	2		2	2				2	3	3
OMCA-FSD-005.4	1	1	2	2	2		2	2				2	3	3
OMCA-FSD-005.5	1	1	2	2	2		2	2				2	3	3

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OMCA-FSD-006: AUTOMATED TESTING USING SELENIUM

Periods/week	Credits	Max. Marks: 100
L: 2 T: 0	2	Continuous Evaluation: 30
Duration of Examination: 3 Hrs		End Semester Examination:70

Pre-requisite: Knowledge of Java
Course Type: Domain Elective

Course Outcomes: At the end of the course, the student will be able to:
OMCA-FSD-006.1 Understand automation testing and Selenium IDE.
OMCA-FSD-006.2 Understand architecture of Selenium Webdriver.
OMCA-FSD-006.3 Work with Selenium Webdriver.
OMCA-FSD-006.4 Analyse the working of Firefox, Chrome and Internet Explorer.
OMCA-FSD-006.5 Handle various HTML elements.

PART-A

UNIT 1: Introduction to Automation
1.1 What is automation testing
1.2 Advantages of Automation Testing
1.3 How to learn any automation tool
1.4 Types of Automation tools

UNIT 2: Introduction to Selenium
2.1 What is Selenium
2.2 Why Selenium
2.3 Features of selenium
2.4 Difference between Selenium and QTP

UNIT 3: Selenium IDE
3.1 Selenium IDE Introduction
3.2 Downloading and Installing Selenium IDE
3.3 Recording and Running a Sample Test
3.4 Selenium IDE – Features
3.5 Selenium Test Runner
3.6 Creating Selenium Test Suites
3.7 Why companies are not using recording
3.8 Limitations of Selenium IDE

PART-B

UNIT 4: Selenium Webdriver
4.1 Why WebDriver? Downloading WebDriver Jar files and configuring in eclipse
4.2 Architecture of selenium webdriver
4.3 Selenium Browser Commands
4.4 Selenium Navigation Commands
4.5 Selenium Javadocs
4.6 Verifying Page Elements – Assertions and Verifications
4.7 Wait Commands (Implicit, Explicit, Pageload, Script)
4.8 Drivers for Firefox, IE, chrome
4.9 First Selenium Code

UNIT 5: Working with Firefox, chrome and IE
5.1 Close and Quit -Difference
5.2 HTMLUnit driver

5.3 Fire path and firebug Add-ons installation
5.4 Inspecting elements in Mozilla, Chrome and IE
5.5 HTML language tags and attributes
5.6 Various locator strategies
5.7 WebDriver Interface

UNIT 6: Web Element Interface
6.1 Finding Web Elements using id, name, class
6.2 Finding Xpaths
6.3 Absolute and Relative Xpaths
6.4 Objects with same id/xpath/cssSelector
6.5 What is class attribute?
6.6 Handling HTML Elements

Suggested Readings:

1. Diego Molina,2018, Selenium Fundamentals, Packt.
2. Gerardus Blokdyk, 2020, Selenium Testing Tool A Complete Guide, 5STARCooks.
3. Zhimin Zhan, 2014, Practical Web Test Automation: Automated test web applications wisely with Selenium WebDriver, second edition, CreateSpace Independent Publishing Platform.
4. Raghavendra Prasad MG, 2015, Learning Selenium Testing Tools - Third Edition, Packt.

Note: Only latest editions of the books are recommended.

Web Links:

1. https://www.slideshare.net/chintal75/automation-testing-using-selenium (last visited date: 22 February 2024)
2. https://www.slidegeeks.com/business/product/introduction-to-selenium-automation-testing-what-is-selenium-grid-ppt-powerpoint-presentation-ideas-show-pdf (last visited date: 22 February 2024)

Instructions for paper setting: Seven questions are to be set in total. First question will be multiple choice covering entire syllabus and will be compulsory to attempt and will be of 18 marks. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 13 marks.

Evaluation Policy:

The evaluation will include two types of assessments:

(clxi) Continuous or formative assessments (in the form of end semester examination or term examination. Weightage of assessments are as follows:

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MCQs	30%
Subjective (Short/Long)	40%
Discussion/Presentation	15%
Projects/Group Activities etc	15%

(clxii) For Summative assessment (End Semester Examination or End-Term Examination):

Minimum: 70 percent. Categorization for the same is:

Objective Type Questions:	30%
Short/Long Questions:	70%

Assessment Tools:

Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO 4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
OMCA-FSD-006.1	1	1	2	2	2		2	2				2	3	3
OMCA-FSD-006.2	1	1	2	2	2		2	2				2	3	3
OMCA-FSD-006.3	1	1	2	2	2		2	2				2	3	3
OMCA-FSD-006.4	1	1	2	2	2		2	2				2	3	3
OMCA-FSD-006.5	1	1	2	2	2		2	2				2	3	3

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH & STUDIES
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OMCA-MC-005: SMART ENERGY

Periods/week	Credits	Max. Marks : 100
L: 2	2	Continuous Evaluation: 30
Duration of Examination: 3 Hrs		End Semester Examination: 70

Co-Requisite: Smart Grids & Concepts of Renewable energy
Course Type: Domain Elective

Course Outcomes: At the end of the course the student will be able to:
OMCA-MC-005.1. Identify the key elements of Smart Grids and visualize the roadmap towards next-Gen electricity networks

OMCA-MC-005.2. Evaluate technology options pertaining to renewable energy generation, energy storage, data handling and communications for Smart Grids
OMCA-MC-005.3. Justify technological and economical choices in the context of existing commercial Smart Grids projects.
OMCA-MC-005.4. Determine the relevance of Smart Grids projects, develop ways to evaluate their impacts and implications.
OMCA-MC-005.5. Analyse the new roles of utilities and consumers in Smart Grids.

PART-A

UNIT 1: Introduction to Smart Grids
1.1 Evolution of Electric Grid & Concept of Smart Grid
1.2 Need of Smart Grid, Functions of Smart Grid, Opportunities & Barriers of Smart Grid
1.3 Difference between conventional & smart grid
1.4 Concept of Resilient & Self Healing Grid
1.5 Present development & International policies in Smart Grid
1.6 Case study of Smart Grid & CDM opportunities in Smart Grid

UNIT 2: Smart Grid Technologies I
2.1 Introduction to Smart Meters
2.2 Real Time Prizing
2.3 Smart Appliances, Automatic Meter Reading (AMR), Outage Management System (OMS)
2.4 Plug in Hybrid Electric Vehicles (PHEV)
2.5 Vehicle to Grid, Smart Sensors, Home & Building Automation

UNIT 3: Smart Grid Technologies II
3.1 Smart Substations, Substation Automation, Feeder Automation
3.2 Geographic Information System (GIS), Intelligent Electronic Devices (IED) & their application for monitoring & protection
3.3 Smart storage like Battery, SMES, Pumped Hydro
3.4 Compressed Air Energy Storage, Wide Area Measurement System (WAMS),
3.5 Phase Measurement Unit (PMU), PMUs application to monitoring & control of power system.

PART –B

UNIT 4: Microgrids and Distributed Energy Resources I
4. 1 Concept of microgrid
4. 2 Need & application of microgrid
4. 3 Formation of microgrid
4. 4 Issues of interconnection
4. 5 protection & control of microgrid

UNIT 5: Microgrids and Distributed Energy Resources II

5. 1 Plastic & Organic solar cells
5. 2 Thin flim solar cells
5. 3 Variable speed wind generators
5. 4 fuel cells
5. 5 microturbines
5. 6 Captive power plants
5. 7 Integration of renewable energy sources

UNIT 6: Power Quality Management in Smart Grid

6. 1 Power Quality & EMC in Smart Grid
6. 2 Power Quality issues of Grid connected Renewable Energy Sources
6. 3 Power Quality Conditioners for Smart Grid
6. 4 Web based Power Quality monitoring

Suggested Readings:

1. Ali Keyhani, Mohammad N. Marwali, Min Dai, 2009, "Integration of Green and Renewable Energy in Electric Power Systems", Wiley.
2. Andres Carvallo, John Cooper, 2011, "The Advanced Smart Grid: Edge Power Driving Sustainability", Artech House Publishers
3. James Northcote, Green, Robert G. Wilson, 2017, "Control and Automation of Electric Power Distribution Systems (Power Engineering)", CRC Press.
4. Mladen Kezunovic, Mark G. Adamiak, Alexander P. Apostolov, Jeffrey George Gilbert "Substation Automation (Power Electronice and Power Systems)", Springer.
5. R.C. Dugan, Mark F. McGranghan, Surya Santoso, H. Wayne Beaty, 2002, "Electrical Power System Quality", 2nd Edition, McGraw Hill Publication.

Note: Only latest editions of the books are recommended.

Web Links:

What is a Smart Grid and How does it Work (tutorialspoint.com) (last visited date: 22 February 2024)
Smart Grid: A Beginner's Guide | NIST (last visited date: 22 February 2024)

Instructions for paper setting: Seven questions are to be set in total. First question will be multiple choice covering entire syllabus and will be compulsory to attempt and will be of 18 marks. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 13 marks.

Evaluation Policy:

The evaluation will include two types of assessments:

(clxiii) Continuous or formative assessments (in the form of end semester examination or term examination. Weightage of assessments are as follows:

For continuous or Formative assessment (in semester): Maximum 30 percent. The categorization for the same is:

MCQs	30%
Subjective (Short/Long)	40%
Discussion/Presentation	15%
Projects/Group Activities etc	15%

(clxiv) For Summative assessment (End Semester Examination or End-Term Examination):

Minimum: 70 percent. Categorization for the same is:

Objective Type Questions:	30%
Short/Long Questions:	70%

Assessment Tools:

Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance

Term end examination

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
OMCA-MC-005.1	1	1	2	2	3		3	2					3	3
OMCA-MC-005.2	1	1		1	1		2	2			3		3	3
OMCA-MC-005.3	1	1		1	2			2			3		2	3
OMCA-MC-005.4	1	1		1	1		2	1			3		2	2
OMCA-MC-005.5	1	1	1	1			2	2					1	2

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH & STUDIES
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OMCA-MC-006: LOGISTICS

Periods/week	Credits	Max. Marks: 100
L: 2	2	Continuous Evaluation: 30
Duration of Examination: 3 Hrs		End Semester Examination: 70

Pre-Requisite: NA
Course Type: Domain Elective

Course Outcomes: After learning the course, the student will be able to:
OMCA-MC-006.1. Understand the fundamentals of networking devices.
OMCA-MC-006.2. Develop computer system configuration
OMCA-MC-006.3. Conduct diagnostics - testing and inspection
OMCA-MC-006.4. Implement Knowledge of hardware components and latest development in the field
OMCA-MC-006.5. Conduct repair and maintenance of PC's Carry out installation of operating system and applications and have knowledge of Networking and system connectivity

PART -A

UNIT 1: Introduction to Logistics
1.1 Logistics: Evolution
1.2 Objectives
1.3 Components and Functions of Logistics Management
1.4 Distribution related Issues and Challenges
1.5 Gaining competitive advantage through Logistics
1.6 Management, Transportation- Functions
1.7 Costs, and Mode
1.8 Network and Decision
1.9 Containerization
1.10 Cross docking

UNIT 2: Introduction to Supply Chain Management
2.1 Supply Chain Concepts: Objectives of a Supply Chain
2.2 Stages of Supply chain
2.3 Value Chain
2.4 Cycle view of Supply Chain Process
2.5 Key issues in SCM, logistics & SCM, Supply
2.6 Chain Drivers and obstacles
2.7 Supply chain strategies, strategic fit
2.8 Best practices in SCM,
2.9 Obstacles of streamlined SCM

UNIT 3: Supply Chain Performance
3.1 Supply Chain Performance: Bullwhip effect and reduction
3.2 Performance measurement: Dimension
3.3 Tools of performance measurement
3.4 SCOR Model
3.5 Demand chain management
3.6 Global Supply chain- Challenges in establishing Global Supply Chain
3.7 Factors that influence designing Global Supply Chain Network.

PART-B

UNIT 4: Warehousing in CRM
4.1 Warehousing: Concept and types

4.2 Warehousing strategy
4.3 Warehouse facility location & network design
4.4 Reverse logistics, Outsourcing- Nature and concept
4.5 Strategic decision to Outsourcing,
4.6 Third party logistics(3PL)
4.7 Fourth party logistics(4PL)

UNIT 5: Supply Chain in CRM
5.1 Supply Chain and CRM- Linkage
5.2 IT infrastructure used for Supply Chain and CRM
5.3 Functional components for CRM
5.4 Green supply chain management
5.5 Supply Chain sustainability

UNIT 6: Export Logistics
6.1 Export logistics: Picking,
6.2 Packing, Vessel Booking
6.3 Customs, Documentation,
6.4 Shipment, Delivery to distribution centres, distributors and lastly the retail outlets-
6.5 Import Logistics: Documents Collection- Valuing- Bonded
6.6 Warehousing Customs Formalities- Clearing
6.7 Distribution to Units

Suggested Readings:

1. Anon., 2006, "The Physical Internet – A Survey of Logistics," The Economist
2. Siems, 2005, "Supply Chain Management: The Science of Better, Faster, Cheaper," Federal Reserve Bank of Dallas – Southwest Economy
3. Laura R. Kopczak and M. Eric Johnson, 2003, "The Supply Chain Management Effect", MIT Sloan Management Review

Note: Only latest editions of the books are recommended.

Weblinks:
https://www.tutorialspoint.com/computer_fundamentals/computer_hardware.htm (last visited date: 22 February 2024)
http://www.learning-about-computers.com/ (last visited date: 22 February 2024)

Instructions for paper setting: Seven questions are to be set in total. First question will be multiple choice covering entire syllabus and will be compulsory to attempt and will be of 18 marks. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 13 marks.

Evaluation Policy:

The evaluation will include two types of assessments:

(clxv) Continuous or formative assessments (in the form of end semester examination or term examination. Weightage of assessments are as follows:

For continuous or Formative assessment (in semester): Maximum 30 percent. The categorization for the same is:

MCQs	30%
Subjective (Short/Long)	40%
Discussion/Presentation	15%
Projects/Group Activities etc	15%

(clxvi) For Summative assessment (End Semester Examination or End-Term Examination):

Minimum: 70 percent. Categorization for the same is:

Objective Type Questions:	30%
Short/Long Questions:	70%

Assessment Tools:

Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
OMCA-MC-006.1.	3				2	2						1		
OMCA-MC-006.2.		2	2	3		1		3				2		1
OMCA-MC-006.3.			1		1		2			2	3		1	
OMCA-MC-006.4.	2			1					2					2
OMCA-MC-006.5.	1				2	2						1		

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES
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OMCA-MM- 005: MULTIMEDIA IN ACTING AND CHOREOGRAPHY

Periods/week Credits	Max. Marks : 100
L: 2 T: 0 2	Continuous Evaluation: 30
Duration of Examination: 3 Hrs	End Semester Examination: 70

Course Outcomes: At the end of the course, the student will be able to:
OMCA-MM-005.1 Describe key points of professional acting and its importance.
OMCA-MM-005.2 Explain the nuances of the trade and will be able to produce live and recorded shows.
OMCA-MM-005.3 Develop a practical knowledge of radio anchoring and it's working.
OMCA-MM-005.4 Understand and analyze the different perspectives and contradictions of society and understand the recent terminology and landmark issues.
OMCA-MM-005.5 Learn core skills of working in the film industry after having a clear view of various program formats.

PART–A

Unit 1- Drama and History of Theatre
1.1 Basic Drawing-Fine arts and aesthetics
1.2 Graphic Design-Illustration and Typography
1.3 Art history and Figure drawing
1.4 Story Designing using Multimedia

Unit 2- Performing Arts
2.1 Concepts Theatre Change in Current scenario using Multimedia
2.2 Characteristics of Performing Art
2.3 Elements of Theatre (Sets, Lights, Costumes, Properties, Make Up) and its enhancement using Multimedia tools
2.4 Multimedia Role in Performing Arts

Unit 3- Practical Work
3.1 Actor's Body: Preparation,
3.2 Modification in Actor's Voice, Speech, and Diction: Using Multimedia Tools
3.3 Preproduction for film and maquette making,

PART –B

Unit 4- Introduction to Dance Theatre
4.1 Understanding Dance Theatre
4.2 History of Dance Theatre in India: Uday Shankar, The Little Ballet Troup, Chitralekha.
4.3 Digital Methods to Understand the global context. Roots in traditional Indian folk forms.
4.4 Contemporary Dance Theatre in India.

Unit -5 Introduction to Choreography Movement on Stage.
5.1 Collective Movement: Dance Ensemble using Digital Methods
5.2 Dialogue with our body; Learning expression using Youtube Videos
5.3 Awareness about the body and use of it for a purposeful expression using AI tools.

Unit 6 Learning Expression

6.1 Live Action Film: Production and Editing
6.2 Imagination and Creative Risks
6.3 VFX -Compositing and Visual Effect
6.4 Audio: Dubbing
6.5 Applied Arts & Comics

Suggested Readings:

1. Jan R. Hakemulder, 2010, Broadcast Journalism, Anmol Publications.
2. Richard and Turner, 2017, Introducing Communication Theory, McGraw Hill
3. Ravindran, R.K. 1999: Media and Society, New Delhi, Common Wealth Publication.

Note: Only latest editions of the books are recommended.

Web Links:

1.https://www.cityheadshots.com/blog/websites-for-acting Last Visited Date: 22-02-2024
2. https://guides.library.cmu.edu/acting Last Visited Date:22-02-2024

Instructions for paper setting: Seven questions are to be set in total. First question will be multiple choice covering entire syllabus and will be compulsory to attempt and will be of 18 marks. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 13 marks.

Evaluation Policy:

The evaluation will include two types of assessments:

(clxvii) Continuous or formative assessments (in the form of end semester examination or term examination. Weightage of assessments are as follows:

For continuous or Formative assessment (in semester): Maximum 30 percent. The categorization for the same is:

MCQs	30%
Subjective (Short/Long)	40%
Discussion/Presentation	15%
Projects/Group Activities etc	15%

(clxviii) For Summative assessment (End Semester Examination or End-Term Examination):

Minimum: 70 percent. Categorization for the same is:

Objective Type Questions:	30%
Short/Long Questions:	70%

Assessment Tools:

Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
OMCA-MM-005.1	1		1				3						3	1
OMCA-MM-005.2	1				1								3	1
OMCA-MM-005.3	1		2	1									2	1
OMCA-MM-005.4	1				1		3						1	2
OMCA-MM-005.5							2							2

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH & STUDIES
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OMCA-MM-006: DIGITAL CHARACTER ANIMATION

Periods/week	Credits	Max. Marks: 100
L: 2 T: 0	2	Continuous Evaluation: 30
Duration of Examination: 3 Hrs		End Semester Examination: 70

Pre-Requisite: Knowledge of multimedia
Course Type: Domain Elective

Course Outcomes: At the end of the course, the student will be able to:
OMCA-MM-006.1. Learn the concepts of 2D animation
OMCA-MM-006.2. Interpret the tools and techniques in creating 2D animation
OMCA-MM-006.3. Trace the process of CGI production from idea to theatre
OMCA-MM-006.4. Understand the real-world body mechanics to draw animated characters
OMCA-MM-006.5. Understand the laws of gravity and motion for movement in animation
OMCA-MM-006.6. Analyze the effective techniques involved in storytelling.

PART-A

Unit 1: Basics of Animation
1.1 Origin and history of animation
1.2 Types of Animation
1.3 Animation techniques
1.4 Disney's 12 principles of animation
1.5 Importance of design elements in drawings

Unit 2: Computer Animation and CGI
2.1 Concept of Bitmap and Vector image
2.2 Kinematics and animatics
2.3 CGI production
2.4 Production processes

Unit 3: 2D Animation and Animation motion
3.1 Animation sequence with layered drawings and backgrounds
3.2 2D animation software
3.3 Graphical tools for digital drawings
3.4 Laws of motion and gravity for animation
3.5 Turning characters into first-rate actors

PART-B

Unit 4: Introduction to Blender

4.1 Concepts of motion capture and keyframe animation
4.2 Power of modern animation techniques
4.3 Process of simulation, Navigation

Unit 5: Character Modeling

5.1 Concept of modeling techniques for character model
5.2 Hide background geometry
5.3 Navigate 3D view using shortcuts
5.4 Perspective and orthographic mode
5.5 Principles of topology

Unit 6: Character animation and storytelling

6.1 Concept of bipedal character model
6.2 Movement of character model
6.3 Walkcycle of rigged character model
6.4 Writing dialogue in script format
6.5 Three-act script structure
6.6 Camera shots, angles and movement
6.7 Create storyboard for animation

Suggested Readings:

1. George Maestri, 2006, Digital Character Animation 3, O'Reilly Publications
2. Richard Williams, 2001, The Animators Survival Kit, Paperback Publications
3. Tony White, 2017, The animator's skectchbook: how to see, interpret and draw like a master animator, CRC Press.
4. Tadashi Ozawa, 2001, How to draw Anime and Game characters, Vol.1: Basics for Beginners and Beyond, CRC Press.

Note: Only latest editions of the books are recommended.

Web Links:

1. https://www.creativehumans.com/blog/types-animation-styles (last visited date: 23 February 2024)
2. https://powerdigitalmarketing.com/blog/importance-of-web-animations/ (last visited date: 23 February 2024)

Instructions for paper setting: Seven questions are to be set in total. First question will be multiple choice covering entire syllabus and will be compulsory to attempt and will be of 18 marks. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three fromeach part. Each question will be of 13 marks.

Evaluation Policy:

The evaluation will include two types of assessments:

(clxix) Continuous or formative assessments (in the form of end semester examination or term examination. Weightage of assessments are as follows:

For continuous or Formative assessment (in semester): Maximum 30 percent. The categorization for the same is:

MCQs	30%
Subjective (Short/Long)	40%
Discussion/Presentation	15%
Projects/Group Activities etc	15%

(clxx) For Summative assessment (End Semester Examination or End-Term Examination):

Minimum: 70 percent. Categorization for the same is:

Objective Type Questions:	30%
Short/Long Questions:	70%

Assessment Tools:

Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
OMCA-MM-006.1	1		1	2	2		3						3	1
OMCA-MM-006.2	1	1	2	3	1		2						3	1
OMCA-MM-006.3	1	2	2	1	2								2	1
OMCA-MM-006.4	1	1	2	1	1		3						1	2
OMCA-MM-006.5	1	1	2	1			2	3					2	2
OMCA-MM-006.6	1	1	2		1		2	3					2	2

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH & STUDIES

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OMCA-DS-318: MULTIMEDIA AND ITS TOOLS

Periods/week	Credits	Max. Marks : 100
L: 2 T: 0	2	Continuous Evaluation : 30
Duration of Examination: 3 Hrs		End Semester Examination: 70

Pre-Requisite: Nil
Course Type: Domain Elective

Course Outcomes: At the end of the course the student will be able to:
OMCA-DS-318.1. Summarize the key concepts in current multimedia technology.
OMCA-DS-318.2. Understand the image fundamentals, formats, compression and editing techniques.
OMCA-DS-318.3. Gain knowledge of different audio file formats, compression and audio software.
OMCA-DS-318.4. Understand the concept of video, recording, editing, compression and animations.
OMCA-DS-318.5. Know the concepts of multimedia authoring.
OMCA-DS-318.6. Create quality multimedia titles.

PART-A

Unit 1: Introduction to Multimedia

1.1 Definition of multimedia
1.2 Components of multimedia
1.3 Web and Internet multimedia applications
1.4 Transition from conventional media to digital media.

Unit 2: Computer Fonts and Hypertext

2.1 Usage of text in Multimedia
2.2 Families and faces of fonts
2.3 outline fonts
2.4 bitmap fonts
2.5 International character sets and hypertext
2.6 Digital fonts techniques

Unit 3: Image fundamentals and representations

3.1 Colour Science
3.2 Colour Models
3.3 Colour palettes,
3.4 Dithering,
3.5 2D Graphics
3.6 Image Compression and File Formats: GIF, JPEG, JPEG 2000, PNG, TIFF, EXIF, PS, PDF
3.7 Basic Image Processing,
3.8 Use of image editing software—White balance correction, Dynamic range correction, Gamma correction, Photo Retouching

PART-B

Unit 4: Audio fundamentals and representations

4.1 Digitization of sound
4.2 Frequency and bandwidth

4.3 Decibel system
4.4 Data rate
4.5 Audio file format,
4.6 Sound synthesis,
4.7 MIDI, wavetable,
4.8 Compression and transmission of audio on Internet
4.9 Adding sound to your multimedia project
4.10 Audio software and hardware

Unit 5: Video and Animation

5.1 Video Basics—How Video Works
5.2 Broadcast Video Standards
5.3 Analog video, Digital video
5.4 Video Recording and Tape formats
5.5 Shooting and Editing Video
5.6 Video Compression and File Formats
5.7 Video compression based on motion compensation, MPEG-1, MPEG-2, MPEG-4, MPEG-7, MPEG-21
5.8 Animation: Cell Animation, Computer Animation, Morphing

Unit 6: **Multimedia Authoring**

6.1 Multimedia Authoring Basics
6.2 Some Authoring Tools
6.3 Macromedia Director
6.4 Flash

Suggested Readings:

1. Tay Vaughan, 2008, "Multimedia making it work", Tata McGraw-Hill.
2. Li & Drew, 2009, " Fundamentals of Multimedia" , Pearson Education.
3. Parekh Ranjan, 2007, "Principles of Multimedia", Tata McGraw-Hill.
4. Rajneesh Aggarwal & B. B Tiwari, 2007, " Multimedia Systems", Excel Publication.

Note: Only latest editions of the books are recommended.

Web Links:

1. https://www.tutorialspoint.com/multimedia/index.htm (last visited date: 22 February 2024)

Instructions for paper setting: Seven questions are to be set in total. First question will be multiple choice covering entire syllabus and will be compulsory to attempt and will be of 18 marks. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three fromeach part. Each question will be of 13 marks.

Evaluation Policy:

The evaluation will include two types of assessments:

(clxxi) Continuous or formative assessments (in the form of end semester examination or term examination. Weightage of assessments are as follows:

For continuous or Formative assessment (in semester): Maximum 30 percent. The categorization for the same is:

MCQs	30%
Subjective (Short/Long)	40%
Discussion/Presentation	15%
Projects/Group Activities etc	15%

(clxxii) For Summative assessment (End Semester Examination or End-Term Examination):

Minimum: 70 percent. Categorization for the same is:
Objective Type Questions: 30%
Short/Long Questions: 70%

Assessment Tools:
Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
OMCA-DS-318.1		2	2	1	2		1					1	2	1
OMCA-DS-318.2	2	2	2	3	1		1					2	3	2
OMCA-DS-318.3	2		1	1	2		3					1	2	2
OMCA-DS-318.4		2	2	3	1		2						1	2
OMCA-DS-318.5	2	1	3	1			2	3				3	2	3
OMCA-DS-318.6	1	1	1	1	1		2	2				2	1	1

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH & STUDIES
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OMCA-DS-319: SOFTWARE PROJECT MANAGEMENT

Periods/week	Credits	Max. Marks: 100
L: 2 T: 0	2	Continuous Evaluation: 30
Duration of Examination: 3 Hrs		End Semester Examination: 70

Pre-Requisite: Knowledge of computer hardware, software and computer networks
Course Type: Domain Elective

Course Outcomes: At the end of the course, the student will be able to:
OMCA-DS-319.1. Monitor & control software project development.
OMCA-DS-319.2. Perform quality audits of software projects.
OMCA-DS-319.3. Examine quality control and quality assurance aspect of software project.
OMCA-DS-319.4. Analyze the process to outsource the project and ensuring quality.
OMCA-DS-319.5. Create Gantt Chart and PERT chart.
OMCA-DS-319.6. Develop project plan and cost estimation.

PART- A

UNIT 1: Introduction to Software Project Management

1.1 Introduction to project management
1.2 Software projects versus other engineering projects
1.3 Software projects activities
1.4 Software projects management control
1.5 Software projects requirement specification
1.6 Software projects issues
1.7 Capability Maturity Model (CMM)

UNIT 2: Software Project Planning

2.1 Overview of software project planning
2.2 Software project selection
2.3 Identify software project scope and project infrastructure,
2.4 Analyze software project characteristics and efforts required
2.5 Software project activity risks

UNIT 3: Software Project Management

3.1 Software project management activities: proposal writing
3.2 Software project planning and scheduling
3.3 Software project costing, monitoring and reviews etc.
3.4 Software project management: project plan, milestones and deliverables
3.5 Software Project scheduling: Program Evaluation and Review Technique, GANTT chart
3.6 Risk management: Risk Identification and Risk Management

PART-B

UNIT 4: Selection of Appropriate Project Approach

4.1 Criteria of choice for process models
4.2 Waterfall, V-process, Spiral model, Prototyping, Incremental
4.3 Software effort estimation: Basis for estimates
4.4 Albrecht function point analysis
4.5 COCOMO cost estimation model
4.6 Procedural code-oriented approach

UNIT 5: Software Project Evaluation
5.1 Software project strategic assessment
5.2 Software project technical assessment
5.3 Software Quality Audits
5.4 Software Quality Assurance
5.5 Software project cost benefit analysis
5.6 Software project evaluation techniques

UNIT 6: Software Projects Future Trends
6.1 Future of software project management
6.2 Project profile of current software
6.3 Next generation software economics
6.4 Modern process transitions
6.5 Issues in Android Software Development

Suggested Readings:

1. Roger S. Pressman, 2008, Software Engineering: A practical Approach, McGraw-Hill
2. Nageswara Rao Pusuluri, 2006, Software Testing Concepts and Tools, DreamTech
3. Pankaj Jalote, 2014, Software Project Management in Practice, Pearson
4. Sanjay Mohapatra, 2011, Software Project Management, Cengage Learning

Note: Only latest editions of the books are recommended.

Web links:
http://www.opensourcetesting.org/ Last Visited Date: 23.02.2024
http://www.onestoptesting.com/ Last Visited Date: 23.02.2024

Instructions for paper setting: Seven questions are to be set in total. First question will be multiple choice covering entire syllabus and will be compulsory to attempt and will be of 18 marks. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three fromeach part. Each question will be of 13 marks.

Evaluation Policy:

The evaluation will include two types of assessments:

(clxxiii) Continuous or formative assessments (in the form of end semester examination or term examination. Weightage of assessments are as follows:

For continuous or Formative assessment (in semester): Maximum 30 percent. The categorization for the same is:

MCQs	30%
Subjective (Short/Long)	40%
Discussion/Presentation	15%
Projects/Group Activities etc	15%

(clxxiv) For Summative assessment (End Semester Examination or End-Term Examination):

Minimum: 70 percent. Categorization for the same is:

Objective Type Questions:	30%
Short/Long Questions:	70%

Assessment Tools:
Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance

Term end examination

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
OMCA-DS-319.1	3		3				3					3	3	2
OMCA-DS-319.2	3	3	3				2		3			3	3	3
OMCA-DS-319.3	2	2	2				2	2		3			3	3
OMCA-DS-319.4			1			3	2	2		3			3	3
OMCA-DS-319.5					3		3						3	3
OMCA-DS-319.6		3	3		3		2	3	3			3	2	3

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH & STUDIES
(Deemed to be University under section 3 of the UGC Act 1956)

OMCA-IOT-005: SENSORS, ACTUATORS AND SIGNAL PROCESSING

Periods/week	Credits	Max. Marks: 100
L: 2	2	Continuous Evaluation: 30
Duration of Examination: 3 Hrs		End Semester Examination: 70

Pre requisites: Basic concepts of signals and systems, sensors and its functions, Basic electronics, Measurements and Instruments.
Course Type: Domain Elective

Course Outcomes: At the end of the course, the student will be able
OMCA-IOT-005.1. To understand basics of sensors, actuators and their operating principle
OMCA-IOT-005.2. To educate the students on different types of microfabrication techniques for designing and developing sensors
OMCA-IOT-005.3. To explain working of various types of electrochemical sensors and actuators
OMCA-IOT-005.4. To provide information about interfacing of sensors and signal conditioning circuits to establish any control system or monitoring system.
OMCA-IOT-005.5. To provide an understanding on characteristic parameters to evaluate sensor performance

PART -A

UNIT 1: Introduction to Sensors
1.1 Difference between sensor, transmitter and transducer
1.2 Primary measuring elements -selection
1.3 Characteristics: Range; resolution, Sensitivity, error, repeatability, linearity and accuracy, impedance, backlash, Response time, Dead band.
1.4 Signal transmission
1.5 Types of signals: Pneumatic signal; Hydraulic signal; Electronic Signal.
1.6 Potentiometer, Proving Rings
1.7 Strain Gauges, Resistance thermometer, Thermistor
1.8 Hot-wire anemometer
1.9 Resistance Hygrometer
1.10 Photo-resistive sensor

UNIT 2: Inductive and Capacitive Sensors
2.1 Inductive transducers: -
2.2 Principle of operation, construction details, characteristics and applications of LVDT,
2.3 Induction potentiometer
2.4 Variable reluctance transducer
2.5 Synchros, microsyn
2.6 Capacitive transducers
2.7 Capacitor microphone

2.8 Capacitive pressure sensor
2.9 Proximity sensor

UNIT 3: Introduction to Actuators
3.1 Definition, types and selection of Actuators
3.2 Linear; rotary; Logical and Continuous Actuators
3.3 Pneumatic actuator- Electro-Pneumatic actuator; cylinder, rotary actuators,
3.4 Mechanical actuating system: Hydraulic actuator - Control valves; Construction,
3.5 Characteristics and Types, Selection criteria.
3.6 Electrical actuating systems
3.7 Solid-state switches, Solenoids,
3.8 Electric Motors- Principle of operation and its application
3.9 D.C motors - AC motors - Single phase & 3 Phase Induction
3.10 Motor; Synchronous Motor; Stepper motors - Piezoelectric Actuator

PART-B

UNIT 4: Micro Sensors
4.1 Principles and example
4.2 Force and pressure micro sensors
4.3 Position and speed micro sensors
4.4 Acceleration micro sensors
4.5 Chemical sensors
4.6 Biosensors
4.7 Temperature micro sensors and flow micro sensors.

UNIT 5: Micro Actuators
5.1 Actuation principle
5.2 Shape memory effects-one way, two way and pseudo elasticity.
5.3 Types of micro actuators- Electrostatic, Magnetic, Fluidic
5.4 Inverse piezo effect
5.5 Other principles

UNIT 6: Sensor Materials and Processing Techniques
6.1 Materials for sensors: Silicon, Plastics, metals, ceramics, glasses, nano materials
6.2 Processing techniques
6.3 Vacuum deposition, sputtering, chemical vapour deposition,
6.4 Electroplating,
6.5 Photolithography
6.6 Silicon micro machining
6.7 Bulk silicon micro machining
6.8 Surface silicon micro machining
6.9 LIGA process

Suggested Books:

1. Patranabis.D,, 1994, "Sensors and Transducers", Wheeler publisher
2. Sergej Fatikow and Ulrich Rembold, 1997, " Microsystem Technology and Microbotics", First edition, Springer, Verlag NEwyork, Inc
3. Jacob Fraden, 2010, "Hand Book of Modern Sensors: Physics, Designs and Application" Fourth edition, Springer

Note: Only latest editions of the books are recommended.

Web Links:

1. https://www.electronicshub.org/sensors-and-transducers-introduction/ (last visited date: 23 February 2024)

Instructions for paper setting: Seven questions are to be set in total. First question will be multiple choice covering entire syllabus and will be compulsory to attempt and will be of 18 marks. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three fromeach part. Each question will be of 13 marks.

Evaluation Policy:

The evaluation will include two types of assessments:

(clxxv) Continuous or formative assessments (in the form of end semester examination or term examination. Weightage of assessments are as follows:

For continuous or Formative assessment (in semester): Maximum 30 percent. The categorization for the same is:

MCQs	30%
Subjective (Short/Long)	40%
Discussion/Presentation	15%
Projects/Group Activities etc	15%

(clxxvi) For Summative assessment (End Semester Examination or End-Term Examination):

Minimum: 70 percent. Categorization for the same is:

Objective Type Questions:	30%
Short/Long Questions:	70%

Assessment Tools:

Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
OMCA-IOT-005.1.	1				2	2						1		
OMCA-IOT-005.2.		2	2	3		1		3				2		1
OMCA-IOT-005.3.			1		1		2			2	3		1	
OMCA-IOT-005.4.	2			1					2					2
OMCA-IOT-005.5	1	2		1			1				1			2

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH & STUDIES
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OMCA-IOT-006: DATA MANAGEMENT IN IOT

Periods/week. Credits
L: 2 T: 0 2
Duration of Examination: 3 Hrs

Max. Marks: 100
Continuous Evaluation: 30
End Semester Examination: 70

Pre-Requisite: Data Mining
Course Type: Domain Elective

Course Outcome: After learning the course, the student will be able
OMCA-IOT-006.1. To introduce IOT
OMCA-IOT-006.2. To familiar with Smart Objects
OMCA-IOT-006.3. To connect with Network
OMCA-IOT-006.4. To describe Data and Analytics for IOT
OMCA-IOT-006.5. To explain Physical Devices
OMCA-IOT-006.6. Learning Raspberry Pi

PART-A

Unit 1: Introduction
1.1 IOT; Genesis of IOT
1.2 IOT and Digitization
1.3 IOT network architecture
1.4 Comparing IOT architectures
1.5 IOT Data Management
1.6 Design Primitives: Protocols
1.7 Security

Unit 2: Smart Objects
2.1 The "THINGS" in IOT
2.2 Sensors, Actuators and smart objects
2.3 Connecting smart objects
2.4 Communications Criteria
2.5 IOT Data Management

Unit 3: Network
3.1 IP as IOT Network Layer
3.2 Need for Optimization
3.3 Application Protocols for IOT
3.4 Transport Layer
3.5 IOT Application Transport Methods

PART-B

Unit 4: Data and Analytics for IOT
4.1 Big Data Analytics tools and technology
4.2 Network Analytics
4.3 Securing IOT
4.4 Formal Risk Analysis Structures: OCTAVE and FAI

Unit 5: Physical Devices

5.1 Arduino UNO
5.2 Installing Arduino UNO
5.3 Programming of Arduino UNO

Unit 6: Raspberry Pi

6.1 Introduction; About Raspberry Pi
6.2 Hardware Layout
6.3 Operating system on Raspberry Pi
6.4 Programming Raspberry Pi with Python
6.5 Wireless temperature monitoring system using Pi
6.6 Remote access to Raspberry

Suggested Readings:

1. Mastering Bitcoin: Unlocking Digital Cryptocurrencies, by Andreas Antonopoulos
2. Blockchain by Melanie Swa, O'Reill
3. Zero to Blockchain – An IBM Redbooks course, by Bob Dill, David Smits

Note: Only latest editions of the books are recommended.

Web Links:

https://www.informatica.com/resources/articles/iot-data-management-and-industrial-iot.html
(Last visited Date: 23 February 2024)

Instructions for paper setting: Seven questions are to be set in total. First question will be multiple choice covering entire syllabus and will be compulsory to attempt and will be of 18 marks. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three fromeach part. Each question will be of 13 marks.

Evaluation Policy:

The evaluation will include two types of assessments:

(clxxvii) Continuous or formative assessments (in the form of end semester examination or term examination. Weightage of assessments are as follows:

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MCQs	30%
Subjective (Short/Long)	40%
Discussion/Presentation	15%
Projects/Group Activities etc	15%

(clxxviii) For Summative assessment (End Semester Examination or End-Term Examination):

Minimum: 70 percent. Categorization for the same is:

Objective Type Questions:	30%
Short/Long Questions:	70%

Assessment Tools:

Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
OMCA-IOT-006.1	1		3	2	1		3			2			3	1
OMCA-IOT-006.2	3	2		2			3	1		1	2	1	3	
OMCA-IOT-006.3	1		2		2	1			1		2		2	
OMCA-IOT-006.4	2		1	2	1		3	1	3		1		2	1
OMCA-IOT-006.5	2		1				3		3		1			
OMCA-IOT-006.5		3		2	1		2			1		1		3

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES
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NAAC 'A' Grade University

OMCA-DaS-005: SQL for Data Science

Periods/week Credits
L :2 T: 0 2.0

Max. Marks: 100
Continuous Evaluation: 30
End Semester Examination: 70

Duration of Examination: 3 Hrs

Pre-Requisite: Basic Knowledge of Databases

Course Outcomes: Students will be able to –

OMCA-DaS-005.1 Understand the key steps for preparing data for analysis.
OMCA-DaS-005.2 Use SQL commands to filter, sort, and summarize data.
OMCA-DaS-005.3 Analyze data in a database using Python.
OMCA-DaS-005.4 To develop the ability for problem analysis and decision-making
OMCA-DaS-005.5 To apply data science concepts and methods to solve problems in real-world contexts.

PART–A

UNIT 1: Introduction to SQL
1.1 Characteristics of SQL
1.2 Importance of SQL for Data Science
1.3 Common database management systems that use SQL (e.g., MySQL, PostgreSQL, SQLite).
1.4 Different Datatypes used in SQL
1.5 Types of SQL Queries:- DDL, DML, DCL, and DCL

UNIT 2: SQL Basics
2.1 Installing a DBMS
2.2 Connecting to the database.
2.3 Creating a sample database.
2.4 Introduction to relational databases and tables.
2.5 Basic SQL queries: SELECT, FROM, WHERE, ORDER BY, LIMIT

UNIT 3: Working with Data
3.1 Creating a table in SQL using CREATE Command
3.2 Inserting data into tables using INSERT.
3.3 Updating existing data using UPDATE.
3.4 Deleting data using DELETE.
3.5 Modifying table structure using ALTER TABLE
3.6 ADD, DROP, or MODIFY a column in a table.

PART – B

UNIT 4: Data Manipulation
4.1 Aggregating data using GROUP BY.
4.2 Filtering groups using HAVING.
4.3 Joining tables using INNER JOIN, LEFT JOIN, RIGHT JOIN.
4.4 Combining result sets using UNION, UNION ALL, INTERSECT, EXCEPT.

UNIT 5: Data Analysis
4.1 Using functions: COUNT, SUM, AVG, MAX, MIN.

4.2 Working with dates and times: DATE, TIME, DATETIME functions.
4.3 Subqueries: nested SELECT statements
4.4 Commonly used SQL functions for data analysis.

UNIT 6: Data Visualization using Python
6.1 Exporting SQL query results to CSV or Excel.
6.2 Connecting SQL with Visualization Tools (pandas and matplotlib)
6.3 MySQL-Connector-Python module in Python
6.4 Connect MySQL database using MySQL-Connector Python

Suggested Readings:

1. Renee M. P. Teate, 2021- SQL for Data Scientists - A Beginner's Guide for Building Datasets for Analysis
2. Cathy Tanimura, 2021, SQL for Data Analysis, O'Reilly Media, Inc.

Note: Only latest editions of the books are recommended.

Web Links:
https://www.edx.org/learn/data-science/ibm-sql-for-data-science (last visited date: 22 February 2024)
https://www.javatpoint.com/sql-tutorial last visited date: 22 February 2024)

Instructions for paper setting: Seven questions are to be set in total. First question will be multiple choice covering entire syllabus and will be compulsory to attempt and will be of 18 marks. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three fromeach part. Each question will be of 13 marks.

Evaluation Policy:
The evaluation will include two types of assessments:
(clxxix) Continuous or formative assessments (in the form of end semester examination or term examination. Weightage of assessments are as follows:

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Objective Type Questions:	30%
Short/Long Questions:	70%

Assessment Tools:
Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO 5	PO 6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
OMCA-DaS-005.1	2	2		3	2		2					1	2	3
OMCA-DaS-005.2	2	2	1	1	2		1						3	2
OMCA-DaS-005.3	2		1	2	2							2		1
OMCA-DaS-005.4	2		1	2	2							2		1
OMCA-DaS-005.5	2		1	2	2							2		1

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES
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NAAC 'A' Grade University

OMCA-DaS-006: Time Series Analytics-I

Periods/week Credits
L :2 T: 0 2.0

Max. Marks: 100
Continuous Evaluation: 30

Duration of Exam: 3 Hrs

End Semester Examination: 70

Pre-Requisite: Basic Knowledge of Statistical concepts and techniques

Course Outcomes: Students will be able to –

OMCA-DaS-006.1 Understand the basics of Time Series Analytics
OMCA-DaS-006.2 Understanding the components and Data types of Time Series Analytics
OMCA-DaS-006.3 Analyse the concept and implementation of moving average methodology
OMCA-DaS-006.4 Run and interpret time series models and regression models for time series
OMCA-DaS-006.5 Implement Machine Learning Models for TSA using Python.

PART –A

UNIT 1: Introduction
1.1 Introduction to time series analysis
1.2 Review of Probability & Statistics
1.3 Measures of Central Tendency- Mean, Mean Mode
1.4 Standard Deviation, Covariance, Autocorrelation
1.5 Fourier Series for TSA
1.6 Significance and Limitations of TSA

UNIT 2: Time Series Components
2.1 Significance of Time Series Components
2.2 Trends, Cycle, Linearity,
2.3 Seasonality, Regularity
2.4 Noise

UNIT 3: Data Types of Time Series Analysis
3.1 Stationary vs Non-Stationary
3.2 Methods to check Stationarity
3.3 Dickey Fuller Test, Augmented Dickey-Fuller (ADF) Test or Unit Root Test
3.4 Kwiatkowski-Phillips-Schmidt-Shin (KPSS) Test
3.5 Converting Non-Stationary into Stationary- detrending, differencing, transformation

PART – B

UNIT 4: Moving Average Methodology
4.1 Time series forecasting methods: moving average
4.2 Moving average models MA(q): SMA, CMA, EMA
4.3 Autoregressive models AR(p).
4.4 ARMA, ARIMA, exponential smoothing

UNIT 5: Time Series Data Visualisation in Python
5.1 Libraries for Time Series Data Visualisation

5.2 Data Visualisation Tools for TSA: Line Plots, Histograms, Density Plot, Box and Whisker Plots.
5.3 Heat Maps, Lag Plots or Scatter Plots, Autocorrelation Plots.
5.4 Importing Libraries, Loading the dataset
5.5 Trends Analysis in Dataset
5.6 Plotting the Changes in Data

UNIT 6: Machine Learning Approaches for TSA
6.1 Data creation
6.2 Univariate Time-series Forecasting method
6.3 Multivariate Time-series Forecasting method
6.4 ML Models for Time-Series Forecasting
6.5 ARIMA, GARCH, LSTM, CNN

Suggested Readings:
1. Tarek A. Atwan, 2022, Time Series Analysis with Python Cookbook: Practical Recipes for Exploratory Data Analysis, Data Preparation, Forecasting, and Model Evaluation
2. Ashish Patel, 2020, Hands-on Time Series Analysis with Python: From Basics to Bleeding Edge Techniques
Note: Only latest editions of the books are recommended.

Web Links:
- Data Mining - Time-Series, Symbolic and Biological Sequences Data - GeeksforGeeks (Last visited: 23rd February 2024)
- Time Series Analysis and Forecasting | Data-Driven Insights (analyticsvidhya.com) (Last visited: 23rd February 2024)

Instructions for paper setting: Seven questions are to be set in total. First question will be multiple choice covering entire syllabus and will be compulsory to attempt and will be of 18 marks. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three fromeach part. Each question will be of 13 marks.

Evaluation Policy:
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(clxxxi) Continuous or formative assessments (in the form of end semester examination or term examination. Weightage of assessments are as follows:

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Projects/Group Activities etc	15%

(clxxxii) For Summative assessment (End Semester Examination or End-Term Examination):
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Objective Type Questions:	30%
Short/Long Questions:	70%

Assessment Tools:
Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO 5	PO 6	PO 7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
OMCA-DaS-006.1	2	2		3	2		2					1	2	3
OMCA-DaS-006.2	2	2	1	1	2		1						3	2
OMCA-DaS-006.3	2		1	2	2							2		1
OMCA-DaS-006.4	1			1	2		1					2		1
OMCA-DaS-006.5	2	2		3	3	1	1					2	2	1

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH & STUDIES

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OMCA-BC-005: APPLICATIONS OF BLOCKCHAIN

Periods/week Credits — Max. Marks: 100
L: 2 2 — Continuous Evaluation: 30
Duration of Examination: 3 Hrs — End Semester Examination: 70

Pre-Requisite: Knowledge of math and statistics & coding
Course Type: Domain Elective

Course Outcomes: At the end of the course the student will be able to:

OMCA-BC-005.1	Understand the fundamental principles of blockchain technology
OMCA-BC-005.2	Understand the Blockchain security and regulations
OMCA-BC-005.3	Analyze the Legal and Ethical Implications in different Industries.
OMCA-BC-005.4	Evaluate the Use of Blockchain in Cryptocurrencies
OMCA-BC-005.5	Understand the fundamental of Blockchain and other Industries
OMCA-BC-005.6	Future Directions and Emerging Technologies

PART-A

UNIT 1: Introduction to Blockchain Technology

1.1 Introduction to data communication
1.2 Overview of blockchain technology
1.3 History and evolution of blockchain technology
1.4 Distributed Ledger Technology (DLT)
1.5 Introduction to cryptocurrencies
1.6 Role of cryptocurrencies in the financial system

UNIT 2: Blockchain security and regulations

2.1 In terms of Security
2.2 In terms of regulations
2.3 In terms of technological implementations
2.4 Blockchain and digital currencies

UNIT 3: Legal and Ethical Implications in different Industries

3.1 Legal issues and regulations
3.2 Ethical issues surrounding Blockchain
3.3 Blockchain in the global economy
3.4 Regulation and compliance
3.5 Privacy and anonymity
3.6 Cryptocurrency theft and fraud

PART-B

UNIT 4: Use of Blockchain in Cryptocurrencies
4.1 Economic principles of cryptocurrencies
4.2 Price volatility and market trends
4.3 Cryptocurrency investment strategies
4.4 Cryptocurrency mining and energy consumption
4.5 Monetary policy and inflation
4.6 Cryptocurrency valuation and investment

UNIT 5: Blockchain and other Industries

5.1 Decentralized applications (DApps) and smart contracts
5.2 Blockchain use cases beyond finance (e.g. supply chain, identity management)
5.3 Potential for blockchain technology to disrupt industries
5.4 Blockchain in Finance
5.5 Blockchain in Supply Chain Management
5.6 Blockchain in Healthcare
5.7 Blockchain in Other Industries

UNIT 6: Future Directions and Emerging Technologies
6.1 Emerging technologies in blockchain and cryptocurrency
6.2 Potential future developments in the cryptocurrency market
6.3 The role of blockchain in emerging fields such as decentralized finance (DeFi)

Suggested Readings:
1. A. Lewis, 2018, "The Basics of Bitcoins and Blockchains", Mango Publishing.
2.Tapscott and A. Tapscott, 2016, "Blockchain Revolution", Penguin Random House.
3. Burniske and J. Tatar, 2017, "Cryptoassets: The Innovative Investor's Guide to Bitcoin and Beyond", McGraw-Hill Education.
4. P. Vigna and M. J. Casey, 2016, "The Age of Cryptocurrency", St. Martin's Press.
5. D. Drescher, 2018, "Blockchain Basics: A Non-Technical Introduction in 25 Steps", Apress.
6. Vigna and M. J. Casey, 2018, "The Truth Machine: The Blockchain and the Future of Everything", St. Martin's Press.
Note: Only latest editions of the books are recommended.

Weblinks:
- https://www.coindesk.com (Last visited: 23rd February 2024)
- https://www.blockchain.com (Last visited: 23rd February 2024)
- https://www.investopedia.com/terms/b/blockchain.asp (Last visited: 23rd February 2024)

Instructions for paper setting: Seven questions are to be set in total. First question will be multiple choice covering entire syllabus and will be compulsory to attempt and will be of 18 marks. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three fromeach part. Each question will be of 13 marks.

Evaluation Policy:
The evaluation will include two types of assessments:
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MCQs 30%
Subjective (Short/Long) 40%
Discussion/Presentation 15%
Projects/Group Activities etc 15%

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Minimum: 70 percent. Categorization for the same is:
Objective Type Questions: 30%
Short/Long Questions: 70%

Assessment Tools:
Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
OMCA-BC-005.1		2		1		1	3						2	1
OMCA-BC-005.2	2	2	2				3			1			3	2
OMCA-BC-005.3		3		1			2						2	
OMCA-BC-005.4	2	3			1		2		1		1		1	2
OMCA-BC-005.5	2	1	1		2		3			1				
OMCA-BC-005.6		3		1			2						2	

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH & STUDIES

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OMCA-BC-006: SMART CONTRACT APPLICATION AND DEVELOPMENT

Periods/week	Credits	Max. Marks: 100
L: 2 T: 0	2	Continuous Evaluation: 30
Duration of Examination: 3 Hrs		End Semester Examination: 70

Pre-Requisite: Knowledge of Block Chain Technology, Data Structures and Algorithm, Computer Programming and Network Security
Course Type: Domain Elective

Course Outcomes: At the end of the course, the student will be able to:
OMCA-BC-006.1. Describe the concept of Blockchain-based tokens.
OMCA-BC-006.2. Develop skills to manage Blockchain-based tokens.
OMCA-BC-006.3. Apply Solidarity programming for generations of various files.
OMCA-BC-006.4. Demonstrate the skills for creating for generating tokens.
OMCA-BC-006.5 Solve the problems related Blockchain-tokens using decentralized apps.

PART-A

UNIT 1: INTRODUCTION TO ETHEREUM

1.1 concepts of Smart Contracts
1.2 Dapps, And DAOs
1.3 Ethereum Virtual Machine (EVM)
1.4 Ethereum Technology Overview
1.5 Architectural Overview
1.6 Ethereum Block chain Platform
1.7 Current and Potential Uses of Ethereum

UNIT 2: INTRODUCTION TO PROGRAMMING SMART CONTRACTS

2.1 A Simple Smart Contract, Account Types
2.2 Gas, and Transactions
2.3 Accessing Contracts and Transactions
2.4 Mix, Dapps, Developer Tools
2.5 Ethereum Tests
2.6 Web3 Base Layer Services
2.7 Installing, Building, Testing, & Deploying Ethereum nodes.

UNIT 3: INTRODUCTION TO SOLIDITY PROGRAMMING

3.1 Layout of a Solidity Source File
3.2 Structure of a Contract, Types
3.3 Units and Globally Available Variables
3.4 Input Parameters and Output Parameters
3.5 Control Structures, Function Calls
3.6 Creating Contracts via new
3.7 Order of Evaluation of Expressions
3.8 Assignment, Scoping and Declarations
3.9 Error handling: Assert, Require, Revert and Exceptions

PART-B

UNIT 4: SOLIDITY PROGRAMMING

4.1 Contracts
4.2 Creating Contracts
4.3 Visibility and Getters
4.4 Function Modifiers
4.5 Constant State Variables
4.6 Functions, Inheritance
4.7 Abstract Contracts
4.8 Interfaces
4.9 Libraries

UNIT 5: INTRODUCTION TO DECENTRALIZED APPS (DAPPS)

5.1 Decentralized Application Architecture
5.2 Connecting to the Block chain and Smart Contract
5.3 Decentralized Apps – Coding Details
5.4 Decentralized Apps – Voting Contract
5.5 Decentralized Apps – App

UNIT 6: DECENTRALIZED APPS (DAPPS)

6.1 Blind Auction Contract and App
6.2 Coding Style Guide
6.3 Design Patterns
6.4 Coding Style Guide
6.5 Code Layout
6.6 Naming Conventions
6.7 Common Design Patterns
6.8 Withdrawal from Contracts

Suggested Readings:

1. Andreas M. Antonopoulos, Dr.Gavin wood, 2019, "Mastering Ethereum" O"Reilly Media Inc.
2. S. Shukla, M. Dhawan, S. Sharma, S. Venkatesan, 2019, Blockchain Technology: Cryptocurrency and Applications, Oxford University Press.
3. Josh Thompson, 2017, Blockchain: The Blockchain for Beginnings, Guild to Blockchain Technology and Blockchain Programming, Create Space Independent Publishing Platform.

Note: Only latest editions of the books are recommended.

Software required/ Weblinks:

https://www.w3schools.io/blockchain/solidity-smart-contract/ (last visited date: 23 February 2024)
https://www.tutorialspoint.com/what-are-smart-contracts (last visited date: 23 February 2024)

Instructions for paper setting: Seven questions are to be set in total. First question will be multiple choice covering entire syllabus and will be compulsory to attempt and will be of 18 marks. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three fromeach part. Each question will be of 13 marks.

Evaluation Policy:

The evaluation will include two types of assessments:

(clxxxv) Continuous or formative assessments (in the form of end semester examination or term examination. Weightage of assessments are as follows:

For continuous or Formative assessment (in semester): Maximum 30 percent. The categorization for the same is:

MCQs	30%
Subjective (Short/Long)	40%
Discussion/Presentation	15%
Projects/Group Activities etc	15%

(clxxxvi) For Summative assessment (End Semester Examination or End-Term Examination):

Minimum: 70 percent. Categorization for the same is:

Objective Type Questions:	30%
Short/Long Questions:	70%

Assessment Tools:

Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO 9	PO1 0	PO 11	PO 12	PSO1	PS O2
OMCA-BC-006.1		1		2			3	2					2	3
OMCA-BC-006.2	1				1			2		2	2		3	3
OMCA-BC-006.3		1		1	2			2			3		2	3
OMCA-BC-006.4	1			1	1		2	1			3		2	2
OMCA-BC-006.5	1	1					2	2					1	2

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH & STUDIES
(Deemed to be University under section 3 of the UGC Act 1956)

OMCA-DO-005: CONTAINERIZATION WITH DOCKER

Periods/week Credits	Max. Marks: 100
L:2 T: 0 2	Continuous Evaluation: 30
Duration of Examination: 3 Hrs	End Semester Examination : 70

Pre-Requisite: Knowledge of A 64-bit installation linux as well as network system configuration.

Course Type: Domain Elective

Course Outcomes: At the end of the course, students will be able to
OMCA-DO-005.1. Define the concepts of Dockerization.
OMCA-DO-005.2. Customization of container on by their own.
OMCA-DO-005.3. Docker Commands and Structures.
OMCA-DO-005.4. Understanding of docker composition operations.
OMCA-DO-005.5. Understanding about Creation of a Multi-Service Multi-Node Web App.

PART-A

Unit-I: Introduction to Docker
1.1 Introducing Docker, Comparing VM and Docker, Docker –
1.2 An Architectural overview,
1.3 The Docker Hub
1.4 A brief Introduction, Preparing docker-machine – Installation and configuration,
1.5 Start containerizing, Play with docker images.

Unit-II: Customized Container
2.1 Customizing container on your own,
2.2 Running Container with Docker – commands,
2.3 Port forwarding with docker container,
2.4 Exercise: Installation of docker and Image Setup,
2.5 Exercise: Creating own Images,
2.6 Exercise: Creating own Images,
2.7 Exercise: Exposing Container Ports to the Host and test it.

Unit-III: Docker Internal System
3.1 The Dockerfile,
3.2 Builds and Network Configuration,
3.3 Dockerfile Directives, USER and RUN,
3.4 RUN Order of Execution, ENV, CMD vs. RUN,
3.5 ENTRYPOINT, EXPOSE, Docker Container Volume Management – An introduction, Docker Networking concepts, List and Inspect, Create and Remove, Assign to Containers.

PART-B

Unit-IV: Structure
4.1 Docker Commands and Structures,
4.2 Inspect Container Processes, Previous Container Management, Controlling Port Exposure on Containers, Naming Our Containers,
4.3 Docker Events, Managing and Removing Base Images, Saving and Loading Docker Images, Image History, Taking Control of Our Tags, Pushing to Docker Hub, Continuous Integration for Docker.

Unit-V: Networking
5.1 Docker-Compose,
5.2 Networking Overview,
5.3 The Default Network, Isolating Containers, Aliases & Container Names, Links,
5.4 How Updates Affect Networking, Using External Networks, Configuring Compose, Bringing an Environment Up,
5.5 Changing a Running Environment, Introspecting On An Environment, Taking an Environment Down.

Unit-VI: Case Study
6.1 Create A Multi-Service Multi-Node Web App,
6.2 Service Placement Preference,
6.3 Node Availability,
6.4 Case study.

Suggested Readings:

1. James Turnbull, 2014, The Docker Book: Containerization Is the New Virtualization
2. Jeeva S. Chelladhurai, Vinod Singh, Pethuru Raj, 2017, Learning Docker, Packet Publishing.
3. Sathyajith Bhat, 2018, Practical Docker with Python: Build, Release and Distribute, O'Reilly
4. Adrian Mouat 2015, Using Docker: Developing and Deploying Software with Containers, O'Reilly

Note: Only latest editions of the books are recommended.

Software required/ Web Links
https://www.tutorialspoint.com/ cyber security/index.htm (last visited date: 23 February 2024)

Instructions for paper setting: Seven questions are to be set in total. First question will be multiple choice covering entire syllabus and will be compulsory to attempt and will be of 18 marks. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three fromeach part. Each question will be of 13 marks.

Evaluation Policy:
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Short/Long Questions:	70%

Assessment Tools:
Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

	PO1	PO2	PO3	PO 4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
OMCA-DO-005.1	1		1	2			2						3	3
OMCA-DO-005.2	1	2	1		3		1						2	2
OMCA-DO-005.3			2	1		2	1							
OMCA-DO-005.4	2	3					2							
OMCA-DO-005.5	2	3	1	2		3	2	2					2	2

Course Articulation Matrix:

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH & STUDIES
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OMCA-DS-006: ADVANCED DEVOPS TOOLS

Periods/week	Credits	Max. Marks: 100
L: 2	2	Continuous Evaluation: 30
Duration of Examination: 3 Hrs		End Semester Examination: 70

Pre requisites: Technical and personal skills such as Coding, re-engineering of processes and collaboration.
Course Type: Domain Elective

Course Outcomes: At the end of the course, the student will be able to
OMCA-DO-006.1 Use visual data exploration methods to aid in data understanding
OMCA-DO-006.2 Identify appropriate data visualization techniques given particular requirements
OMCA-DO-006.3 Build data graphics with the appropriate data visualization and analytics software.
OMCA-DO-006.4 Refine the data graphics to improve readability, clarity, and accessibility of the data insights
OMCA-DO-006.5 provide students with the knowledge and skills necessary to implement DevOps practices in cloud environments using AWS services

PART-A

Unit 1: Introduction to DevOps

1.1 DevOps Principles in detail
1.2 DevOps Engineer Skills in the market
1.3 Knowing DevOps Delivery Pipeline
1.4 Market trend of DevOps
1.5 DevOps Technical Challenges
1.6 Tools we use in DevOps

Unit 2: GIT – A version control tool

2.1 Knowing about Version control
2.2 Git – A CLI and Essentials of GIT in industry
2.3 How to setup GIT-Installing Git, First-Time Git Setup, Getting a Git Repository
2.4 Working with various commands in GIT
2.5 Recording Changes to the Repository like How to check the Status of Your Files, how to track New Files
2.6 Git workflows

Unit 3: Jenkins – Continuous integration

3.1 Essentials of Continuous Integration, usage of CI
3.2 Jenkins and its architecture
3.3 Jenkins tool Management in detail
3.4 Installing Jenkins and Post-installation setup wizard
3.5 Unlocking Jenkins
3.6 Customizing Jenkins with plugins

PART-B

Unit 4: Ansible – A configuration Management

4.1 Introducing Ansible – A configuration management tool
4.2 Understanding Ansible architecture
4.3 Hosts and Groups

4.4 Host Variables & Group Variables
4.5 Various ansible Modules

Unit 5: DevOps on Cloud

5.1 Essentials of Cloud computing?
5.2 Cloud and virtualization architecture
5.3 Why we need DevOps on Cloud?
5.4 Cloud DevOps Engineer and Cloud Engineer
5.5 Cloud, Security and Operations

Unit 6: DevOps on Cloud

6.1 Introducing to Amazon web services
6.2 Various AWS services for Devops – An overview
6.3 DevOps using AWS – Demo
6.4 AWS Management and Monitoring
6.5 Security and Identity
6.6 Cost Management

Suggested Readings:

1. Gene Kim, Patrick Debois, John Willis, 2016, The DevOps Handbook: How to Create World-Class Agility, Reliability, and Security in Technology Organizations Paperback.
2. Jennifer Davis, Ryn, 2016, Effective DevOps: Building a Culture of Collaboration, Affinity, and Tooling at Scale, O'Reilly Media.

Web Links:

1. https://d1.awsstatic.com/whitepapers/AWS_DevOps.pdf (last visited date: 23 February 2024)
2. https://www.javatpoint.com/devops (last visited date: 23 February 2024)

Instructions for paper setting: Seven questions are to be set in total. First question will be multiple choice covering entire syllabus and will be compulsory to attempt and will be of 18 marks. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three fromeach part. Each question will be of 13 marks.

Evaluation Policy:

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Short/Long Questions:	70%

Assessment Tools:
Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
OMCA-DO-006.1	1				2			2					2	3
OMCA-DO-006.2		3	2				1	1					2	3
OMCA-DO-006.3	2			2			2	1	3					3
OMCA-DO-006.4	2			2			2		3					3
OMCA-DO-006.5	2		2	2			2		3				2	

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH & STUDIES
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OMCA-CN-005: ADVANCED COMPUTER NETWORK

Periods/week	Credits	Max. Marks: 100
L: 2	2	Continuous Evaluation: 30
Duration of Examination: 3 Hrs		End Semester Examination: 70

Pre-Requisite: Computer networks
Course Type: Domain Elective

Course Outcomes: At the end of the course the student will be able to:
OMCA-CN-005. 1 Design and implement advanced network architectures to support modern IT infrastructures.
OMCA-CN-005.2 Analyse and optimize network performance using advanced techniques and tools.
OMCA-CN-005.3 Implement secure networking solutions to protect against various cyber threats.
OMCA-CN-005.4 Design and deploy scalable and fault-tolerant network services.
OMCA-CN-005.5 Evaluate emerging networking technologies for real-world use.

PART-A

Unit 1: Network Design and Architecture

1.1 Introduction to Advanced Network Architectures
1.2 Hierarchical Network Design
1.3 Software-Defined Networking (SDN)
1.4 SDN Architecture
1.5 SDN Applications
1.6 Network Function Virtualization (NFV)
1.7 Virtual Network Functions (VNFs)
1.8 Cloud Networking

Unit 2: Advanced Routing Protocols

2.1 OSPFv3 (Open Shortest Path)
2.2 Enhanced Interior Gateway Routing Protocol
2.3 Border Gateway Protocol
2.4 Multicast Routing
2.5 IP Multicast Basics
2.6 Multicast Routing Protocols (DVMRP, PIM-SM, PIM-DM)

Unit 3: Quality of Service (QoS)

3.1 Introduction to QoS in Networking
3.2 Traffic Policing and Shaping
3.3 Congestion Management and Avoidance
3.4 QoS in Wireless Networks
3.5 QoS Models

PART-B

Unit 4: Network Security

4.1 Threats and Vulnerabilities in Computer Networks
4.2 Vulnerability Assessment and Penetration Testing
4.3 Cryptography and Encryption Techniques
4.4 Digital Signatures and Certificates
4.5 Cryptographic Protocols (SSL/TLS, IPSec)
4.6 Network Access Control (NAC)
4.7 Intrusion Detection and Prevention Systems (IDPS)

Unit 5: Network Performance Optimization

5.1 Performance Metrics and Monitoring Tools
5.2 Network Monitoring Techniques (SNMP, NetFlow, Packet Capture)
5.3 Traffic Engineering and Load Balancing
5.4 Network Virtualization
5.5 Network Function Chaining (NFC)
5.6 Network Slicing in 5G Networks

Unit 6: Emerging Technologies

6.1 Internet of Things (IoT) and Networking
6.2 5G Networks and Beyond
6.3 Blockchain Technology and Networking
6.4 Edge Computing and Networking

Suggested Readings:

1. Larry L. Peterson, Bruce S. Davie, 2019, "Computer Networks: A Systems Approach", Morgan Kaufmann.
2. William Stallings, 2020, "Network Security Essentials: Applications and Standards", Pearson.
3. Kurose, J.F., & Ross, K.W. (2021). "Computer Networking: A Top-Down Approach". Pearson.
4. Andrew S. Tanenbaum, David J. Wetherall, 2011, "Computer Networks", Pearson.
5. Glyn James, 2010, Advanced Modern Engineering Mathematics, Pearson Education

Note: Only latest editions of the books are recommended.

Web Links:

1. https://onlinecourses.nptel.ac.in/noc23_cs35/preview (last visited date:23 February 2024)
2. https://www.netacad.com/ (last visited date: 23 February 2024)
3. https://www.coursera.org/courses?query=computer%20network (last visited date: 23 February 2024)

Instructions for paper setting: Seven questions are to be set in total. First question will be multiple choice covering entire syllabus and will be compulsory to attempt and will be of 18 marks. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 13 marks.

Evaluation Policy:

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Short/Long Questions: 70%

Assessment Tools:
Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
OMCA-CN-005.1	3	2		2									3	2
OMCA-CN-005.2	3	3	2	3	2								3	2
OMCA-CN-005.3	2	2	2		2								3	2
OMCA-CN-005.4	3	3	3	2	2								3	2
OMCA-CN-005.5	3	3	3										3	2

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH & STUDIES
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OMCA-CN-006: NETWORK MANAGEMENT

Periods/week	Credits	Max. Marks: 100
L: 2	2	Continuous Evaluation: 30
Duration of Examination: 3 Hrs		End Semester Examination: 70

Co-Requisite: Basic concepts of computer networks
Course Type: Domain Elective

Course Outcomes: At the end of the course the student will be able to:
OMCA-CN-006.1 Analyze the issues and challenges pertaining to management of emerging network technologies such as wired/wireless networks and high-speed internets.
OMCA-CN-006.2 Apply network management standards to manage practical networks.
OMCA-CN-006.3 Formulate possible approaches like SNMPv1, RMON for managing the network
OMCA-CN-006.4 Learn to handle user broadband demands as well as emerging multimedia applications using technologies like HFCT, DSL, ADSL etc.
OMCA-CN-006.5 Optimize a network using techniques like event correlation techniques
OMCA-CN-006.6 Learn various security breaches as well as techniques to secure a network

PART-A

UNIT 1: Introduction to Network Management
1.1. Telephone Network Management: Introduction & Data and Telecommunication Network Distributed computing Environments
1.2. TCP/IP-Based Networks: Communication protocols, Communication Architectures, Protocol Layers and Services
1.3. Case Histories of Networking and Management
1.4. Issues, Challenges & Applications

UNIT 2: Standards, Models and Language
2.1 Network Management Standards
2.2 Different models : Network Management Model, Organization Model, Information Model & Functional Model
2.3 ASN.1: Definition & associated concepts
2.4 Macros

UNIT 3: SNMPv1 Network Management
3.1 SNMP: Communication Model, Architecture
3.2 SNMP: Administrative Model, specifications, Operations
3.3 SNMP: Functional Model
3.4 RMON, RMON1, RMON2

PART –B

UNIT 4: Introduction to Broadband Access Technology
4.1 Broadband Access Networks & Technology: Introduction
4.2 HFCT Technology
4.4 HFC Management
4.5 RF Spectrum Management
4.6 DSL & ADSL Technology

UNIT 5: Performance Statistics
5.1 Configuration Management
5.2 Fault Management

5.3 Performance Management
5.4 Event Correlation Techniques: Rule-Based Reasoning, Model-Based Reasoning, Case Based Reasoning
5.5 Codebook correlation Model, State Transition Graph Model & Finite State Machine Model

UNIT 6: Security Management
6.1 Security Management
6.2 Security Breaches and their prevention
6.3 Authentication and Authorization
6.4 Accounting Management, Report Management, Policy-Based Management, Service Level Management.

Suggested Readings:

1. Mani Subramanian, 2010, Network Management- Principles and Practice, 2nd Pearson Education.
2. J. Richard Burke, 2008, Network management Concepts and Practices: a Hands-On Approach, PHI.

Web Links:

1. What is Network Management (tutorialspoint.com) (Last visited: 23-02-2024)
2. An Introduction to SNMP (Simple Network Management Protocol) | DigitalOcean (Last visited: 23-02-2024)

Instructions for paper setting: Seven questions are to be set in total. First question will be multiple choice covering entire syllabus and will be compulsory to attempt and will be of 18 marks. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 13 marks.

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Surprise questions during lectures/Class Performance
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COURSE ARTICULATION MATRIX:

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OMCA-CN-006.1	1	1	2	2	3		3	2					3	3
OMCA-CN-006.2	1	1	1	1	1		2	2			3		3	3
OMCA-CN-006.3	1	1	1	1	2		2	2			3		2	3
OMCA-CN-006.4	1	1	1	1	1		2	1			3		2	2
OMCA-CN-006.5	1	1	1	1			2	2					1	2
OMCA-CN-006.6	1		1	3			3	2						2

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH & STUDIES

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OMCA-AR-005: GAME DESIGN FUNDAMENTALS

Periods/week	Credits	Max. Marks: 100
L: 2 T: 0	2	Continuous Evaluation: 30
Duration of Examination: 3 Hrs		End Semester Examination: 70

Pre-Requisite: Nil
Course Type: Domain Elective

Course Outcomes: At the end of the course, the student will be able to:

OMCA-AR-005.1 : Be familiar with the emergence of the academic study of design methods and game design.
OMCA-AR-005.2 : Be familiar with central concepts within the field.
OMCA-AR-005.3 : Be able to select and apply appropriate methods and techniques during different stages of the development cycle.
OMCA-AR-005.4 : Be able to structure and conduct a game design project from conceptualization to playable prototype.
OMCA-AR-005.5: Proficient in contributing to the collaborative learning and development processes.
OMCA-AR-005.6 : Understand how design can be applied to the academic process of generating new knowledge

PART-A

Unit 1: Introduction to Game Design

1.1 Determinism, Non-Determinism,
1.2 Solvability, Trivial Solvability, Theoretical Complete Solvability,
1.3 Solving Non-Deterministic Games,
1.4 Solving Intransitive Games, Perfect Information,
1.5 Symmetry, Meta-game
1.6 Board Game Development Project

Unit 2: Numeric Relationships, Transitive Mechanics and Cost Curves

2.1 Identity relationships, Linear relationships,
2.2 Exponential relationships. Triangular relationships.
2.3 Setting hard-limits. Central resources.
2.4 Signs of imbalance. Relationship diagrams.
2.5 Examples of Transitive Mechanics

Unit 3: Probability ,Randomness and Variables

3.1 Finite and Probability Exercise
3.2 Dependent v. Independent Variables
3.3 The Monty Hall Problem
3.4 The Sibling Problem
3.5 The Lottery Card Calculation
3.6 Puzzle Design

PART-B

Unit 4: Introduction to Reasoning

4.1 Randomness and Pseudorandomness
4.2 Interference from human psychology in randomness.
4.3 Ethics and transparency in probability
4.4 Advancement, Progression and Pacing
4.5 Additive and Subtractive Mechanics

Unit 5: Universal Interfaces

5.1 Feedback process. Examples of positive and obstructive design.
5.2 Discussion of current UI trends.
5.3 Games With Purpose
5.4 Games As Art
5.5 Games As Business

Unit 6:
6.1 Introduction to Programming
6.2 Concepts & Application
6.3 Applied Learning
6.4 Case Studies of Situational Balance
6.5 Attack vs. Defense
6.6 Single-Target vs. Area Damage

Suggested Readings:
1. Jesse Schell, 2019, The Art of Game Design, A Book of Lenses, Third Edition, CRC Press.
2. Tracy Fullerton, 2018, Game Design Workshop, CRC Press

Note: Only latest editions of the books are recommended.

Web links:
The Complete Guide to Video Game Design (gamedesigning.org) (Last visited Date: 22-02-2024)
Game Design: Examples- CS First (Last visited Date: 22-02-2024)

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OMCA-AR-005.2	1	1	1	1	1		2	2			3		3	3
OMCA-AR-005.3	1	1	1	1	2		2	2			3		2	3
OMCA-AR-005.4	1	1	1	1	1		2	1			3		2	2
OMCA-AR-005.5	1	1	1	1			2	2					1	2
OMCA-AR-005.6	1			3			3	2			1		1	1

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH & STUDIES

(Deemed to be University under section 3 of the UGC Act 1956)

OMCA-AR-006: IMMERSIVE TECHNOLOGY AND MEDIA (AR/VR)

Periods/week Credits — Max. Marks: 100
L: 2 T: 0 — Continuous Evaluation : 30
Duration of Examination: 3 Hrs — End Semester Examination : 70

Pre-Requisite: Nil
Course Type: Domain Elective

Course Outcomes: At the end of the course, the student will be able to:

OMCA-AR-006.1 Use Augmented Reality (AR) and Virtual Reality (VR) technologies Basic concept.
OMCA-AR-006.2 Implement AR and VR to enhance the experience of digital interactions for their clients, employees, and consumers.
OMCA-AR-006.3 Design, create, and integrate audio, visual, and interactive elements into a comprehensive immersive experience
OMCA-AR-006.4 Able to use Augmented Reality to create immersive content for their consumers,
OMCA-AR-006.5 While integrating immersive technologies to help advance the sophistication of their offerings with AR and VR.

PART-A

Unit I: Introduction to Augmented Reality (AR)
1.1 Introduction;
1.2 How does AR work
1.3 AR examples
1.4 Benefits of Augmented Reality

Unit II: AR Hardware and Software
2.1 Sensory hardware, Limitations and interactions
2.2 AR and VR together;
2.3 Introduction to AR headset and smart glasses;
2.4 Various AR software available;
2.5 Introduction to Spark AR;
2.6 Unity installation;
2.7 What is Software Development Kit (SDK);

Unit III: 3D Computer Graphics
3.1 Introduction to AR foundation;
3.2 Installing AR foundation SDK; SDK setup
3.3 3D computer graphics basics;
3.4 Creating 3D objects

PART-B

Unit IV: Scripting Basics
4.1 C-Sharp basics;
4.2 Unity classes; Vectors in Unity
4.3 Creating a Virtual Environment for AR
4.4 Basics of creating a virtual environment for AR; Applying physics

Unit V: Interactions in AR
5.1 Types of interaction in AR;
5.2 How to test your project
5.3 Interactive movies in AR;
5.4 Healthcare; Measurement in various scales;

5.5 R as a marketing tool

Unit VI: Future of AR
6.1 AR and VR together;
6.2 Future of interactions in AR and AI;
6.3 Future of AR as location-based experiences;
6.4 Intelligent Virtual Wardrobe trial; Spatial journalism

Suggested Readings:

1. M. Claudia tom Dieck ,Sandra M. C. Loureiro, 2021, Augmented Reality and Virtual Reality: New Trends in Immersive Technology, Springer.
2. Pierre, 2023, Immersive Technologies: Virtual Reality, Augmented Reality, Mixed Reality and the immersive ecosystem, Blurb

Note: Only latest editions of the books are recommended.

Web links:

https://www.researchgate.net/publication/358137827_Immersive_Technology_Uses_in_Interactive_Media_A_Collection_of_Case_Studies (Last visited Date: 22 February 2024)

Instructions for paper setting: Seven questions are to be set in total. First question will be multiple choice covering entire syllabus and will be compulsory to attempt and will be of 18 marks. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 13 marks.

Evaluation Policy:

The evaluation will include two types of assessments:

(cxcvii) Continuous or formative assessments (in the form of end semester examination or term examination. Weightage of assessments are as follows:

For continuous or Formative assessment (in semester): Maximum 30 percent. The categorization for the same is:

MCQs	30%
Subjective (Short/Long)	40%
Discussion/Presentation	15%
Projects/Group Activities etc	15%

(cxcviii) For Summative assessment (End Semester Examination or End-Term Examination):

Minimum: 70 percent. Categorization for the same is:

Objective Type Questions:	30%
Short/Long Questions:	70%

Assessment Tools:
Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
OMCA-AR-006.1	1	2		2	2		2	3					3	3
OMCA-AR-006.2	1	3	3		1		2	2			3		3	3
OMCA-AR-006.3	1		2	2	3		2	2			3		2	3
OMCA-AR-006.4	3	1	1	2			2	3			2		3	2
OMCA-AR-006.5	1	3		2			2	3					1	2

SEMESTER-IV

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH & STUDIES

(Deemed to be University under section 3 of the UGC Act 1956)

OMCA-DS-410: Introduction to .NET

Periods/week	Credits	Max. Marks: 100
L: 3 T: 0	3	Continuous Evaluation: 30
Duration of Examination: 3Hrs		End Semester Examination: 70

Prerequisite: Knowledge of Object-Oriented Programming Approach
Course Type: Core

Course Outcomes: At the end of the course, students will be able to
OMCA-DS-410.1. Define the concepts of windows application programming concepts.
OMCA-DS-410.2. Describe the internal working of .Net Framework.
OMCA-DS-410.3. Demonstrate the usage of different tools and controls used in C# programming.
OMCA-DS-410.4. Analyze the various types of database connectivity with visual studio .net.
OMCA-DS-410.5. Assess various ASP.NET components and justify their usage in various programming situations.
OMCA-DS-410.6. Develop a full-fledged Web Application using ASP.NET with database connectivity.

PART-A

UNIT 1: Introduction to .Net Architecture

1.1 Introduction to Visual Studio and .Net Architecture
1.2 Visual Studio IDE, Development Environment Setup
1.3 .NET Overview, CLR, Assemblies (monolithic vs. component-based applications)
1.4 Execution Model, Client-Side vs. Server-Side Programming.
1.5 Debugging using Visual Studio.
1.6 Creating Different types of Projects in Visual Studio (Web, Desktop, Library)

UNIT 2: C# Basics

2.1 Variables, Constants
2.2 Strings, Data Types
2.3 Arrays Different Types of Arrays and Operations on Arrays
2.4 Decision statements
2.5 Loop statements
2.6 Exception Handling using try – catch –finally
2.7 Name Space
2.8 Class and Objects, Creating and using Objects

Unit 3: Inheritance and Interface

3. 1 Concept of Inheritance
3. 2 Sealed class
3. 3 Operator Overloading
3. 4 Method Overloading
3. 5 Indexer Overloading
3. 6 Creating an Interface
3. 7 Implementing an Inheritance
3. 8 Inheriting an Interface

PART-B

Unit 4: Desktop Applications and Event Handling

4. 1 Windows Forms
4. 2 MsgBox, DialogBox
4. 3 Handling Mouse and Keyboard Events
4. 4 Basic Control Programming for following controls
4. 5 Button, Label , Textbox , Rich Textbox
4. 6 Radio Button , Checkbox , List Box
4. 7 Checked List Box.
4. 8 Tree View
4. 9 Picture Box, Tab Control

UNIT 5: Database Programming

5. 1 Architecture of ADO.NET
5. 2 Data Providers in ADO.NET
5. 3 Connection and Command Class
5. 4 DataReader
5. 5 DataAdapter
5. 6 DataSet and DataTable
5. 7 DataReader
5. 8 DataGridView Control
5. 9 Binding Controls with DataSets
5. 10 Reading and Writing into XML Data Files.
5. 11 Executing Stored Procedures from ADO

UNIT 6: Web Applications using ASP.NET

1.1 Web Development and ASP NET
1.2 Session Tracking
1.3 ASP.NET Components: Web forms
1.4 Basic Components (Textbox, Dropdown, Button)
1.5 GridView and DataList Controls
1.6 State Management
1.7 Deploying Application in IIS Server
1.8 Web.Config and Global.asax
1.9 Creating Web Services
1.10 Consuming RESTfulWeb Service in C#

Suggested Readings:

1. Daniel M. Solis, 2010, Illustrated C#, Apress Publications
2. Jack Purdum, 2007, Beginning C# 3.0 An introduction to object oriented programming, Wrox Publication
3. Jon Skeet, 2008, C# in depth, Manning Publications Co.
4. Matthew McDonald, 2010, Beginning ASP.NET 4 in C#, Apress Publications
5. Imar Spaanjaars, 2010, Beginning ASP.NET 4.5 in C# and VB,Wrox Publications

Note: Only latest editions of the books are recommended.

Software required/ Web links:
Visual Studio 2010
Database Server: SQL Server 2008
https://docs.microsoft.com/en-us/dotnet/csharp/quick-starts/ last visited date: 22 February 2024)
https://www.tutorialspoint.com/csharp/ last visited date: 22 February 2024)

Instructions for paper setting: Seven questions are to be set in total. First question will be multiple choice covering entire syllabus and will be compulsory to attempt and will be of 18 marks. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 13 marks.

Evaluation Policy:
The evaluation will include two types of assessments:

(cxcix) Continuous or formative assessments (in the form of end semester examination or term examination. Weightage of assessments are as follows:

For continuous or Formative assessment (in semester): Maximum 30 percent. The categorization for the same is:

MCQs	30%
Subjective (Short/Long)	40%
Discussion/Presentation	15%
Projects/Group Activities etc	15%

(cc) For Summative assessment (End Semester Examination or End-Term Examination):
Minimum: 70 percent. Categorization for the same is:

Objective Type Questions:	30%
Short/Long Questions:	70%

Assessment Tools:
Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
OMCA-DS-410.1	2		2	2	3	2	2		1				2	2
OMCA-DS-410.2	2	2	2		3		2		1				2	2
OMCA-DS-410.3	2		2	2	3	1	1			2			2	2
OMCA-DS-410.4	2	2	2	2	3	2		1		2			2	2
OMCA-DS-410.5	2	2	2	2	3	2	1	1		1			2	3

OMCA-DS-410.6	2	2	2		3	2	1	1		1			2	3

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH & STUDIES
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OMCA-DS-411: ADVANCED JAVA

Periods/week	Credits	Max. Marks: 100
L: 3 T: 0	3	Continuous Evaluation: 30
Duration of Examination: 3 Hrs		End Semester Examination: 70

Pre-Requisite: Knowledge of Core Java
Course Type: Core

Course Outcomes: At the end of the course the student will be able to:
OMCA-DS-411.1 Apply the concept of Servlet and its life cycle to create web application.
OMCA-DS-411.2 Apply JSP tags and its services to web application.
OMCA-DS-411.3 Create packages and interfaces in the web application context.
OMCA-DS-411.4 Build Database connection for the web applications.
OMCA-DS-411.5 Develop enterprise applications using Java Beans concepts for the given problem.

PART-A

UNIT 1: Java Database Connectivity (JDBC)
1.1 Overview of RDBMS
1.2 Introduction to Call Level Interface (CLI)
1.3 Introduction to JDBC
1.4 JDBC Architecture
1.5 Types of JDBC Drivers
1.6 Establishing a JDBC Connection
1.7 Managing Transactions in JDBC

Unit 2: Servlet
2.1 Servlet Structure
2.2 Servlet packaging
2.3 HTML Building utilities, Lifecycle
2.4 Single Thread Model Interface
2.5 Handling Client request: Form Data, HTTP Request Headers
2.6 Generating Server Response: HTTP Status Codes, HTTP Response Headers,
2.7 Handling Cookies, Session Tracking

Unit 3: Introduction to JSP
3.1 JSP Technology, Need of JSP, Benefits of JSP, Advantages of JSP
3.2 Invoking Java code with JSP Scripting Elements, Creating Template Text
3.3 Invoking Java Code form JSP, Limiting Java Code in JSP,
3.4 Using JSP Expressions
3.5 Comparing Servlets And JSP, Writing Scriptlets

PART-B

Unit 4: Controlling the structure
4.1 The JSP Page directive, Import Attribute, Session Attribute
4.2 isElignore, Buffer, Autoflush, Info Attributes

4.3 errorPage, iserrorPage, isThreadSafe, extends, language Attributes
4.4 Including Files and Applets in JSP Pages using Java Beans
4.5 JAR File, Manifest file

UNIT 5: Enterprise Java Beans
5.1 Introduction to Enterprise Java Beans
5.2 EJB – Environment Setup.
5.3 EJB – Create Application
5.4 EJB – Stateless Bean
5.5 EJB – Stateful Bean
5.6 EJB – Persistence
5.7 EJB – Message Driven Beans
5.8 EJB – Exception Handling.
5.9 EJB – Web Services

UNIT 6: JSP Expression Language (EL)
6.1 Syntax
6.2 Implicit objects
6.3 Operators
6.4 Functions

Suggested Readings:
1. ED Roman, Rima Patel, 2014, Mastering Enterprise Java Beans, Wiley Publishing Inc.
2. Uttam Roy, 2015, Advanced Java Programming, Oxford University Press.
3. Murach, 2005, Murach's beginning JAVA JDK 5, SPD.
4. Knuckles, 2005, Web Applications Technologies Concepts, John Wiley.
5. Pekowsky, 2004, Java Server Pages, Pearson publication.

Note: Only latest editions of the books are recommended.

Web links:
https://www.tutorialspoint.com/jdbc **(**Last Visited Date:22-02-2024)
https://www.javatpoint.com/java-jdbc **(**Last Visited Date:22-02-2024)
https://www.w3schools.com/xml/ **(**Last Visited Date:22-02-2024)
https://www.javatpoint.com/servlet-tutorial **(**Last Visited Date:22-02-2024)
https://www.guru99.com/jsp-tutorial.html **(**Last Visited Date:22-02-2024)
https://www.tutorialspoint.com/jsp/jsp_expression_language.htm **(**Last Visited Date:22-02-2024)
https://www.tutorialspoint.com/ejb/ejb_tutorial.pdf **(**Last Visited Date:22-02-2024)

Instructions for paper setting: Seven questions are to be set in total. First question will be multiple choice covering entire syllabus and will be compulsory to attempt and will be of 18 marks. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 13 marks.

Evaluation Policy:
The evaluation will include two types of assessments:

(cci) Continuous or formative assessments (in the form of end semester examination or term examination. Weightage of assessments are as follows:

For continuous or Formative assessment (in semester): Maximum 30 percent. The categorization for the same is:

MCQs	30%
Subjective (Short/Long)	40%
Discussion/Presentation	15%
Projects/Group Activities etc	15%

(ccii) For Summative assessment (End Semester Examination or End-Term Examination):

Minimum: 70 percent. Categorization for the same is:
Objective Type Questions: 30%
Short/Long Questions: 70%

Assessment Tools:
Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
OMCA-DS-411.1	3	3	2	2	3		3						3	1
MCA-DS-411.2	1	1	2	3	1		2						3	1
MCA-DS-411.3	1	2	2	1	2								2	1
MCA-DS-411.4	1	1	2	1	1		3						1	2
MCA-DS-411.5	1	1	2	1			2	3					2	2

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH & STUDIES
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OMCA-DS-461: ADVANCED JAVA LAB

Periods/week	Credits	Max. Marks: 100
P: 2 T: 0	1	Continuous Evaluation: 30
Duration of Examination: 2 Hrs		End Semester Examination: 70

Pre-Requisite: Knowledge of Java Programming, Database Concepts.
Course Type: Core

Course Outcomes: At the end of the course, the student will be able to:
OMCA-DS-461.1 Apply the concept of Servlet and its life cycle to create web application.
OMCA-DS-461.2 Apply JSP tags and its services to web application.
OMCA-DS-461.3 Create packages and interfaces in the web application context.
OMCA-DS-461.4 Build Database connection for the web applications.
OMCA-DS-461.5 Design and develop an application for the given problem.
OMCA-DS-461.6 Develop application programs using beans concept.

Concepts & List of Experiments:
1. Write a JAVA Servlet Program to implement a dynamic HTML using Servlet (username and Password should be accepted using HTML and displayed using a Servlet).
2. Write a JAVA Servlet Program to Auto Web Page Refresh (Consider a webpage which is displaying Date and time or stock market status. For all such type of pages, you would need to refresh your web page regularly; Java Servlet makes this job easy by providing refresh automatically after a given interval). AJU-MCA Syllabus w.e.f Batch 2020 132
3. Write a JAVA Servlet Program to implement and demonstrate GET and POST methods (Using HTTP Servlet Class).
4. Write a JAVA Servlet Program using cookies to remember user preferences.
5. Write a JAVA Servlet program to track HttpSession by accepting user name and password using HTML and display the profile page on successful login.
6. Write a JSP Program which uses jsp:include and jsp:forward action to display a Webpage.
7. Write a JSP Program which uses tag to run an applet
8. Write a JSP Program to get student information through a HTML and create a JAVA Bean class, populate Bean and display the same information through another JSP
9. Write a JSP program to implement all the attributes of page directive tag.
10. Write a JAVA Program to insert data into Student DATA BASE and retrieve info based on particular queries (For example update, delete, search etc…).
11. An EJB application that demonstrates Session Bean (with appropriate business logic). 12. An EJB application that demonstrates MDB (with appropriate business logic).
13. An EJB application that demonstrates persistence (with appropriate business logic).
Note: Case Study on real applications.

Note: Faculty can suggest more practical assignments and projects as per the need.

Suggested Readings:
1. Patrick Naughton and Herbert Schildt, 2000, Complete Reference Java, Latest Edition, Tata
2. Hans Bergstan, 2003, Java Server Pages
3. Murach, 2005, Murach's beginning JAVA JDK 5, SPD
4. Knuckles, 2005, Web Applications Technologies Concepts- John Wiley
5. Pekowsky, 2004, Java Server Pages, Pearson

Software required/ Web links:
Java SDK or JRE 1.6 or higher
Java Servlet Container (Free Servlet Container available) (Last visited date: 22 February 2024)

http://www.oracle.com/technetwork/java/javase/downloads/jdk8-downloads-2133151.html (last visited date: 22 February 2024)

Evaluation Policy:

The evaluation will include two types of assessments:

(cciii) Continuous or formative assessments (in the form of end semester examination or term examination. Weightage of assessments are as follows:

For continuous or Formative assessment (in semester): Maximum 30 percent. The categorization for the same is:

MCQs	30%
Subjective (Short/Long)	40%
Discussion/Presentation	15%
Projects/Group Activities etc	15%

(cciv) For Summative assessment (End Semester Examination or End-Term Examination):

Minimum: 70 percent. Categorization for the same is:

Objective Type Questions:	30%
Short/Long Questions:	70%

Assessment Tools:

Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
OMCA-DS-461.1	3	3	2	2	2		1				2		2	2
OMCA-DS-461.2	3	3	2	2	2		1				2		3	1
OMCA-DS-461.3	3	2	3	2	2		1				2		2	2
OMCA-DS-461.4	3	2	2	2	1		3				1		2	2
OMCA-DS-461.5	2	3	2	12			2	3					2	2
OMCA-DS-461.6	3	3	2	2	1		2	2					2	2

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH & STUDIES
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OMCA-DS-460: Introduction to .NET LAB

Periods/week	Credits	Max. Marks: 100
P: 4 T: 0	2	Continuous Evaluation: 30
Duration of Examination: 3 Hrs		End Semester Examination: 70

Co-requisite: Knowledge of Object-oriented programming approach
Course Type: Core

Course Outcomes: After completing this course, the student will be able to:
OMCA-DS-460.1 Understand and explain the windows application programming concepts.
OMCA-DS-460.2 Identify the different tools and controls used in the programming.
OMCA-DS-460.3 Explore the concept of Objects and classes to be used in C#.
OMCA-DS-460.4 Learn advanced concepts like file handling and event handling in C#
OMCA-DS-460.5 Demonstrate the basic concepts of database connectivity with visual studio .net
OMCA-DS-460.6 Implement the object oriented concepts in C#.

1. Revision of Basic programming techniques using C#.

2. Implement the Concept to C# that inputs a positive integer n and then prints a triangle of asterix n times high and 2n-1 column wide. For example If input is 5 then the output would pyramid.

3. Implement the concept of bubble sort in C#.

4. Create two classes DF & DM distance in Cm & m. Implement the Concept to read the dimensions in one of these metrics & convert them to other & display the same.

5. Implement the concept of a class to represent a Bank Account comprising the given specifications & concept of member functions.

6. Implement the concept of file handling to read XML file and display all the values in a read only Form.

7. Concept of three variables: temp, pressure and water level for a chemical industry boiler from the keyboard. Throw an event called alert, if these variables level shoot above a certain level. [Event Handling]

8. Concept to illustrate overloading an indexer.

9. Implement the concept in C# consisting of a delegate called student that refers to a method called student record (), your program should get the details of student record and display. [Delegate]

10. Develop the Concept to create a class that does metric conversion from meters, centimeter to feet, inches respectively. Create a class called meters.txt and read the data from the user by prompting. Convert this data into feet and inches and save it in another file called feet.txt. [File Handling]

11. Prepare a login form, which will accept unique username, password of alphanumeric type, re-type password, date of birth, and text to remember password. And put all necessary validation. If user does not fill the complete form it should show valid error message. Also if user is new then there should be option for creating new Login and a checkbox to remember on computer. [Windows application].

12. Prepare & develop the concept of with Menu Bar, Context Bar and Tool Bar.

13. Prepare a ASP.NET page to fill student details. Use any of the components available as deemed fit for the requirements. on the press of save button user should be able to save the form data in a mysql table

14. Develop an ASP page to display the data of students entered in the previous form in tabular format using any of the grids .use Dataset to populate the grid.

15. Create a ASP.NET page to fill student details. Use any of the components available as deemed fit for the requirements. on the press of save button user should be able to save the form data in a mysql table.

16. Create an ASP page to display the data of students entered in the previous form in tabular format using any of the grids. Use Dataset to populate the grid.
17. Make a mini project based on above mentioned list of practical. Suggested mini projects are:
    a. Student Tracking System
    b. Mobile Wallet
    c. Toll Collection
    d. Asset Tracking System
    e. Feedback system

Suggested Reading:

1. Daniel M. Solis, 2010, Illustrated C#, Apress Publications
2. Jack Purdum, 2007, Beginning C# 3.0 An introduction to object oriented programming, Wrox Publication
3. Jon Skeet, 2008, C# in depth, Manning Publications Co.
4. Matthew McDonald, 2010, Beginning ASP.NET 4 in C#, Apress Publications
5. Imar Spaanjaars, 2010, Beginning ASP.NET 4.5 in C# and VB,Wrox Publications

Note: Only latest editions of the books are recommended.

Software required/ Web links:

Visual Studio 2010 Professional
Database Server: SQL Server 2019
https://docs.microsoft.com/en-us/dotnet/csharp/quick-starts/ last visited date: 22 February 2024)
https://www.tutorialspoint.com/csharp/ last visited date: 22 February 2024)

Evaluation Policy:

The evaluation will include two types of assessments:

(ccv) Continuous or formative assessments (in the form of end semester examination or term examination. Weightage of assessments are as follows:

For continuous or Formative assessment (in semester): Maximum 30 percent. The categorization for the same is:

MCQs	30%
Subjective (Short/Long)	40%
Discussion/Presentation	15%
Projects/Group Activities etc	15%

(ccvi) For Summative assessment (End Semester Examination or End-Term Examination):
Minimum: 70 percent. Categorization for the same is:

Objective Type Questions:	30%
Short/Long Questions:	70%

Assessment Tools:

Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

COURSE ARTICULATION MATRIX:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2
OMCA-DS-460.1	2		2	2	3	2			1				2	1
OMCA-DS-460.2	2	2	2		3		1	1	1				3	1
OMCA-DS-460.3	2		2	2	3	1	1			2			2	2
OMCA-DS-460.4	2		2		3	2	1	1		2		1	2	2
OMCA-DS-460.5	2	2	2		3	2		1		2	1	1	2	3
OMCA-DS-460.6	2	2	2		3	2	1			1	1		2	3

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH & STUDIES
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OMCA-DS-412: DIGITAL IMAGE PROCESSING

Periods/week	Credits	Max. Marks: 100
L: 2	2	Continuous Evaluation: 30
Duration of Examination: 3 Hrs		End Semester Examination: 70

Pre requisites: Basic Knowledge of probability and statistics.
Course Type: Domain Elective

Course Outcomes: At the end of the course, the student will be able
OMCA-DS-412.1. To introduce the students to the fundamental techniques and algorithms used for acquiring, processing and extracting useful information from digital images.
OMCA-DS-412.2. To understand techniques of image sampling and quantization, image transforms, image enhancement and restoration, image encoding, image analysis and pattern recognition.
OMCA-DS-412.3. To apply the methods to solve real-world problems in several areas including medical, remote sensing and surveillance
OMCA-DS-412.4. To provide develop the insight necessary to use the tools of digital image processing (DIP) to solve any new problem.
OMCA-DS-412.5. To provide an understanding on characteristic parameters to evaluate DIP performance.

PART-A

UNIT 1: Digital image fundamentals & Image Transforms
1.1 Digital Image fundamentals
1.2 Sampling and quantization
1.3 Relationship between pixels
1.4 Walsh transform, Hadamard Transform
1.5 Discrete cosine Transform, Discrete Wavelet Transform.

UNIT 2: Image enhancement in spatial domain
2.1 Introduction, Image Enhancement in Spatial Domain
2.2 Enhancement Through Point Operation
2.3 Types of Point Operation,
2.4 Histogram Manipulation
2.5 Gray level Transformation
2.6 Local or neighborhood operation
2.7 Median filter
2.8 Spatial domain high pass filtering.

UNIT 3: Image enhancement in Frequency domain
3.1 Filtering in Frequency Domain
3.2 Obtaining Frequency Domain Filters from Spatial Filters
3.3 Generating Filters Directly in the Frequency Domain
3.4 Low Pass(smoothing) filters in Frequency Domain
3.5 High Pass (sharpening) filters in Frequency Domain

PART-B

UNIT 4: Image Restoration
4.1 Degradation Model
4.2 Algebraic Approach to Restoration
4.3 Inverse Filtering
4.4 Least Mean Square Filters
4.5 Constrained Least Squares Restoration.

UNIT 5: Image Segmentation and Image Processing
5.1 Detection of discontinuities.
5.2 Edge linking and boundary detection
5.3 Thresholding
5.4 Region oriented segmentation
5.5 Morphological Image Processing- Dilation and Erosion
5.6 Structuring Element Decomposition
5.7 Opening and Closing
5.8 The Hit or Miss Transformation.

UNIT 6: Image Compression Techniques
6.1 Redundancies and their Removal Methods
6.2 Fidelity Criteria
6.3 Image Compression Models
6.4 Huffman and Arithmetic Coding
6.5 Error Free Compression
6.6 Lossy Compression
6.7 Lossy and Lossless Predictive Coding
6.8 Image Transform Based Compression
6.9 JPEG 2000 Standards

Suggested Readings:

1. R.C. Gonzalez, R.E. Woods, and S. L. Eddins, 2004, "Digital Image Processing using MATLAB, , Pearson Prentice-Hall.
2. Rafeal C. Gonzalez, Richard E. Woods, 2008, Digital Image Processing, 3rd Edition, Pearson.
3. S Jayaraman, S. Essakkirajan, T. Veerakumar, 2010, Digital Image Processing,TMH.

Note: Only latest editions of the books are recommended.

Web Links:
https://www.geeksforgeeks.org/digital-image-processing-basics/ (Last visited Date: 25 February 2024)

Instructions for paper setting: Seven questions are to be set in total. First question will be multiple choice covering entire syllabus and will be compulsory to attempt and will be of 18 marks. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 13 marks.

Evaluation Policy:
The evaluation will include two types of assessments:

(ccvii) Continuous or formative assessments (in the form of end semester examination or term examination. Weightage of assessments are as follows:

For continuous or Formative assessment (in semester): Maximum 30 percent. The categorization for the same is:

MCQs	30%
Subjective (Short/Long)	40%
Discussion/Presentation	15%
Projects/Group Activities etc	15%

(ccviii) For Summative assessment (End Semester Examination or End-Term Examination):
Minimum: 70 percent. Categorization for the same is:

Objective Type Questions:	30%
Short/Long Questions:	70%

Assessment Tools:
Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
OMCA-DS-412.1.	1				2	2						1		
OMCA-DS-412.2.		2	2	3		1		3				2		1
OMCA-DS-412.3.			1		1		2			2	3		1	
OMCA-DS-412.4.	2			1					2					2
OMCA-DS-412.5	1	2		1			1				1			2

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH & STUDIES
(Deemed to be University under section 3 of the UGC Act 1956)

OMCA-DS-413: SOFTWARE API PROCESSES

Periods/week	Credits	Max. Marks: 100
L: 2 T: 0	2	Continuous Evaluation: 30
Duration of Examination: 3 Hrs		End Semester Examination: 70

Pre-Requisite: Knowledge of Core Java
Course Type: Domain Elective

Course Outcomes: At the end of the course the student will be able to:
OMCA-DS-413.1 Define the basic Software API processes, and their appropriate application.
OMCA-DS-413.2 Able to develop, deploy, and manage APIs.
OMCA-DS-413.3 Able to establish connectivity between APIs that allow software systems to communicate.
OMCA-DS-413.4 Compare the various testing strategies at functional and behavior level.
OMCA-DS-413.5 Assess software quality attributes and secure APIs.

PART-A

UNIT 1: Introduction
1.1 Overview
1.2 API processes Strategy & Planning
1.3 The Software API process
1.4 Benefits

Unit 2: Fundamentals
2.1 API Functional Types & Protocols
2.2 Definition of an Endpoint
2.3 Principles of Data Exchange & Messaging
2.4 API Security
2.5 Error Messaging

Unit 3: Software API connectivity
3.1 Using JSON
3.2 Using Shared Preferences
3.3 Working with SQLite Database
3.4 Making RESTful API Calls with HTTP,
3.5 Using Firebase/Firestore

PART-B

UNIT 4: Controlling the structure
4.1 Import Attribute, Session Attribute
4.2 isElignore, Buffer, Autoflush, Info Attributes
4.3 errorPage, iserrorPage, isThreadSafe, extends, language Attributes
4.4 Including Files and Applets in JSP Pages using Java Beans
4.5 JAR File, Manifest file

Unit 5: Testing Techniques
5.1 Using Tools
5.2 Functional Testing
5.2.1 GET, POST, PUT
5.2.2 Request/Response
5.2.3 API Data Validation
5.3 Error Testing

5.4 Automating API Tests

UNIT 6: Maintenance
6.1 Server Access & Security Tokens
6.2 Tools
6.3 Test Maintenance

Suggested Reading:
1. Christian Reilly, 2012, The REST API Design Handbook: George Reese, Kindle Edition
2. Mark Masse, 2011, REST API Design Rulebook, O'Reilly Media, Inc.

Note: Only latest editions of the books are recommended.

Web links:
1. https://www.ibm.com/topics/api (Last Visited Date: 23rd February, 2024)
2. https://blogs.mulesoft.com/learn-apis/api-led-connectivity/what-are-apis-how-do-apis-work/ (Last Visited Date: 23rd February, 2024)
3. https://en.wikipedia.org/wiki/API (Last Visited Date: 23rd February, 2024)

Instructions for paper setting: Seven questions are to be set in total. First question will be multiple choice covering entire syllabus and will be compulsory to attempt and will be of 18 marks. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 13 marks.

Evaluation Policy:

The evaluation will include two types of assessments:

(ccix) Continuous or formative assessments (in the form of end semester examination or term examination. Weightage of assessments are as follows:

For continuous or Formative assessment (in semester): Maximum 30 percent. The categorization for the same is:

MCQs	30%
Subjective (Short/Long)	40%
Discussion/Presentation	15%
Projects/Group Activities etc	15%

(ccx) For Summative assessment (End Semester Examination or End-Term Examination):

Minimum: 70 percent. Categorization for the same is:

Objective Type Questions:	30%
Short/Long Questions:	70%

Assessment Tools:
Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO 5	PO 6	PO 7	PO8	PO9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2
OMCA-DS-413.1	3	3	2	2	3		3						3	1
OMCA-DS-413.2	1	1	2	3	1		2						3	1
OMCA-DS-413.3	1	2	2	1	2								2	1
OMCA-DS-413.4	1	1	2	1	1		3						1	2
OMCA-DS-413.5	1	2	1	1	1		2						1	1

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH & STUDIES

(Deemed to be University under section 3 of the UGC Act 1956)

OMCA-CC-007: CLOUD SECURITY MANAGEMNET

Periods/week	Credits	Max. Marks: 100
L: 2	2	Continuous Evaluation: 30
Duration of Examination: 3 Hrs		End Semester Examination: 70

Pre-Requisite: Introduction to Cloud Computing
Course Type: Domain Elective

Course Outcomes: At the end of the course, students will be able to

OMCA-CC-007.1 Describe the security architecture of cloud computing and security service models.
OMCA-CC-007.2 Analyze the Strategies to Secure operation of cloud and list the security requirements.
OMCA-CC-007.3 Explain different key strategies for data security and apply the best practice models in real time application.
OMCA-CC-007.4 Apply the security model for cloud application with network, data and security considerations.
OMCA-CC-007.5 Develop an information security framework model for cloud operation.

PART –A

UNIT 1: Introduction
1.1 Cloud Security Basics
1.2 Security design principles
1.3 Secure Isolation Strategies
1.4 Comprehensive Data Protection
1.5 Monitoring and Auditing

UNIT 2: Securing the Cloud Architecture
2.1 Security Concerns
2.2 Risk Tolerance- Legal and Regulatory Issues
2.3 Security Requirements for Cloud Architecture
2.4 Cloud Security Architecture
2.5 Key Strategies for Secure Operation

Unit 3: Data Protection for Cloud Infrastructure
3.1 Cloud based Information Life Cycle
3.2 Data protection for Confidentiality and Integrity
3.3 Common attack vectors and threats
3.4 Encryption, Data Redaction, Tokenization & Obfuscation
3.5 Data Protection Strategies

PART-B

UNIT 4: Access Control for Cloud Infrastructure
4.1 Access Control Requirements
4.2 Access Control Strategies
4.3 Roles-based Access Control
4.4 Host, Storage and Network Access Control
4.5 OS Hardening and minimization
4.6 Firewalls, IDS, IPS and honeypots

UNIT 5: Monitoring, Auditing and Management
5.1 Proactive Activity Monitoring, Incident Response
5.2 Auditing – Record generation, Reporting and Management
5.3 Tamper-proofing Audit Logs

5.4 Quality of Services
5.5 Secure Management

UNIT 6: Security Patterns for Cloud Computing
6.1 Trusted Platform
6.2 Cloud VM Platform Encryption
6.3 Trusted Cloud Resource Pools
6.4 Secure Cloud Interfaces
6.5 Cloud Resource Access Control
6.6 Cloud Data Breach Protection

Suggested Readings:

1. Vic (J.R.) Winkler, 2011,"Securing the Cloud: Cloud Computer Security Techniques and Tactics", Elsevier.
2. Sushil Jajodia, Krishna Kant, 2014, "Secure Cloud Computing", Elsevier
3. Curtis Franklin, Jr. ,Brian J. S. Chee, 2019,"Securing the Cloud: Security Strategies for the Ubiquitous Data Center", CRC Press

Note: Only latest editions of the books are recommended.

Weblinks:

https://www.coursera.org/learn/cloud-computing-security last visited date: 22 February 2024)
https://solutionsreview.com/cloud-platforms/free-cloud-computing-ebooks/ last visited date: 22 February 2024

Instructions for paper setting: Seven questions are to be set in total. First question will be multiple choice covering entire syllabus and will be compulsory to attempt and will be of 18 marks. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 13 marks.

Evaluation Policy:

The evaluation will include two types of assessments:

(ccxi) Continuous or formative assessments (in the form of end semester examination or term examination. Weightage of assessments are as follows:

For continuous or Formative assessment (in semester): Maximum 30 percent. The categorization for the same is:

MCQs	30%
Subjective (Short/Long)	40%
Discussion/Presentation	15%
Projects/Group Activities etc	15%

(ccxii) For Summative assessment (End Semester Examination or End-Term Examination):
Minimum: 70 percent. Categorization for the same is:

Objective Type Questions:	30%
Short/Long Questions:	70%

Assessment Tools:
Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
OMCA-CC-007.1		2		1		1	3						2	1
OMCA-CC-007.2	2	2	2				3			1			3	2
OMCA-CC-007.3		3		1			2						2	
OMCA-CC-007.4	2	3			1		2		1		1		1	2
OMCA-CC-007.5	2	1	1		2		3			1				

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES
(Deemed to be University under section 3 of the UGC Act 1956)

OMCA-CC-008: ETHICS AND STANDARD OF CLOUD

Periods/week	Credits	Max. Marks : 100
L :2 T: 0	2.0	Continuous Evaluation : 30
Duration of Exam: 3 Hrs		End Semester Examination: 70

Pre-Requisite: Cloud Computing fundamentals
Course Type: Domain Elective

Course Outcomes: Students will be able to:

OMCA-CC-008.1 Understand ethics and standards of cloud computing.
OMCA-CC-008.2 Define the ethics of data in cloud computing.
OMCA-CC-008.3 Understand ethics of providers of cloud computing services.
OMCA-CC-008.4 Explain ethics of cloud computing users.
OMCA-CC-008.5 Evaluate legal challenges and the laws and standards of cloud environment.

PART-A

Unit-1: Introduction to Ethics & Standards
1.1 Differentiate between Law and Ethics
1.2 Ten Commandments of Computer Ethics
1.3 Ethics and Education
1.4 Professional Organizations and their Codes of Ethics
1.5 Organizational Liability and the Need for Counsel

Unit-2: Ethics of Data in Cloud Computing
2.1 Data Ownership
2.2 Data Security
2.3 Data Privacy
2.4 Data Availability
2.5 Data Preservation and Deletion

Unit-3: Ethics of Providers of Cloud Computing Services
3.1. Codes of Ethics for Cloud Computing: Promoting Trust
3.2. Green and Sustainable Cloud Computing
3.3. Concentration of Power and Oligopolies in the Cloud Computing Industry

PART-B

Unit-4: Ethics of Cloud Computing Users
4.1. Prosumers
4.2. Technological and Ethical Awareness
4.3. Epistemic Virtues

Unit-5: Legal Challenges
5.1. International Laws and Legal Bodies
5.2. International v/s National Perspective
5.3. Jurisdictional Issues
5.4. Ways to Address Legal Implications
5.5. The Financial Services Modernization Act

Unit-6: Cloud Computing Standards & Law
6.1. Cloud Interoperability
6.2. Data Protection Standards

6.3. Cloud Security Standards
6.4. Service Level Indicators
6.5. Cloud Service Level Agreement

Suggested Books:
1. Thomas Erl, 2013, Cloud Computing: Concepts, Technology & Architecture, Pearson Publication.
2. Barrie Sosinsky, 2010, Cloud Computing Bible, John Wiley & Sons.
3. Kamal Kant Hiran, Ruchi Doshi, Temitayo Fagbola, Mehul Mahrishi, 2019, Cloud Computing: Master the Concepts, Architecture and Applications with real world examples and case studies, BPB Publications.

Note: Only latest editions of the books are recommended.

Software Required/Weblinks
https://www.w3schools.in › Cloud Computing (last visited date: 22 February 2024)
https://www.ibm.com/developerworks/connect/ (last visited date: 22 February 2024)

Instructions for paper setting: Seven questions are to be set in total. First question will be multiple choice covering entire syllabus and will be compulsory to attempt and will be of 18 marks. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 13 marks.

Evaluation Policy:

The evaluation will include two types of assessments:

(ccxiii) Continuous or formative assessments (in the form of end semester examination or term examination. Weightage of assessments are as follows:

For continuous or Formative assessment (in semester): Maximum 30 percent. The categorization for the same is:

MCQs	30%
Subjective (Short/Long)	40%
Discussion/Presentation	15%
Projects/Group Activities etc	15%

(ccxiv) For Summative assessment (End Semester Examination or End-Term Examination):

Minimum: 70 percent. Categorization for the same is:

Objective Type Questions:	30%
Short/Long Questions:	70%

Assessment Tools:
Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

COURSE ARTICULATION MATRIX:

CO Statement	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
OMCA-CC-008.1		1	3	2	1	1	1	2		1	2	1	1	1
OMCA-CC-008.2	1		2	2	2	1	3	1	1	2		2	1	
OMCA-CC-008.3	1	1	2	2		1	2	1		2	1	2		1
OMCA-CC-008.4	1		1	1		1	1	1		2	1	2		3
OMCA-CC-008.5		1	1		1	1		1	1	2		1	1	2

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH & STUDIES
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OMCA-AI-007: NEURAL NETWORKS & DEEP LEARNING

Periods/week	Credits		
L: 2 T: 0	2	Max. Marks	: 100
		Continuous Evaluation	: 30
Duration of Examination: 3 Hrs.		End Semester Examination	: 70

Pre-Requisite: Basics of Machine Learning.
Course Type: Domain Elective

Course Outcomes: At the end of the course the student will be able to:

OMCA-AI-007.1 Understand the context of neural networks and deep learning.
OMCA-AI-007.2 Know how to use a neural network.
OMCA-AI-007.3 Understand the data needs of deep learning.
OMCA-AI-007.4 Have a working knowledge of neural networks and deep learning
OMCA-AI-007.5 Explore the parameters of neural networks

PART- A

Unit 1: The simplest possible Neural Networks
- 1.1 Machine Learning
- 1.2 Basics of human brain and Neural Network
- 1.3 Models of neuron
- 1.4 Neural network viewed as Directed Graphs
- 1.5 Feedback

Unit 2: Learning Neural networks
- 2.1 Network architectures
- 2.2 Knowledge representation
- 2.3 Learning processes
- 2.4 Learning Tasks

Unit 3: Rosenblatt's Perceptron
- 3.1 Introduction
- 3.2 Perceptron
- 3.3 Relation between Perceptron and Bayes theorem
- 3.4 The Batch Perceptron algorithm
- 3.5 Convolutional neural networks
- 3.6 Recurrent Neural Networks

PART-B

Unit 4: Fundamentals of Deep Learning
- 4.1 Introduction to Deep Learning
- 4.2 Applications
- 4.3 Weight and Activation Functions
- 4.4 Data Processing

Unit 5: Applications of Deep Learning
- 5.1 Deep learning and Reinforcement learning
- 5.2 Robotic manipulation
- 5.3 Deep learning and Natural Language Processing
- 5.4 Automatic Language Translation
- 5.5 Automatic Text Classification

Unit 6: Advanced Deep Learning

6.1 Generative Adversarial networks
6.2 Deep Reinforcement learning
6.3 Adversarial attacks

Suggested Readings:

1. Hertz, John, Anders Krogh 2013, "Introduction to the Theory of Neural Computation", Addison-Wesley Pub.Co.
2. Francois Challet, 2020, "Deep Learning with Python", Manning Publications.
3. AurolienGeron, 2017, "Hands-On Machine Learning with Scikit-Learn and TensorFlow, Shroff/O'Reilly".
4.Ethem Alpadyn, 2020, "Introduction to Machine Learning", Shroff/O'Reilly.

Note: Only latest editions of the books are recommended.

Software required/ Web links:

- https://www.deeplearningbook.org/ (Last visited Date: 23 February 2024)
- http://neuralnetworksanddeeplearning.com (Last visited Date: 23 February 2024)
- /https://www.udacity.com/course/intro-to-machine-learning--ud120 (Last visited Date: 23 February 2024)

Instructions for paper setting: Seven questions are to be set in total. First question will be multiple choice covering entire syllabus and will be compulsory to attempt and will be of 18 marks. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 13 marks.

Evaluation Policy:

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MCQs	30%
Subjective (Short/Long)	40%
Discussion/Presentation	15%
Projects/Group Activities etc	15%

(ccxvi) For Summative assessment (End Semester Examination or End-Term Examination):

Minimum: 70 percent. Categorization for the same is:

Objective Type Questions:	30%
Short/Long Questions:	70%

Assessment Tools:

Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
OMCA-AI-007.1	2	1		2			2						3	3
OMCA-AI-007.2	1	3	1	1			2						2	2
OMCA-AI-007.3	1	2	1	1			2						2	3
OMCA-AI-007.4	1	2	2	3	2		1						3	2
OMCA-AI-007.5	2	1	1	3	2		2						2	2

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH & STUDIES

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OMCA-AI-008: MACHINE LEARNING AND PATTERN RECOGNITION

Periods/week	Credits	Max. Marks : 100
L: 2 T: 0	2	Continuous Evaluation : 30
Duration of Examination: 3 Hrs		End Semester Examination: 70

Pre-Requisite: Introduction to Computer Science, Probability, Statistics and Stochastic Processes
Course Type: Domain Elective

Course Outcomes: At the end of the course the student will be able to:

OMCA-AI-008.1 Understand various key paradigms for pattern classification and machine learning approaches
OMCA-AI-008.2 Familiarize with the mathematical and statistical techniques used in pattern recognition and machine learning
OMCA-AI-008.3 Select an appropriate Pattern Analysis tools and different models for analyzing data in a given feature Space.
OMCA-AI-008.4 Apply pattern recognition and machine learning techniques such as classification and feature selection to practical applications and detect patterns in the data
OMCA-AI-008.5 Classify the data objects and develop template matching module to recognize the Pattern
OMCA-AI-008.6 Apply Supervised & Unsupervised learning algorithm & clustering algorithm to data objects.

PART-A

Unit 1: Introduction to Pattern Recognition

1.1 Problems, applications,
1.2 Design cycle
1.3 Learning and adaptation, examples,
1.4 Probability Distributions,
1.5 Parametric Learning - Maximum likelihood and Bayesian Decision
1.6 Theory- Bayes rule, discriminant functions, loss functions and Bayesian error analysis

Unit 2: Linear models

2.1 Linear Models for Regression
2.2 Linear regression,
2.3 Logistic regression
2.4 Linear Models for Classification

Unit 3: Neural Networks

3.1 Perceptron, multi-layer perceptron,
3.2 Back propagation algorithm, error surfaces,
3.3 Practical techniques for improving back propagation,
3.4 Additional networks and training methods,
3.5 Adaboost,
3.6 Deep Learning

PART-B

Unit 4: Linear discriminant functions

4.1 Decision surfaces,
4.2 Two-category, multi-category,
4.3 Minimum- squared error procedures,
4.4 Ho-Kashyap procedures,
4.5 Linear programming algorithms,
4.6 Support vector machine

Unit 5: Supervised learning and classification

5.1 Discriminant functions and decision boundaries
5.2 Linear discriminant functions
5.3 Minimum distance classifier
5.4 Bayesian decision theory, Maximum likelihood classification
5.5 Parameter estimation, component analysis and discriminants (PCA, Fisher's)
5.6 Nonparametric techniques, Density estimation, K-NN estimation

Unit 6: **Unsupervised learning and clustering**
6.1 Data description and clustering –similarity measures
6.2 Criterion for clustering,
6.3 Methods of clustering – Sequential and hierarchical Clustering,
6.4 Graph theoretic, density based, k-means, k-mediod,
6.5 Fuzzy c-means clustering,
6.6 Vector Quantization, Cluster validity

Suggested Readings:
1. Richard O. Duda, Peter E. Hart, David G. Stork, 2001, "Pattern Classification", 2nd Edition John Wiley & Sons
2. C.M Bishop, 2006, "Pattern Recognition and Machine Learning", Springer.
3. T. M. Michell, 2017, Machine Learning, McGraw Hill Education, 1st Edition.
4. A. Konar, 2005, Computational Intelligence: Principles, Techniques, and Applications, Springer.
Note: Only latest editions of the books are recommended.

Web Links:
https://www.simplilearn.com/pattern-recognition-and-ml-article (Last visited Date: 25 February 2024)

Instructions for paper setting: Seven questions are to be set in total. First question will be multiple choice covering entire syllabus and will be compulsory to attempt and will be of 18 marks. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 13 marks.

Evaluation Policy:
The evaluation will include two types of assessments:
(ccxvii) Continuous or formative assessments (in the form of end semester examination or term examination. Weightage of assessments are as follows:

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MCQs	30%
Subjective (Short/Long)	40%
Discussion/Presentation	15%
Projects/Group Activities etc	15%

(ccxviii) For Summative assessment (End Semester Examination or End-Term Examination):
Minimum: 70 percent. Categorization for the same is:

Objective Type Questions:	30%
Short/Long Questions:	70%

Assessment Tools:
Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO 5	PO 6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
OMCA-AI-008.1	1		2	3	2		2						3	1
OMCA-AI-008.2	2	1	2	3	1		2						3	2
OMCA-AI-008.3	2	3	1	1	2							1	2	1
OMCA-AI-008.4	1	2	2	3	1		2						1	2
OMCA-AI-008.5	2	1	2	1			2	3					2	3
OMCA-AI-008.6	1	1	2	1	1		2	2				3	1	1

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OMCA-CS-007: CYBER LAWS

Periods/week Credits
L:2 T: 0 2
Duration of Examination: 3 Hrs

Max. Marks: 100
Continuous Evaluation: 30
End Semester Examination : 70

Pre-Requisite: Introduction to cyber laws and activities
Course Type: Domain Elective

Course Outcomes: At the end of the course, students will be able to
OMCA-CS-007.1. Define the concepts of cyber activities.
OMCA-CS-007.2. India IT Act 2000.
OMCA-CS-007.3. Cyber Space Jurisdiction
OMCA-CS-007.4. E – commerce and Laws in India
OMCA-CS-007.5. Intellectual Property Rights, Domain Names and Trademark Disputes

Unit-I: Introduction to IT Act

1.1 Evolution of the IT Act, Genesis and Necessity,
1.2 Salient features of the IT Act, 2000, various authorities under IT Act and their powers. ;
1.3 Penalties & Offences, amendments.
1.4 Impact on other related Acts (Amendments), Amendments to Indian Penal Code. Amendments to Indian Evidence Act., Amendments to Bankers Book Evidence Act., Amendments to Reserve Bank of India Act.

Unit-II: Laws and Jurisdiction

2.1 Cyber Space Jurisdiction
2.2 Jurisdiction issues under IT Act, 2000
2.3 Traditional principals of Jurisdiction,
2.4 Extra-terrestrial Jurisdiction,
2.5 Case Laws on Cyber Space Jurisdiction

Unit-III: E-Commerce

3.1 E – commerce and Laws in India,
3.2 Digital / Electronic Signature in Indian Laws,
3.3 E – Commerce; Issues and provisions in Indian Law,
3.4 E – Governance; concept and practicality in India,
3.5 E – Taxation issues in Cyberspace,
3.6 E – Contracts and its validity in India,
3.7 Cyber Tribunal & Appellate Tribunal,
3.8 Cyber Regulations

Unit-IV: Intellectual Property Rights

4.1 Intellectual Property Rights,
4.2 Domain Names and Trademark Disputes,
4.3 Concept of Trademarks / in Internet Era,
4.4 Cyber Squatting, Reverse Hijacking, Jurisdiction in Trademark Disputes,
4.5 Copyright in the Digital Medium, Copyright in Computer Programmes, Copyright and WIPO Treaties,
4.6 Concept of Patent Right, Relevant Provisions of Patent Act 1970

Unit-V: Sensitive Personal Data or Information

5.1 Sensitive Personal Data or Information (SPDI),
5.2 Cyber, Law,
5.3 SPDI Definition and Reasonable Security,

5.4 Practices in India, Reasonable Security Practices – International perspective, Cloud Computing & Law

Unit VI: Cyber Laws

6.1 Cyber Law: International Perspective,
6.2 EDI: Concept and legal Issues,
6.3 UNCITRAL, Model Law,
6.4 Electronic Signature Law's of Major Countries,
6.1 Cryptography Laws, Cyber Law's of Major Countries, EU Convention on Cyber Crime

Suggested Books:

1. Nilakshi Jain**,** 2020, Cyber Security and Cyber Laws, Wiley.
2. Dr. Kasturi Bora & Upasana Borah, 2021, A Handbook of Cyber Laws and Information Technology in India, Notion.
3. Gregor Urbas**,** 2004, Cyber Criminals on Trial, Cambridge University press.

Note: Only latest editions of the books are recommended.

Software required/ Web links:

https://www.tutorialspoint.com/ cyber security/index.htm (last visited date: 22 February 2024)

Instructions for paper setting: Seven questions are to be set in total. First question will be multiple choice covering entire syllabus and will be compulsory to attempt and will be of 18 marks. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 13 marks.

Evaluation Policy:

The evaluation will include two types of assessments:

(ccxix) Continuous or formative assessments (in the form of end semester examination or term examination. Weightage of assessments are as follows:

For continuous or Formative assessment (in semester): Maximum 30 percent. The categorization for the same is:

MCQs	30%
Subjective (Short/Long)	40%
Discussion/Presentation	15%
Projects/Group Activities etc	15%

(ccxx) For Summative assessment (End Semester Examination or End-Term Examination):

Minimum: 70 percent. Categorization for the same is:

Objective Type Questions:	30%
Short/Long Questions:	70%

Assessment Tools:

Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

Course Articulation Matrix:

	PO1	PO2	PO3	PO 4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
OMCA-CS-007.1	1	2		2	3		2						2	3
OMCA-CS-007.2	2	3	1		1		1						3	3
OMCA-CS-	2		2	3	2		1							

007.3														
OMCA-CS-007.4	1	2	3		2									
OMCA-CS-007.5	3	2	1	2		3	2	1					2	2

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH & STUDIES
(Deemed to be University under section 3 of the UGC Act 1956)

OMCA-CS-008: INFORMATION SECURITY

Periods/week	Credits	Max. Marks: 100
L: 2 T: 0	2	Continuous Evaluation: 30
Duration of Examination: 3 Hrs		End Semester Examination: 70

Pre-Requisite: None

Course Type: Domain Elective

Course Outcomes: At the end of the course the student will be able to:

OMCA-CS-008.1 Understand the concepts of Information Security, cryptography and its applications.

OMCA-CS-008.2 Familiarize various authentication and integrity techniques available.

OMCA-CS-008.3 Understand firewalls and intrusion detection systems.

OMCA-CS-008.4 Familiarize relevant security parameters in the web, internet, database and operating systems

PART-A

Unit 1: Introduction

1.1 Introduction to Information Security
1.2 Principles, services and attacks
1.3 Functional requirements of security
1.4 Current trends in security

Unit 2: Cryptography and Authentication

2.1 Cryptography: Concept: Symmetric and Asymmetric Cryptography.
2.2 Mathematics of cryptography
2.3 Modular Arithmetic Additive Inverse, Multiplicative Inverse
2.4 Euclidean Algorithm and Extended Euclidean Algorithm.
2.5 Stream Cipher and Block Cipher, Concept of Confusion and Diffusion
2.6 Modes of Operation of Block Cipher: ECB, CBC, OFB, CFB, DES, RSA
2.7 Numerical on RSA
2.8 Authentication: Types of Authentication
2.9 Biometric Authentication and Third-Party Authentication using KDC and Kerberos Version 5
2.10 Mutual authentication, reflection attack

Unit 3: Digital Certificates and Integrity

3.1 Digital Signature: Concept, Compare Digital Signature with Public Key Cryptography
3.2 Digital Signature Schema.
3.3 Public Key Infrastructure (PKI): Private Key management
3.4 Public Key Cryptography Standards (PKCS)
3.5 Digital Certificate Creation Steps, X.509 Certificate, Certificate Revocation
3.6 Integrity: Message Integrity
3.7 Hash functions Properties Algorithm: MDC, MAC, HMAC, MD5, and SHA 512

PART-B

Unit 4 Internet and web security

4.1 SSL, IPSec,
4.2 E.mail Security- PGP, Email attacks
4.3 Web services Security: web app versus web service concept
4.4 WS-Security
4.5 SOAP web service
4.6 SAML assertion
4.7 Browser attacks
4.8 Web attacks targeting users
4.9 Obtaining user or website data

Unit 5 Firewall and IDS Firewall

5.1 Introduction, Characteristic
5.2 Types: Packet Filter, Stateful and Stateless Packet Filter,
5.3 Attacks of Packet Filter, Circuit Level and Application Level Firewall
5.4 Bastion Host
5.5 Firewall Configurations.
5.6 Intrusion: What is Intrusion, Intruders?
5.7 Intrusion Detection,
5.8 Behavior of Authorized user and Intruder
5.9 Approaches for Intrusion Detection: Statistical Anomaly Detection and Rule based Detection
5.10 Audit Record and Audit Record Analysis

Unit 6: Database and OS Security

6.1 Introduction to database,
6.2 Security requirements of database
6.3 Sensitive data
6.4 Database access control, inference
6.5 Security in operating systems: Operating System Structure
6.6 Security Features of Ordinary Operating Systems
6.7 Operating System Tools to Implement Security Functions
6.8 Rootkit: Phone Rootkit, Sony XCP Rootkit, TDSS Rootkits.

Suggested Readings:

1) C. P. Pfleeger, and S. L. Pfleeger, 2003, Security in Computing, Pearson Education, 4th Edition
2) Matt Bishop, 2003, Computer Security: Art and Science, Pearson Education.
3) Stallings, 2006, Cryptography & N/w Security: Principles and practice, 4th Edition.
4) Kaufman, Perlman, Speciner, 2003, Network Security, Prentice Hall, 2nd Edition
5) Eric Maiwald, 1999, Network Security: A Beginner's Guide, TMH
6) Macro Pistoia, 1999, Java Network Security, Pearson Education, 2nd Edition
7) Whitman, Mattord, 2005, Principles of Information Security, Thomson, 2nd Edition.

Note: Only latest editions of the books are recommended.

Weblinks:

1) http://www.cs.gsu.edu/~cscyqz/courses/ai/aiLectures.html last visited date: 22 February 2024)
2) http://www.eecs.qmul.ac.uk/~mmh/AINotes/ last visited date: 22 February 2024)

Instructions for paper setting: Seven questions are to be set in total. First question will be multiple choice covering entire syllabus and will be compulsory to attempt and will be of 18 marks. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 13 marks.

Evaluation Policy:

The evaluation will include two types of assessments:

(ccxxi) Continuous or formative assessments (in the form of end semester examination or term examination. Weightage of assessments are as follows:

For continuous or Formative assessment (in semester): Maximum 30 percent. The categorization for the same is:

MCQs	30%
Subjective (Short/Long)	40%
Discussion/Presentation	15%
Projects/Group Activities etc	15%

(ccxxii) For Summative assessment (End Semester Examination or End-Term Examination):

Minimum: 70 percent. Categorization for the same is:

Objective Type Questions:	30%
Short/Long Questions:	70%

Assessment Tools:

Assignment/Tutorials

Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
OMCA-CS-008.1	1	1	1	2	2		3	1	1	1			3	1
OMCA-CS-008.2		2	2	3	1	2	2	1					2	1
OMCA-CS-008.3	1	2	2	1	2			1	1		1	1	2	1
OMCA-CS-008.4	1	1	2	1	1		3						1	2

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH & STUDIES

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OMCA-FSD-007: REACT JS

Periods/week	Credits	Max. Marks : 100
L: 2 T: 0	2	Continuous Evaluation : 30
Duration of Examination: 3 Hrs		End Semester Examination: 70

Pre-Requisite: HTML, CSS, Fundamentals of JavaScript
Course Type: Domain Elective

Course Outcomes: At the end of the course the student will be able to:

OMCA-FSD-007.1. Understand basic concept of React JS, and understand its features & components
OMCA-FSD-007.2. Learn best practices of setting up, using and implementing React JS
OMCA-FSD-007.3. Go beyond the basics with routing, central state management, server-side rendering
OMCA-FSD-007.4. Write code, build real-world projects in a work-like environment and learn hands-on
OMCA-FSD-007.5. Gain a deeper knowledge of Flux and Redux
OMCA-FSD-007.6. Implement unit tests for React components

PART-A

Unit 1: Introduction of React JS

1.1 Origins of React, React.js Syntax
1.2 Key Features, Advantages & Limitations
1.3 Work flow of React JS
1.4 Scope of React JS
1.5 Overview of JSX
1.6 Introduction of Virtual DOM
1.7 Difference between JS and JSX
1.8 Components of React JS, Setting Properties
1.9 Containers and components, Child Components
1.10 Namespaced components

Unit 2: Environment Setup

2.1 Creating Root Folder
2.2 Node setup, NPM
2.3 Installing Global Packages
2.4 Add Dependencies and Plugins
2.5 Create the Files
2.6 Set Compiler, Server and Loaders
2.7 Rendering Html, JSX and Main.js
2.8 Running the Server

Unit 3: Forms & UI

1.1 Lists of Form components
1.2 Setup Controlled and Uncontrolled form components
1.3 JS Components life cycles
1.4 States, Props
1.5 Component API
1.6 Control Input elements.
1.7 Form validations
1.8 Styles
1.9 Animations
1.10 Creating a Dynamic UI In React

PART-B

Unit 4: Routing & Event Handling

4.1 Configuring React Router, router library
4.2 Pass and receive parameters, React-cookies, Keys
4.3 Event handling, Event Pooling
4.4 Primary events in React JS
4.5 Sharing events between the components
4.6 Refs
4.7 CSS & styled components

Unit 5: Flux and REDUX

5.1 Flux Architecture & Components
5.2 Stores, Dispatchers
5.3 View Controllers
5.4 Actions, Views
5.5 Flux and React, Store
5.6 Overview & installing REDUX
5.7 Introduction to One Store
5.8 Provider Component
5.9 Actions, Reducers
5.10 Sagas, Dispatchers
5.11 View Controllers, Selector

Unit 6: **Unit Testing**

6.1 Tools required for Unit Testing
6.2 React Unit Testing overview
6.3 Introduction to JEST.
6.4 Testing React Components
6.5 Testing Router

Suggested Readings:

1. Anthony Accomazzo, Nate Murray, Ari Lerner, Clay Allsopp, David Guttman, and Tyler McGinnis, 2017, "Full Stack React - The Complete Guide to ReactJS and Friends" Fullstack.io
2. Alex Banks, 2017, "Learning React: Functional Web Development with React and Redux" O'Reilly Media.
3. Robin Wieruch, 2017, "The Road to React"
4. Mark Tielens Thomas, 2018, "React in Action" , Manning.

Note: Only latest editions of the books are recommended.

Web Links:

https://www.w3schools.com/REACT/DEFAULT.ASP (last visited date: 22 February 2024)

Instructions for paper setting: Seven questions are to be set in total. First question will be multiple choice covering entire syllabus and will be compulsory to attempt and will be of 18 marks. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 13 marks.

Evaluation Policy:

The evaluation will include two types of assessments:

(ccxxiii) Continuous or formative assessments (in the form of end semester examination or term examination. Weightage of assessments are as follows:

For continuous or Formative assessment (in semester): Maximum 30 percent. The categorization for the same is:

MCQs	30%
Subjective (Short/Long)	40%
Discussion/Presentation	15%
Projects/Group Activities etc	15%

(ccxxiv) For Summative assessment (End Semester Examination or End-Term Examination):

Minimum: 70 percent. Categorization for the same is:

Objective Type Questions:	30%
Short/Long Questions:	70%

Assessment Tools:

Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO 5	PO 6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
OMCA-FSD-007.1		1	3	1	1		1					1	2	2
OMCA-FSD-007.2	2		2	2	1		1						3	2
OMCA-FSD-007.3	2	1	1	1	2		3					1	2	2
OMCA-FSD-007.4		2	2	3	1		2						2	2
OMCA-FSD-007.5	2		3	2			2	3				3	2	3
OMCA-FSD-007.6	1	1	1	1	1		2	2				2	1	1

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH & STUDIES

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OMCA-FSD-008: CLOUD SECURITY

Periods/week	Credits	Max. Marks: 100
L: 2	2	Continuous Evaluation: 30
Duration of Examination: 3 Hrs		End Semester Examination: 70

Pre-Requisite: Introduction to Cloud Computing
Course Type: Domain Elective

Course Outcomes: At the end of the course, students will be able to
OMCA-FSD-008.1. Describe the security architecture of cloud computing and security service models.
OMCA-FSD-008.2. Analyze the Strategies to Secure operation of cloud and list the security requirements.
OMCA-FSD-008.3. Explain different key strategies for data security and apply the best practice models in real time application.
OMCA-FSD-008.4. Apply the security model for cloud application with network, data and security considerations.
OMCA-FSD-008.5. Develop an information security framework model for cloud operation.

PART –A

UNIT 1: Introduction
1.1 Cloud Security Basics
1.2 Security design principles
1.3 Secure Isolation Strategies
1.4 Comprehensive Data Protection
1.5 Monitoring and Auditing

UNIT 2: Securing the Cloud Architecture
2.1 Security Concerns
2.2 Risk Tolerance- Legal and Regulatory Issues
2.3 Security Requirements for Cloud Architecture
2.4 Cloud Security Architecture
2.5 Key Strategies for Secure Operation

Unit 3: Data Protection for Cloud Infrastructure
3.1 Cloud based Information Life Cycle
3.2 Data protection for Confidentiality and Integrity
3.3 Common attack vectors and threats
3.4 Encryption, Data Redaction, Tokenization & Obfuscation
3.5 Data Protection Strategies

PART-B

UNIT 4: Access Control for Cloud Infrastructure
4.1 Access Control Requirements
4.2 Access Control Strategies
4.3 Roles-based Access Control
4.4 Host, Storage and Network Access Control
4.5 OS Hardening and minimization
4.6 Firewalls, IDS, IPS and honeypots

UNIT 5: Monitoring, Auditing and Management
5.1 Proactive Activity Monitoring, Incident Response
5.2 Auditing – Record generation, Reporting and Management

5.3 Tamper-proofing Audit Logs
5.4 Quality of Services
5.5 Secure Management

UNIT 6: Security Patterns for Cloud Computing
6.1 Trusted Platform
6.2 Cloud VM Platform Encryption
6.3 Trusted Cloud Resource Pools
6.4 Secure Cloud Interfaces
6.5 Cloud Resource Access Control
6.6 Cloud Data Breach Protection

Suggested Readings:

1. Vic (J.R.) Winkler, 2011, "Securing the Cloud: Cloud Computer Security Techniques and Tactics", Elsevier.
2. Sushil Jajodia, Krishna Kant, 2014, "Secure Cloud Computing", Elsevier.
3. Curtis Franklin, Jr. ,Brian J. S. Chee, 2019, "Securing the Cloud: Security Strategies for the Ubiquitous Data Center", CRC Press.

Note: Only latest editions of the books are recommended.

Weblinks:
https://www.coursera.org/learn/cloud-computing-security (last visited date: 22 February 2024)
https://solutionsreview.com/cloud-platforms/free-cloud-computing-ebooks/ (last visited date: 22 February 2024)

Instructions for paper setting: Seven questions are to be set in total. First question will be multiple choice covering entire syllabus and will be compulsory to attempt and will be of 18 marks. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 13 marks.

Evaluation Policy:
The evaluation will include two types of assessments:
(ccxxv) Continuous or formative assessments (in the form of end semester examination or term examination. Weightage of assessments are as follows:

For continuous or Formative assessment (in semester): Maximum 30 percent. The categorization for the same is:

MCQs	30%
Subjective (Short/Long)	40%
Discussion/Presentation	15%
Projects/Group Activities etc	15%

(ccxxvi) For Summative assessment (End Semester Examination or End-Term Examination):
Minimum: 70 percent. Categorization for the same is:

Objective Type Questions:	30%
Short/Long Questions:	70%

Assessment Tools:
Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
OMCA-FSD-008.1		2		1		1	3						2	1
OMCA-FSD-008.2	2	2	2				3			1			3	2
OMCA-FSD-008.3		3		1			2						2	
OMCA-FSD-008.4	2	3			1		2		1		1		1	2
OMCA-FSD-008.5	2	1	1		2		3			1				

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH & STUDIES
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OMCA-MC-007: AMBIENT ASSISTED LIVING/MOBILE HEALTH

Periods/week	Credits	Max. Marks: 100
L: 2 T: 0	2	Continuous Evaluations : 30
Duration of Examination: 3 Hrs		End Semester Examination: 70

Pre-Requisite: Cloud Computing
Course Type: Domain Elective

Course Outcomes: At the end of the course, the student will be able to:
OMCA-MC-007.1. Understand general concepts of Internet of Things (IoT) also recognize various devices, sensors and applications.
OMCA-MC-007.2. Apply design concept to IoT solutions.
OMCA-MC-007.3. Analyze various M2M and IoT architectures.
OMCA-MC-007. 4. Evaluate design issues in IoT applications.
OMCA-MC-007. 5. Create IoT solutions using sensors, actuators and Devices.

PART-A

UNIT 1: Health Care Information System
1.1 Health care information systems interoperability, security and efficiency
1.2 Ambient intelligence for wellbeing and e-health applications, supported by RFID technology and Wireless Sensor Networks
1.3 Mobile applications and ubiquitous devices in Healthcare and lifestyle training
1.4 Robotic systems and devices for health care and medicine
1.5 Technologies to promote a healthy and secure society

UNIT 2: E-Health
2.1 Big Data Analytics for e-health
2.2 Assessment of Acceptance/Adoption models
2.3 Cultural Evaluation of e-health
2.4. Acceptance e-health and economic growth factors affecting e-health adoption
2.5. Machine learning for healthcare
2.6. Intelligent systems for young and elderly people using mobile devices
2.7. Activities of daily living

UNIT 3: Factor and Embedded System in E-Health
1.1 Human factors, efficient cost control and management in society
1.2 Intelligent decision support and data systems in health care, medicine and society
1.3 Innovation in people supporting activities (e.g., health care, schooling and services)
3.4. Embedded systems for healthcare
3.5. IT Acceptance Models Acceptance of e-health services

PART-B

UNIT 4: Various Facilitators for E-Health
4.1 Major barriers and facilitators for e-health
4.2 Bio-signal Acquisition, Analysis and Processing
4.3 Semantic Technologies and Cognition
4.4 Neural Networks

UNIT 5: E-health using Mobile Devices
5.1 Physiological Computing in Mobile Devices
5.2 Telemedicine

5.3 Physiological Computing in Mobile Devices
5.4 Augmented Reality in Healthcare using wearable devices

UNIT 6: **Developing IoT solutions in E-Heath**
6.1 Sensors and Actuators
6.2 ICT for development
6.3 Cloud computing for healthcare
6.4 Mobile application concepts and technologies for different mobile platforms

Suggested Readings:

1. Akash Kumar, 2021, IoT in Healthcare and Ambient Assisted Living: 933 (Studies in Computational Intelligence), Springer.
2. McCullagh, P.J.,Roberts, J.,Augusto, J.C., Kameas, A.,Huch, M.,Maitland, J.,Sixsmith, A.,Wichert, 2012, Handbook of Ambient Assisted Living, IOS Press.
3. Chintan M Bhatt, 2016, Cloud Computing Systems and Applications in Healthcare (Advances in Healthcare Information Systems and Administration), IGI Global.

Note: Only latest editions of the books are recommended.

Web links:
https://builtin.com/cloud-computing/cloud-computing-in-healthcare(Last visited date :23rd February 2024)
http://www.e-health-connect.com/(Last visited date :23rd February 2024)
https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4029126/ (Last visited date :23rd February 2024)
https://journals.lww.com/jfmpc/Fulltext/2022/01000/Mobile_technology__A_tool_for_healthcare_and_a.7.aspx (Last visited date :23rd February 2024)

Instructions for paper setting: Seven questions are to be set in total. First question will be multiple choice covering entire syllabus and will be compulsory to attempt and will be of 18 marks. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 13 marks.

Evaluation Policy:
The evaluation will include two types of assessments:
(ccxxvii) Continuous or formative assessments (in the form of end semester examination or term examination. Weightage of assessments are as follows:

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MCQs	30%
Subjective (Short/Long)	40%
Discussion/Presentation	15%
Projects/Group Activities etc	15%

(ccxxviii) For Summative assessment (End Semester Examination or End-Term Examination):
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Objective Type Questions:	30%
Short/Long Questions:	70%

Assessment Tools:
Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2

OMCA-MC-007.1.	1	1		2			2	3		2		2	3	3
OMCA-MC-007.2	3	3		2			3	3		2		2	2	
OMCA-MC-007.3	1	1	3		2		3	3		2	3		2	1
OMCA-MC-007.4	1	1	1	2	2		2	3			3		1	
OMCA-MC-007.5	1	1		2			3	3		2	3			3

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH & STUDIES

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OMCA-MC-008: MOBILE INFOTAINMENT

Periods/week	Credits	Max. Marks : 100
L: 2 T: 0	2	Continuous Evaluation : 30
Duration of Examination: 3 Hrs		End Semester Examination: 70

Pre-Requisite: Nil
Course Type: Domain Elective

Course Outcomes: At the end of the course the student will be able to:
OMCA-MC-008.1. Understand the basics of infotainment systems and related features.
OMCA-MC-008.2. Define the connectivity modules and protocols.
OMCA-MC-008.3. Draw the architecture of mobile infotainment systems and define layers.
OMCA-MC-008.4. Realize the operating systems of infotainment systems.
OMCA-MC-008.5. Interpret the middleware connectivity and associated modules and protocols.
OMCA-MC-008.6. Illustrate the advanced functions, features and characteristics of the infotainment systems.

PART-A

Unit 1: Introduction to Infotainment Systems

1.1 Design considerations
1.2 EMI/EMC compliance
1.3 Tuner technology
1.4 Text-to-speech, SMS voice messaging
1.5 Gesture & Voice recognition, Sensors integration
1.6 Hands-free calling, Touch screen
1.7 Rear View Display
1.8 Lane Departure Warning
1.9 Steering wheel control
1.10 Head-up display

Unit 2: Connectivity Modules

2.1 GPS, GNSS systems
2.2 Connectivity/integration possibilities and implications
2.3 Wifi – Bluetooth - USBH + USBF
2.4 SD-Card
2.5 Mobile broadband
2.6 Smartphone integration
2.7 Automotive bus protocols

Unit 3: System Architecture

1.1 Infotainment System Architecture
1.2 System block diagram
1.3 Hardware, OS, Middleware layer, HMI layer
1.4 Embedded Processors
1.5 Small memory footprint
1.6 Infotainment from a platform perspective
1.7 SoC, HW IP, Multicore
1.8 DMIPS capability, RAM, Flash requirement
1.9 Volatile & Non-volatile memory
1.10 Most dominant IoS
1.11 Bandwidth requirement from IOs like: External bus - DDR3

PART-B

Unit 4: Operating Systems for Infotainment

4.1 Role of a Hypervisor
4.2 Application
4.3 RTOS partition
4.4 Rear view camera
4.5 Digital Radio, Audio
4.6 Video playback
4.7 Cell phone hands free
4.8 GPOS (Embedded Linux) partition
4.9 OS layer –Proprietary,
4.10 Open Source RTOS – H
4.11 Hard & Soft Real time Process - From AUTOSAR to Gen VI

Unit 5: Middleware connectivity

5.1 Middleware layer
5.2 Connectivity to device: iPhone, iPod, iPad, Android devices
5.3 MTP, Media Players, Smartphones
5.4 Thumb drives - USB,
5.5 Bluetooth, Wi-Fi, 3G, 4G, iPod
5.6 Connectivity with application
5.7 Navigation
5.8 Data formats: GDF, PSF, OSM
5.9 Route guidance algorithm
5.10 Media Player, Browser, Application layer

Unit 6: **Advanced infotainment features**

6.1 Integrated Head-Unit
6.2 Heads-Up Display
6.3 Automotive Sensors Integration
6.4 Digital Instrument Cluster
6.5 Support Vehicle Functions
6.7 Advanced Vehicular functions
6.8 Multimedia Support
6.9 Smart Dashboard
6.10 Infotainment Apps

Suggested Readings:

1. Ronald K Jurgen, 2007, "Infotainment Systems on Fast Forward", SAE International
2. Dennis, 2002, "Automotive Telematics: The One-stop Guide to In-vehicle Telematics and Infotainment Technology and Applications", Red Hat Publishing
3. Nuredini Shkumbin, 2014, "The Impact of Smartphones on In-Vehicle Infotainment Systems" LAP Lambert Academic Publishing

Note: Only latest editions of the books are recommended.

Web Links:

https://www.youtube.com/watch?v=IyYGUdeoAbQ (last visited date: 22 February 2024)

Instructions for paper setting: Seven questions are to be set in total. First question will be multiple choice covering entire syllabus and will be compulsory to attempt and will be of 18 marks. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 13 marks.

Evaluation Policy:

The evaluation will include two types of assessments:

(ccxxix) Continuous or formative assessments (in the form of end semester examination or term examination. Weightage of assessments are as follows:

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MCQs	30%
Subjective (Short/Long)	40%
Discussion/Presentation	15%
Projects/Group Activities etc	15%

(ccxxx) For Summative assessment (End Semester Examination or End-Term Examination):

Minimum: 70 percent. Categorization for the same is:

Objective Type Questions:	30%
Short/Long Questions:	70%

Assessment Tools:

Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO 5	PO 6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
OMCA-MC-008.1	2		1	1	2		2						1	1
OMCA-MC-008.2	1	2	2	2	1		2						3	1
OMCA-MC-008.3	2	1	1	1	2								2	1
OMCA-MC-008.4	2	2	2	1	1		2						2	2
OMCA-MC-008.5	1	1	2	1			2	3					2	2
OMCA-MC-008.6	1	2	2	1	1		2	2				3	1	1

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES
(Deemed to be University under section 3 of the UGC Act 1956)

OMCA-MM- 007: MULTIMEDIA IN MEDIA PRODUCTION

Periods/week	Credits	Max. Marks	: 100
L: 2 T: 0	2	Internal	: 30
Duration of Examination: 3 Hrs		External	: 70

Pre-Requisite: Nil
Course Type: Domain Elective

Course Outcomes: At the end of the course, the student will be able to:
OMCA-MM-007.1 Describe key points of Media production, its need, and its importance.
OMCA-MM-007.2 Explain mass media's effects on society and understood it after studying various theories.
OMCA-MM-007.3 Develop abstract and critical reasoning by studying logical proofs and the axiomatic method.
OMCA-MM-007.4 Understand and analyze the different perspectives andcontradictions of society and understand the recent terminology and landmark issues.
OMCA-MM-007.5 Learn core skills of news judgment, news values, and priorities.

PART–A

Unit 1- Socio-Economic Issues & the Media
1.1. Power & Politics concerning caste, Religion & Minorities, Communalism.
1.2. The Bias in the Media, the Mass Media & Democracy.
1.3. The Mass Media, Public Opinion & Social control, Terrorism, Corruption, Political Defections.
1.4. Intercultural Relations in Indian Society.

Unit 2- Media- Developmental Issues
2.1 Sensitization towards Equality, Physically and Mentally Challenged.
2.2 Media and society.
2.3 Media and development –Use of traditional and mainstream media.

Unit 3- Media and Civil society
3.1 Truth and Media, Ethical Issues.
3.2 Media and Civil Society, Citizen Journalism, Mediated Democracy, Civic ritual.
3.3 Media and Violence.
3.4 Human Rights and Media.

PART–B

Unit 4- Cultural Change- Media and Globalization
4.1 Cultural politics: media hegemony.
4.2 The Rise of New Media- dimension & Formation of Responsibility.
4.3 Globalization and Social Change.
4.4 Popular Culture and opinion making.

Unit 5- Different Facets of Media
5.1 Changing Nature of the Indian Political System.
5.2 Paid News and Fake News.
5.3 Yellow journalism.
5.4 Social Networking Analysis

Unit-6-Major Issues and Concerns
6.1. Population Explosion.

6.2. Public Health and Hygiene.
6.3. Caste Conflicts.
6.4. Communal tensions.
6.5. Gender Inequality.

Suggested Readings:

1. W. Schramm,1971, The Process and Effects of Mass Communication, University of Illionois Press
2. A. Mattelart & M. Mattelart, 1998, Theories of communication Short Introduction, SAGE Publications Ltd
3. McQuail, 2020, Communication: An Introduction, SAGE Publication Ltd
4. Richard and Turner, 2013, Introducing Communication Theory, McGraw Hill.
5. Ravindran, R.K., 1999, Media and Society, New Delhi, Common Wealth Publication.

Note: Only latest editions of the books are recommended.

Web Links:

1. https://webflow.com/made-in-webflow/media%20production (last visited date: 22 February 2024)

2. https://www.yansmedia.com/blog/website-video-production-companies (last visited date: 22 February 2024)

Instructions for paper setting: Seven questions are to be set in total. First question will be multiple choice covering entire syllabus and will be compulsory to attempt and will be of 18 marks. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 13 marks.

Evaluation Policy:

The evaluation will include two types of assessments:

(ccxxxi) Continuous or formative assessments (in the form of end semester examination or term examination. Weightage of assessments are as follows:

For continuous or Formative assessment (in semester): Maximum 30 percent. The categorization for the same is:

MCQs	30%
Subjective (Short/Long)	40%
Discussion/Presentation	15%
Projects/Group Activities etc	15%

(ccxxxii) For Summative assessment (End Semester Examination or End-Term Examination):

Minimum: 70 percent. Categorization for the same is:

Objective Type Questions:	30%
Short/Long Questions:	70%

Assessment Tools:

Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
OMCA-MM-007.1	1		1		2		3						3	1
OMCA-MM-007.2	1		2		1								3	1
OMCA-MM-007.3	1		2	1									2	1
OMCA-MM-007.4	1	1		1	1		3						1	2
OMCA-MM-007.5	1			1			2						2	2

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH & STUDIES
(Deemed to be University under section 3 of the UGC Act 1956)

OMCA-MM-008: MULTIMEDIA SECURITY

Periods/week	Credits	Max. Marks: 100
L: 2	2	Continuous Evaluation: 30
Duration of Examination: 3 Hrs		End Semester Examination: 70

Prerequisites: Basics of Network Security.
Course Type: Domain Elective

Course Outcomes: After learning the course, the student will be able to:
OMCA-MM-008.1 Ensure secure uses of multimedia data and to use multimedia data for security applications.
OMCA-MM-008.2 Gain knowledge and hands-on experience about multimedia systems and security technologies
OMCA-MM-008.3 Implement multimedia compression technologies and standards, such as MPEGs
OMCA-MM-008.4 Understand survey algorithms in research of multimedia security, e.g., copyright protection, authenticity verification, etc.
OMCA-MM-008.5 Learn theories, research issues and recent developments of multimedia-based security systems, such as video surveillance, biometric feature applications, and sensor networks.

PART -A

UNIT 1: Introduction to Digital Rights Management Framework
1.1 Requirements of a DRM system
1.2 Architectures, Dimensions to content protection
1.3 Tracing (fingerprinting)
1.4 Authentication
1.5 Encryption
1.6 Key management and access control.

UNIT 2: Multimedia Fingerprinting
2.1 Fingerprinting basics
2.2 Marking assumption
2.3 Collusion attack
2.4 Frame proof and anti-collusion codes
2.5 Combining fingerprint modulation with coding
2.6 Introduction to coded fingerprint modulation
2.7 Semi-fragile fingerprinting
2.8 Multicast fingerprinting problem
2.9 Bandwidth security tradeoff;
2.10 Efficient security architectures
2.11 WHIM Water casting
2.12 Chameleon cipher; Joint fingerprinting and decryption (JFD)framework
2.13 Fingercasting

UNIT 3: Multimedia Encryption
3.1 Traditional symmetric key ciphers
3.2 Shannon's principles ofconfusion and diffusion;
3.3 Overview of Advanced Encryption Standard (AES)
3.4 Block and stream ciphers
3.5 Information theoretic secrecy
3.6 Multimedia encryption: Concept of layering
3.7 Multimedia compression technologies and standards
3.8 Principles for selective encryption

3.9 Image and Video encryption schemes

PART-B

UNIT 4: Content Authentication Techniques

4.1 Data authentication
4.2 One way hash functions
4.3 Message authentication codes (MACs)
4.4 Multimedia authentication: Perceptual hashes
4.5 Parameterization
4.6 Watermarking based authentication
4.7 Notion of semi-fragility
4.8 Construction and design of semi-fragile watermarks
4.9 Principles of video authentication: Scalability issues, packet loss, post-processing

UNIT 5: Key Management Techniques

5.1 Chaotic maps, Transform domain encryption
5.2 Huffman tree mutation
5.3 Streaming media encryption: Scalable video protection
5.4 Key management and distribution schemes
5.5 Key management for IP Multimedia
5.6 Public key methods,
5.7 Key distribution by data embedding
5.8 Key exchange in multicast group
5.9 Key refresh problem,
5.10 Logical Key Hierarchy (LKH)
5.11 Key distribution for fine grained access control

UNIT 6: Privacy Preserving Protocols

6.1 Zero knowledge protocols
6.2 Anonymous fingerprinting
6.3 Public key watermarking
6.4 Non-perfect secret sharing constructions for anonymous fingerprinting with shared access control.

Suggested Readings:

1. W. Zeng, H. Yu and C. Lin, 2006, Multimedia Security Technologies for Digital Rights Management, Elsevier.
2. K. Karthik and D. Hatzinakos, 2008, Multimedia Encoding for Access Control With Traitor Tracing: Balancing Secrecy, Privacy and Traceability, VDM Verlag, ISBN: 978-3-8364-3638-0, Germany
3. B. Furht and D. Kirovski (Eds.), 2005, Multimedia Security Handbook, CRC press, U.S.
4. B. Schneier, 2007, Applied Cryptography: Protocols, Algorithms and Source Code in C, 2nd Edition, Wiley India,(Reprint).

Note: Only latest editions of the books are recommended.

Web Links:

https://www.igi-global.com/dictionary/multiple-description-coding-application-multimedia/19609 (Last visited Date: 24 February 2024)

Instructions for paper setting: Seven questions are to be set in total. First question will be multiple choice covering entire syllabus and will be compulsory to attempt and will be of 18 marks. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three fromeach part. Each question will be of 13 marks.

Evaluation Policy:

The evaluation will include two types of assessments:

(ccxxxiii) Continuous or formative assessments (in the form of end semester examination or term examination. Weightage of assessments are as follows:

For continuous or Formative assessment (in semester): Maximum 30 percent. The categorization for the same is:

MCQs	30%
Subjective (Short/Long)	40%
Discussion/Presentation	15%
Projects/Group Activities etc	15%

(ccxxxiv) For Summative assessment (End Semester Examination or End-Term Examination):

Minimum: 70 percent. Categorization for the same is:

Objective Type Questions:	30%
Short/Long Questions:	70%

Assessment Tools:

Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
OMCA-MM-008.1.	3				2	2						1		
OMCA-MM-008.2.		2	2	3		1		3				2		1
OMCA-MM-008.3.			1		1		2			2	3		1	
OMCA-MM-008.4.	2			1					2					2
OMCA-MM-008.5	1	2		1			1				1			2

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES
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OMCA-DS-414: INTELLIGENT DECSION SUPPORT SYSTEM

Periods/week Credits
L: 2 T: 0 2.0
Duration of Exam: 3 Hrs

Max. Marks: 100
Continuous Evaluation: 30
End Semester Examination: 70

Pre-Requisite: Basic Knowledge of computers
Course Type: Domain Electives

Course Outcomes: Students will be able to-
OMCA-DS-414.1 Demonstrate quantitative reasoning skills and critical thinking surrounding the theory of DSS and related systems.
OMCA-DS-414.2 Define the structure and the components of a Decision Support System (DSS), as well as using methodologies and techniques to design and implement DSS.
OMCA-DS-414.3 Develop models, and design tools to support decision-making.
OMCA-DS-414.4 Use the main concepts of Decision Theory and Multicriteria Analysis.

PART- A

Unit-1: Decision Making and Computerized Support
1.1 Phases of Decision-Making Process,
1.2 Decision-Making: The Intelligence Phase, Decision Making: The Design Phase, Decision Making: The Choice Phase,
1.3 Decision Making: Implementation Phase, How decisions are supported, Personality types, gender, human cognition, and decision styles; The Decision –Makers.

Unit-2: Decision Support Systems
2.1 An Overview: DSS Configuration, What is DSS?
2.2 Characteristics and Capabilities of DSS, Components of DSS,
2.3 The Data Management Subsystem, The Model Management Subsystem,
2.4 The User Interface Subsystem, The Knowledge-Based Management Subsystem,
2.5 The User, DSS Hardware, DSS Classification.

Unit-3: Decision Support Systems Development
3.1 Introduction to DSS development, The Traditional System Development Life cycle,
3.2 Alternate Development Methodologies, Prototyping: The DSS Development Methodology,
3.3 DSS Technology Levels and Tools, DSS Development Platforms,
3.4 DSS Development Tool Selection, Team-Developed DSS, End User-Developed DSS, Putting the System Together.

PART–B

Unit-4: Group Support Systems
4.1 Group Decision Making, Communication and Collaboration, Communication Support,
4.2 Collaboration Support: Computer- Supported Cooperative work, Group Support Systems,
4.3 Group Support Systems Technologies, Group Systems Meeting Room and Online,
4.4 The GSS Meeting Process, Distance Learning, Creativity and Idea Generation.

Unit-5: Enterprise Information Systems
5.1 Concepts and definitions, Evolution of Executive and Enterprise Information Systems,
5.2 Executive's roles and information needs, Characteristics and capabilities of Executive Support Systems, Comparing and integrating EIS and DSS,
5.3 Supply and Value Chains and Decision Support, Supply Chain problems and solutions,
5.4 MRP, ERP / ERM, SCM, CRM, PLM, BPM, and BAM.

Unit-6: Knowledge Management

6.1 Introduction, Organizational learning and Transformation,
6.2 Knowledge management initiatives, Approaches to Knowledge management,
6.3 IT in Knowledge management, Knowledge management systems implications,
6.4 Role of people in Knowledge management, Ensuring success of Knowledge management.

Suggested Books:

1. Efrem G. Mallach, 2002, Decision Support and Data Warehouse Systems, Tata McGraw-Hill.
2. Efraim Turban, Jay E. Aronson, 2004, Decision Support Systems and Intelligent Systems, Pearson Education

Web Links:

https://www.techtarget.com/searchcio/definition/decision-support-system (Last visited Date: 24 February 2024)

Instructions for paper setting: Seven questions are to be set in total. First question will be multiple choice covering entire syllabus and will be compulsory to attempt and will be of 18 marks. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three fromeach part. Each question will be of 13 marks.

Evaluation Policy:

The evaluation will include two types of assessments:

(ccxxxv) Continuous or formative assessments (in the form of end semester examination or term examination. Weightage of assessments are as follows:

For continuous or Formative assessment (in semester): Maximum 30 percent. The categorization for the same is:

MCQs	30%
Subjective (Short/Long)	40%
Discussion/Presentation	15%
Projects/Group Activities etc	15%

(ccxxxvi) For Summative assessment (End Semester Examination or End-Term Examination):

Minimum: 70 percent. Categorization for the same is:

Objective Type Questions:	30%
Short/Long Questions:	70%

Assessment Tools:

Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

COURSE ARTICULATION MATRIX:

CO Statement	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
OMCA-DS-414.1	1	-	3	-	3	3	-	-	-	-	-	3	1	-
OMCA-DS-414.2	2	-	2	1	3	-	-	2	-	-	-	-	-	2
OMCA-DS-414.3	-	2	-	-	-	-	-	1	-	1	-	1	2	3

OMCA-DS-414.4	3	-	3	2	-	-	3	2	-	3	2	1	2	3

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES
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OMCA-DS-415: SIMULATION & MODELLING

Periods/week	Credits	Max. Marks: 100
L: 2 T: 0	2.0	Continuous Evaluation: 30
Duration of Exam: 3 Hrs		End Semester Examination: 70

Pre-Requisite: Basic Knowledge of computers
Course Type: Domain Electives

Course Outcomes: Students will be able to-

OMCA-DS-415.1 Describe the role of important elements of discrete event simulation and modeling paradigm.
OMCA-DS-415.2 Demonstrate real world situations related to systems development decisions, originating from source requirements and goals.
OMCA-DS-415.3 Interpret the model to resolve critical issues in a real-world environment.
OMCA-DS-415.4 Develop simulation software to construct system model solutions.
OMCA-DS-415.5 Apply goal-driven system models solutions for particular problems.

PART- A

Unit-1: Introduction to Simulation

1.1 History of simulation, desirable software features, General purpose simulation package,
1.2 Simulation, Advantages, Disadvantages, Areas of application,
1.3 System environment, components of a system,
1.4 Simulation Examples: Simulation of Queuing systems,
1.5 Simulation of Inventory System, Other simulation examples.

Unit-2: General Principles

2.1. Concepts in discrete - event simulation, event scheduling/ Time advance algorithm,
2.2. simulation using event scheduling,
2.3. Random Numbers: Properties, Generations methods, Tests for Random number,
2.4. Frequency test, Runs test, Autocorrelation test.

Unit-3: Random Variate Generation

3.1. Inverse Transform Technique- Exponential,
3.2. Uniform, Weibull, Triangular distributions,
3.3. Direct transformation for Normal and log normal Distributions,
3.4. convolution methods- Erlang distribution, Acceptance Rejection Technique,
3.5. Optimisation Via Simulation: Meaning, difficulty,
3.6. Robust Heuristics, Random Search.

PART –B

Unit-4: Analysis of Simulation Data

4.1 Input Modelling: Data collection, Identification and distribution with data,
4.2 Parameter estimation, Goodness of fit tests,
4.3 Selection of input models without data, Multivariate and time series analysis,
4.4 Verification and Validation of Model – Model Building, Verification,
4.5 Calibration and Validation of Models.

Unit-5: Output Analysis

5.1. Types of Simulations with Respect to Output Analysis, Stochastic Nature of output data,
5.2. Measures of Performance and their estimation, Output analysis of terminating simulation,

5.3. Output analysis of steady state simulations,
5.4. Simulation Software: Selection of Simulation Software,
5.5. Simulation packages, Trend in Simulation Software.

Unit-6: Analog vs Digital System

6.1. Simulation of water reservoir system, simulation of a servo system,
6.2. simulation of an auto-pilot, descrete system simulation,
6.3. Fixed time step vs event to event model,generation of random numbers,
6.4. Test for randomness, Monte-carlo computation vs stochastic simulation.

Suggested Books:

1. Geoffrey Gordon, 1978, System Simulation, 2nd Edition, Prentice Hall publication.
2. A.V. Aho, J.E. Hopcroft and T.D. Ullman, 1978, Data Structures and Algorithms, Pearson.
3. Jerry Banks, John S Carson, II, Berry L Nelson, David M Nicol, 2009, Discrete Event system Simulation, 5th Edition,Pearson Education
4. Averill M Law, W David Kelton, 2000, Simulation Modelling & Analysis, 3rd Edition, McGraw Hill
5. Kamathne, 2004, Introduction to Data Structures in C , 1st Edition, Pearson Education
6. Narsingh Deo, 2004, Systems Simulation with Digital Computer, 3rd Edition, PHI Publication

Software required/Weblinks:

www.tutorialpoint.com (last visited date: 22 February 2024)
www.nptel.com (last visited date: 22 February 2024)
www.w3schools.com (last visited date: 22 February 2024)

Instructions for paper setting: Seven questions are to be set in total. First question will be multiple choice covering entire syllabus and will be compulsory to attempt and will be of 18 marks. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three fromeach part. Each question will be of 13 marks.

Evaluation Policy:

The evaluation will include two types of assessments:

(ccxxxvii) Continuous or formative assessments (in the form of end semester examination or term examination. Weightage of assessments are as follows:

For continuous or Formative assessment (in semester): Maximum 30 percent. The categorization for the same is:

MCQs	30%
Subjective (Short/Long)	40%
Discussion/Presentation	15%
Projects/Group Activities etc	15%

(ccxxxviii) For Summative assessment (End Semester Examination or End-Term Examination):

Minimum: 70 percent. Categorization for the same is:

Objective Type Questions:	30%
Short/Long Questions:	70%

Assessment Tools:

Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

COURSE ARTICULATION MATRIX:

CO Statement	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
OMCA-DS-415.1	1	-	-	-	2	-	-	-	-	-	-	3	-	-
OMCA-DS-415.2	2	-	-	1	3	-	-	-	-	-	-	-	-	-
OMCA-DS-415.3	-	-	-	-	-	-	-	-	-	1	-	1	3	2
OMCA-DS-415.4	3	-	3	3	-	-	-	-	-	-	2	1	1	3
OMCA-DS-415.5	3	-	-	3	-	-	-	-	-	-	-	3	-	2

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH & STUDIES
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OMCA-IOT-007: IOT SECURITY MANAGEMENT

Periods/week	Credits	Max. Marks: 100
L: 2	2	Continuous Evaluation: 30
Duration of Examination: 3 Hrs		End Semester Examination: 70

Pre-Requisite: Fundamentals of computer network, wireless sensor network, communication & internet technology, web technology, information security.
Course Type: Domain Specific

Course Outcome: After learning the course, the student will be able:
OMCA-IOT-007.1 Understand the vision of IoT from a global context.
OMCA-IOT-007.2 Understand the application of IoT.
OMCA-IOT-007.3 Determine the Market perspective of IoT.
OMCA-IOT-007.4 Use of Devices, Gateways and Data Management in IoT.
OMCA-IOT-007.5 Building state of the art architecture in IoT.
OMCA-IOT-007.6 Application of IoT in Industrial and Commercial Building Automation & Real-World Design Constraints.

PART-A

Unit-1: IoT & Web Technology
1.1 The Internet of Things Today,
1.2 Time for Convergence, Towards the IoT Universe,
1.3 Internet of Things Vision, IoT Strategic Research and Innovation Directions, IoT Applications,
1.4 Future Internet Technologies, Infrastructure,
1.5 Networks and Communication, Processes,
1.6 Data Management, Security, Privacy & Trust,
1.7 Device Level Energy Issues, IoT Related Standardization,
1.8 Recommendations on Research Topics.

Unit-2: M2M to IoT – A Basic Perspective–
2.1 Introduction, Some Definitions, M2M Value Chains,
2.2 IoT Value Chains, an emerging industrial structure for IoT, international driven global value chain and global information monopolies.
2.4 M2M to IoT-An Architectural Overview– Building an architecture,
2.4 Main design principles and needed capabilities, An IoT architecture outline, standards considerations.

Unit-3: IoT Architecture
1.1 State of the Art – Introduction,
1.2 State of the art, Architecture Reference Model- Introduction, Reference Model and architecture,
1.3 IoT reference Model, IoT Reference Architecture- Introduction
1.4 Functional View, Information View, Deployment and Operational View, Other Relevant architectural views.

PART-B

Unit-4: IoT Applications for Value Creations
1.1 Introduction, IoT applications for industry: Future Factory Concepts, Brownfield IoT, Smart Objects, Smart Applications,
1.2 Four Aspects in your Business to Master IoT, Value Creation from Big Data and Serialization, IoT for Retailing Industry, IoT for Oil and Gas Industry, Opinions on IoT Application and Value for Industry, Home Management, eHealth.

Unit-5: Internet of Things Privacy, Security and Governance

5.1 Introduction, Overview of Governance,
5.2 Privacy and Security Issues, Contribution from FP7 Projects, Security, Privacy and Trust in IoT-Data-Platforms for Smart Cities,
5.3 First Steps Towards a Secure Platform,
5.4 Smartie Approach. Data Aggregation for the IoT in Smart Cities, Security.

Unit-6: Cloud Platforms for IOT

6.1 Virtualization concepts and Cloud Architecture,
6.2 Cloud computing, benefits,
6.3 Cloud services — SaaS, PaaS, IaaS, Cloud providers & offerings,
6.4 Study of IOT Cloud platforms,
6.5 ThingSpeak API and MQTT, Interfacing ESP8266 with Web services

Suggested Books:

1. Vijay Madisetti and Arshdeep Bahga, 2014, "Internet of Things (A Hands-on-Approach)", VPT.
2. Francis da Costa, 2013, "Rethinking the Internet of Things: A Scalable Approach to Connecting Everything", Après Publications.
3. Cuno Pfister, 2011, Getting Started with the Internet of Things, O'Reilly Media

Note: Only latest editions of the books are recommended.

Web Links:

https://www.fortinet.com/resources/cyberglossary/iot-security (Last Visited Date: 22nd February, 2024)

https://internetinitiative.ieee.org/images/files/resources/white_papers/internet_of_things_feb2017.pdf (Last Visited Date: 22nd February, 2024)

https://www.geeksforgeeks.org/security-threats-to-iot-devices/ (Last Visited Date: 22nd February, 2024)

https://www.techtarget.com/whatis/feature/IoT-basics-A-guide-for-beginners (Last Visited Date: 22nd February, 2024)

Instructions for paper setting: Seven questions are to be set in total. First question will be multiple choice covering entire syllabus and will be compulsory to attempt and will be of 18 marks. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three fromeach part. Each question will be of 13 marks.

Evaluation Policy:

The evaluation will include two types of assessments:

(ccxxxix) Continuous or formative assessments (in the form of end semester examination or term examination. Weightage of assessments are as follows:

For continuous or Formative assessment (in semester): Maximum 30 percent. The categorization for the same is:

MCQs	30%
Subjective (Short/Long)	40%
Discussion/Presentation	15%
Projects/Group Activities etc	15%

(ccxl) For Summative assessment (End Semester Examination or End-Term Examination):

Minimum: 70 percent. Categorization for the same is:

Objective Type Questions:	30%
Short/Long Questions:	70%

Assessment Tools:
Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
OMCA-IOT-007.1.	1	1		2			2	3						
OMCA-IOT-007.2.	1	1		2			3	3						
OMCA-IOT-007.3.	1	1	1		2		3	3					2	1
OMCA-IOT-007.4.	1	1	1	2	2		2	3					1	
OMCA-IOT-007.5.	1	1		2			3	3						
OMCA-IOT-007.6.	1	2	2		2		3	3					2	1

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH & STUDIES
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OMCA-IOT-008: IoT APPLICATIONS

Periods/week	Credits	Max. Marks: 100
L: 2 T: 0	2	Continuous Evaluations: 30
Duration of Examination: 3 Hrs		End Semester Examination: 70

Pre-Requisite: Cloud Computing
Course Type: Domain Elective

Course Outcomes: At the end of the course, the student will be able to:
OMCA-IOT-008.1. Understand general concepts of Internet of Things (IoT) also recognize various devices, sensors and applications.
OMCA-IOT-008. 2. Apply design concept to IoT solutions.
OMCA-IOT-008. 3. Analyze various M2M and IoT architectures.
OMCA-IOT-008. 4. Evaluate design issues in IoT applications.
OMCA-IOT-008. 5. Create IoT solutions using sensors, actuators and Devices.

PART-A

UNIT 1: INTRODUCTION TO IoT
1.1 Requirement and Basic Properties in Internet of Things
1.2 Primary challenges in security maintenance
1.3 Confidentiality, Integrity, Availability, Non-Repudiation
1.4 Sensing
1.5 Actuation
1.6 Networking basics
1.7 Communication Protocols
1.8 Sensor Networks

UNIT 2: Architecture of Internet of Things
2.1 Device – device
2.2 Device – Cloud
2.3 Device – Gateway
2.4 Gateway – Cloud
2.5 Cloud – Backend – Applications

UNIT 3: M2M to IoT
3.1 The Vision-Introduction
3.2 From M2M to IoT
3.3 M2M towards IoT-the global context
3.4 a use case example
3.5 Differing Characteristics.
3.6 Definitions, M2M Value Chains, IoT Value Chains
3.7 An emerging industrial structure for IoT.

PART-B

UNIT 4: M2M vs IoT: An Architectural Overview
4.1 Building architecture
4.2 Main design principles and needed capabilities
4.3 An IoT architecture outline
4.4 standards considerations
4.5 Reference Architecture and Reference Model of IoT.

UNIT 5: IoT Reference Architecture
5.1 Getting Familiar with IoT Architecture
5.2 Various architectural views of IoT such as Functional, Information, Operational and Deployment.
5.3 Constraints affecting design in IoT world- Introduction
5.4 Technical design Constraints

UNIT 6: **Developing IoT solutions**
6.1 Introduction to Python
6.2 Introduction to different IoT tools
6.3 Introduction to Arduino and Raspberry Pi Implementation of IoT with Arduino and Raspberry
6.4 Cloud Computing
6.5 Fog Computing, Connected Vehicles
6.6 Data Aggregation for the IoT in Smart Cities
6.7 Privacy and Security issues in IoT.

Suggested Readings:

- Jan Holler, Vlasios Tsiatsis, Catherine Mulligan, Stefan Avesand, Stamatis Karnouskos, David Boyle, 2014, "From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence", 1st Edition, Academic Press
- Vijay Madisetti and Arshdeep Bahga, 2014, "Internet of Things (A Hands-on- Approach)", 1st Edition, VPT.
- Francis daCosta, 2013, "Rethinking the Internet of Things: A Scalable Approach to Connecting Everything", 1st Edition, Apress Publications

Note: Only latest editions of the books are recommended.

Web links:
https://www.geeksforgeeks.org/characteristics-of-internet-of-things/ Last Visited Date:Date: 22.02.2024
https://www.techtarget.com/iotagenda/definition/Internet-of-Things-IoT Last Visited Date:Date: 22.02.2024
https://www.geeksforgeeks.org/difference-between-iot-and-m2m/ Last Visited Date:Date: 22.02.2024
https://www.airtel.in/blog/business/difference-between-iot-and-m2m/ Last Visited Date:Date: 22.02.2024

Instructions for paper setting: Seven questions are to be set in total. First question will be multiple choice covering entire syllabus and will be compulsory to attempt and will be of 18 marks. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three fromeach part. Each question will be of 13 marks.

Evaluation Policy:
The evaluation will include two types of assessments:

(ccxli) Continuous or formative assessments (in the form of end semester examination or term examination. Weightage of assessments are as follows:

For continuous or Formative assessment (in semester): Maximum 30 percent. The categorization for the same is:

MCQs	30%

Subjective (Short/Long) 40%
Discussion/Presentation 15%
Projects/Group Activities etc 15%

(ccxlii) For Summative assessment (End Semester Examination or End-Term Examination):
Minimum: 70 percent. Categorization for the same is:
Objective Type Questions: 30%
Short/Long Questions: 70%

Assessment Tools:
Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
OMCA-IOT-008.1.	1	1		2			2	3				2	3	3
OMCA-IOT-008.2	3	3		2			3	3				2	2	
OMCA-IOT-008.3	1	1	3		2		3	3					2	1
OMCA-IOT-008.4	1	1	1	2	2		2	3					1	
OMCA-IOT-008.5	1	1		2			3	3		2	3			3

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES
(Deemed to be University under section 3 of the UGC Act 1956)
NAAC 'A' Grade University

OMCA-DaS-007: Statistical Methods in Decision Making

Periods/week Credits
L :2 T: 0 2.0

Max. Marks: 100
Continuous Evaluation: 30
Duration of Examination: 3 Hrs End Semester Examination: 70

Pre-Requisite: Basic knowledge of statistics

Course Outcomes: Students will be able to –

OMCA-DaS-007.1 Identify the limitations of statistical analyses and when they should or should not be used.
OMCA-DaS-007.2 Apply the theoretical discrete probability distributions like binomial, Poisson, etc., in the relevant application areas
OMCA-DaS-007.3 Use sample information to make inferences about the population with a certain level of confidence about the accuracy of the estimations.
OMCA-DaS-007.4. Apply statistics in decision-making
OMCA-DaS-007.5 Implement techniques of inferential data analysis and regression modelling.

PART –A

UNIT 1: Introduction
1.1 Quantitative and qualitative data
1.2 Scales of measurement
1.3 Measures of Central Value
1.4 Measures of Dispersion
1.5 Graphical Analysis of Ordered Data (Histograms, Stem and Leaf Plots, Box-and-Whisker Plots)

UNIT 2: Probability
2.1 Meaning and Need of Probability
2.2 Theorems of addition and multiplication
2.3 Conditional probability
2.4 Bayes' theorem.
2.5 Random Variable- discrete and continuous

UNIT 3: Sampling Distribution
3.1 Probability Distribution
3.2 Sampling distribution of mean and proportion
3.3 Central limit theorem
3.4 Estimation: Point and interval estimates for population parameters
3.5 Determining the sample size

PART – B

UNIT 4: Testing of Hypothesis - Parametric Tests
4.1 Testing of Hypothesis
4.2 Level of Significance
4.3 Type I and Type II error

4.4 Test of hypothesis concerning Mean: z test & t-test

UNIT 5: Non-Parametric Tests
5.1 Chi-square test
5.2 Goodness of fit
5.3 Sign test for paired data
5.4 Rank sum test
5.5 Kolmogorov-Smirnov Test.

UNIT 6: Correlation and Regression
6.1 Correlation
6.2 Coefficient of Determination
6.3 Methods of studying simple correlation
6.4 Simple Regression
6.5 Estimation of Regression line
6.6 Standard Error of estimate

Suggested Readings:

1. S.P. Gupta, Statistical Methods, Sultan Chand & Sons
2. Ken Black, Applied Business Statistics, 7th Edition, Wiley India Edition, 2012.

Note: Only latest editions of the books are recommended.

Web Links:
https://www.w3schools.com/statistics/ (Last visited:23rd February, 2024)

https://www.tutorialspoint.com/statistics/index.htm (Last visited:23rd February, 2024)

Instructions for paper setting: Seven questions are to be set in total. First question will be multiple choice covering entire syllabus and will be compulsory to attempt and will be of 18 marks. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three fromeach part. Each question will be of 13 marks.

Evaluation Policy:
The evaluation will include two types of assessments:

(ccxliii) Continuous or formative assessments (in the form of end semester examination or term examination. Weightage of assessments are as follows:

For continuous or Formative assessment (in semester): Maximum 30 percent. The categorization for the same is:

MCQs	30%
Subjective (Short/Long)	40%
Discussion/Presentation	15%
Projects/Group Activities etc	15%

(ccxliv) For Summative assessment (End Semester Examination or End-Term Examination):
Minimum: 70 percent. Categorization for the same is:

Objective Type Questions:	30%
Short/Long Questions:	70%

Assessment Tools:
Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO 6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
OMCA-DaS-007.1	3	3	3	3								1	2	3
OMCA-DaS-007.2	3	3	3	3									3	2
OMCA-DaS-007.3	3	3	3	3								2		1
OMCA-DaS-007.4	3	3	3	3									2	2
OMCA-DaS-007.5	3	3	2		2	3		1		2		3	3	1

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES
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NAAC 'A' Grade University

OMCA-DaS-008: Time Series Analytics-II

Periods/week Credits
L :2 T: 0 2.0

Max. Marks: 100
Continuous Evaluation: 30
Duration of Examination: 3 Hrs
End Semester Examination: 70

Pre-Requisite: Time Series Analytics-I

Course Outcomes: Students will be able to –

OMCA-DaS-008.1 Understand the key steps for preparing data for analysis
OMCA-DaS-008.2 Use Python for time series analysis
OMCA-DaS-008.3. Analyse time series forecasting using Python.
OMCA-DaS-008.4 Implement Advance Machine Learning Models for TSA using Python.
OMCA-DaS-008.5 Implement time series data visualisation in Python

PART –A

UNIT 1: Introduction to Time Series Data
1.1 Introduction to time series data
1.2 Time series components: trend, seasonality, noise
1.3 Time series as a discrete stochastic process. Stationarity. Main
1.4 Characteristics of stochastic processes (means, auto covariation and autocorrelation functions).

UNIT 2: Basic Date Time Operations in Python
2.1 Working with dates and times: DATE, TIME, DATETIME functions
2.2 Date Operations in Python- datetime.date
2.3 Time Operations in Python- datetime.time, datetime.datetime
2.4 Advanced Date Time Operations datetime.tzinfo, datetime.timedelta, datetime.timezone

UNIT 3: Time Series Techniques
3.1 Stationary stochastic processes.
3.2 Stationarity as the main characteristic of stochastic component of time series.
3.3 Decomposition Techniques
3.4 Wold decomposition.
3.5 Lag operator.

PART – B

UNIT 4: Time Series Forecasting Methods
4.1 Time series forecasting methods: moving average, ARIMA, exponential smoothing
4.2 Moving average models MA(q)
4.3 Condition of invertibility
4.4 Autoregressive models AR(p).
4.5 Forecasting, trend and seasonality in Box-Jenkins model

UNIT 5: Time Series Data Visualisation in Python
5.1 Libraries for Time Series Data Visualisation
5.2 Loading the dataset
5.3 Trends Analysis in Dataset
5.4 Plotting the Changes in Data

UNIT 6: Machine Learning Approaches for TSA

6.1 Data creation, windows and baseline model
6.2 Genetic programming: Symbolic Regression
6.3 Extreme Learning Machines
6.4 Gaussian Processes
6.5 Convolutional Neural Network

Suggested Readings:

1.Tarek A. Atwan, 2022, Time Series Analysis with Python Cookbook: Practical Recipes for Exploratory Data Analysis, Data Preparation, Forecasting, and Model Evaluation
2. Ashish Patel, 2020, Hands-on Time Series Analysis with Python: From Basics to Bleeding Edge Techniques

Note: Only latest editions of the books are recommended.

Web Links:

ML Approaches for Time Series. In this post I play around with some… | by Pablo Ruiz | Towards Data Science last visited date: 22 February 2024)

Time Series Prediction: How Is It Different From Other Machine Learning? [ML Engineer Explains] (neptune.ai) last visited date: 22 February 2024)

Instructions for paper setting: Seven questions are to be set in total. First question will be multiple choice covering entire syllabus and will be compulsory to attempt and will be of 18 marks. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three fromeach part. Each question will be of 13 marks.

Evaluation Policy:

The evaluation will include two types of assessments:

(ccxlv) Continuous or formative assessments (in the form of end semester examination or term examination. Weightage of assessments are as follows:

For continuous or Formative assessment (in semester): Maximum 30 percent. The categorization for the same is:

MCQs	30%
Subjective (Short/Long)	40%
Discussion/Presentation	15%
Projects/Group Activities etc	15%

(ccxlvi) For Summative assessment (End Semester Examination or End-Term Examination):

Minimum: 70 percent. Categorization for the same is:

Objective Type Questions:	30%
Short/Long Questions:	70%

Assessment Tools:

Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO 6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
OMCA-DaS-008.1	2	2		3	2		2					1	2	3
OMCA-DaS-008.2	2	2	1	1	2		1						3	2
OMCA-DaS-008.3	2		1	2	2							2		1
OMCA-DaS-008.4	2		2							2			2	1
OMCA-DaS-008.5	2	1	1	2									2	1

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH & STUDIES

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OMCA-BC-007: SPRING FRAMEWORK

Periods/week	Credits	Max. Marks: 100
L: 2 T: 0	2	Continuous Evaluation: 30
Duration of Examination: 3 Hrs		End Semester Examination: 70

Pre-Requisite: Knowledge of Object-Oriented Programming (OOP), Eclipse or IntelliJ IDEA. and HTTP, HTML, and CSS.
Course Type: Domain Elective

Course Outcomes: At the end of the course, the student will be able to:
OMCA-BC-007.1 Understand the core concepts of Spring Framework such as Dependency Injection (DI), Inversion of Control (IoC), and Bean Lifecycle.
OMCA-BC-007.2. Use Spring to develop web applications using Spring MVC, including handling requests, views, and form data. MCA-DS-602.4. Analyze the process to outsource the project and ensuring quality.
OMCA-BC-007.3. Develop microservices and RESTful APIs using Spring Boot.
OMCA-BC-007.4 Integrate applications using Spring Integration, including message channels, endpoints, and routing.

PART- A

UNIT 1: Introduction to the Spring Framework Introduction to project management
- 1.1 Overview of Spring Framework
- 1.2 Key features and benefits of Spring
- 1.3 Setting up a Spring development environment
- 1.4 Spring architecture and design patterns
- 1.5 Spring project ecosystem

UNIT 2: Dependency Injection and Inversion of Control
- 2.1 Dependency injection and inversion of control concepts
- 2.2 Spring's core container and application context
- 2.3 Configuring a Spring application using XML and annotations
- 2.4 Spring bean scopes and lifecycle
- 2.4 Working with profiles and environments

UNIT 3: Aspect-Oriented Programming
- 3.1 Overview of aspect-oriented programming
- 3.2 Using Spring's aspect-oriented programming features
- 3.3 Implementing cross-cutting concerns with Spring AOP
- 3.4 AspectJ integration with Spring
- 3.5 Transaction management with Spring

PART-B

UNIT 4: Spring Web Development
- 4.1 Overview of Spring MVC
- 4.2 Handling HTTP requests and responses with Spring
- 4.3 Managing views and templates with Spring
- 4.4 Form processing and validation with Spring
- 4.5 Exception handling and error reporting with Spring

UNIT 5 Spring Web Development Security
- 5.1 Spring Security for authentication and authorization
- 5.2 Session and cookie management with Spring
- 5.3 Integrating client-side technologies like HTML, CSS, and JavaScript with Spring

5.4 Working with RESTful services using Spring MVC
5.5 Building reactive web applications with Spring WebFlux

UNIT 6: Spring Data Access
6.1 Overview of Spring's data access features
6.2 Using Spring JDBC for database access
6.3 Working with object-relational mapping (ORM) frameworks like Hibernate and JPA
6.4 Spring Data repositories and query methods
6.6 Data access with NoSQL databases using Spring Data

Suggested Readings:

1. Marten Deinum, Daniel Rubio, Josh Long, and Gary Mak, 2020, "Spring 5 Recipes: A Problem-Solution Approach, Fourth Edition", Apress.
2. John Carnell, 2019, "Spring Microservices in Action, Second Edition",Manning Publications.
3. Marten Deinum, Daniel Rubio, and Josh Long, 2020, "Spring Boot 2 Recipes: A Problem-Solution Approach, Third Edition", Apress.
4. Josh Long and Mark Heckler, 2021, "Reactive Spring", O'Reilly Media.
5. Baggio and M. Bellini, 2020, "Spring REST", Packt Publishing.
6. Felipe Gutierrez, 2019, "Pro Spring Boot 2: An Authoritative Guide to Building Microservices, Web and Enterprise Applications, and Best Practices, Second Edition", Apress.

Note: Only latest editions of the books are recommended.

Web links:
https://springframework.guru/ (Last visited: 23-02-2024)
https://www.apress.com/in/ (Last visited: 23-02-2024)

Instructions for paper setting: Seven questions are to be set in total. First question will be multiple choice covering entire syllabus and will be compulsory to attempt and will be of 18 marks. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three fromeach part. Each question will be of 13 marks.

Evaluation Policy:
The evaluation will include two types of assessments:

(ccxlvii) Continuous or formative assessments (in the form of end semester examination or term examination. Weightage of assessments are as follows:

For continuous or Formative assessment (in semester): Maximum 30 percent. The categorization for the same is:

MCQs	30%
Subjective (Short/Long)	40%
Discussion/Presentation	15%
Projects/Group Activities etc	15%

(ccxlviii)For Summative assessment (End Semester Examination or End-Term Examination):
Minimum: 70 percent. Categorization for the same is:

Objective Type Questions:	30%
Short/Long Questions:	70%

Assessment Tools:
Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
OMCA-BC-007.1	3		3				3					3	3	2
OMCA-BC-007.2	3	3	3				2		3			3	3	3
OMCA-BC-007.3	2	2	2				2	2		3			3	3
OMCA-BC-007.4			1			3	2	2		3			3	3

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH & STUDIES
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OMCA-BC-008: CRYTOGRAPHY ALGORITHMS

Periods/week Credits — Max. Marks: 100

L: 2 T: 0 2 — Continuous Evaluation: 30

Duration of Examination: 3 Hrs — End Semester Examination: 70

Pre-Requisite: Basic knowledge of algebra, probability theory, and computer science.
Course Type: Domain Elective

Course Outcomes: At the end of the course, students will be able to
OMCA-BC-008.1 Understand the basic principles of modern cryptography.
OMCA-BC-008.2 Design, analyze, and implement cryptographic algorithms.
OMCA-BC-008.3 Identify and evaluate the strengths and weaknesses of different cryptographic systems.
OMCA-BC-008.4 Understand the threats and attacks against cryptographic systems and ways to mitigate them.
OMCA-BC-008.5 Analyze and evaluate security protocols that use cryptographic primitives.

PART –A

UNIT 1: Awareness about Cryptography techniques
1.1 Terminology and concepts in cryptography
1.2 Classical cryptography algorithms
1.3 Basic number theory and algebraic concepts used in cryptography
1.4 Quantum Cryptography and classical cryptography algorithms
1.5 Quantum Algorithms and their implementations

UNIT 2: Symmetric-Key Cryptography
2.1 Symmetric-key cryptography and its concepts
2.2 Symmetric-key encryption and decryption algorithms
2.3 Block ciphers and their modes of operation
2.4 Data Encryption Standard (DES) and Advanced Encryption Standard (AES)
2.5 Stream ciphers and their use in real-world applications

UNIT 3: Public-Key Cryptography
3.1 Public-key cryptography and its concepts
3.2 Public-key encryption and decryption algorithms
3.3 RSA and its applications in secure communication
3.4 Digital signatures and their use in authentication and integrity verification
3.5 Key management and distribution in public-key cryptography

Part B

UNIT 4: Hash Functions and Message Authentication Codes

4.1 Hash functions and their properties
4.2 Secure hash algorithms (SHA-1, SHA-2, SHA-3)
4.3 Message authentication codes (MACs) and their use in secure communication
4.4 HMAC and its applications in message authentication
4.5 Digital certificates and public key infrastructure (PKI)

Unit 5: Cryptographic Protocols and Applications
5.1 Overview of common cryptographic protocols
5.2 Transport Layer Security (TLS) and its use in secure communication
5.3 Secure Sockets Layer (SSL) and its applications in web security
5.4 Secure Electronic Transaction (SET) protocol for secure e-commerce
5.5 Pretty Good Privacy (PGP) and its applications in email securityVulnerability scanning

Unit 6: Emerging Trends in Web Application Security
6.1 Overview of advanced topics in cryptography
6.2 Quantum cryptography and its applications
6.3 Cryptographic attacks and their classifications
6.4 Side-channel attacks and countermeasures
6.5 Cryptographic research and future developments

Suggested Readings:
1. William Stallings, 2017, "Cryptography and Network Security: Principles and Practice, 7th Edition", Pearson.
2. Douglas Stinson, 2020, "Cryptography: Theory and Practice, Fourth Edition", CRC Press.
3. Henri Cohen and Gerhard Frey, 2020, "Handbook of Elliptic and Hyperelliptic Curve Cryptography, Second Edition" by CRC Press.
4. Oded Goldreich, 2021, "Foundations of Cryptography, Volume 1: Basic Tools", Cambridge University Press.

Note: Only latest editions of the books are recommended.

Web Links:
1. https://www.khanacademy.org/computing/computer-science/cryptography (Last Visited Date: 23-02-2024)
2. https://www.coursera.org/learn/crypto (Last Visited Date: 23-02-2024)
3. https://www.youtube.com/playlist?list=PLD7HFcN7LXRdg6Xz5i0HuYzID6tOhf4Kk (Last Visited Date: 23-02-2024)

Instructions for paper setting: Seven questions are to be set in total. First question will be multiple choice covering entire syllabus and will be compulsory to attempt and will be of 18 marks. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three fromeach part. Each question will be of 13 marks.

Evaluation Policy:
The evaluation will include two types of assessments:
(ccxlix) Continuous or formative assessments (in the form of end semester examination or term examination. Weightage of assessments are as follows:

For continuous or Formative assessment (in semester): Maximum 30 percent. The categorization for the same is:

MCQs	30%
Subjective (Short/Long)	40%
Discussion/Presentation	15%
Projects/Group Activities etc	15%

(ccl) For Summative assessment (End Semester Examination or End-Term Examination):
Minimum: 70 percent. Categorization for the same is:

Objective Type Questions:	30%

Short/Long Questions: 70%

Assessment Tools:
Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
OMCA-CS-008.1							2	1						
OMCA-CS-008.2		1			2		1	1						
OMCA-CS-008.3				1			1						1	
OMCA-CS-008.4						2	1							
OMCA-CS-008.5	1					1								

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH & STUDIES
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OMCA-DO-007: WEB APPLICATION ON CLOUD

Periods/week	Credits	Max. Marks: 100
L: 2 T: 0	2	Continuous Evaluation: 30
Duration of Examination: 3 Hrs		End Semester Examination: 70

Pre-Requisite: Basics of web Application
Course Type: Domain Elective

Course Outcomes: At the end of the course the student will be able to:
OMCA-DO-007.1 Learn the basic & thorough understanding of HTML
OMCA-DO-007.2 Learn about Cascading Style Sheets.
OMCA-DO-007.3 Learn various techniques of Client-side web development programming.
OMCA-DO-007.4 Learn & Understand about Google Cloud Platform & How to manage it.
OMCA-DO-007.5 Learn how to use Google Cloud App Engine, Cloud Run and Cloud Functions to manage your application on cloud.

PART-A

UNIT 1: HTML:
1.1 HTML Introduction
1.2 HTML-Basic Formatting Tags
1.3 HTML-Grouping Using Div Span
1.4 HTML-Lists, Images, Hyperlink, Table, Frame, Form, Headers

Unit 2: CSS:
2.1 CSS Introduction, syntax, selectors
2.2 CSS - Color Background Cursor, Text Fonts
2.3 CSS - Lists Tables
2.4 CSS - Box Model
2.5 CSS - Display Positioning, CSS – Floats, CSS -Headers

Unit 3: Java Script: Client-Side Programming
3.1 Introduction to JavaScript, Basic Syntax
3.2 Variables and Data types, Statements, Operators
3.3 Functions, Objects, Arrays

PART-B

Unit 4: XML:
4.1 Relation between XML and HTML
4.2 Goals of XML
4.3 Structure and Syntax of XML
4.4 Well Formed XML
4.5 DTD and its Structure
4.6 tree structures in data organization
4.7 Searching with XPath

UNIT 5: Google Cloud Platforms (GCP):
5.1 Introduction
5.2 Managing Google Cloud Platform with Console

5.3 Managing Google Cloud Platform with Command Line
5.4 Google Cloud SDK Installation
5.5 Understand gcloud, gsutil, and other Command-Line Tools
5.6 Google Cloud Platform Projects and Billings

UNIT 6: GCP: Application Development
6.1 Compute Service and App Engine
6.2 Cloud Function
6.3 Cloud Run
6.4 Cloud VMware Engine

Suggested Readings:
1. Raymond Greenlaw and Ellen, 2017, Fundamentals of the Internet and the World Wide Web, TMH.
2. Deitel, Deitel & Nieto, 1999, Internet & World Wide Programming, Pearson Education.
3. Aron Weiss, 1997, Complete reference guide to Java script, QUIE.
4. Dick Oliver, 2000, Tech Yourself HTML 4 in 24 Hours, Techmedia.
5. Satish Jain, 2020, "O" – Level Information Technology, Generic.

Note: Only latest editions of the books are recommended.

Web Links:
1. https://aws.amazon.com/what-is/web-application/ Last Visited Date: 22.02.2024
2. https://www.ramotion.com/blog/cloud-based-application-development/ Last Visited Date 22.02.2024
3. https://www.reply.com/alpha-reply/en/content/cloud-computing-in-web-app-development-what-are-you-waiting-for Last Visited Date: 22.02.2024

Instructions for paper setting: Seven questions are to be set in total. First question will be multiple choice covering entire syllabus and will be compulsory to attempt and will be of 18 marks. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three fromeach part. Each question will be of 13 marks.

Evaluation Policy:
The evaluation will include two types of assessments:
(ccli) Continuous or formative assessments (in the form of end semester examination or term examination. Weightage of assessments are as follows:

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MCQs	30%
Subjective (Short/Long)	40%
Discussion/Presentation	15%
Projects/Group Activities etc	15%

(cclii) For Summative assessment (End Semester Examination or End-Term Examination):
Minimum: 70 percent. Categorization for the same is:

Objective Type Questions:	30%
Short/Long Questions:	70%

Assessment Tools:
Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance

Term end examination

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
OMCA-DO-007.1	3	1	2	3	2	2	3						3	2
OMCA-DO-007.2	2	3	2	3	1	1	2						3	3
OMCA-DO-007.3	1	1	2	1	2	2	1						1	1
OMCA-DO-007.4	2	2	1	2	3	3	3						2	2
OMCA-DO-007.5	2	1	2	2			1	3					2	2

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH & STUDIES
(Deemed to be University under section 3 of the UGC Act 1956)

OMCA-DO-008: DEVOPS PROJECT MANAGEMENT

Periods/week	Credits	Max. Marks: 100
L: 2 T: 0	2	Continuous Evaluation : 30
Duration of Examination: 3 Hrs		End Semester Examination : 70

Pre-Requisite: Azure fundamentals
Course Type: Domain Elective

Course Outcomes: At the end of the course the student will be able to:
OMCA-DO-008.1. Understand the usage of Azure Boards
OMCA-DO-008.2. Understand Kanban reorder cards
OMCA-DO-008.3. Concept of Sprints, scrum forecast
OMCA-DO-008.4. Understanding Azure Boards
OMCA-DO-008.5. Review delivery plans.
OMCA-DO-008.6. Learning portfolio management

PART-A

Unit 1: Introduction to Azure Boards
- 1.1 Introduction, Azure Boards
- 1.2 Tools for job
- 1.3 Permission and access

Unit 2: Planning in Azure Boards
- 2.1 Plan and track work
- 2.2 Customize boards
- 2.3 Manage project

Unit 3: Azure Boards and Github
- 3.1 Github integration
- 3.2 Azure boards app
- 3.3 Github commits, pull requests and issue
- 3.4 Add or remove repositories
- 3.5 Enable DevSecOps with Azure and Github

Unit 4: Sprints and Scrum
- 4.1 Change sprints date
- 4.2 Forecast, plan and work a sprint
- 4.3 Customize sprint backlogs
- 4.4 End of sprint activities

Unit 5: Plans and Portfolio

5.1Plans agile at scale
5.2 Edit plan permissions
5.1Scaled agile framework

Unit 6: Plans and Portfolios

6.1 Portfolio management
6.2 Review team delivery plan

Suggested Readings:

1. Joachim Rossberg, 2019,"Agile Project Management with DevOps", Apress.

Note: Only latest editions of the books are recommended.

Web Links:

1) https://learn.microsoft.com/en-us/shows/inside-azure-for-it/?wt.mc_id=rmskilling_az_usage_webpage_gdc (Last visited date: 23rd February, 2024)

Instructions for paper setting: Seven questions are to be set in total. First question will be multiple choice covering entire syllabus and will be compulsory to attempt and will be of 18 marks. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three fromeach part. Each question will be of 13 marks.

Evaluation Policy:

The evaluation will include two types of assessments:

(ccliii) Continuous or formative assessments (in the form of end semester examination or term examination. Weightage of assessments are as follows:

For continuous or Formative assessment (in semester): Maximum 30 percent. The categorization for the same is:

MCQs	30%
Subjective (Short/Long)	40%
Discussion/Presentation	15%
Projects/Group Activities etc	15%

(ccliv) For Summative assessment (End Semester Examination or End-Term Examination):

Minimum: 70 percent. Categorization for the same is:

Objective Type Questions:	30%
Short/Long Questions:	70%

Assessment Tools:

Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
OMCA-DO-008.1	1		1		2		3			1			3	

OMCA-DO-008.2		2		3			2	3		1	2	1		2
OMCA-DO-008.3		1	2			3			2		3	1	2	
OMCA-DO-008.4	1		1	2		1		3	2		2			3
OMCA-DO-008.5		1	3		2			2	2		3		3	
OMCA-DO-008.6	3		2			1		1		3	1		1	

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH & STUDIES

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OMCA-CN-007: NEXT GENERATION NETWORKING

Periods/week	Credits	Max. Marks: 100
L: 2	2	Continuous Evaluation: 30
Duration of Examination: 3 Hrs		End Semester Examination: 70

Pre-Requisite: Computer Networks

Course Type: Fundamentals

Course Outcomes: At the end of the course the student will be able to:

OMCA-CN-007.1 Evaluate the importance of packet switching for NGN.
OMCA-CN-007.2 Analyze and differentiate various architectures of a next generation network (NGN).
OMCA-CN-007.3 Comprehend the multiple services offered by NGN.
OMCA-CN-007.4 Understand the concept of convergence management in NGN.
OMCA-CN-007.5 Build appreciation of the role of regulations in NGNs.

Part-A

PART-A

Unit 1: Introduction

1.1 Concepts of Groups
1.2 Changes, Opportunities and Challenges
1.3 Technologies
1.4 Networks, and Services
1.5 Requirements for NGN
1.6 Next Generation Network Concept
1.7 Next Generation Society

Unit 2: Next Generation Technology

2.1 Technologies influencing change
2.2 IP Networks (Migration from circuit Switching to Packet Switching)
2.3 Building blocks for NGN, Wireline NG Technologies: Fiber to Premises
2.4 Long-Haul Managed Ethernet
2.5 Wireless NG Technologies: Broadband Bluetooth & ZigBee
2.6 Long Term Evolution, VOIP, Multi service Flexible Networks architecture.
2.7 VPNs, ITU - NGN Architecture, Numbering, naming and addressing in NGN

Unit 3: IMS and Convergence Management

3.1 IMS Architecture
3.2 IMS Services : Push to Talk over cellular Service
3.3 IMS Based FMC Services

PART-B

Unit 4: IPTV & HbbTV

4.1 Introduction, Architecture of NGN Based IPTV
4.2 NGN Based IPTV Services
4.3 Protocols Used for IPTV, HbbTV (Hybrid Broadcast Broadband TV) Services
4.4 HBB–NEXT
4.5 Multiple-User Environment

Unit 5: Next Generation Multiservice Technology

5.1 MPLS
5.2 MPLS services and components
5.3 MPLS &QoS
5.4 overview of VPN
5.5 layer2 VPN
5.6 layer 3 VPN

Unit 6: NGN Services

6.1 Software- Based Business Services
6.2 High- Definition Voices
6.3 Three Dimensional Television
6.4 Mobile and Manages Peer-to Peer Service
6.5 Converged/ Personalized / Interactive Multimedia Services
6.6 Grand- Separation for Pay-per-Use Service
6.7 Consumer and Business Oriented Apps Storefront

Suggested Readings:

- Thomas Plavyk, 2012, "Next generation Telecommunication Networks, Services and Management", Wiley & IEEE Press Publications
- Keith Knightson, Consultant, Naotaka Morita, NTT Corporation, Thomas Towle. Lucent Technologies, 2005, NGN Architecture: Generic Principles, Functional Architecture, and Implementation Bell Laboratories, IEEE Communications Magazine

Note: Only latest editions of the books are recommended.

Web Links: https://www.slideshare.net/abdulquyyum/ngn-next-generation-networks (last visited date: 23 February 2024)

Instructions for paper setting: Seven questions are to be set in total. First question will be multiple choice covering entire syllabus and will be compulsory to attempt and will be of 18 marks. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three fromeach part. Each question will be of 13 marks.

Evaluation Policy:

The evaluation will include two types of assessments:

(cclv) Continuous or formative assessments (in the form of end semester examination or term examination. Weightage of assessments are as follows:

For continuous or Formative assessment (in semester): Maximum 30 percent. The categorization for the same is:

MCQs	30%
Subjective (Short/Long)	40%
Discussion/Presentation	15%
Projects/Group Activities etc	15%

(cclvi) For Summative assessment (End Semester Examination or End-Term Examination):
Minimum: 70 percent. Categorization for the same is:
Objective Type Questions: 30%
Short/Long Questions: 70%

Assessment Tools:
Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
OMCA-CN-007.1	1		1	2	2		3						3	1
OMCA-CN-007.2	1	1	2	3	1		2						3	1
OMCA-CN-007.3	1	2	2	1	2								2	1
OMCA-CN-007.4	1	2	2	1	1								2	1
OMCA-CN-007.5	1	2	2	3	2								3	1

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH & STUDIES

(Deemed to be University under section 3 of the UGC Act 1956)

OMCA-CN-008: WIRELESS NETWORKING

Periods/week	Credits	Max. Marks: 100
L: 2 T: 0	2	Continuous Evaluation: 30
Duration of Examination: 3 Hrs		End Semester Examination: 70

Pre-Requisite: Basic Understanding of Computer Networks
Course Type: Fundamentals

Course Outcomes: At the end of the course the student will be able to:

OMCA-CN-008.1 Define wireless communication principles.
OMCA-CN-008.2 Explain the components of different wireless network types.
OMCA-CN-008.3 Evaluate case studies of successful wireless deployments.
OMCA-CN-008.4 Design a basic wireless network architecture.
OMCA-CN-008.5 Develop solutions for wireless network optimization

PART-A

Unit 1: Introduction to Wireless Networking

1.1 Overview of wireless communication
1.2 Evolution of wireless networks
1.3 Wireless network types: WLAN, PAN, MAN, WAN
1.4 Applications and use cases of wireless networks

Unit 2: Wireless Communication Technologies

2.1 Radio frequency fundamentals
2.2 Modulation and demodulation
2.3 Spread spectrum techniques
2.4 Multiplexing in wireless communication

Unit 3: Wireless Network Architecture

3.1 Infrastructure vs. ad-hoc networks
3.2 WLAN components: Access points, clients, and routers
3.3 Wireless mesh networks
3.4 Network topologies in wireless environments

PART-B

Unit 4: Wireless Protocols

4.1 IEEE 802.11 standards (a/b/g/n/ac)
4.2 Bluetooth and Zigbee
4.3 Cellular networks (3G, 4G, 5G)
4.4 Near Field Communication (NFC) and RFID

Unit 5: Wireless Security

5.1 Security challenges in wireless networks
5.2 WEP, WPA, WPA2, WPA3
5.3 Wireless Intrusion Detection Systems (WIDS)
5.4 Security best practices for wireless networks

Unit 6: Wireless Network Design and Deployment

6.1 Site survey and planning
6.2 Antenna selection and placement
6.3 Network optimization and performance tuning
6.4 Network coverage and capacity planning
6.5 Real-world examples of successful wireless network deployments
6.6 Industry-specific applications (healthcare, finance, manufacturing)
6.7 Challenges and solutions in practical wireless implementations

Suggested Readings:

1. William Stallings, 2014, "Wireless Communications and Networks", Volume II, Pearson Education
2. Theodore S. Rappaport, 2021, Wireless Communications: Principles and Practice, PHI
3. Simon Haykin , Michael Moher, David Koilpillai, —Modern Wireless Communications‖, First Edition, Pearson Education 2013

Note: Only latest editions of the books are recommended.

Weblinks:

https://www.slideshare.net/jeniferchristy/wireless-networks-ppt-38868910 (last visited date: 22 Feb 2024)
https://www.slideserve.com/gratia/w-reless-network last visted date: 22 Feb 2024)

Instructions for paper setting: Seven questions are to be set in total. First question will be multiple choice covering entire syllabus and will be compulsory to attempt and will be of 18 marks. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 13 marks.

Evaluation Policy:

The evaluation will include two types of assessments:

(cclvii) Continuous or formative assessments (in the form of end semester examination or term examination. Weightage of assessments are as follows:

For continuous or Formative assessment (in semester): Maximum 30 percent. The categorization for the same is:

MCQs	30%
Subjective (Short/Long)	40%
Discussion/Presentation	15%
Projects/Group Activities etc	15%

(cclviii) For Summative assessment (End Semester Examination or End-Term Examination):

Minimum: 70 percent. Categorization for the same is:

Objective Type Questions:	30%
Short/Long Questions:	70%

Assessment Tools:
Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
OMCA-CN-008.1	1		1	2	2		3						3	1
OMCA-CN-008.2	1	1	2	3	1		2						3	1
OMCA-CN-008.3	1	2	2	1	2								2	1
OMCA-CN-008.4	1	1	2	1	1		3						1	2
OMCA-CN-008.5	1	1	2	1			2	3					2	2

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH & STUDIES
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OMCA-AR-007: VIRTUAL REALITY: INTERFACE, APPLICATION AND DESIGN

Periods/week	Credits	Max. Marks: 100
L: 2 T: 0	2	Continuous Evaluations: 30
Duration of Examination: 3 Hrs		End Semester Examination: 70

Pre-Requisite: Linear Algebra & Statistical Techniques
Course Type: Elective

Course Outcomes: At the end of the course, the student will be able to:
OMCA-AR-007.1. Describe how VR systems work and list the applications of VR.
OMCA-AR-007.2. Understand the design and implementation of the hardware that enables VR systems
OMCA-AR-007.3. Understand the system of human vision and its implication on perception and rendering.
OMCA-AR-007.4. Explain the concepts of motion and tracking in VR system.
OMCA-AR-007.5. Describe the importance of interaction and audio in VR systems.

PART-A

UNIT 1: Introduction to Virtual
1.1 Defining Virtual Reality
1.2 History of VR
1.3 Human Physiology and Perception
1.4 Key Elements of Virtual Reality Experience
1.5 Virtual Reality System
1.6 Interface to the Virtual World-Input & output- Visual
1.7 Aural & Haptic Displays
1.8 Applications of Virtual Reality.

UNIT 2: Representing the Virtual World
2.1 Representation of the Virtual World
2.2 Visual Representation in VR
2.3 Aural Representation in VR and Haptic Representation in VR

UNIT 3: The Geometry of Virtual Worlds & the Physiology of Human
3.1 Geometric Models, Changing Position and Orientation
3.2 Axis-Angle Representations of Rotation
3.3 Viewing Transformations, Chaining the Transformations
3.4 Human Eye, eye movements & implications for VR.

PART-B

UNIT 4: Visual Perception & Rendering
4.1 Visual Perception - Perception of Depth
4.2 Perception of Motion
4.3 Perception of Color
4.4 Combining Sources of Information Visual Rendering -Ray Tracing and Shading Models
4.5 Rasterization
4.6 Correcting Optical Distortions
4.7 Improving Latency and Frame Rates

UNIT 5: Motion & Tracking
5.1 Motion in Real and Virtual Worlds- Velocities and Accelerations
5.2 The Vestibular System
5.3 Physics in the Virtual World

5.4 Mismatched Motion and Vection Tracking- Tracking 2D & 3D Orientation
5.5 Tracking Position and Orientation
5.6 Tracking Attached Bodies

UNIT 6: **Interaction & Audio**
6.1 Interaction - Motor Programs and Remapping
6.2 Locomotion, Manipulation, Social Interaction.
6.3 Audio -The Physics of Sound
6.4 The Physiology of Human Hearing
6.5 Auditory Perception
6.6 Auditory Rendering.

Suggested Readings:
1. Virtual Reality, Steven M. LaValle, Cambridge University Press, 2016
2. Understanding Virtual Reality: Interface, Application and Design, William R Sherman and Alan B Craig, (The Morgan Kaufmann Series in Computer Graphics)". Morgan Kaufmann Publishers, San Francisco, CA, 2002
3. Developing Virtual Reality Applications: Foundations of Effective Design, Alan B Craig, William R Sherman and Jeffrey D Will, Morgan Kaufmann, 2009

Note: Only latest editions of the books are recommended.

Web links:
http://lavalle.pl/vr/book.html Last Visited Date: 22.02.2024
https://nptel.ac.in/courses/106/106/106106138/ Last Visited Date: 22.02.2024
https://www.coursera.org/learn/introduction-virtual-reality Last Visited Date: 22.02.2024

Instructions for paper setting: Seven questions are to be set in total. First question will be multiple choice covering entire syllabus and will be compulsory to attempt and will be of 18 marks. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 13 marks.

Evaluation Policy:
The evaluation will include two types of assessments:
(cclix) Continuous or formative assessments (in the form of end semester examination or term examination. Weightage of assessments are as follows:

For continuous or Formative assessment (in semester): Maximum 30 percent. The categorization for the same is:

MCQs	30%
Subjective (Short/Long)	40%
Discussion/Presentation	15%
Projects/Group Activities etc	15%

(cclx) For Summative assessment (End Semester Examination or End-Term Examination):
Minimum: 70 percent. Categorization for the same is:

Objective Type Questions:	30%
Short/Long Questions:	70%

Assessment Tools:
Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
OMCA-AR-007.1	1	1		2			2	3		2			2	3
OMCA-AR-007.2	1	1		2			3	3		2			2	2

OMCA-AR-007.3	1	1	1		2		3	3				2	2	1
OMCA-AR-007.4	1	1	1	2	2		2	3				2	1	
OMCA-AR-007.5	1	1		2			3	3			2			

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH & STUDIES
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OMCA-AR-008: INTERACTIVE APPLICATION DEVELOPMENT

Periods/week	Credits	Max. Marks: 100
L: 2 T: 0	2	Continuous Evaluation : 30
Duration of Examination: 3 Hrs		End Semester Examination : 70

Course outcomes: Upon completion of the course, students should be able to:

OMCA-AR-008.1 Understand basic concepts related to interactive multimedia including data standards, algorithms and software.
OMCA-AR-008.2 Develop multimedia software by utilizing existing libraries and descriptions of algorithms.
OMCA-AR-008.3 Develop interactive multimedia applications.
OMCA-AR-008.4 Develop Flutter applications
OMCA-AR-008.5 Work with Firebase/Firestore with Flutter databases

Part-A

Unit 1: Flutter Introduction
1.1 Flutter,
1.2 Why Flutter? The other options,
1.3 Native solutions,
1.4 What is Dart, Basics of Dart
1.5 Keywords, built-in types.

Unit 2: Oops concept
2.1 Functions
2.2 Operators
2.3 Control flow statements
2.4 Exceptions, classes, generics, libraries and visibility, asynchrony, support, generators, callable classes, isolates, typedefs, metadata, comments,
2.5 Setting up Flutter development environment

Unit 3: Flutter: The basics of writing Flutter code
3.1 Hello World Flutter App,
3.2 Basic Widgets such as Appbar,
3.3 Column, Row, Container, Image, Icon, Buttons, Text, etc;
3.4 Summiting Project Title.

Part-B

Unit 4: Flutter UI
4.1 Important widgets,
4.2 Themes, and layout: The base features of Flutter app,
4.3 Comment on project application features

Unit 5: User Interaction
5.1 Forms and Gestures,
5.2 Flutter Animation and Using the canvas,
5.3 Painting to the canvas and details of using flutter animation,
5.4 Flutter routing in depth, Flutter state management MID EXAM, Asnyc Dart and Flutter and Infinite Scrolling

Unit 6: Working with files
6.1 Including libraries in your Flutter app,
6.2 Including a file with your app, Reading/Writing to files, Using JSON,
6.3 Using Shared Preferences, Working with SQLite Database,

6.4 Making RESTful API Calls with HTTP, Architecting Large Flutter Application,
6.5 Using Firebase/Firestore with Flutter, Working with Location and Maps, Testing Flutter Application.

Suggested Readings:
1. MOBILE APPLICATION DEVELOPMENT - PRACTICAL APPROACH, Dr. K Venkata Nagendra, Notion Press, 2020
2. Beginning Flutter: A Hands On Guide to App Development, By Marco L. Napoli, John wiley & Sons,Inc., 2020**.**

Note: Only latest editions of the books are recommended.

Web links:
https://en.wikipedia.org/wiki/Interactive_Application_System (Last visited Date: 23rd February, 2024)

https://en.wikipedia.org/wiki/Interactive_programming (Last visited Date: 23rd February, 2024)

Instructions for paper setting: Seven questions are to be set in total. First question will be multiple choice covering entire syllabus and will be compulsory to attempt and will be of 18 marks. Three questions will be set from each Part A and Part B (one from each unit). Student needs to attempt two questions out of three from each part. Each question will be of 13 marks.

Evaluation Policy:

The evaluation will include two types of assessments:

(cclxi) Continuous or formative assessments (in the form of end semester examination or term examination. Weightage of assessments are as follows:

For continuous or Formative assessment (in semester): Maximum 30 percent. The categorization for the same is:

MCQs	30%
Subjective (Short/Long)	40%
Discussion/Presentation	15%
Projects/Group Activities etc	15%

(cclxii) For Summative assessment (End Semester Examination or End-Term Examination):

Minimum: 70 percent. Categorization for the same is:

Objective Type Questions:	30%
Short/Long Questions:	70%

Assessment Tools:
Assignment/Tutorials
Sessional tests
Surprise questions during lectures/Class Performance
Term end examination

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
OMCA-AR-008.1	3	3	2	2	3		3						3	1
OMCA-AR-008.2	1	1	2	3	1		2						3	1
OMCA-AR-008.3	1	2	2	1	2								2	1
OMCA-AR-008.4	1	1	1	2	2		2	3				2	1	
OMCA-AR-008.5	1	1		2			3	3			2			

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH & STUDIES
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OMCA-DS-462: PROJECT

Periods/week Credits	Max. Marks: 100
P: 10 T: 0 5	Continuous Evaluation: 30
Duration of Examination: 2 Hrs	End Semester Examination: 70

Course Outcomes: At the end of the course, students will be able to

OMCA-DS-462.1 Describe the Systems Development Life Cycle (SDLC).
OMCA-DS-462.2 Construct and evaluate data flow diagrams.
OMCA-DS-462.3 Design and evaluate system outputs
OMCA-DS-462.4 Construct and evaluate entity-relationship (ER) diagrams for real projects
OMCA-DS-462.5 Determine the various test cases and analyze the results.
OMCA-DS-462.6 Develop soft-skills including writing formal reports and delivering oral presentations.

Note: Project guidelines are enclosed in Annexure-A

The evaluation of the industrial training shall be made as per following:

Continuous Evaluation during training:

1. Evaluation by the Supervisor in the Industry	:	15 marks
2. Synopsis, High Level Design and Low Level Design	:	10 marks
3. Internal Seminar cum Presentation	:	05 marks
Total Internal Marks	:	**30**

External Evaluation after training:

1. Project Report	:	20 marks
2. Seminar cum Presentation	:	15 marks
3. Viva	:	35 marks
Total External marks	**:**	**70**

Annexure-A:

1. Guidelines for submission of Project

All the candidates of MCA Final year are required to submit a project report based on the work done by him/her during the project period based on any programming language. Presentation / viva will be based on the project work carried during the semester. The Project topics should be based on syllabus or beyond.

The project is evaluated on the basis of following heads:
1. Presentation
2. Viva
3. Project report
4. Software Coding
5. Documentation
6. Testing

2. Project Report Preparation Guidelines

Project report should consist the following:

I. Cover page as per the format (Annexure 1)

II. Declaration by the Student (Annexure 2)

III. Certificate from Department (Annexure 3)

IV. Acknowledgement

V. Index (Table of Contents in tabular form)

VI. Introduction

(a) About Organization

(b) Aims & Objectives

(c) Manpower

VII. System Study
- a) Existing System along with limitations
- b) Proposed System along with advantages

VIII. Feasibility Study
- a) Technical
- b) Behavioural
- c) Economic

IX. Project Monitoring System
- a) Gantt Chart

X. System Analysis
- a) Requirement Specification
- b) System Flowcharts
- c) DFDs /ERDs (up to Level 2)

XI. System Design
- a) File/ Data Design

XII. Input / Output Form Design
- a) Screen Design (Screenshots of all screens In Color)
- b) Report Design

XIII. System Testing
- a) Preparation of Test Data
- b) Testing With Live Data

c) Test Cases with results

XIV. System Implementation
a) System Requirements (Hardware/Software)

XV. Documentation
XVI. Scope of the Project
XVII. Bibliography

3. Project Report Submission Guidelines

a) Make 2 copies of the project.

b) Submit one original hard and one original soft copy of the project report to concerned guide.

c) A photocopy of the complete Project should be retained by the student for future reference.

d) Cover page should be properly formatted. (See Annexure 1)

e) The project report must be about 80-100 pages.

f) Source code or pseudo code should not be included in the project report

g) Student will be giving a presentation of about 5-10 minutes, highlighting the project objective, summary and report and findings of the project at the time of viva.

h) Project completed in all aspects with necessary enclosures should be submitted to the concerned Guide in specified time period.
i) The dimension of the project report should be in A4 size.
j) The project report should be bound using flexible cover of the thick plastic paper (Spiral Binding).
k) Report should use Font Arial/ Times New Roman; Font Size: 14 (For Headings Bold) and 12 (For Paragraphs). Document can have maximum of 1.5 lines spacing.

l) Project completed in all aspects with necessary enclosures should be submitted to the concerned Guide.

m) Violation of the project guidelines will lead to the rejection of the project at any stage.

n) A photocopy of the project report is not acceptable for submission.

COURSE ARTICULATION MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
OMCA-DS-462.1		3	3		3			2	2		2	2	2	3
OMCA-DS-462.2	1	3						3			3			3
OMCA-DS-462.3		2	3	1				2			2	2		1
OMCA-DS-462.4	1	2			2		1	3			2	2		2
OMCA-DS.462.5	2	2	2	2	2			3			3		1	3
OMCA-DS-462.6						3	3		3			2		1

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH & STUDIES
(Deemed to be University under section 3 of the UGC Act 1956)

OMCA-DS-463: MAJOR PROJECT

Periods/week	Credits	Max. Marks: 100
20-22 weeks	18	Continuous Evaluation: 30
		End Semester Examination: 70

Course Outcomes: At the end of the course, students will be able to

OMCA-DS-463.1 Describe the Systems Development Life Cycle (SDLC).
OMCA-DS-463.2 Construct and evaluate data flow diagrams.
OMCA-DS-463.3 Design and evaluate system outputs
OMCA-DS-463.4 Construct and evaluate entity-relationship (ER) diagrams for real projects
OMCA-DS-463.5 Determine the various test cases and analyze the results.
OMCA-DS-463.6 Develop soft-skills including writing formal reports and delivering oral presentations.

Objective:

The objective of the MCA project work is to develop quality software solution. The student will get opportunity to work on live projects in IT Industry which help the students to enhance their technical skills. Six months training provides comprehensive learning platform to students where they can enhance their employ ability skills and become job ready along with real corporate exposure.

The evaluation of the industrial training shall be made as per following:

Continuous Evaluation during training:

1. Evaluation by the Supervisor in the Industry	:	15 marks
2. Evaluation by Faculty visiting industry during training	:	10 marks
3. Internal Seminar cum Presentation	:	05 marks
Total Internal Marks	:	**30**

External Evaluation after training:

1. Project Report	:	20 marks
2. Seminar cum Presentation	:	15 marks
3. Viva	:	35 marks
Total External marks	**:**	**70**

The parameters for evaluation by Supervisor during the training shall be as under:

	Marks
a) Work/Project undertaken	10
b) Punctuality	05
c) Regularity	05
d) Discipline	10
e) Overall Conduct	10
f) Willingness to Work	10
g) Innovation	10
h) Resourcefulness in acquiring technical knowledge	10
i) Relations with Seniors and others	10
j) Overall Proficiency achieved during training	10
k) Any contribution to the organization	10

	Total 70

The parameters for evaluation by the faculty visiting the industry during training shall be as under:

	Marks
a) Maintenance of Training Diary and Regularity	05

b) Relations with Seniors and others	05
c) Overall Conduct	10
d) Willingness to Work	05
e) Proficiency achieved	05

	30

COURSE ARTICULATION MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
OMCA-DS-463.1		3	3		3			2	2		2	2	2	3
OMCA-DS-463.2	1	3						3			3			3
OMCA-DS-463.3		2	3	1				2			2	2		1
OMCA-DS-463.4	1	2			2		1	3			2	2		2
OMCA-DS-463.5	2	2	2	2	2			3			3		1	3
OMCA-DS-463.6						3	3		3			2		1

- ***Project guidelines are enclosed in Annexure I***

MASTER OF COMPUTER APPLICATIONS

(MCA)

PROJECT GUIDELINES
w.e.f
(2018)

Faculty of Computer Applications
MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH & STUDIES
(Deemed to be University under section 3 of the UGC Act 1956)

Sector 43, Faridabad

Guidelines for submission of MCA Major Project
All the candidates of MCA final project are required to submit a project report based on the work done by him/her during the project period.

Project Time

The MCA Major Projects would be approximately 20-22 weeks and carries a total of 900 marks (300 Internals & 600 Externals). The Project topics should be based on syllabus or beyond.

Note:

If the company/organization in which the student has done his project is not allowing the student to submit the code to the University then the company/organization has to send a confidential report, clearly indicating the percentage of marks obtained by the student for his software project. To proceed with the project work, it is important to select a right topic and right organization, where you will get required information for the successful completion of the project work.

If on the basis of viva if the examiner feels that the project work has not actually being done by the student then he/she can allot zero marks for software coding.

1. Synopsis Preparation Guidelines:

Synopsis should be submitted within a week's time, after finalization of the topic. Synopsis, preferably, should be of about 3-4 pages. The content should be as brief as is sufficient enough to explain the objective and implementation of the project that the candidate is going to take up. The write up must adhere to the guidelines and should include the following (not necessarily in order as given below).

a) Name / Title of the Project Statement about the Problem
b) Why is the particular topic chosen?
c) Objective and scope of the project
d) Methodology (including a summary of the project)
e) Hardware & Software to be used
f) Testing Technologies used.
g) What contribution would the project make?
h) Details of both internal and external guides.

I. Topic of the Project

This should be explicitly mentioned at the beginning of the Synopsis. Since the topic itself gives a peep into the project to be taken up, candidate is advised to be prudent on naming the project. This being the overall impression on the future work, the topic should corroborate the work.

II. Objective and Scope

This should give a clear picture of the project. Objective should be clearly specified. What the project ends up to and in what way this is going to help the end user has been mentioned.

III. Process Description

The process of the whole software system proposed, to be developed, should be mentioned in brief. This may be supported by DFD's / Flowcharts to explain the flow of the information.

IV. Resources and Limitations

The requirement of the resources for designing and developing the proposed system must be given. The resources might be in form of the hardware / software or the data from the industry. The limitations of the proposed system in respect of a larger and comprehensive system must be given.

V. Conclusion

The write-up must end with the concluding remarks-briefly describing innovations in the approach for implementing the project, main achievements and also any other important feature that makes the system stands out from the rest.

Communication of Approval of Synopsis

After allocation of the project from the organization and go-ahead from the internal guide students should send the synopsis and 1-2 page write up of the organization to the Internal Guide or TPO in soft/hard copy. Incomplete Synopsis in any respect will be straightway rejected. An E-Mail regarding the approval / non approval of the project synopsis will be sent to the candidate within weeks of the receipt of the synopsis. In case of non-approval, the suggestions for reformulating the project will be communicated. Revised Project Synopsis Performa should be resubmitted along with a copy of the earlier synopsis and comments of the guide.

Page Specification:

Left Margin	3.0 cms
Right Margin	3.0 cms
Top Margin	2.7 cms

Bottom Margin	2.7 cms

Page numbers - All text pages as well as program source code listing should be numbered at the bottom centre of the pages.

Fonts:

Headings	Times New Roman	14	Bold
Sub Headings	Times New Roman	12	Bold
Paragraph Text	Times New Roman	12	Normal

Document Format:

The document should be sent in doc format.

2. Schedule:

- Submission of Proof of Training -- TBA
- Submission of complete synopsis -- TBA
- Review of Design Document (High Level) -- TBA
- Review of Design Document (Low Level) -- TBA
- Review of Project Report (Soft Copy) -- TBA
- Project Report submission (Soft Binding) -- TBA
- Final Project Assessment & Viva(Internal) -- TBA
- Final Report Submission & Viva(External) -- TBA

3. Project Report Preparation Guidelines:

Project report should consist the following:

I. Cover page as per the format

II. Declaration by the Student (Annexure 3)

III. Certificate from Department (Annexure 2)
- Extreme Left (Candidate's Sign.)
- Extreme Right (Project Supervisor)
- Right Bottom: Head of Department.

IV. Certificate from Organization (Annexure 2)

V. Acknowledgement
- Properly signed (right side)
- Date on Left

VI. Index (Table of Contents in tabular form)

VII. Introduction
- About Organization
- Aims & Objectives
- Manpower

VIII. System Study
- Existing System along with limitations/ deficiencies

- Proposed System along with intended objectives

IX. Feasibility Study
- Technical
- Economic, etc.

X. Project Monitoring System
- Gantt Chart

XI. System Analysis
- Requirement Specification
- System Flowcharts
- DFDs/HIPOs/ERDs (up to Level 2)

XII. System Design
- File/ Data Design

XIII. Data Dictionary

This should give a catalogue of the data elements used in the system / sub system developed. The following are the details required. Write NA if NOT applicable:

a. Data Name
b. Aliases if any
c. Length (size)
d. Type, Numeric, Alpha, Binary etc.
e. Program Specifications

XIV. Input / Output Form Design
- Screen Design (Screenshots of all screens In Color)
- Report Design

XV. System Testing
- Preparation of Test Data
- Testing With Live Data
- Test Cases with results (Minimum 100 test cases of different modules)

XVI. System Implementation
- Installation Instructions
- System Requirements (Hardware/Software)

XVII. Documentation
- User Manual
- Miscellaneous

XVIII. Scope of the Project
- Deficiencies
- Further Scope

Project Report Submission Guidelines:

1. Make 2 copies of the project.
2. Submit two original hard and original soft copy of the project report before exam.

3. Bring one original hard and original soft copy of the project for the exam, on exam date for viva and presentation.
4. Cover page should be properly formatted. (See Annexure 1)
5. You can make a third copy for your own record.
6. The full content of the report must be hard bound together so that the pages cannot be removed or replaced.
7. The project report must be about 100-150 pages
8. One of the copies should contain all the original certificates related to the training.
9. Other copy should have colored copies of the certificates.
10. Rest of the contents should be same.
11. Screenshots of all the forms should be printed in color.
12. Project report should contain at least 100 test cases of different modules.
13. Source code or pseudo code should not be included in the project report
14. The diagrams attached (DFD's and Flow charts) should be neat clean and clearly visible.
15. Student will be giving a presentation of about 5 Mins, highlighting the project objective, summary and report and findings of the project.
16. Text pages should be printed on one side of the paper, preferably with 1.5 spacing, and page numbers at the bottom of the each page. Margins should be 2" on the left and 1" on the right.
17. The project work must be undertaken in a company and it should be original in nature.
18. The project work should be designed in such a way that, it would be useful to the organization.
19. Do submit your project in specified time period.
20. Fonts:

Headings	Times New Roman	14	Bold
Sub Headings	Times New Roman	12	Bold
Paragraph Text	Times New Roman	12	Normal

Annexure 1

Title of the Project

(Organization: For Whom Developed)

Submitted to:

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH & STUDIES,
Faridabad (Haryana)

In Partial Fulfillment of

Master of Computer Applications (MCA)

Session: 2012-2015

Under the Supervision of:
(Name of Project Guide, Designation)

By:
Name: ( )
Roll No: ( )

Faculty of Computer Applications

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH & STUDIES

Sector-43, Aravalli Hills
Faridabad – 121001, Haryana

Annexure 2

Certificate from the Guide

This is to certify that the project report entitled "_____" submitted in partial fulfillment of the degree of MASTER OF COMPUTER APPLICATIONS (MCA) to MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH & STUDIES , Faridabad is an authentic and original work carried out by Mr. / Ms._____ with Roll no. _____under my guidance.

The matter embodied in this project is genuine work done by the student and has not been submitted whether to this University or to any other University / Institute for the fulfillment of the requirements of any course of study.

Signature of the Student:
Date:
Name and Address
of the student

Signature of the Guide
Date:
Name, Designation
and Address of the
Guide:

(HOD)

Annexure 3

Declaration

I do hereby declare that this project work entitled "_____" submitted by me for the partial fulfillment of the requirement for the award of MASTER OF COMPUTER APPLICATIONS (MCA) is a record of my own work. The report embodies the finding based on my study and observation and has not been submitted earlier for the award of any degree or diploma to any Institute or University.

Appendix-A

List of courses having relevance to the Local/Regional, National and Global Development needs.

Course Code	Course Name	Regional	National	Global
OMCA-RIC-I	Research Innovation Catalyst-I			√
OMCA-DS-110	Linear Algebra and Statistical Techniques			√
OMCA-DS-111	Data Structures		√	
OMCA-DS-112	Object Oriented Programming in Java			√
OMCA-DS-161	Data Structures Lab			√
OMCA-DS-162	Object Oriented Programming in Java Lab			√
OMCA-DS-163	Python Programming Lab			√
OMCA-DS-113	Python Programming			√
OCDC 511	Placement Competency Enhancement -I			√
OMCA-DS-115	MATLAB			√
OMCA-DS-116	Soft Programming			√
OMCA-CC-001	Azure Fundamentals			√
OMCA-CC-002	Fundamentals of Cloud Computing			
OMCA-AI-001	Concepts of AI & Machine Learning			√
OMCA-AI-002	Probabilistic Reasoning			√
OMCA-CS-001	Network Security			√
OMCA-FSD-001	Gaming Technology-I			√
OMCA-FSD-002	Advanced Web Technologies			√
OMCA-MC-001	Mobile Computing basics			
OMCA-MC-002	Mobile Software Technologies			√
OMCA-MM-001	Digital methods I: Photoshop, Illustrator		√	
OMCA-MC-002	Animation Fundamentals			√
OMCA-DS-117	Basics of E-Commerce			
OMCA-DS-118	Introduction to Open Source Software and Open Standards			√
OMCA-IOT-001	IoT Basics and Technology			√
OMCA-IOT-002	Hardware Architectures			√
OMCA-DAS-001	Probability and Statistics			√
OMCA-DAS-002	Introduction to Data Science			√
OMCA-BC-001	Introduction to block chain			√

OMCA-BC-002	Block chain implementation and applications			√
OMCA-DO-001	DevOps Essentials			√
OMCA-DO-002	AWS Services			√
OMCA-CN-001	Fundamentals of Computer Networks			√
OMCA-CN-002	Routing Protocols and Architectures			√
OMCA-AR-001	Augmented Reality Foundations			√
OMCA-AR-002	Animation and Rendering Techniques		√	
OMCA-RIC-II	Research Innovation Catalyst-II			√
OMCA-DS-210	Data Communications		√	
OMCA-DS-211	Analysis & Design of Algorithm		√	
OMCA-DS-212	Int to Artificial Intelligence			√
OMCA-DS-264	Android Application Development Lab			√
OMCA-DS-263	R Programming Lab			√
OMCA-DS-213	Vocational Training		√	
OCDC 512	Placement Competency Enhancement-II			√
OMCA-DS-214	Computer Graphics		√	
OMCA-DS-215	Web Applications Development using PHP			√
OMCA-CC-003	Cloud Computing platforms			√
OMCA-CC-004	Programming wth AWS			√
OMCA-AI-003	Supervised Learning			√
OMCA-AI-004	Text Mining			√
OMCA-CS-003	Cryptographic			√
OMCA-CS-004	Ethical Hacking			√
OMCA-FSD-003	Gaming Technology -II			√
OMCA-FSD-004	Angular			√
OMCA-MC-003	Autmotive Computing			√
OMCA-MC-004	Mobile games		√	
OMCA-MM-003	Compositing and Visual Effect			√
OMCA-MM-004	Modelling & Texturing			√
OMCA-DS-217	Social Network Analytics			√
OMCA-IOT-003	Communication technologies in IoT			√
OMCA-IOT-004	Software & Programming in IoT			√
OMCA-DAS-003	Data Analytics & Visualization using Excel			√
OMCA-DAS-004	Data Analytics & Visualization using Python		√	

OMCA-BC-003	Blockchain architecture			√
OMCA-BC-004	Blockchain and smart contracts			√
OMCA-DO-003	DevOps Software Engineering			√
OMCA-DO-004	Continouos integration & Version Control			√
OMCA-CN-003	Network Protocols		√	
OMCA-CN-004	TCP/IP			√
OMCA-AR-003	3D Models for Augmented and Virtual Reality			√
OMCA-AR-004	VR and 360 Video Production			√
OMCA-DS-216	Advance Database Systems		√	
OMCA-RIC-III	Research Innovation Catalyst-III			√
OMCA-DS-311	Software Engineering & Testing			√
OMCA-DS-312	Operations Research			√
OMCA-DS-314	Big Data Analytics			√
OMCA-DS-310	Data Mining & warehousing			
OMCA-DS-364	Big Data Analytics lab			√
OMCA-DS-360	Data Mining Lab		√	
OMCA-DS-316	Automata Theory		√	
OMCA-DS-317	Compiler Design		√	
OMCA-CC-005	Cloud Data Storage & Management			√
OMCA-CC-006	Programming with GAE			√
OMCA-AI-005	Unsupervised Learning			√
OMCA-AI-006	IoT with machine Learning			√
OMCA-CS-005	Cyber Forensics		√	
OMCA-CS-006	Web Application Security			√
OMCA-FSD-005	Agile, Methodologies and DevOps			√
OMCA-FSD-006	Automated Testing Using Selenium			√
OMCA-MC-005	Smart Energy			√
OMCA-MC-006	Logistics			√
OMCA-MM-005	Multimedia in Acting and Choreography			√
OMCA-MM-006	Digital Character Animation			√
OMCA-DS-318	Multimedia and its tools			√
OMCA-IOT-005	Sensors, Actuators and Signal Processing			√
OMCA-IOT-006	Data Management in IoT			√
OMCA-DAS-005	SQL for Data Science			√

OMCA-DAS-006	Time series Analytics-I			√
OMCA-BC-005	Applications of Blockchain			√
OMCA-BC-006	Smart Contract Application & Development			√
OMCA-DO-005	Containerization with Docker			√
OMCA-DO-006	Advanced DevOps Tools			√
OMCA-CN-005	Advanced Computer Network			√
OMCA-CN-006	Network Management			√
OMCA-AR-005	Game Design Fundamentals			√
OMCA-AR-006	Immersive Technology and Media			√
OMCA-DS-319	Software Project Management		√	
OMCA-DS-410	Introduction to .NET			
OMCA-DS-411	Advance Java			√
OMCA-DS-461	Advance Java Lab			√
OMCA-DS-462	Project		√	√
OMCA-DS-463	Major Project		√	√
OMCA-DS-412	Digital Image Processing			√
OMCA-DS-413	Software API processes			√
OMCA-CC-007	Cloud Security Management			√
OMCA-CC-008	Ethics and standard of cloud.			√
OMCA-AI-007	Neural Networks and Machine Learning			√
OMCA-AI-008	Machine Learning and Pattern Recognition			√
OMCA-CS-007	Cyber Laws			√
OMCA-CS-008	Information Security			√
OMCA-FSD-007	React JS			√
OMCA-FSD-008	Cloud Security			√
OMCA-MC-007	Ambient Assisted Living/Mobile Health			√
OMCA-MC-008	Mobile Infotainment			√
OMCA-MM-007	Multimedia in Media Production			√
OMCA-MM-008	Multimedia Security		√	
OMCA-DS-414	Intelligent Decision Support System			√
OMCA-DS-415	Simulation Modelling			√
OMCA-IOT-007	IoT Security Management			√
OMCA-IOT-008	IoT Applications			√
OMCA-DAS-007	Statistical methods in Decision making			√

OMCA-DAS-008	Time Series Analytics-II			√
OMCA-BC-007	Spring framework			√
OMCA-BC-008	Cryptography Algorithms			√
OMCA-DO-007	Web Application on Cloud			√
OMCA-DO-008	DevOps Project Management			√
OMCA-CN-007	Next Generation Networking			√
OMCA-CN-008	Wireless Networking		√	
OMCA-AR-007	Virtual Reality: Interface, Application and Design			√
OMCA-AR-008	Interactive Application Development.			√
OMCA-DS-410	Introduction to .NET		√	
OMCA-DS-460	Introduction to .NET Lab		√	

Appendix B: List of courses having focus on Employability, Entrepreneurship and Skill Development

Course Code	Course Name	Employability	Entrepreneurship	Skill development
OMCA-DS-161	Data Structures Lab	√		√
OMCA-DS-162	Object oriented programming in Java Lab	√		√
OMCA-DS-163	Python Programming Lab	√		√
OMCA-DS-264	Android Application Development Lab	√		√
OMCA-DS-263	R Programming Lab	√		√
OCDC 511	Placement Competency Enhancement-I	√		
OCDC 512	Placement Competency Enhancement-II	√		
OMCA-DS-460	. NET Lab	√		√
OMCA-DS-364	Big Data Analytics Lab	√		√
OMCA-DS-360	Data Mining Lab	√		√
OMCA-DS-461	Advance Java Lab	√		√
OMCA-DS-462	Major Project	√	√	√
OMCA-DS-463	Project	√	√	√

Appendix C: List of courses and proposed activities relevant to Professional Ethics, Gender, Human Values, Environment and Sustainability

	Environment and Sustainability	**Professional Ethics**	**Human Values**	**Gender Equality**
Activity on Gender Sensitization				√
Workshop on Ethical Hacking		√		