



**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  
AND**

**SCHEME OF EXAMINATION**

**MASTER OF COMPUTER APPLICATIONS  
(ONLINE DEGREE PROGRAMME) AS PER NEP 2020**

**BATCH: 2024- 26 AND ONWARDS**

## **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.

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## **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, industryready 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.

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**MAPPING OF PEOs WITH POs and PSOs**

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

<b>PSO1</b>	Ability to pursue careers in IT industry/ consultancy/ research and development, teaching and allied areas related to computer science.	<b>1,2,4</b>
<b>PSO2</b>	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.	<b>1,2,3</b>

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## **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 32 credits.



# MCA STUDY SCHEME (FOR 2024-26 Batch)

## Semester-I

Course Type	Course Name	Course Code	Internal marks	External marks	Total	Credits
Core	Research Innovation Catalyst-I	O6.0CA100C05	100	-	100	0.5
Core	Linear Algebra & Statistical Techniques	O6.0CA100C01	30	70	100	3
Core	Data Structures	O6.0CA101C01	30	70	100	3
Core	Object oriented programming in Java	O6.0CA102C01	30	70	100	3
Core	Python Programming	O6.0CA103C01	30	70	100	3
Core	Data Structures Lab	O6.0CA151C01	30	70	100	1
Core	Object oriented programming in Java Lab	O6.0CA152C01	30	70	100	1
Core	Python Programming Lab	O6.0CA153C01	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	O6.0CDC196C05	30	70	100	1
Bridge	Fundamentals of Computer Programming	O6.0CA100C09	30	70	100	Audit Pass
Bridge	Elements of Mathematics	O6.0CA101C09	30	70	100	Audit Pass
Total Credits						20.5

	General	Cloud Computing	Artificial Intelligence	Cyber Security	FSD	Mobile Computing	Multimedia
<b>ELECTIVE-I</b>	MATLAB (O6.0CA100E02)	Azure Fundamentals (O6.0CA102E02)	Concepts of AI & Machine Learning. (O6.0CA104E02)	Network Security (O6.0CA106E02)	Gaming Technology – I (O6.0CA108E02)	Mobile Computing Basics (O6.0CA110E02)	Digital methods I: Photoshop, Illustrator (O6.0CA112E02)
	Soft Programming (O6.0CA101E02)	<i>Fundamentals of Cloud Computing</i> (O6.0CA103E02)	Probabilistic Reasoning (O6.0CA105E02)	Cyber Security (O6.0CA107E02)	Advanced Web Technologies. (O6.0CA109E02)	Mobile Software Technologies. (O6.0CA111E02)	<b>Animation Fundamentals</b> (O6.0CA113E02)
		<b>IoT</b>	<b>Data Science</b>	<b>Block Chain</b>	<b>DevOps</b>	<b>Networking</b>	<b>Gaming with AR VR</b>
<b>ELECTIVE-II</b>	<i>Basics of E-Commerce</i> (O6.0CA114E02)	IoT Basics and Technology (O6.0CA116E02)	Probability and Statistics (O6.0CA118E02)	Introduction to block chain (O6.0CA120E02)	DevOps Essentials (O6.0CA122E02)	Fundamentals of Computer Networks (O6.0CA124E02)	Augmented Reality Foundations (O6.0CA126E02)
	Introduction to Open Source Software and Open Standards (O6.0CA115E02)	Hardware Architectures (O6.0CA117E02)	Introduction to Data Science (O6.0CA119E02)	Block chain implementation and applications (O6.0CA121E02)	AWS Services (O6.0CA123E02)	Routing Protocols and Architectures (O6.0CA125E02)	Animation and Rendering Techniques (O6.0CA127E02)

## Semester-II

Course Type	Course Name	Course Code	Pre-requisite Course if any		L	T	P	Total	Int marks	Ext marks	Total	Duration of Exam	Credits
			Title	Code									
Core	Data Communications	O6.0CA220C01	NA	NA	3			3	100	100	200	3	3
Core	Analysis & Design of Algorithm	O6.0CA221C01	Data Structures	O6.0CA101 C01	3			3	100	100	200	3	3
Core	Introduction to Artificial Intelligence	O6.0CA222C01	Data Structures	O6.0CA101 C01	3			3	100	100	200	3	3
Core	Vocational Training	O6.0CA200C06	NA	NA					100		100	2	2
Core	R Programming Lab	O6.0CA276C01	Linear Algebra	O6.0CA100 C01			2	2	50	50	100	2	1
Core	Android Application Development Lab	O6.0CA277C01	Java Lab	O6.0CA152 C01			2	2	50	50	100	2	1
Domain Elective	Elective-III				2			2	100	100	200	3	2
Domain Elective	Elective-IV				2			2	100	100	200	3	2
SEC	Research Innovation Catalyst-II	O6.0CA219C05	Research Innovation Catalyst-I	O6.0CA100 C05		1		1	50		50	-	0.5
SEC	Placement Competency Enhancement-II	O6.0CDC296C05	Placement Competency Enhancement -I	O6.0CDC196C05			6	6	50	50	100	2	1
Total Credits													18.5

	General	Cloud Computing	Artificial Intelligence	Cyber Security	FSD	Mobile Computing	Multimedia
<b>Elective-III</b>	Computer Graphics (O6.0CA200E02)	Cloud Computing Platforms (O6.0CA202E02)	Supervised Learning (O6.0CA204E02)	Cryptographic (O6.0CA206E02)	Gaming Technology -II (O6.0CA208E02)	Automotive Computing (O6.0CA210E02)	Compositing and Visual Effect (O6.0CA212E02)
	Web Applications Development using PHP (O6.0CA201E02)	Programming with AWS (O6.0CA203E02)	Text Mining (O6.0CA205E02)	Ethical Hacking. (O6.0CA207E02)	Angular (O6.0CA209E02)	Mobile games (O6.0CA211E02)	Modelling & Texturing (O6.0CA213E02)
		<b>IoT</b>	<b>Data Science</b>	<b>Block Chain</b>	<b>DevOps</b>	<b>Networking</b>	<b>Gaming with AR VR</b>
<b>Elective-IV</b>	Advance Database Systems (O6.0CA214E02)	Communication technologies in IoT (O6.0CA216E02)	Data Analytics & Visualization using Excel (O6.0CA218E02)	Blockchain architecture (O6.0CA220E02)	DevOps Software Engineering (O6.0CA222E02)	Network Protocols (O6.0CA224E02)	3D Models for Augmented and Virtual Reality (O6.0CA226E02)
	Social Network Analytics (O6.0CA215E02)	Software & Programming in IoT (O6.0CA217E02)	Data Analytics & Visualization using Python (O6.0CA219E02)	Blockchain and smart contracts (O6.0CA221E02)	Continuous integration & Version Control (O6.0CA223E02)	TCP/IP (O6.0CA225E02)	VR and 360 Video Production (O6.0CA227E02)

### Semester-III

Course Type	Course Name	Course Code	Pre-requisite Course if any		L	T	P	Total	Int marks	Ext marks	Total	Duration of Exam	Credits
			Title	Code									
Core	Data Mining and warehousing	O6.5CA100C01	Linear Algebra	O6.0CA100C01	3			3	100	100	200	3	3
Core	Software Engineering & Testing	O6.5CA101C01	Advance Data base systems	O6.0CA214E02	3			3	100	100	200	3	3
Core	Operations Research	O6.5CA102C01	Linear Algebra	O6.0CA100C01	3			3	100	100	200	3	3
Core	Big Data Analytics	O6.5CA103C01	Advanced Data base systems	O6.0CA214E02	3			3	100	100	200	3	3
Core	Data Mining Lab	O6.5CA151C01	Data Structures Lab	O6.0CA151C01			2	2	50	50	100	2	1
Core	Big Data Analytics Lab	O6.5CA152C01	Python Programming Lab	O6.0CA153C01			2	2	50	50	100	2	1
Domain Elective	Elective-V				2			2	100	100	200	3	2
Domain Elective	Elective-VI				2			2	100	100	200	3	2
SEC	Research Innovation Catalyst-III	O6.5CA100C05	Research Innovation Catalyst-II	O6.0CA219C05		2		2	100		100	-	1
Total Credits													19

	General	Cloud Computing	Artificial Intelligence	Cyber Security	FSD	Mobile Computing	Multimedia
<b>Elective-V</b>	Automata Theory (O6.5CA100E02)	Cloud Data Storage & Management (O6.5CA102E02)	Unsupervised Learning (O6.5CA104E02)	Cyber Forensics (O6.5CA106E02)	Agile Methodologies and DevOps (O6.5CA108E02)	Smart Energy (O6.5CA110E02)	Multimedia in Acting and Choreography (O6.5CA112E02)
	Compiler Design (O6.5CA101E02)	Programming with GAE (O6.5CA103E02)	IoT with machine Learning (O6.5CA105E02)	Web Application Security (O6.5CA107E02)	Automated Testing Using Selenium. (O6.5CA109E02)	Logistics (O6.5CA111E02)	Digital Character Animation (O6.5CA113E02)
	<b>General</b>	<b>IoT</b>	<b>Data Science</b>	<b>Block Chain</b>	<b>DevOps</b>	<b>Networking</b>	<b>Gaming with AR VR</b>
<b>Elective-VI</b>	Multimedia and its tools (O6.5CA114E02)	Sensors, Actuators and Signal Processing (O6.5CA116E02)	SQL for Data Science (O6.5CA118E02)	Applications of Blockchain (O6.5CA120E02)	Containerization with Docker (O6.5CA122E02)	Advanced Computer Network (O6.5CA124E02)	Game Design Fundamentals (O6.5CA126E02)
	Software Project Management (O6.5CA115E02)	Data Management in IoT (O6.5CA117E02)	Time series Analytics-I (O6.5CA119E02)	Smart Contract Application & Development (O6.5CA121E02)	Advanced DevOps Tools (O6.5CA123E02)	Network Management (O6.5CA125E02)	Immersive Technology and Media (AR/VR) (O6.5CA127E02)

## Semester-IV

Course Type	Course Name	Course Code	Pre-requisite Course if any		L	T	P	Total	Int marks	Ext marks	Total	Duration of Exam	Credits
			Title	Code									
Core	Introduction to .NET	O6.5CA200C01	Web Applications Development	O6.0CA201E02	3			3	100	100	200	3	3
Core	Advanced Java	O6.5CA201C01	Object oriented programming in Java	O6.0CA102C01	3			3	100	100	200	3	3
Core	Introduction to .NET Lab	O6.5CA251C01				4		4	50	50	100	2	2
Core	Advanced Java Lab	O6.5CA252C01	Object oriented programming in Java Lab	O6.0CA152C01		2		2	50	50	100	2	1
Core	Project	O6.5CA200C07					10		300	200	500	2	5
Domain Elective	<b>Elective-VII</b>				<b>2</b>			<b>2</b>	100	100	200	3	2
Domain Elective	<b>Elective-VIII</b>				<b>2</b>			<b>2</b>	100	100	200	3	2
OR													
Core	Major Project	O6.5CA201C07					20-22 Week Industrial Training		600	300	900	-	18
Total Credits													18

	General	Cloud Computing	Artificial Intelligence	Cyber Security	FSD	Mobile Computing	Multimedia
<b>Elective-VII</b>	Digital Image Processing (O6.5CA200E02)	Cloud Security Management (O6.5CA202E02)	Neural Networks and Deep Learning (O6.5CA204E02)	Cyber Laws (O6.5CA206E02)	React JS (O6.5CA208E02)	Ambient Assisted Living/Mobile Health (O6.5CA210E02)	Multimedia in Media Production (O6.5CA212E02)
	Software API processes (O6.5CA201E02)	Ethics and standard of cloud. (O6.5CA203E02)	Machine Learning and Pattern Recognition (O6.5CA205E02)	Information Security (O6.5CA207E02)	Cloud Security (O6.5CA209E02)	Mobile Infotainment (O6.5CA211E02)	Multimedia Security (O6.5CA213E02)
		<b>IoT</b>	<b>Data Science</b>	<b>Block Chain</b>	<b>DevOps</b>	<b>Networking</b>	<b>Gaming with AR VR</b>
<b>Elective-VIII</b>	Intelligent Decision Support System (O6.5CA214E02)	IoT Security Management (O6.5CA216E02)	Statistical methods in Decision making (O6.5CA218E02)	Spring framework (O6.5CA220E02)	Web Application on Cloud (O6.5CA222E02)	Next Generation Networking. (O6.5CA224E02)	Virtual Reality: Interface, Application and Design (O6.5CA226E02)
	Simulation Modelling (O6.5CA215E02)	IoT Applications (O6.5CA217E02)	Time series Analytics-II (O6.5CA219E02)	Cryptography Algorithms (O6.5CA221E02)	DevOps Project Management (O6.5CA223E02)	Wireless Networking (O6.5CA225E02)	Interactive Application Development. (O6.5CA227E02)

**Note: For Successful completion of the MCA 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

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

## 6.0CA100C05: RESEARCH INNOVATION CATALYST-I

Periods/week Credits  
T: 1 0.5

Max. Marks: 50  
Continuous Evaluation: 50  
End Semester Examination: Nil

**Pre-requisites:** Basic knowledge of Research and Innovation

**Course Type:** SEC

**Course Outcomes:**

- 6.0CA100C05.1. The students will be able to understand what is Research and Innovation.
- 6.0CA100C05.2. To be in a position to describe the process and the procedure to carry out research/ innovation
- 6.0CA100C05.3. To understand the research documentation that is needed for, journals publication, conferences etc.
- 6.0CA100C05.4. To understand and adopt the ethical practice in the research / Innovation activities.
- 6.0CA100C05.5. To comprehend the benefits obtained by means of systematic research/ Innovation
- 6.0CA100C05.6. 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	<input type="checkbox"/> Percentage of classes attended by the students	3+2	5
Group participation and response of the students to a given task	<input type="checkbox"/> Judge individual student in the group <input type="checkbox"/> Meeting timelines as per lesson plan	5 10	15
Selection of research/ Innovation topics and Literature Survey	<input type="checkbox"/> Student interaction with faculty mentors <input type="checkbox"/> Relevance of the topic <input type="checkbox"/> Usage of Scientific Literature Databases. e.g., Scopus/ Web of Science/ etc. <input type="checkbox"/> Scientific/Technical writing <input type="checkbox"/> Number of relevant papers referred for the given topic	3 2 1 2 2	10
Presentation and Report Making	<input type="checkbox"/> Report structure and Slide sequence, <input type="checkbox"/> Contribution of individual group member towards the presentation and report <input type="checkbox"/> Reference listing <input type="checkbox"/> Plagiarism/Authenticity of the report	5 5 5 5	20

**Course Articulation Matrix:**

CO Statement (XX-300)	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
6.0CA100C05.1	√	√	√	√	√	√			√		√		√	√
6.0CA100C05.2			√	√	√				√				√	√
6.0CA100C05.3		√		√					√	√			√	√
6.0CA100C05.4								√					√	√
6.0CA100C05.5	√					√	√					√	√	√
6.0CA100C05.6	√	√							√			√	√	√

**MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH & STUDIES**

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

**06.OCA100C01: LINEAR ALGEBRA AND STATISTICAL TECHNIQUES**

Periods/week                      Credits  
L: 4    T: 0                              3  
Duration of Examination: 3 Hrs

Max. Marks: 100  
Continuous Evaluation: 30  
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:

- 06.OCA100C01.1. Learn the concepts and methods of Linear Algebra.
- 06.OCA100C01.2. Interpret the ability to solve problems using Linear Algebra.
- 06.OCA100C01.3. Relate Linear Algebra to other domains of study.
- 06.OCA100C01.4. Examine the impact of Skewness and outliers on the various statistical interpretations.
- 06.OCA100C01.5. Apply various types of statistical tools & Linear Programming in research & real-time problems.

**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 Cayley-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
O6.0CA100C01.1	1		1	2	2		3						3	1
O6.0CA100C01.2	1	1	2	3	1		2						3	1
O6.0CA100C01.3	1	2	2	1	2								2	1
O6.0CA100C01.4	1	1	2	1	1		3						1	2
O6.0CA100C01.5	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)

## 06.0CA101C01: DATA STRUCTURES

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

Max. Marks: 100  
Continuous Evaluation: 30  
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:

- O6.0CA101C01.1. Describe the concept to evaluate asymptotic performance of algorithms.
- O6.0CA101C01.2. Develop skills to design and analyze simple linear and non-linear data structures.
- O6.0CA101C01.3. Apply for solving problem like traversing, searching, sorting, insertion and deletion of data.
- O6.0CA101C01.4. Demonstrate linear and non-linear data structures in real life problems.
- O6.0CA101C01.5 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)
- 2.4 Queues: 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
- 5.2 Types 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](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	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
O6.0CA101C01.1	1	1	2	2	3		3	2					3	3
O6.0CA101C01.2	1	1	1	1	1		2	2			3		3	3
O6.0CA101C01.3	1	1	1	1	2		2	2			3		2	3
O6.0CA101C01.4	1	1	1	1	1		2	1			3		2	2
O6.0CA101C01.5	1	1	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)

## 06.OCA102C01: OBJECT ORIENTED PROGRAMMING IN JAVA

Periods/week                      Credits  
L: 3                                      3  
Duration of Examination: 3 Hrs

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

**Pre-Requisite: Knowledge of C++ Programming**

**Course Type: Core**

- O6.OCA102C01.1. Understand the Object-oriented concepts of modern programming language.
- O6.OCA102C01.2. Identify classes, objects, functions and relationships among them needed for a specific problem.
- O6.OCA102C01.3. Use Java in a variety of technologies and on different platforms.
- O6.OCA102C01.4. Demonstrate the concepts of Polymorphism and Inheritance.
- O6.OCA102C01.5. Design solutions of basic problems using Object-oriented approach.
- O6.OCA102C01.6. 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%
Subjective (Short/Long)	40%
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	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
O6.0CA102C01.1	2	2		3	1								2	3
O6.0CA102C01.2	2	1		3	2									3
O6.0CA102C01.3	2	2	1	3				1						3
O6.0CA102C01.4	3	3	1	2				1					2	2
O6.0CA102C01.5	2	2	1	2				1			3			3
O6.0CA102C01.6	3	2	1	2			1							3



# MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH & STUDIES

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## 06.OCA103C01: PYTHON PROGRAMMING

Periods/week Credits

L: 2 3

Max. Marks: 100

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

- O6.OCA103C01.1. Define the methodology and procedures related to python programming
- O6.OCA103C01 2. Demonstrate the concepts of control structures in Python.
- O6.OCA103C01.3. Use Python data structures to solve complex problems.
- O6.OCA103C01.4. Illustrate the use of various python libraries and functions.
- O6.OCA103C01.5. 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)

**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:

- (vii) 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%

- (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	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
O6.0CA103C01.1	3	2	1			2							2	2
O6.0CA103C01.2		1		1			1	1	1	2			1	1
O6.0CA103C01.3		3							1				1	3
O6.0CA103C01.4		3						1					1	3
O6.0CA103C01.5		3	3	2	2	1	1	1		1			2	3

**MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH & STUDIES**  
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**06.0CA151C01: DATA STRUCTURES LAB**

Periods/week                      Credits  
P: 2    T: 0                              1  
Duration of Examination: 3 Hrs

Max. Marks: 100  
Continuous Evaluation: 30  
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:

- O6.0CA151C01.1 Analyze the asymptotic performance of various algorithms
- O6.0CA151C01.2 Design and implement various algorithms with use of arrays, records, linked structures, stacks, queues, trees, and graphs
- O6.0CA151C01.3 Demonstrate different methods for traversing trees.
- O6.0CA151C01.4 Compare alternative implementations of data structures with respect to performance.
- O6.0CA151C01.5 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](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	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
O6.0CA151C01.1	1	1	1		2		2						2	3
O6.0CA151C01.2	1	1	1				2						3	3
O6.0CA151C01.3	1	1	2	2	1		1	2					1	2
O6.0CA151C01.4	1	1	2	2	1		2	2				3	2	2
O6.0CA151C01.5	1	1	1	1	2		2	3				3	2	1

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

**06.0CA152C01: 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:

- O6.0CA152C01.1. Solve basic problems using concepts of object-oriented programming.
- O6.0CA152C01.2. Implement solutions to complex problems using Control Structures, string manipulation and functions.
- O6.0CA152C01.3. Propose the use of techniques (inheritance, polymorphism) by implementing them in the Java programming language to solve the given problem
- O6.0CA152C01.4. 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:

<b>Units</b>	<b>Bill Rate</b>
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**

>90

>60 and <=90

Below 60

The format of output is as follow:

Marks of subject 1

Marks of Subject 2

Marks of subject 3

Marks obtained

Total Marks

%Age

**Grade**

Excellent

Good

Average

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
O6.0CA152C01.1	3				1	1	2						1	2
O6.0CA152C01.2		2	2		2	2	2				2		3	3
O6.0CA152C01.3	2	2		1		1	1	1	1		2		2	3
O6.0CA152C01.4	2	2				1	1	1	1		1	1	3	



## MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH & STUDIES

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### 06.0CA153C01 : 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

O6.0CA153C01.1. Develop programs using basics of Python.

O6.0CA153C01.2. Use Python data structures to solve complex problems.

O6.0CA153C01.3. Demonstrate the concepts of control structures in Python.

O6.0CA153C01.4. Apply the concepts of file handling and regular expression using packages.

O6.0CA153C01.5. 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:
- 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.
  - 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
O6.0CA153C01.1	3						3						1	2
O6.0CA153C01.2	2	3					3						2	3
O6.0CA153C01.3			2				3						1	3
O6.0CA153C01.4		2	2		2		3						2	1
O6.0CA153C01.5	2	2	2		2		3						3	2

# MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH & STUDIES

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

## O6.0CA100E02: MATLAB

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 basic Programming concepts  
Course Type: Domain Elective

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

- O6.0CA100E02.1. To learn features of MATLAB as a programming tool.
- O6.0CA100E02.2. To promote new teaching model that will help to develop programming skills and technique to solve mathematical problems.
- O6.0CA100E02.3. To understand MATLAB graphic feature and its applications.
- O6.0CA100E02.4. Interpret and visualize simple mathematical functions and operations thereon using plots/display
- O6.0CA100E02.5. 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](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%
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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
O6.0CA100E02.1	2	3	3	3	3	2	3				2	3	3	3
O6.0CA100E02.2	3	2	3	2	2	1	2			2	2	3	2	3
O6.0CA100E02.3	3	3	3	3	3	1	3		2		2	2	3	3
O6.0CA100E02.4	3	2	2	3	1		2		1			3	2	3
O6.0CA100E02.5	3	3	3	3	2	1	3	2				3	3	3

## MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH & STUDIES

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### 06.0CA101E02: SOFT PROGRAMMING

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 AI**

**Course Type: Domain Elective**

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

O6.0CA101E02.1. Learn soft computing techniques and their applications.

O6.0CA101E02.2. Analyze various neural network architectures.

O6.0CA101E02.3. Define the fuzzy systems.

O6.0CA101E02.4. Understand the genetic algorithm concepts and their applications.

O6.0CA101E02.5. Identify and select a suitable Soft Computing technology to solve the problem

O6.0CA101E02.6. 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 Computing
- 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](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/qalibdoc.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	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
O6.0CA101E02 .1	2	1		2			2						3	3
O6.0CA101E02 .2	1	3	1	1			2						2	2
O6.0CA101E02 .3	1	2	1	1			2						2	3
O6.0CA101E02 .4	1	2	2	3	2		1						3	2
O6.0CA101E02 .5	2	1	1	3	2		2						2	2
O6.0CA101E02 .6	1	1	1		2	2	2						2	2

**MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH & STUDIES**  
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**06.0CA102E02: Azure Fundamentals**

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

Max. Mark: 100  
Continuous Evaluation: 30  
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:

- 06.0CA102E02.1 Be familiar with the general cloud technology concepts
- 06.0CA102E02.2 Build knowledge of Azure services and Azure workloads.
- 06.0CA102E02.3 Detail knowledge of security and privacy in Azure, Azure pricing and support.
- 06.0CA102E02.4 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 Threat 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



# MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH & STUDIES

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

## 06.0CA103E02: FUNDAMENTALS OF CLOUD COMPUTING

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 Data Communication & Networking**

**Course Type: Domain Elective**

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

O6.0CA103E02.1 Define cloud computing and memorize the different cloud services and deployment models.

O6.0CA103E02.2 Describe importance of virtualization along with their respective technology.

O6.0CA103E02.3 Use and examine different cloud computing services.

O6.0CA103E02.4 Analyze and compare various different cloud computing platforms such as AWS, Microsoft Azure.

O6.0CA103E02.5 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](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](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](http://eddiejackson.net/web_documents/The_Definitive_Guide_to_Cloud_Computing.pdf) (Last visited Date: 21 February, 2024)
- <https://ptqmedia.pearsoncmq.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	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
O6.0CA103E02.1	2		1	1			2						3	3
O6.0CA103E02.2	1	3	1		1		1						2	2
O6.0CA103E02.3	1	2	2	2		2	1						2	3
O6.0CA103E02.4	1	2	2	2	3	2	1						3	2
O6.0CA103E02.5	2	3	2	2		2	2	1					2	2

**MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH & STUDIES**  
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**06.0CA104E02: 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:

O6.0CA104E02.1 Develop a good understanding of fundamental principles of machine learning.

O6.0CA104E02.2 Understand various Modelling Techniques.

O6.0CA104E02.3 Learn to use machine learning operations for classification and regression.

O6.0CA104E02.4 Analyze the concepts of neural networks for learning linear and non-linear activation functions..

O6.0CA104E02.5 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:**

- 1.1 Prediction Modeling
- 1.2 Probabilistic interpretation, Regularization,
- 1.3 Logistic regression, multi class classification
- 1.4 Support Vector Machines- Large margin classifiers
- 1.5 Nonlinear SVM,
- 1.6 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 Naïve 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. Christopher 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:

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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
O6.0CA104E02.1	2	1		2			2						3	3
O6.0CA104E02.2	1	3	1	1			2						2	2
O6.0CA104E02.3	1	2	1	1			2						2	3
O6.0CA104E02.4	1	2	2	3	2		1						3	2
O6.0CA104E02.5	2	1	1	3	2		2						2	2
O6.0CA104E02.6	1	1	1		2	2	2						2	2

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**MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH & STUDIES**  
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**06.0CA105E02: PROBABILISTIC REASONING**

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:** Python Programming

**Course Type:** Domain Elective

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

O6.0CA105E02.1 The basic principles of probability and random variables.

O6.0CA105E02.2 The skills of extracting probabilistic models from the data with the help of continuous probability distributions and Gaussian approach.

O6.0CA105E02.3 The estimation statistics and decision-making techniques, algorithms which plays vital role in data mining.

O6.0CA105E02.4 Demonstrate advanced knowledge of decision theory for formal computation and its relationship to languages

O6.0CA105E02.5 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 \(buffalo.edu\)](8.2.6-FromBNtoMN.ppt) (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)

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

- (xx) 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	
O6.0CA105E02.1	2	1		2			2						3	
O6.0CA105E02.2	1	3	1	1			2						2	
O6.0CA105E02.3	1	2	1	1			2						2	
O6.0CA105E02.4	1	2	2	3	2		1						3	
O6.0CA105E02.5	2	1	1	3	2		2						2	
O6.0CA105E02.6	1	1	1		2	2	2						2	

**MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH & STUDIES**  
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**06.0CA106E02: NETWORK 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:** Introduction to Network and Security

**Course Type:** Domain Elective

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

O6.0CA106E02.1 Analyze the basic concepts of network security.

O6.0CA106E02.2 Recognize various security threats, their harm, strategies and tactics to protect the networks.

O6.0CA106E02.3 Explore various aspects of network security and access control mechanism.

O6.0CA106E02.4 Network Security Policy Design and Implementation.

O6.0CA106E02.5 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 consider 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](https://www.tutorialspoint.com/Network%20security/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:

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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  
 Performance Term end examination

**COURSE ARTICULATION MATRIX:**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
O6.OCA106E02 .1	2					1	2	1					3	3
O6.OCA106E02 .2	1	3	1		3		1						2	2
O6.OCA106E02 .3			2	2		3	1							
O6.OCA106E02 .4	1	2					1						1	1
O6.OCA106E02 .5	2	3	1	3		1	3	1					2	2



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**O6.OCA107E02: CYBER 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:** NA  
**Course Type:** Domain Elective

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

- O6.OCA107E02.1. Understand basic concepts and issues related to Cyber Security.
- O6.OCA107E02.2. Distinguish various tools used in Cyber Security.
- O6.OCA107E02.3. Identify various mechanisms to protect themselves from various security threats on the internet.
- O6.OCA107E02.4. Use security tools to enhance system security.
- O6.OCA107E02.5. 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	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
O6.0CA107E02 .1	2		1	1			2						3	3
O6.0CA107E02 .2	1	3	1		1		1						2	2
O6.0CA107E02 .3			2	2		2	1							
O6.0CA107E02 .4	1	2					1							
O6.0CA107E02 .5	2	3	2	2		2	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**

**06.OCA108E02: GAMING TECHNOLOGY - I**

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

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

**Pre-requisites: Basic knowledge of computer graphics and gaming**

**Course Type: Program Elective**

**Course Outcomes:** The students would be able:

- O6.0CA108E02.1. To learn Game Essentials, Types of Games, Stages of Design process.
- O6.0CA108E02.2. To understand requirements of designing a game.
- O6.0CA108E02.3. To learn how a concept turns into a game, and game world
- O6.0CA108E02.4. To create a expressive play, characters in the game
- O6.0CA108E02.5. To understand what a storytelling is, various components of storytelling
- O6.0CA108E02.6. 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:**

<b>CO Statement</b>	<b>P O 1</b>	<b>P O 2</b>	<b>P O 3</b>	<b>P O 4</b>	<b>P O 5</b>	<b>P O 6</b>	<b>P O 7</b>	<b>P O 8</b>	<b>P O 9</b>	<b>P O 10</b>	<b>P O 11</b>	<b>P O 12</b>	<b>PS O 1</b>	<b>PSO 2</b>
O6.0CA108E02.1	3	2	2	1	2	2	1	1	1	2	2	2	2	1
O6.0CA108E02.2	3	3	2	2	2	2	1	1	2	2	2	2	2	1
O6.0CA108E02.3	3	2	2	2	2	2	2	1	2	2	2	2	2	2
O6.0CA108E02.4	3	3	2	2	2	2	2	1	2	2	2	2	2	3
O6.0CA108E02.5	3	2	2	2	2	2	2	1	1	2	2	2	2	3
O6.0CA108E02.6	3	3	2	3	2	2	2	1	2	3	3	1	2	3

# MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH & STUDIES

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

## 06.0CA109E02: ADVANCED WEB TECHNOLOGIES

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:** Web Development concepts

**Course Type:** Domain Elective

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

O6.0CA109E02.1 Create UI applications using C#

O6.0CA109E02.2 Design and develop secure web applications using asp.net according to industry standards

O6.0CA109E02.3 Define and create custom web services

O6.0CA109E02.4 Apply the concept of Servlet and its life cycle to create web application.

O6.0CA109E02.5 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:

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

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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
O6.0CA109E02.1	3	3	2	2	3		3						3	1
O6.0CA109E02.2	1	1	2	3	1		2						3	1
O6.0CA109E02.3	1	2	2	1	2								2	1
O6.0CA109E02.4	1	1	2	1	1		3						1	2
O6.0CA109E02.5	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)

**06.OCA110E02: MOBILE COMPUTING BASICS**

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 Networks**  
**Course Type: Domain Elective**

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

- O6.OCA110E02.1 Define the concept of wireless communication & design of various cellular systems.
- O6.OCA110E02.2 Describe working principle of wireless LAN and its standards.
- O6.OCA110E02.3 Explain various techniques of multiple user access to scarce radio spectrum resources.
- O6.OCA110E02.4 Compare different protocols for mobile adhoc networks
- O6.OCA110E02.5 Analyze the working of the GPS system and the concept of location-based routing.
- O6.OCA110E02.6 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, Lthar 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](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](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)

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### **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
O6.0CA110E02.1	2		1	1			2						3	3
O6.0CA110E02.2	1	3	1		1		1						2	2
O6.0CA110E02.3	1	2	2	2		2	1						2	3
O6.0CA110E02.4	1	2	2	2	3	2	1						3	2
O6.0CA110E02.5	2	3	2	2		2	2	1					2	2
O6.0CA110E02.6	3	2	2	1		1	2						2	2

**MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH & STUDIES**

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

**06.OCA111E02: 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:

- 06.OCA111E02.1 Install and configure Android application development tools.
- 06.OCA111E02.2 Design and develop user Interfaces for the Android platform.
- 06.OCA111E02.3 Save state information across important operating system events.
- 06.OCA111E02.4 Apply Java programming concepts to Android application development.
- 06.OCA111E02.5 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:

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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	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
O6.0CA111E02.1	2		1	1			2						3	3
O6.0CA111E02.2	1	3	1		1		1						2	2
O6.0CA111E02.3	1	2	2	2		2	1						2	3
O6.0CA111E02.4	1	2	2	2	3	2	1						3	2
O6.0CA111E02.5	2	3	2	2		2	2	1					2	2
O6.0CA111E02.6	3	2	2	1		1	2						2	2

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# MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH & STUDIES

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

## 06.0CA112E02: DIGITAL METHODS I: PHOTOSHOP, ILLUSTRATOR

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 basics of Computer Graphics and Multimedia.**

**Course Type: Domain Elective**

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

O6.0CA112E02.1 Develop critical and creative thinking skills and perceptual awareness necessary for understanding and producing designs using specific design programs.

O6.0CA112E02.2 Understand and apply media, technology, and processes.

O6.0CA112E02.3 Organize the components of a work into a cohesive whole through knowledge of organizational principles of design and art elements.

O6.0CA112E02.4 Evaluate a range of subject matter and ideas to communicate intended meaning in designs through innovative methods.

O6.0CA112E02.5 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 module.

#### 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:

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%

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

Objective Type Questions:  
Short/Long Questions:

30%  
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
O6.0CA112E02 .1					1	1	1		1	1	1		1	1
O6.0CA112E02 .2					1	1	1		1	1	1		1	1
O6.0CA112E02 .3					1	1	1		1	1	1		1	1
O6.0CA112E02 .4					1	1	1		1	1	1		1	1
O6.0CA112E02 .5					1	1	1		1	1	1		1	1

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

**O6.0CA113E02: ANIMATION FUNDAMENTALS**

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 is required**

**Course Type: Domain Elective**

**Course Outcomes:** Students will be able to –

O6.0CA113E02.1. Understand the basic concept of computer graphics, Graphic devices, Graphics APIs, Graphics Pipeline, Open Source 3D computer graphics software/tools.

O6.0CA113E02.2 Describe and identify the concept of Typography, Typesetting, Handwriting & Calligraphy, Graffiti, Architectural lettering.

O6.0CA113E02.3. Apply the concept of Color theory, Color wheel, Color systems, page Layout, User interface design

O6.0CA113E02.4. Analyze the Blender open source tool to design the Graphics and Animation.

O6.0CA113E02.5. Evaluate the GIMP and Movie sandbox open source tool to design the Graphics and Animation.

O6.0CA113E02.6. 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\\_\(software\)](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](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:**

The evaluation will include two types of assessments:

- (xxxv) 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%



**MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH & STUDIES**

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**06.0CA114E02: 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:

- 06.0CA114E02. 1: Understand the fundamentals and importance of E-Commerce.
- 06.0CA114E02.2: Classify trading relationships including Business to Consumer, Business-to-Business, Inter-organization.
- 06.0CA114E02.3: Interpret the key features of Internet, Intranets and Extranets by demonstrating their relation with each other.
- 06.0CA114E02.4: Analyze the major security challenges in using and making On-line transactions.
- 06.0CA114E02.5: Examine the legal issues and Privacy in E-Commerce.
- 06.0CA114E02..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, Theodore 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](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
O6.0CA114E02.1			1		2	3	1	1	1				1	1
O6.0CA114E02.2		1	1		2	2	1			2		1	1	
O6.0CA114E02.3		1	1	1	1	2	1		1	1			1	1
O6.0CA114E02.4		1			1	2	1			1	2		1	1
O6.0CA114E02.5		1	1		1	2	1			1	1		1	
O6.0CA114E02.6	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)

### 06.0CA115E02: INTRODUCTION TO OPEN SOURCE SOFTWARE AND OPEN STANDARDS

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

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

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

#### **Course Outcomes:**

O6.0CA115E02.1 Gain knowledge of Open Standards including evolution of open standards.

O6.0CA115E02.2 Gain knowledge about the standard setters with clear differentiation between De Jure and De facto standard setters.

O6.0CA115E02.3 Gain knowledge about the adoption of open standards along with case studies.

O6.0CA115E02.4 Gain knowledge of open-source software including operating system LINUX and graphical user interface etc.

O6.0CA115E02.5 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%
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# MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH & STUDIES

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## 06.OCA116E02: IOT BASICS AND TECHNOLOGY

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 Basics of Electronics & Networking**

**Course Type: Domain Elective**

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

- O6.OCA116E02.1. Interpret the vision of IoT & explain in a concise manner how Internet of Things work
- O6.OCA116E02.2. Understand the basics of IoT networking, communication protocols, & sensor networks
- O6.OCA116E02.3. Use & application of wireless technologies and mobile networks for Internet of Things
- O6.OCA116E02.4. Compare and contrast the use of devices, gateways and data management in IoT
- O6.OCA116E02.5. Interfacing of sensing devices & implementation of IoT using Arduino & Raspberry Pi
- O6.OCA116E02.6. 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 Arduino 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 Madiseti 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](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)

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### **Evaluation Policy:**

The evaluation will include two types of assessments:

- (xii) 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	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
O6.0CA116E02.1	1		1	1	2		2						2	1
O6.0CA116E02.2	1	1	2	3	1		2						3	2
O6.0CA116E02.3	2	2	1	1	2								2	1
O6.0CA116E02.4	1	2	2	1	1		2						1	2
O6.0CA116E02.5	1	1	2	1			2	3					2	2
O6.0CA116E02.6	1	1	2	1	1		2	2				3	1	1

# MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH & STUDIES

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## 06.0CA117E02: HARDWARE ARCHITECTURES

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 concepts of C Programming**

**Course Type: Domain Elective**

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

O6.0CA117E02.1. Learn the functional block diagram of a single bus architecture of a computer.

O6.0CA117E02.2. Describe the function of the instruction execution cycle, RTL interpretation of instructions, addressing modes, instruction set.

O6.0CA117E02.3. Demonstrate assembly language program for specified microprocessor for computing 16-bit multiplication, division and I/O device interface (ADC, Control circuit, serial port communication).

O6.0CA117E02.4. Categorize & describe the process for Concurrent access to memory and cache coherency in Parallel Processors.

O6.0CA117E02.5. 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.

O6.0CA117E02.6. 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:

- (xl) 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%

- (xli) 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:**

<b>CO Statement</b>	<b>PO 1</b>	<b>PO 2</b>	<b>PO 3</b>	<b>PO 4</b>	<b>PO 5</b>	<b>PO 6</b>	<b>PO 7</b>	<b>PO 8</b>	<b>PO 9</b>	<b>PO1 0</b>	<b>PO1 1</b>	<b>PO1 2</b>	<b>PS 0 1</b>	<b>PS 0 2</b>
O6.0CA117E02.1	2			1						1		2	-	2
O6.0CA117E02.2	3	3			2	1	2			2			2	2
O6.0CA117E02.3		3	3	2				1	1					2
O6.0CA117E02.4	2	3		2		2			1	1		3	2	2
O6.0CA117E02.5	3			2	1	-	2	1	2			3		2
O6.0CA117E02.6	3			2	2			2	2	2	2	-	3	3

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

**O6.0CA118E02: PROBABILITY AND STATISTICS**

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 basic mathematics

**Course Type:** Domain Elective

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

- O6.0CA118E02.1. Learn the language and core concepts of probability theory
- O6.0CA118E02.2. Interpret the ability to solve problems based on basic principles of statistical inference.
- O6.0CA118E02.3. Relate Statistical Techniques in other domains of study.
- O6.0CA118E02.4. Examine the impact of Skewness and outliers on the various statistical interpretations.
- O6.0CA118E02.5. Develop critical reasoning by studying statistical concepts
- O6.0CA118E02.6. 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
O6.0CA118E02.1	1		1	1	2		3						2	3
O6.0CA118E02.2	1	1	2	3	1		2						3	3
O6.0CA118E02.3	1	2	0	1	2								3	1
O6.0CA118E02.4	1		2	1	1		3						1	3
O6.0CA118E02.5	1	2		1			2	3					1	2

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

**06.0CA119E02: INTRODUCTION TO DATA SCIENCE**

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 Mathematics and Python

**Course Type:** Domain Elective

**Course Outcomes:** Students will be able to –

- O6.0CA119E02.1 Demonstrate proficiency with statistical analysis of data.
- O6.0CA119E02.2 Execute statistical analyses with professional statistical software.
- O6.0CA119E02.3. Apply data science concepts and methods to solve problems in real-world contexts and will communicate these solutions effectively.
- O6.0CA119E02.4. 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
O6.0CA119E02.1	2	2		3	2		2					1		1
O6.0CA119E02.2	2	1	2	1	1		1						3	2
O6.0CA119E02.3	2		1	1	2							1		2
O6.0CA119E02.4	1	2	2	3	1		2						1	2

MRPDRS

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

**O6.0CA120E02: INTRODUCTION TO BLOCKCHAIN**

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: Fundamentals of Cybersecurity**  
**Course Type: Domain Elective**

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

- O6.0CA120E02.1. Understand the concepts of Blockchain
- O6.0CA120E02.2. Know about usage of the protocols
- O6.0CA120E02.3. Understand the hyper ledger fabric
- O6.0CA120E02.4. Learn the implementation of the blockchain
- O6.0CA120E02.5. Learn about application of Blockchain in Financial Systems
- O6.0CA120E02.6. 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: 23<sup>rd</sup> 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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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	PO 10	PO 11	PO 12	PO 13	PO 14
O6.0CA120E02 .1	2		1	2	1		2			1			3	1
O6.0CA120E02 .2	1			1			3	1		1	2	1	2	
O6.0CA120E02 .3	2		2		1	1			1		2		2	
O6.0CA120E02 .4	1		1	2			3	1	3		2		3	2

O6.0CA120E02. 5		1	1		2		3	1			2		1	
O6.0CA120E02. 6	2		3		1		3		2		3		1	3

MRIR

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

**06.0CA121E02: BLOCK CHAIN IMPLEMENTATION & APPLICATIONS**

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

Max. Marks: 100  
Continuous Evaluation : 30  
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:**

- O6.0CA121E02.1. Contentedly discuss and describe the history, types and applications of Blockchain
- O6.0CA121E02.2. Gain familiarity with cryptography and Consensus algorithms.
- O6.0CA121E02.3. Create and deploy projects using Web3j.
- O6.0CA121E02.4. 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 IPFS
- 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.

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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
O6.0CA121E02.1	1		1	2	2		3						3	1
O6.0CA121E02.2	1	1	2	3	1		2						3	1
O6.0CA121E02.3	1	2	2	1	2								2	1
O6.0CA121E02.4	1	1	2	1	1		3						1	2

**MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH & STUDIES**  
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**O6.0CA122E02: 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:

O6.0CA122E02.1. Define discuss the key concepts and principles of DevOps.

O6.0CA122E02.2. Learning the basics of Git, version control, and repositories..

O6.0CA122E02.3. Utilize Jenkins for automation and continuous integration to streamline software development processes

O6.0CA122E02.4. Understanding the concept of treating infrastructure as code.

O6.0CA122E02.5. Learning Docker fundamentals, containers, and images.

O6.0CA122E02.6. 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](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
<b>O6.0CA122E02.1</b>	3	1		1	2			1			1		1	
<b>O6.0CA122E02.2</b>		3			2							1	2	2
<b>O6.0CA122E02.3</b>			3		2		2			1			2	1
<b>O6.0CA122E02.4</b>		3			2						1		1	
<b>O6.0CA122E02.5</b>	1			3		2							2	2
<b>O6.0CA122E02.6</b>	3		3					2					2	2

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

**06.0CA123E02: AWS SERVICES**

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 the student will be able to:

O6.0CA123E02.1. Identify and understand the concept of AWS

O6.0CA123E02.2. Understand the concept of cloud storage over the traditional storage

O6.0CA123E02.3. Analyse the concept of a Virtual private cloud

O6.0CA123E02.4. Apply the concept of configuring Auto Scaling for real Application Infrastructure

O6.0CA123E02.5. 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, DynamoDB, 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: 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:

- (iv) 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%

- (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

MRIPS

**COURSE ARTICULATION MATRIX:**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
O6.0CA123E02.1	1		1	2	2		2						3	1
O6.0CA123E02.2	1	1	2	3	1		2						3	1
O6.0CA123E02.3	1	2	1	1	2								2	1
O6.0CA123E02.4	1	1		1	1		3						1	2
O6.0CA123E02.5	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**

**O6.0CA124E02: 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 –

- O6.0CA124E02.1. Explain basic concepts, OSI reference model, services and role of each layer of OSI model.
- O6.0CA124E02.2 Describe and assign the IP addresses.
- O6.0CA124E02.3. Understand the various protocols in Wireless Networking
- O6.0CA124E02.4. Design and implement the utilities in TCP/IP Networking.

**PART –A**

**UNIT 1: Introduction to Networking & OSI Model**

- 1.1 Why use networks
- 1.2 Types 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
- 3.7 Wireless 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](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:

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%

- (lviii) 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
O6.0CA124E02.1	2	2		3	2		2					1		1
O6.0CA124E02.2	2	1	2	1	1		1						3	2
O6.0CA124E02.3	2		1	1	2							1		2
O6.0CA124E02.4	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)

## 06.0CA125E02: ROUTING PROTOCOLS AND ARCHITECTURES

Periods/week Credits

L: 2 2

Duration of Examination: 3 Hrs

Max. Marks: 100

Continuous Evaluation: 30

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

O6.0CA125E02.1. Understand basic concept of Routing in Computer Networks.

O6.0CA125E02.2. Explore various Routing Protocols and their Characteristics.

O6.0CA125E02.3. Understand the concept of Routing Algorithm and Apply different routing protocols over network layer and transport layer.

O6.0CA125E02.4. Analyze different routing protocols requires to be configured in real routers along with the framework of the concerned routing algorithms.

O6.0CA125E02.5. 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 Attributes
- 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. Uyles 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](http://www.tutorialspoint.com/listtutorials/networking/1) 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:

- (lix) 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%

- (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
O6.0CA125E02.1		2		1		1	3						2	1
O6.0CA125E02.2	2	2	2				3			1			3	2
O6.0CA125E02.3		3		1			2						2	
O6.0CA125E02.4	2	3			1		2		1		1		1	2
O6.0CA125E02.5	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)

### 06.0CA126E02: AUGMENTED REALITY FOUNDATIONS

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:** Nil

**Course Type:** Domain Elective

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

- O6.0CA126E02.1. Historical and modern overviews and perspectives of Augmented Reality
- O6.0CA126E02.2. Understand the technologies, components and hardware needed for AR
- O6.0CA126E02.3. Implement the AR and hand-on preparation
- O6.0CA126E02.4. Impart the importance of augmented reality with real-time examples
- O6.0CA126E02.5. Gain knowledge of software tools required for AR
- O6.0CA126E02.6. 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)

**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:

- (Ixi) 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%

(lxii) 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
O6.0CA126E0 2.1	2	2		3	2		2					1		1
O6.0CA126E0 2.2	2	1	2	1	1		1						3	2
O6.0CA126E0 2.3	2		1	1	2							1		2
O6.0CA126E0 2.4	1	2	2	3	1		2						1	2
O6.0CA126E0 2.5		1	2	1			2	3				1	2	3
O6.0CA126E0 2.6	1	1	1	1	1		2	2				2	1	1

**MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES**  
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**06.0CA127E02: ANIMATION & RENDERING TECHNIQUES**

Periods/week    Credits  
L :2    T: 0            2.0

Max. Marks: 200  
Continuous Evaluation: 100  
End Semester Examination: 100

Duration of Exam: 3 Hrs

**Pre-Requisite:** Basic Knowledge of Animation is required

**Course Type:** Domain Elective

**Course Outcomes:** Students will be able to –

O6.0CA127E02.1. Understand the basic concept of computer graphics, Graphic devices, Graphics APIs, Graphics Pipeline, open-source 3D computer graphics software/tools.

O6.0CA127E02.2 Describe and identify the concept of Character setup.

O6.0CA127E02.3. Apply the concept of 3D Muscle system in Animation

O6.0CA127E02.4. Analyze the Surfacing concept and its practical usage in Animation.

O6.0CA127E02.5. Evaluate the role of 3D Lighting to design the Graphics and Animation.

O6.0CA127E02.6. Create different Animations using different tools and Rendering

**Unit-1: Introduction to Computer Graphics and Animation**

Introduction, History of computer graphics

Graphics Design overview, Types of computer graphics

2D & 3D computer graphics, Graphics areas, Graphic devices

Display techniques.

Major applications, Graphics APIs, Graphics Pipeline

Graphics transformation.

Open source 2D & 3D computer graphics software/tool

2D/3D Graphics Primitives

**Unit-2: Introduction to Character setup**

Riggers role & Criteria for a good rig

Joints and skeletons, Creating skeleton hierarchy, Constraints

Forward (FK) and Inverse kinematics (IK), FK, IK joint structures

Animation controllers, Blend shapes, Clusters, Biped Rig- Analyzing reference

Anatomy of human body, Bone placements, Setting up Torso, Biped Arms, Fingers, Legs/Foot controls, Skinning,

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**

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

### **Unit -4: Surfacing**

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

### **Unit -5: 3D Lighting**

Directional lights  
Spot lights,  
Types of lights in 3D space,  
Light attributes,  
3 Point lighting, 2 Point lighting,  
Shadows, photo real environmental lighting

### **Unit- 6: Rendering**

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

### **Suggested Books:**

Graphics and Animation Tools, IBM ICE Publication.  
Roland Hess, Blender Foundations - The essential Guide to learning Blender 2.6  
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

### **Guidelines for the End Semester Question Paper:**

The question paper will be divided into 2 parts, with one question in Part A and four questions in Part B. The questions will be of 20 marks each.



In Part A, the first question will consist of 10 conceptual questions (2 marks each) covering the entire syllabus and all the COs (up to BTL 3). There will be no choice in question 1.

In Part B (question number 2 to 5), there can be an internal choice between each of the questions covering the same (set) of COs and BTL. All COs will be covered in Part B.

**Distribution of Continuous Evaluation:**

Sessional- I	30%
Sessional- II	30%
Assignment/Tutorial	20%
Class Work/ Performance	10%
Attendance	10%

**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
O6.0CA127E02.1	-	1	-	2	3	-	-	-	-	-	-	-	-	1
O6.0CA127E02.2	-	1	-	2	3	-	-	-	-	-	-	-	-	1
O6.0CA127E02.3	-	1	2	-	-	-	-	-	-	-	-	-	-	-
O6.0CA127E02.4	-	-	-	2	3	-	-	-	-	-	-	-	2	-
O6.0CA127E02.5	-	-	-	2	-	-	-	-	-	-	-	-	2	-
O6.0CA127E02.6	-	-	-	2	3	-	-	-	-	-	-	-	3	-

**Manav Rachna International Institute of Research and Studies**  
(Deemed to be University under section 3 of UGC Act 1956)

**06.0CDC196C05: Placement Competency Enhancement-I**

L T P Credits  
6 1

Duration of Examination: 2 Hrs

Total Marks: 100

Continuous Evaluation: 50

End Semester Examination: 50

**Mode of End-Term Examination: Online + Practical**

**Course Type: SEC**

**Course Outcomes: The students will be able to:**

- 6.0CDC196C05.1: Enhance their reading and writing skills and accurately construct simple and complex sentences.
- 6.0CDC196C05.2: Enhance their personal effectiveness and become proficient in acing interviews.
- 6.0CDC196C05.3: Solve problems based on verbal reasoning
- 6.0CDC196C05.4: Solve problems based on number system, Percentage, Profit, Ratio, Time, Speed Distance
- 6.0CDC196C05.5: Apply advanced problem-solving techniques encompassing algorithms, arrays, searching, sorting, strings, recursion, OOP, and bit manipulation to solve complex programming challenges effectively.
- 6.0CDC196C05.6: Demonstrate competence in integrating algorithmic thinking and Object-Oriented Programming principles to develop solutions for real-world problems.

**PART – A (VERBAL ABILITY)**

**Unit 1: Communication Accuracy**

- Relevance of Verbal Ability and Preparatory Guidelines
- Functional Grammar – Subject Verb Agreement
- Tenses – Perfect, Simple, Continuous
- Common Errors and rectification, Idioms and Phrases
- Word Power Building Skills - Root word technique, antonyms, synonyms, verbal analogies

**Unit 2: Reading & Writing Skills**

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

**PART – B (INTERVIEW ENHANCEMENT )**

**Unit 3: Personal Effectiveness**

- Communication Enhancement
- Teamwork, Leadership & Entrepreneurship Skills
- Time Management
- Design Thinking
- Managing Personal Finance

**Unit 4: Interview Preparation-1**

- Developing the employability mindset and Researching the employer
- Preparing for Self -Introduction
- Drafting Cover letters / Emails
- Dressing Do's & Don'ts
- 4.5 Group Discussion

## PART – C (APTITUDE)

### Unit 5: Arithmetic

Numbers  
Percentages  
Profit and Loss  
Simple Interest & Compound Interest  
Ratio & Proportion  
Partnership  
Time Speed & Distance

### Unit 6: Reasoning

Blood Relation  
Coding Decoding  
Direction Sense

## PART – D

### Unit 7: Problem Solving

Mathematical Algorithm: Foundational problems (Factorial, HCF, GCD, LCM), Prime Number & Factorization, Sieve Algorithm.

7.1. Advance Patterns (based on Loops, Conditional statement)

### Unit 8: Array

8.1. Array 1D & 2D: Static, Dynamic size, Kadane's algorithm  
8.2. 2-pointer approach (same direction with same pace, same direction with different pace, and opposite direction)  
8.3. Sliding window technique

### Unit 9: Searching & Sorting

9.1 Linear, Binary Search (iterative and recursive),  
9.2. Problem-solving using various sorting algorithms

### Unit 10: Strings

10.1. String ASCII codes, Anagram, Substring & Subsequence  
10.2. Pattern searching (Naive Algorithm, KMP Algorithm, Z algorithm, Boyer Moore Algorithm)  
10.3. Rabin Karp Algorithm

### Unit 11: Recursion

11.1. Boundary/Corner base case condition, Tail recursion  
11.2. Recursion using arrays and strings

### Unit 12: OOPS & Bit Manipulation

12.1. Class, objects, Constructors, Static members, Function overloading and related concepts, Abstraction, Encapsulation, Inheritance, Polymorphism  
12.2. Bit Manipulation and Bitmasking

### Recommended Texts and Readings:

1. Aggarwal, R. S. (2018). Quantitative aptitude for competitive exams (7th ed.). S. Chand & Company Pvt. Ltd.
2. Sharma, A. (2014). How to prepare for logical reasoning for CAT (4th ed.). Tata McGraw Hill Education.
3. Wren, P. C., & Martin, H. (2017). High school English grammar and composition (Revised ed.). S. Chand & Company Pvt. Ltd.

4. Lewis, N. (2015). Word power made easy (1st ed.). Penguin Random House Pvt. Ltd.  
Prasoon, S. Group discussion

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5. Reed, J. (2017). Why you? 101 interview questions you'll never fear again (1st ed.). Penguin Books.
6. Karumanchi, N. (2016). Data structures and algorithms made easy (5th ed.). CareerMonk Publications.
7. <https://www.forbes.com/sites/bernardmarr/2022/07/26/10-most-important-leadership-skills-for-the-21st-century-workplace-and-how-to-develop-them/?sh=70b7ec254de6> (Last accessed - May 17, 2024)

**Assessment Tools:**

- Continuous Assessment: Assignments/ Activities/ Quiz
- Sessional examination (Online mode) at 2nd sessional
- Term-end examination (Practical + Online mode)

**Internal Marks Distribution:**

Sessional examination (At the time of 2nd sessional)	30 marks
Continuous assessment	15 marks
Attendance	5 marks

**Course Articulation Matrix:**

Course Outcome (CO)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
O6.0CDC196C05.1	2	-	-	-	-	-	-	-	2	-	-	-	2	-
O6.0CDC196C05.2	-	-	-	-	-	3	3	-	-	-	-	-	3	3
O6.0CDC196C05.3	-	2	-	-	-	-	-	-	-	-	-	-	2	-
O6.0CDC196C05.4	-	2	-	-	-	-	-	-	-	-	-	-	2	-
O6.0CDC196C05.5	-	3	3	-	2	1	-	-	-	-	-	2	-	2
O6.0CDC196C05.6	-	3	3	-	-	1	-	-	-	-	2	2	-	2

**06.0CA100C09: 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  
06.0CA100C09.1 Understand the structured programming designs and the basic elements of Computer Programming  
06.0CA100C09.2 Describe and differentiate various types of Open Source Software  
06.0CA100C09.3. Construct program code using simple and nested selection/decision control structure to make decision.  
06.0CA100C09.4. Use pre& post tested loop/repetitive control structure while writing program code to process same sequence of tasks/activities.  
06.0CA100C09.5. 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**

- 2.1 Flow Chart
- 2.2 Pseudo 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, 7<sup>th</sup> 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)

**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:

- (lxiii) 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%

- (lxiv) 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	PO1 1	PO1 2	PSO 1	PSO 2
O6.0CA100C09. 1	1				2	1	3	2	1	-			2	1
O6.0CA100C09. 2		3	2	1			3			3		1		3
O6.0CA100C09. 3	1	3	2	2	2				1				2	1
O6.0CA100C09. 4	2	1		1	2							1	2	2
O6.0CA100C09. 5	1	1	2		2	1				2			2	2



**O6.0CA101C09: ELEMENTS OF MATHEMATICS**

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

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

**Pre-Requisite: None**

**Course Type: Fundamental**

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

- O6.0CA101C09.1. Understand the concept of matrices and various operations performed on matrices
- O6.0CA101C09.2. Learn basic concepts of probability
- O6.0CA101C09.3. Use different types of functions
- O6.0CA101C09.4. Develop the concept of Set, Relations and Function
- O6.0CA101C09.5. 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.**

**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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Projects/Group Activities etc	15%

- (Ivi) 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
O6.0CA101C09.1	1		1	2	2		3						3	1
O6.0CA101C09.2	1	1	2	3	1		2						3	1
O6.0CA101C09.3	1	2	2	1	2								2	1
O6.0CA101C09.4	1	1	2	1	1		3						1	2
O6.0CA101C09.5	1	1	2	1			2	3					2	2

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