



**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**

**(BACHELOR OF COMPUTER APPLICATIONS)**

**(ONLINE DEGREE PROGRAMME)**

**BATCH: July 2025 Onwards**

## Preamble

The programme BCA 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 Programme Education Objectives (PEOs) of BCA 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 BCA student talent pool that can serve the IT technological needs of the national and global software industry. Many courses are meant to meet the IT technological needs such as Data Warehousing, Python Programming, RDBMS using Oracle , Programming in .NET using C#, Introduction to Cloud Computing etc. Also subjects like Elements of Mathematics And Mathematical Foundations of Computer Science are offered to enhance the basic mathematical skills of regional students.

The curriculum includes courses focusing on employability, entrepreneurship and skill development which map strongly with the POs defining demonstration of technical knowledge and engagement in independent and life-long learning. Examples of such courses are Employability Augmentation, Employability Skills, Entrepreneurship Development and various lab courses based on numerous dimensions of computer applications.

Certain courses are meant to create awareness about the environment and sustainability and inculcate professional ethics, like Environmental Studies, Social Media Norms & Etiquette. Also, various activities are organized to inculcate human values and respect for the other genders.

The design of curriculum is done in accordance with the predetermined Programme Education Objectives. The syllabus content of each course is meticulously created to develop thorough understanding and gain in-depth knowledge. 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 programme outcomes and programme 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, projects etc.

Although the curriculum has 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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# **MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH & STUDIES**

(Deemed to be University under section 3 of the UGC Act1956)

## **CENTRE FOR DISTANCE AND ONLINE EDUCATION**

### **VISION AND MISSION OF THE DEPARTMENT**

#### **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 facilitates 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**

The ultimate touchstone of quality education is the quality culture permeating in any education Institution. In today's world of digitization, technical education stands at the crossroads of keeping pace with the emerging needs of humankind along with fast changing trends in governance and scientific development. The global transformation, trend of learning by doing, relevance to people and nation development – Manav Rachna International Institute of Research and Studies is the right place to gear up with a world class competitive edge. We are trusted to nurture juvenile minds and prepare them to deal with challenges of their future endeavors. Continuing the Legacy of our Founder Dr. O.P Bhalla, Manav Rachna has launched —Manav Rachna Centre for Distance and Online Education to provide quality programmes to those students who are not able to draw benefits from conventional systems of Education. Seven programmes in different streams namely Computer Applications, Management, Commerce, Business Administration and Economics will be offered by university in online mode with specialization in different domains. In Today's opportunistic world specialized education is essential for successful professional life. Manav Rachna Centre for Distance and Online Education has collaboration with prominent industry partners to provide global career opportunities to the students and prepare the students to acquire the increased technology intensive needs of today. In addition, Manav Rachna Centre for Distance and Online Education provides a multidisciplinary approach for the students to shape their career inside and outside their domain of education and to meet the evolving needs of the society. The commitment of multidisciplinary education is to broaden the participation of students in higher education and leads to a more diverse community. In a multidisciplinary approach, students are inspired to select divergent courses from different disciplines to expand their knowledge, discover themselves through creative thinking and learn the skills of collaboration. The online programmes will help the students to achieve an academic degree along with flexibility and relaxation. These online programs hold equal academic value to an on-campus degree and help students in developing themselves into an industry ready as equivalent to a conventional degree. Students can perfectly reshape their career and

future through impeccably designed online programmes. The renowned faculty, cutting –edge advanced curriculum, technology driven and a remarkable content delivery will be helpful in the successful implementation of online programs.

## **PROGRAMME EDUCATION OBJECTIVES (PEOs)**

The objective of the programme is to develop students to work in the field of computer applications in various sectors. The BCA programme is focused on exposing students to business application areas. The programme provides a strong foundation with an integrated understanding of information technology-based applications. The programme 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 BCA programme tends more towards software application development and exposure to the latest software tools and techniques to develop the applications.

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

When the above objectives are achieved, the graduates will be:

- a. Well-prepared for successful careers in industry / consultancy / research & development / teaching and allied areas related to the subjects of computer applications.
- b. Academically prepared to lead organizations they join or start.
- c. Engage in professional and extension activities in the field of computer applications & its allied areas and contribute to the profession and society at large by pushing the frontiers in technology.
- d. Successful in higher education in allied areas and in management, if pursued, leading to masters and research programmes.
- e. Groomed as software developers, enabling them to contribute effectively to the growth and development of the knowledge body.

## **PROGRAMME SPECIFIC OUTCOMES (PSOs)**

PSO1. Explore technical comprehension in varied areas of computer applications and experience a conducive environment in cultivating skills for thriving career and higher studies.

PSO2. Comprehend, explore and build up computer programs in the allied areas like Algorithms, System Software, Multimedia, Web Design and Data Analytics for efficient design of computer-based systems of varying complexity.

## **PROGRAMME 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. These Outcomes are statements that

describe what students are expected to know or do by the time of 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 programme outcomes are the following:

**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: 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 economic, environmental, social, health, legal, ethical issues involved in the use of computer technology and other consequential responsibilities relevant to professional practice.

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

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

## MAPPING OF PEOs WITH POs and PSOs

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

<b>PO12</b>	Innovation and Entrepreneurship: Identify opportunities,	<b>1,3</b>
	entrepreneurship vision and use of innovative ideas to create value and wealth for the betterment of the individual and society.	
<b>PSO1</b>	Explore technical comprehension in varied areas of Computer Applications and experience a conducive environment in cultivating skills for thriving career and higher studies.	<b>2,4</b>
<b>PSO2</b>	Comprehend, explore and build up computer programs in the allied areas like Algorithms, System Software, Multimedia, Web Design and Data Analytics for efficient design of computer-based systems of varying complexity.	<b>1</b>

## 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 practice in a week.

### **(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, students 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

For the Award of Degree of a programme Bachelor of Computer Applications, he/she has to earn a minimum 120 credits during the 3-year duration of the programme in 6 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 86 credits required to be earned under —Compulsory Courses Basket and 34 credits under —Elective Courses Basket.

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

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

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

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

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

**Semester Study Scheme with contact hours, assigned credits & distribution of marks:**

BCA SEMESTER- I								
S.No.	Course Type	Course Code	Title of Course	Continuous Assessment	End Semester Exam	Total	Duration of Exam	Credits
1	Foundation	O4.5CA100C00	Elements of Mathematics	30	70	100	3	4
2	Core	O4.5CA100C01H	Introduction to IT & Programming in C	30	70	100	3	5
3	Core	O4.5CA101C01H	Web Technologies	30	70	100	3	2
4	Core	O4.5CA102C01H	Database Management System	30	70	100	3	4
5	AEC	O4.5SBSS100C04	Indian Knowledge System	30	70	100	3	2
6	SEC	O4.5CDC196C05	Placement Competency Enhancement – I	30	70	100	3	1
7	Core	O4.5QA100C04	Introduction to Sustainable Development Goals	30	70	100	3	2
TOTAL								20

BCA SEMESTER- II								
S.No.	Course Type	Course Code	Title of Course	Continuous Assessment	End Semester Exam	Total	Duration of Exam	Credits
1	Foundation	O4.5CA200C00	Mathematical Foundation of Computer Science	30	70	100	3	4
2	Core	O4.5CA200C01H	Data Structures using C	30	70	100	3	5
3	Core	O4.5CA201C01H	Object Oriented Programming using Java	30	70	100	3	4
4	AEC	O4.5SET100C04	Environmental Studies	30	70	100	3	4
5	SEC	O4.5CA200C05	Digital Editing & Motion Graphics	30	70	100	3	2
6	SEC	O4.5CDC296C05	Placement Competency Enhancement-II	30	70	100	3	1
<b>Elective Courses (Any 1)</b>								
7	Open Elective	O4.5CACS200E02	Information Security Fundamentals and Ethical Hacking	30	70	100	3	4
		O4.5CAAI200E02	Cloud Fundamentals					
		O4.5CADS200E02	Statistics for Machine Learning					
<b>TOTAL</b>								<b>24</b>

BCA SEMESTER- III								
S.No.	Course Type	Course Code	Title of Course	Continuous Assessment	End Semester Exam	Total	Duration of Exam	Credits
1	Core	O5.0CA100C01	Digital Logic and Computer System Architecture	30	70	100	3	3
2	Core	O5.0CA101C01H	Python Programming	30	70	100	3	2
3	Core	O5.0CA102C01	Software Engineering	30	70	100	3	3
4	Core	O5.0CA152C01	Minor Project-I	30	70	100	3	2
5	Internship	O5.0CA100C06	Internship	100	-	100	3	1
6	AEC	O5.0SBSS100C04	Universal Human Values	30	70	100	3	2
7	SEC	O5.0FLGR00E03	Foreign Language-I (German)	30	70	100	3	2
8	SEC	O5.0CA100C05	Research Innovation Catalyst I	100	-	100	3	1
9	SEC	O5.0CDC196C05	Placement Competency Enhancement-III	30	70	100	3	1
<b>Elective Courses (Any 1)</b>								
10	Open Elective	O5.0CAAI100E02	Cloud Based AI Solutions	30	70	100	3	4
		O5.0CACS100E02	Network Monitoring, Assessment, Troubleshooting and Risk Management					
		O5.0CADS100E02	Programming for Data Science					
<b>TOTAL</b>								<b>21</b>

BCA SEMESTER- IV								
S.No.	Course Type	Course Code	Title of Course	Continuous Assessment	End Semester Exam	Total	Duration of Exam	Credits
1	Core	O5.0CA200C01	Numerical Analysis and Statistical Techniques	30	70	100	3	4
2	Core	O5.0CA201C01H	Operating System	30	70	100	3	4
3	SEC	O5.0FLGR00E03	Foreign Language	30	70	100	3	2
4	SEC	O5.0CA200C05	Research Innovation Catalyst II	100	-	100	3	1
5	SEC	O5.0CDC296C05	Placement Competency Enhancement-IV	30	70	100	3	1
6	Audit Pass	O5.0SAHS100C09	Sports & Yoga	30	70	100	3	0
<b>Elective Courses (Any 1)</b>								
7	Discipline Electives	O5.0CA200E02	Introduction to Data Science	30	70	100	3	3
		O5.0CA201E02	Fundamentals of Artificial Intelligence & Machine Learning					
		O5.0CA202E02	Introduction to Cyber Security, Cyber laws & Act					
<b>Elective (Any 1)</b>								
8	Discipline Electives	O5.0CAAI200E02	Cloud Based ML Solutions	30	70	100	3	4
		O5.0CACs200E02	Cyber Security Framework and digital forensics					
		O5.0CADS200E02	Data Management Techniques					
<b>TOTAL</b>								19

BCA SEMESTER- V								
S.No.	Course Type	Course Code	Title of Course	Continuous Assessment	End Semester Exam	Total	Duration of Exam	Credits
1	Core	O5.5CA100C001H	Computer Networks	30	70	100	3	4
2	Core	O5.5CA101C001H	Computer Graphics	30	70	100	3	4
3	SEC	O5.5SCA100C05	Research Innovation Catalyst III	100	-	100	3	1
4	Internship	O5.5CA100C06	Summer Internship	30	70	100	3	2
Elective Courses								
5	Discipline Elective	O5.5CA100E02	Data Visualization using Python	30	70	100	3	3
		O5.5CA101E02	Introduction to Block Chain					
		O5.5CA102E02	Full Stack Development					
6	Discipline Elective	O5.5CA103E02	Data Warehousing & Data Mining	30	70	100	3	3
		O5.5CA104E02	Fundamentals of Open-Source Software					
		O5.5CA105E02	System Programming					
Elective (Any 1)								
7	Discipline Elective	O5.5CAAI100E02	Advanced Cloud Based ML Solutions	30	70	100	3	4
		O5.5CACs100E02	Security of cloud-based platforms					
		O5.5CADs100E02	Visual Statistics and Model Building					
TOTAL								21

BCA SEMESTER- VI								
S.No.	Course Type	Course Code	Title of Course	Continuous Assessment	End Semester Exam	Total	Duration of Exam	Credits
1	Dissertation	O5.5CA200C07	Major Project	30	70	100	3	6
Elective Courses								
2	Discipline Elective	O5.5CA200E02H	Cloud Computing	30	70	100	3	4
		O5.5CA201E02H	Soft Computing					
3	Discipline Elective	O5.5CA202E02	Mobile Application Development	30	70	100	3	3
		O5.5CA203E02	Advanced Web Technologies					
4	Discipline Elective	O5.5CA204E02H	Digital Image Processing	30	70	100	3	4
		O5.5CA205E02H	Mobile Computing					
		O5.5CA206E02H	Ethical Hacking					
TOTAL								17

# **First Semester**

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**O4.5CA100C00: ELEMENTS OF MATHEMATICS**

**Credits: 4**

**Max. Marks: 100**

**Duration of Examination: 3 Hrs.  
70**

**Continuous Evaluation: 30**

**End Semester Examination:**

**Pre-Requisites: NA**

**Course Type: Foundation**

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

- O4.5CA100C00.1 Understand the concept of matrices along with its operations
- O4.5CA100C00.2 Analyze the concept of power and exponent.
- O4.5CA100C00.3 Compute word problems using permutation and combination.
- O4.5CA100C00.4 Demonstrate the rules of continuity and differentiation to evaluate elementary functions.
- O4.5CA100C00.5 Apply the concept of power series to find the expansion of any given function.

**UNIT 1: Matrices and Determinants**

- 1.1 Matrices
- 1.2 Types of matrices
- 1.3 Operation on matrices
- 1.4 Scalar multiplication and multiplication of matrices
- 1.5 Determinant
- 1.6 Inverse of matrices, Cramer's Rule
- 1.7 Rank of matrix

**UNIT 2: Indices and Surds**

- 2.1 Basics of indices
- 2.2 Applications of indices
- 2.3 Basics of surds
- 2.4 Applications of surds
- 2.5 Concept of Logarithm
- 2.6 Applications of Logarithm

**UNIT 3: Binomial and Permutations, Combinations**

- 3.1 Definition and basics of binomial theorem
- 3.2 Positive index
- 3.3 Applications of binomial theorem (Only positive index)
- 3.4 Basics of Permutations and Combinations

**UNIT 4: Trigonometry**

- 4.1 Systems of measuring angles
- 4.2 Trigonometric functions
- 4.3 Identities and signs
- 4.4 Values of t-ratios
- 4.5 t-ratios of allied angles
- 4.6 Addition and subtraction formulae
- 4.7 Transformation of products into sum or difference of t-ratios

#### **UNIT 5: Continuity and Differentiation**

- 5.1 Elementary results on limits
- 5.2 Continuity
- 5.3 Differentiation
- 5.4 Derivatives of composite functions
- 5.5 Differentiation of implicit functions
- 5.6 Differentiation of parametric forms

#### **UNIT 6: Taylor's & Maclaurin's Theorems**

- 6.1 Definition of Taylor's theorem
- 6.2 Application of Taylor's theorem
- 6.3 Definition of Maclaurin's Theorems
- 6.4 Applications of Maclaurin's Theorems
- 6.5 Applications to expansion of functions.

#### **Suggested Readings:**

1. Dr. Babu Ram, 2012, Engineering Mathematics, Pearson Education
2. D. C. Sancheti, V K Kapoor, 2014, Business Mathematics, Sultan Chand
3. Birkhauser, 2009, 103 Trigonometry Problems, Universities Press
4. Shanti Narayan, 2005, Differential Calculus, S.Chand

**Note: Only latest editions of the books are recommended.**

#### **Web links:**

1. [http://www.hec.ca/en/cam/help/topics/Matrix\\_determinants.pdf](http://www.hec.ca/en/cam/help/topics/Matrix_determinants.pdf)
2. <http://www.kkuniyuk.com/PrecalcBook/Precalc08.pdf>
3. [https://www.oup.com.au/\\_data/assets/pdf\\_file/0028/58276/IM9\\_5.2-5.3\\_ch11\\_Surds\\_and\\_indices.pdf](https://www.oup.com.au/_data/assets/pdf_file/0028/58276/IM9_5.2-5.3_ch11_Surds_and_indices.pdf) [http://www.schurzhs.org/ourpages/auto/2015/9/6/44741179/Chapter%205%20Indices%20and%20Surds%20pg\\_%2096%20-%20135.pdf](http://www.schurzhs.org/ourpages/auto/2015/9/6/44741179/Chapter%205%20Indices%20and%20Surds%20pg_%2096%20-%20135.pdf) (Last visited date:21 May 2024)
4. <https://www.vedantu.com/ncert-solutions/ncert-solutions-class-10-maths-chapter-8-introduction-to-trigonometry> (Last visited date:21 May 2024)
5. [http://www.ctr.maths.lu.se/media/MATA14/2014ht2014/Taylor\\_series.pdf](http://www.ctr.maths.lu.se/media/MATA14/2014ht2014/Taylor_series.pdf) (Last visited date:21 May 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:

(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:**

CO-PO Statement	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
O4.5CA100C00.1	1	1		2			2	3						
O4.5CA100C00.2	1	1		2			3	3						
O4.5CA100C00.3	1	1	1		2		3	3					2	1
O4.5CA100C00.4	1	1	1	2	2		2	3					1	
O4.5CA100C00.5	1	1		2			3	3						

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**O4.5CA100C01H: INTRODUCTION TO IT & PROGRAMMING IN C**

**Credits: 5**

**Max. Marks: 100**

**Continuous Evaluation: 30**

**Duration of Examination: 3 hrs**

**End Semester Examination: 70**

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**Pre-Requisites:** NA

**Course Type:** Core

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

**O4.5CA100C01H.1:** Identify different programming methods like top-down and bottom-up and explain how computer hardware and software work together.

**O4.5CA100C01H.2:** Understand how parts of a problem are connected and draw flowcharts, write pseudo-code, and use decision tables to find solutions.

**O4.5CA100C01H.3:** Understand the basic concepts and building blocks of C programming.

**O4.5CA100C01H.4:** Design and implement programs using C language constructs, including decision-making structures, loops, and dynamic memory management

**O4.5CA100C01H.5:** Compare different ways to solve a problem using algorithms and choose the best one.

**O4.5CA100C01H.6:** Design and build simple programs to solve real-life or mathematical problems using structured programming.

**UNIT 1: Information Technology Fundamentals**

1.1 Introduction to Computers: Basics of computer, Characteristics of computers, Limitations of computers, Number System, System Components, Input devices, Output devices, Computer Memory

1.2 Introduction to Assemblers

1.3 Introduction to Compilers, Interpreters, Linkers

1.4 Techniques of Problem-Solving: Flowcharting, Algorithm, Pseudocode

1.5 Browser and Internet basics.

1.6 Email and Social Media Tools

**UNIT 2: Basics of C Language and its Preprocessor**

2.1 Preprocessor: various preprocessor directives.

2.2 Tokens, identifiers and keywords; constants and variables

2.3 Program structure

2.4 Data Types

2.5 Operators: Arithmetic; Relational; Logical; Bitwise; Increment; Decrement; Assignment, Conditional operators

2.6 Compilation and execution of C program in DOS

**UNIT 3: I/O Functions and Control Statements**

3.1 Built in I/O functions: getch(); getche(); getchar(); putchar();

3.2 Console based formatted I/O: printf(); scanf()

3.3 Selection: if; nested if; If-else-if

- 3.4 Iteration: for; while and do-while loop
- 3.5 Alternative and Jump: switch statement; break; continue; goto; exit() function

**UNIT 4: Arrays and String**

- 4.1 Arrays: Single- and two-dimensional arrays
- 4.2 Accessing and Initializing an Array
- 4.3 Advantages and Disadvantages of Arrays
- 4.4 Applications of Arrays
- 4.5 Concept of Strings
- 4.6 String Manipulation Functions
- 4.7 String I/O functions: gets() ,puts(),getchar() and putchar().

**UNIT 5: Functions**

- 5.1 Functions: Declaration and definition
- 5.2 Function Prototype
- 5.3 Passing parameters to Functions
- 5.4 Sharing variables between functions
- 5.5 Variable scope: local and global variables
- 5.6 Call by reference and call by value
- 5.7 Introduction to recursion

**UNIT 6: Structure and Union, Pointers**

- 6.1 Structure and Union: Declaration and initializing
- 6.2 Accessing members
- 6.3 Array of structure and union
- 6.4 Pointers: Basics of pointer
- 6.5 Pointer operator
- 6.6 Application of pointer
- 6.7 Precedence of &,\* operators.
- 6.8 Array and Pointers; Dynamic memory allocation (malloc (), calloc () realloc())

**Suggested Readings:**

1. Byron Gottorfried, 2010, Schaum’s Outline of Programming with C, Tata McGraw- Hill.
2. E. Balaguruswami, 2010, Programming in ANSI ‘C’, Tata McGraw- Hill.
3. Yashwant Kanetkar, 2017, Let Us C, BPB Publications
4. Ashok Kamthane, 2006, Programming with ANSI and TURBO C, Pearson Publications

**Note: Only the latest editions of the books are recommended.**

**List of Experiments:**

**BEGINNER LEVEL (NSQF LEVEL: 1-3)**

S. No.	Name of the Program	Bloom Level with Cognitive Process
1	Write a Program to perform arithmetic operations (Addition, Subtraction, Multiplication, Division) on two numbers.	Apply (Performing arithmetic operations) / L3
2	Write a Program to calculate gross salary of an employee [using formula: gross_sal =	Apply (Using arithmetic

	basic_sal+hra+da].	expressions) / L3
3	Write a Program to find sum and reverse of a three-digit number.	Apply (Manipulating digits using basic operations) / L3
4	Write a Program to swap two numbers without using a third variable.	Apply (Using arithmetic logic) / L3
5	Write a Program to print a table of any number.	Apply (Using loops for repeated operations) / L3
6	Write a Program to find greatest among three numbers.	Apply (Using conditional statements) / L3
7	Write a Program to check whether entered year is a leap year or not.	Apply (Using conditional branching) / L3
8	Write a Program to find whether a given number is even or odd.	Apply (Using modulus operator and conditional statements) / L3
9	Write a Program to find the roots of a Quadratic Equation.	Apply (Applying quadratic formula) / L3
10	Write a Program to use switch statement to display Monday to Sunday.	Apply (Using control structures - switch case) / L3
11	Write a Program to calculate power of a number using #DEFINE.	Apply (Using macros and mathematical operations) / L3

#### INTERMEDIATE LEVEL (NSQF LEVEL: 4-6)

S. No.	Name of the Program	Bloom Level with Cognitive Process
12	Write a program to display the first 10 natural numbers and calculate their sum.	Apply (Using loops and arithmetic operations) / L3
13	Write a program to calculate the factorial of a given number.	Apply (Using loops and recursive logic) / L3
14	Write a program to generate the Fibonacci series up to 'n' terms.	Apply (Using iterative or recursive methods) / L3
15	Write a program to print a pattern of stars in increasing sequence.	Apply (Nested loops for pattern generation) / L3
16	Write a program to check whether a given number is a palindrome or not.	Apply (Using loops and conditional checking) / L3
17	Write a program to find the maximum number in an array.	Apply (Array traversal and comparison operations) / L3
18	Write a program to search an element in an array.	Apply (Using linear search technique) / L3
19	Write a program to calculate the sum of two matrices.	Apply (Matrix manipulation and arithmetic operations) / L3
20	Write a program to perform subtraction of two matrices.	Apply (Matrix operations using arrays) / L3
21	Write a program to perform multiplication of two matrices.	Apply (Nested loops and matrix multiplication logic) / L3
22	Write a program to find the transpose of a matrix.	Apply (Matrix manipulation using nested loops) / L3
23	Write a program to concatenate two strings without using the built-in strcat function.	Apply (String manipulation using loops)

		/ L3
24	Write a program using functions to check whether a number is Prime and/or Armstrong.	Apply (Modular programming and mathematical operations) / L3
25	Write a program to convert a binary number to decimal and vice-versa.	Apply (Number system conversion techniques) / L3
26	Write a program to create, initialize, assign, and access a pointer variable.	Apply (Understanding and using pointers) / L3
27	Write a function that reverses the elements of an array in-place, accepting a pointer and returning void.	Apply (Pointer manipulation and array operations) / L3
28	Write a program to create a structure Student containing Roll No., Name, Class, Year, and Total Marks.	Apply (Using structures for data organization) / L3
29	Write a program to add two distances (in feet and inches) using structures.	Apply (Using structures and arithmetic operations) / L3
30	Write a program to add two complex numbers by passing structures to a function.	Apply (Passing structures to functions for computation) / L3

#### ADVANCED LEVEL (NSQF LEVEL: 7-10)

S. No.	Program Statement	Bloom's Level with Cognitive Process	Programs Mapped with Ability Enhancement Courses (IKS / SDG / EVS / FinTech)
31	Write a C program to calculate the Air Quality Index (AQI) for PM2.5 pollutant based on CPCB NAQI standards. Input PM2.5 concentration and display the AQI category (Good, Satisfactory, Moderate, Poor, Very Poor, Severe).	Apply (Using conditional logic and CPCB standard mapping) / L3	EVS
32	Write a C program to calculate the Body Mass Index (BMI) using weight and height inputs. Display BMI value and corresponding health status (Underweight, Normal, Overweight, Obese).	Apply (Mathematical computation and conditional display) / L3	SDG
33	Write a C program to recommend the ideal daily water intake based on weight, using the formula Water Intake = weight $\times$ 0.033. Display result with hydration tips.	Apply (Simple arithmetic formula application) / L3	SDG
34	Write a C program to calculate the Life Path Number from a date of birth (DD- MM-YYYY) by summing all digits until a	Apply (Digit extraction and iterative sum) / L3	IKS

	single-digit number is obtained.		
35	Write a C program to calculate the day of the week for a given Gregorian date using Zeller's Congruence and display its Sanskrit weekday name (e.g., Somvar, Mangalvar).	Analyze (Algorithm application and traditional mapping) / L4	IKS
36	Write a C program to take the speed of a vehicle as input and determine if a fine needs to be charged based on predefined over-speeding rules. Calculate and display the fine amount.	Apply (Conditional branching and decision making) / L3	SDG
37	Write a C program to calculate the approximate positions of the Moon, Sun, and Earth based on a Gregorian date using simplified astronomical formulas. Display celestial positions or phases.	Analyze (Use of scientific approximations and computation) / L4	IKS
38	Write a C program to simulate a simple FinTech transaction: Take user input for account balance and transaction amount; check for sufficient funds, perform a transaction, and print the updated balance or a decline message.	Apply (Financial transactions and validations) / L3	FinTech

### Suggested Readings:

1. E. Balaguruswami, 2010, Programming in ANSI 'C', Tata McGraw- Hill.
2. Ashok Kamthane, 2006, Programming with ANSI and TURBO C, Pearson Education.
3. K R. Venugopal, 2016, Mastering C, Tata McGraw Hill.
4. Herbert Schildt, 2017, The Complete Reference, Tata McGraw Hill.

**Note: Only the latest editions of the books are recommended.**

### Software required/Web links:

GCC Compiler, Dev C++

<https://sourceforge.net/projects/orwelldvcpp/> (Last accessed: April 28, 2025).

<http://www.codeblocks.org/> (Last accessed: April 28, 2025)

**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:**

CO-PO/ Statement	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO12	PSO1	PSO2
<b>O4.5CA100C 01H.1</b>	3	2					2					2	3	3
<b>O4.5CA100C 01H.2</b>	2	3	2	2			2					2	3	3
<b>O4.5CA100C 01H.3</b>	3	2					2					2	3	3
<b>O4.5CA100C 01H.4</b>	2	3	3	2	3		2				2	3	3	3
<b>O4.5CA100C 01H.5</b>	2	3	3	2	2		2				2	3	3	3
<b>O4.5CA100C 01H.6</b>	2	2	3	2	3		2				2	3	3	3

# MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

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

## O4.5CA101C01H: WEB TECHNOLOGIES

**Credits: 2**

**Max. Marks: 100**

**Duration of Examination: 3 Hrs**

**Continuous Evaluation: 30**  
**End Semester Examination: 70**

**Pre- Requisites:** NA

**Course Type: Core**

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

**O4.5CA101C01H.1** Understand the concept of the World Wide Web, its structure, and basic applications.

**O4.5CA101C01H.2** Design and develop static web pages using HTML and CSS to display content and enhance visual appeal.

**O4.5CA101C01H.3** Apply CSS techniques for styling, including layout, colors, fonts, and multimedia to create interactive web pages.

**O4.5CA101C01H.4** Implement JavaScript for dynamic content interaction, event handling, and form validation to improve user experience.

**O4.5CA101C01H.5** Compare and explore server-side scripting and database integration for developing dynamic, real-world web applications.

### **UNIT 1: Introduction to Networks, Protocols and Web Technologies**

- 1.1 History of Networks & Their Types
- 1.2 Internet and its applications
- 1.3 Internet Addressing
- 1.4 History and Evolution of the Web
- 1.5 Web Architecture and Components
- 1.6 Web Standards and the W3C
- 1.7 Different Web Browsers and their Characteristics
- 1.8 Search Engines and their Features

### **UNIT 2: User Interface Design using HTML**

- 2.1 Introduction to HTML
- 2.2 Different HTML Documents
- 2.3 Basic Structure of HTML Document
- 2.4 Markup Tags used in HTML
- 2.5 Heading-Paragraphs and Line Breaks
- 2.6 Elements of HTML: Working with Text
- 2.7 Working with Hyperlinks
- 2.8 Images and Multimedia used in HTML

### **UNIT 3: Lists, Tables and Forms in HTML**

- 3.1 Lists in HTML
- 3.2 Ordered and Unordered List

- 3.3 Definition List and Directory List
- 3.4 HTML table and its Structure
- 3.5 Table Formatting, Spanning of multiple rows and columns.
- 3.6 Forms in HTML
- 3.7 Creating Forms using <FORM> tag
- 3.8 Named Input Fields: Text Box; Radio Button; Check Box; List Box; Combo Box
- 3.9 Creating Submit, Reset Button, and Multiple Line Text Windows

#### **UNIT 4: Cascading Style Sheets (CSS)**

- 4.1 Introduction to Cascading Style Sheets
- 4.2 The Need for Style Sheets
- 4.3 Basic Syntax and Structure of Style Sheets
- 4.4 Inline Style sheets; Internal Style sheets; External Style sheets; Embedding Style sheets
- 4.5 Linking External Style sheets
- 4.6 Background; Manipulating Text; Margins and Padding
- 4.7 Positioning using CSS

#### **UNIT 5: JavaScript Basics**

- 5.1 Introduction to JavaScript
- 5.2 Variables, Data Types, and Operators
- 5.3 Control Structures: Conditionals and Loops
- 5.4 Functions and Scope
- 5.5 Events and Event Handling
- 5.6 Manipulating the DOM
- 5.7 Objects and Array
- 5.8 Asynchronous JavaScript: Callbacks, Promises, and Async/Await
- 5.9 Error Handling and Debugging
- 5.10 Using JavaScript Libraries (e.g., jQuery)

#### **UNIT 6: Server-Side Scripting and Introduction to Databases**

- 6.1 Introduction to Server-Side Technologies
- 6.2 Setting up a Server with Node.js and Express.js
- 6.3 Building RESTful APIs
- 6.4 Middleware and Routing
- 6.5 Overview of Other Server-Side Languages: PHP, ASP.NET
- 6.6 Introduction to Databases and Basics of SQL
- 6.7 Connecting to Databases from Server-Side Scripts
- 6.8 Performing CRUD Operations
- 6.9 Introduction to NoSQL Databases (e.g., MongoDB)

#### **Suggested Readings:**

1. Ivan Bayross, 2005, HTML, DHTML, PERL, CGI, BPB Publications.
2. Behrouz A. Forouzan, 2013, Data Communication and Networking, McGraw Hill.
3. Stuart Langridge, 2005, DHTML Utopia - Modern Web Design Using JavaScript & DOM, Sitepoint.
4. Elizabeth Castro, 2013, HTML 4 for World Wide Web: Visual Quick Start Guide, Peachpit Press.

**Note: Only the latest editions of the books are recommended.**

**Software required/ Weblinks:**

1. W3schools.com (Last visited date: 17 May 2024)
2. <https://www.tutorialspoint.com/html/> (Last visited date:17 May 2024)
3. <https://www.csstutorial.net/> (Last visited date:17 May 2024)
4. <https://javascript.info/> (Last visited date:17 May 2024)

**List of Experiments:****BEGINNER LEVEL (NSQF LEVEL: 1-3)**

<b>S. No.</b>	<b>Program</b>	<b>Bloom Level with Cognitive Process</b>
1	Create a simple HTML page using basic tags.	Apply (Using basic HTML tags) / L3
2	Create a web page that displays your name to the screen.	Apply (Using HTML to display content) / L3
3	Create a web page and show the output from 1 to 10 in separate lines.	Apply (Using HTML to display multiple lines) / L3
4	Create a web page and show the output from 1 to 10 in separate lines, each number being in different colour.	Apply (Using HTML and CSS for color styling) / L3
5	How do I make a picture as a background on my web pages?	Understand (Using CSS for background image) / L2
6	Create a web page to print a paragraph with 4-5 sentences, each sentence shall have a different font.	Apply (Using HTML and CSS for different fonts) / L3
7	Write HTML code to print a paragraph that is a description of a book, it shall include the title of the book, its author name; name and title should be underlined and all adjectives shall be bold and Italics.	Apply (Using HTML for text formatting and structure) / L3
8	Write HTML code to print your name using Heading tag, every letter shall be of different heading size.	Apply (Using HTML heading tags and size attributes) / L3
9	Write HTML code to print the sequence of numbers 1-20. Each number shall be in a different line with number 2 next to it as subscript, an equal sign and the result.	Apply (Using HTML, subscript, and mathematical operations) / L3
10	Write HTML code to display an image with a border of size 200x200 pixels, leaving Hspace and Vspace of your choice with the image hanging on the right side of the screen.	Apply (Using HTML and CSS for image formatting and positioning) / L3

**INTERMEDIATE LEVEL (NSQF LEVEL: 4-6)**

<b>S. No.</b>	<b>Program</b>	<b>Bloom Level with Cognitive Process</b>
11	Write HTML code to create a web page with a heading at the top-center and an image below it, centered on the page using basic HTML and CSS.	Apply (Using HTML and CSS for basic page layout) / L3
12	Write HTML code to use multimedia tags like <audio> and	Apply (Using HTML multimedia tags) / L3

	<video> for including audio and video on a webpage.	
13	Create a table in HTML using rowspan and colspan to organize	Apply (Using HTML table with
	student records, displaying name, roll number, and marks.	rowspan and colspan) / L3
14	Write HTML code to create a table using <table> tag and set the cellpadding and cellspacing attributes to control spacing within and around the table cells.	Apply (Using HTML table attributes) / L3
15	Create unordered, ordered, and definition lists for your subjects in MCA 1st, 2nd, and 3rd semesters using HTML <ul>, <ol>, and <dl> tags.	Apply (Using HTML list tags) / L3
16	Write HTML code using <frameset> and <frame> tags to display multiple sections of a webpage with scrollable frames.	Apply (Using frames for webpage layout) / L3
17	Write HTML code to design a simple form with controls like textbox, textarea, password, submit button, browse button, and a drop-down menu.	Apply (Creating a form with HTML form elements) / L3
18	Design a basic registration form using HTML with controls like textboxes, radio buttons, and a submit button.	Apply (Designing a form with HTML controls) / L3
19	Write HTML code to create a student admission form with fields like name, roll number, course, etc., and a submit button.	Apply (Creating a student admission form using HTML) / L3
20	Create a simple home page for yourself using HTML components like headings, paragraphs, images, and links, and apply styles.	Apply (Designing a basic home page) / L3
21	Write HTML code to create a local hyperlink that links to another page or section within the same webpage using anchor <a> tags.	Apply (Creating a local hyperlink) / L3
22	Write HTML code to create an inter hyperlink that links to another webpage or section within a different page using anchor <a> tags.	Apply (Creating an inter hyperlink) / L3
23	Write HTML code to create an external hyperlink that links to a completely different website using anchor <a> tags.	Apply (Creating an external hyperlink) / L3
24	Write HTML code to link an external CSS file to your HTML page using the <link> tag.	Apply (Linking external CSS file) / L3
25	Write HTML code to include internal CSS within a <style> tag inside the <head> section of the webpage.	Apply (Using internal CSS) / L3
26	Write HTML code to use inline CSS styles within an element using the style attribute.	Apply (Using inline CSS) / L3
27	Write a JavaScript program to add two numbers using an HTML form and display the result.	Apply (Using HTML form and JavaScript to perform a

		calculation) / L3
28	Write a JavaScript program to swap two images on mouseover using the onmouseover event.	Apply (Using JavaScript to manipulate DOM with events) / L3
29	Write a simple JavaScript program to sort an array of numbers in ascending order and display the result.	Apply (Using JavaScript to sort arrays) / L3
30	Write a JavaScript program to take three numbers from the user, find the minimum and maximum, and display them in bold text in the specified format: MINIMUM = [value], MAXIMUM = [value].	Apply (Using JavaScript for user input, logic, and DOM manipulation) / L3

### ADVANCED LEVEL (NSQF LEVEL: 7-10)

S.No.	Name of the Program	Bloom level with Cognitive process	Programs mapped with Ability Enhancement Courses
1	Create a personal blog webpage where you can showcase posts about various topics, such as technology, lifestyle, travel, etc. Each blog post will include a title, an image, and a short description. This	Create (Web Design) / L3	IKS
	webpage will have a navigation bar at the top with links to different categories, allowing the user to navigate between different blog sections.		
2	Design a contact form webpage that allows visitors to send messages to the site owner. The form will include fields for the user's name, email, subject, and message. It will also include a button to submit the form. This program will practice handling form inputs and basic form submission concepts.	Apply (Form Handling) / L3	IKS
3	Design a webpage for an online store that displays products for sale. Each product will have an image, description, and price. The page will be divided into sections for different product categories (e.g., Electronics, Clothing, Accessories). Use CSS to style the layout, ensuring it looks visually appealing.	Create (eCommerce Design) / L3	FinTech

4	Create a web page to help individuals and organizations estimate the amount of CO2 they could potentially save by transitioning from traditional fossil fuel-based energy sources (such as coal or natural gas) to renewable energy sources, specifically solar power. By entering their monthly energy consumption (in kWh), users can calculate the estimated reduction in CO2 emissions they would achieve by using solar energy instead of coal or natural gas. The program provides output that shows the amount of CO2 saved per month, making it a useful tool for individuals and businesses looking to understand the environmental impact of their energy choices and promote sustainable practices.	Analyze (Energy Calculations) / L4	EVS
5	Develop a web application where users can input their daily water usage for activities like showering, toilet flushing, dishwashing, and washing clothes, and the application will calculate total water consumption, compare it with sustainable standards, and provide personalized tips for reducing water usage to promote water conservation and sustainability.	Evaluate (Sustainability Analysis) / L5	SDG

**Suggested Readings:**

1. Ivan Bayross, HTML, DHTML, PERL, CGI, BPB Publications.
2. Behrouz A. Forouzan, Data Communication and Networking, McGraw Hill.
3. Stuart Langridge, DHTML Utopia - Modern Web Design Using JavaScript & DOM, Sitepoint.
4. Elizabeth Castro, HTML 4 for World Wide Web: Visual Quick Start Guide, Peachpit Press.

**Software required/Weblinks:**

Notepad / Notepad++ / Visual Studio Code / Sublime  
Text Web Browser (Google Chrome / Mozilla Firefox)

<https://www.tutorialspoint.com/java/index.htm> (Last visited Date: 28 April 2025)

<https://www.javatpoint.com/java-tutorial> (Last visited Date: 28 April 2025)

<https://archive.nptel.ac.in/courses/106/105/106105191/> (Last visited Date: 16 April 2025)

**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:**

CO-PO Statement	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
O4.5CA101C01H.1	3	2					2			2		2	3	2
O4.5CA101C01H.2	2	2	3		3		2				2	2	3	3
O4.5CA101C01H.3	2	2	3		3		2				2	2	3	3
O4.5CA101C01H.4	2	2	3	2	3		2				2	3	3	3
O4.5CA101C01H.5	2	3	3	2	3		2				2	3	3	3

# MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

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

## O4.5CA102C01H: DATABASE MANAGEMENT SYSTEM

**Credits: 4**

**Max. Marks: 100**

**Continuous Evaluation: 30**

**Duration of Examination: 3 Hrs**

**End Semester Examination: 70**

**Pre-Requisites: NA**

**Course Type: Core**

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

**O4.5CA102C01H.1** Learn the basic concepts of databases and understand the three-schema architecture of database systems.

**O4.5CA102C01H.2** Study and apply various strategies of database security, recovery, and performance optimization.

**O4.5CA102C01H.3** Create tables and databases using SQL and apply queries based on given conditions.

**O4.5CA102C01H.4** Analyze and design interfaces that work with normalized databases to ensure efficient structure.

**O4.5CA102C01H.5** Develop a complete database schema from a problem statement to conceptualize and implement database design.

### **UNIT 1: Introduction to Database**

- 1.1 Database: Definition
- 1.2 Characteristics of database approach
- 1.3 Components of a DBMS
- 1.4 Advantages and disadvantages of a DBMS
- 1.5 Applications of DBMS
- 1.6 Database system Vs file system
- 1.7 Three level architecture of a DBMS
- 1.8 DBMS architecture

### **UNIT 2: Data Modeling using Entity Relationship Model**

- 2.1 Data Independence: physical independence; logical independence
- 2.2 Data Dictionary
- 2.3 Role of DBA
- 2.4 Data Models: Hierarchical, Network, Relational Data Models
- 2.5 Introduction: Entities; Entity types; Entity set; Attributes
- 2.6 E-R Diagram; Case Studies to represent E-R Diagram

### **UNIT 3: Domains, Keys and SQL**

- 3.1 Concept of Keys: Primary Key; Candidate Key; Composite Key; Alternate Key; Secondary Key; Foreign Key
- 3.2 Constraints: Relational Constraints, Domain Constraints, Key Constraints, Integrity Constraints

- 3.3. Relational Algebra: set operations; basic operations
- 3.4. Relational calculus
- 3.5 Introduction to SQL: History of SQL; Basic Structure
- 3.6 DDL Commands, DML Commands
- 3.7 SQL functions: Character functions, Aggregate Functions, Date functions

#### **UNIT 4: Normalization**

- 4.1 Anomalies in databases and its solution
- 4.2 Functional dependencies: Full, Partial, Transitive, Multi-valued
- 4.3 Introduction to normalization
- 4.4 Advantages of Normalization
- 4.5 Normal Forms: 1NF, 2NF, 3NF, BCNF for Relational Databases
- 4.6 Case study to implement normalization on data

#### **UNIT 5: Concurrency Control**

- 5.1 Transaction Management: Introduction; Transaction properties; Transaction states
- 5.2 Introduction to Concurrency Control
- 5.3 Problems of concurrent transaction
- 5.4 Locks: Introduction; types of locks
- 5.5 Algorithms of concurrency control

#### **UNIT 6: Advanced Concepts in Databases**

- 6.1 Data base Security: Introduction; security risks
- 6.2 Techniques to implement data base security
- 6.3 Data base Recovery: Introduction; causes of failure
- 6.4 Recovery Methods: log-based recovery; checkpoints; shadow paging
- 6.5 Introduction to Distributed Databases

#### **Suggested Readings:**

1. R.Elmasri, S.B. Navathe, 2016, Fundamentals of Database Systems, Pearson Education/Addison Wesley
2. Parteek Bhatia, Gurvinder Singh, 2016, Simplified approach to DBMS, Kalyani Publishers
3. Thomas Cannolly and Caroly
4. Henry F Korth, Abraham Silberschatz, 2011, Database System Concepts, McGraw Hill

**Note: Only latest editions of the books are recommended.**

#### **Software required/Weblinks:**

- ORACLE 10g
- <https://www.tutorialspoint.com/dbms> (Last visited date: 21 May 2024)
- <https://www.w3schools.in> > DBMS (Last visited date: 21 May 2024)

## List of Experiments

### BEGINNER LEVEL (NSQF LEVEL: 1-3)

#### Q1: Create the following tables

Student

Column_name	Data type	Size	Constraint
StudentId	Number	4	Primary Key
Student name	Varchar2	40	Not null
Address1	Varchar2	300	
Gender	Varchar2	15	
Course	Varchar2	8	

Course:

CourseID	Data type	Size	Constraint
DeptNo	Number	2	Primary Key
Dname	Varchar2	20	
Location	Varchar2	10	

1. Insert five records into each table.
2. List all information about all students from the Student table.
3. List all student IDs along with their respective courses.
4. List course names and their corresponding locations from the Course table.
5. List the details of students enrolled in the MCA course.
6. List the names of students whose IDs are 7369, 7777, and 2233.
7. List the names of students not belonging to department 10 or 40.
8. List the names of students who are not assigned any course.  
List the names of students whose names start with uppercase "S".
9. List the names of students whose names end with the letter "s".
10. Display examples of all arithmetic functions used in SQL.
11. List the student names, course fees, and 10% of the fee as scholarship amount.
12. List student names having "k" as the second character.

13. List the students not assigned to any department.
14. List student details in ascending order by course.
15. Count the number of students enrolled in the BCA course.
16. Count the total number of students in the student table.
17. Create a table with a primary key constraint.
18. Create a table with all columns having NOT NULL constraints.
19. Create a foreign key constraint referencing the Course table.
20. Create a table with a UNIQUE key constraint on a column.
21. Display different students from departments 1 and 2.
22. Display the list of students ordered by course.
23. Display an alphabetically sorted list of student names.

**Q2: Create the tables Customer and Orders as per the following:** Table CUSTOMER

column name Characteristic	
SID	Primary Key
Last_Name	
First_Name	

Table ORDERS

column name Characteristic	
Order_ID Primary Key	
Order_Date	
Customer_SID Foreign Key	
Amount	Check > 20000

1. Insert five records for each table

Column_name	Data type	Size	Constraint
-------------	-----------	------	------------

2. The Customer\_SID column in the ORDERS table is a foreign key pointing to the SID column in the CUSTOMER table.
3. List the details of the customers along with the amount.
4. List the customers whose names end with "s".
5. List the orders where amount is between 21000 and 30000
6. List the orders where amount is increased by 500 and replace with name "new"

- amount”.
7. Display the order\_id and total amount of orders
  8. Calculate the total amount of orders that has more than 15000.
  9. Display all the contents of s4 and s5 using union clause.
  10. Find out the intersection of s4 and s5 tables.
  11. Display the names of s4 and s5 tables using left, right, inner and full join.
  12. Display the first name of employee and their managers using self-join.
  13. Find out the names of s4 which are distinct
  14. Write a query to Grant access and modification rights to customer table to user
  15. Write a query to revoke access rights to customer table to user
  16. Write a query to take backup of a database
  17. Write a query to restore a database

### **INTERMEDIATE LEVEL (NSQF LEVEL: 4-6)**

Case Study:

Develop three different methods to combine data from multiple tables into single result. Tables are:

Event

Column_name	Data type	Size	Constraint
Event_id	Varchar2	6	Primary Key
Duration	Number	20	
Status_code	Varchar2	6	Foreign Key
Reason_code	Varchar2	15	Foreign Key

Status

Column_name	Data type	Size	Constraint
Status_code	Varchar2	6	Primary Key
Name	Char	20	

Ready Reason

Reason_code	Varchar2	15	Primary Key
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Name	Char	20	
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Delay Reason

Column_name	Data type	Size	Constraint
Reason_code	Varchar2	15	Primary Key
Name	Char	20	

Method 1: Joining to the Status table to get the status name (using Inner Join).

Method 2 : Utilizing UNION to Combine Reason Table Rows

**ADVANCED LEVEL (NSQF LEVEL: 7-10)**

1. Design a database management system to help cities or municipalities efficiently manage and track sustainable urban transport options, such as electric buses, carpooling systems, and bicycle rentals. The system will allow administrators to track the number of vehicles, energy consumption, passenger load, and operational efficiency, providing insights for improvement and making the transport system more eco-friendly.

**Database Design:**

- A vehicles table to store information about electric vehicles (ID, type, model, energy consumption, etc.)
- A routes table for storing information about various bus routes (Route ID, start location, end location, distance, etc.).
- A passenger\_data table for storing information about passengers (Passenger ID, name, contact details, total trips taken, etc.).
- A trips table to record each trip made by the vehicle, including its route, date, energy consumption, number of passengers, etc.
- A sustainability\_metrics table to store the data related to the emission savings, energy consumption, and operational efficiency.

2. Design and implement a Waste Management and Recycling System using SQL to track waste disposal, recycling operations, and the overall efficiency of waste management processes. The system will help organizations or municipalities to monitor and manage their waste collection and recycling processes, estimate the environmental impact of recycling, and track sustainability metrics. The main goal is to allow organizations to effectively manage the types of waste collected, the recycling process, and the environmental benefits (e.g., CO2 emissions reduced) of recycling efforts.

**Database Design:**

- A waste\_types table to store information about various types of waste (e.g., plastic, glass, organic, electronic, etc.).
- A collection\_centers table for storing information about the locations where waste is collected (ID, name, location).
- A collection\_schedule table to store the schedule of waste collection for different types of waste (date, collection center, waste type).
- A recycling\_facilities table to store information about recycling plants (ID, name, location, recycling capacity).
- A recycling\_records table for storing the quantity of waste recycled by type and facility.
- A sustainability\_metrics table to store data related to CO2 emission reductions, energy saved, and amount of recycled waste.

### **UserRoles:**

- **Administrator:** Can add/update/delete waste types, collection centers, recycling facilities, and schedule collections.
  - **Waste Collector:** Can update waste collection records and report waste collection statistics.
  - **Recycling Facility Operator:** Can update recycling operations and track how much waste has been recycled.
3. Design and implement a database-driven system to manage vehicle access control using RFID tags. The system should maintain a database to store vehicle-related information along with their associated RFID tags and wallet balances. It must include a mechanism (using queries or triggers) to automatically allow or deny a vehicle's passage based on the current wallet balance. If sufficient balance is available, the system should deduct a predefined toll amount and allow the vehicle to pass. If the balance is insufficient, the passage should be denied. Additionally, the system must support functionality to recharge the wallet as required.
  4. Design and implement a database-based solution to automate the billing system for a grocery store. The system should maintain a database to store information about products (including product ID, name, price, and stock quantity), customers, and transactions. Upon generating a bill, the system should allow the entry of multiple products purchased by a customer, calculate the total bill amount including applicable taxes (e.g., GST), and update the product stock accordingly. The solution must also include the ability to view past bills and customer purchase history using appropriate queries.

### **Suggested Readings:**

1. Parteek Bhatia, Gurvinder Singh, 2016, Simplified approach to DBMS ,Kalyani Publishers
2. IyanByross, 2010, Introduction to PL/SQL, BPB Publications

**Note: Only the latest editions of the books are recommended.**

### **Software required/Web links: Oracle Live SQL**

<https://livesql.oracle.com/>

<https://www.tutorialspoint.com/sql> (Last accessed: April 28, 2025)

<https://www.w3schools.com/sql/> (Last accessed: April 28, 2025)

**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:**

CO-PO/ Statement	PO1	P O2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO12	PSO1	PSO2
O4.5CA102C01H.1	3	2					2					2	3	2
O4.5CA102C01H.2	2	3	2	2	2		2				2	2	3	3
O4.5CA102C01H.3	2	3	3	2	3		2				2	2	3	3
O4.5CA102C01H.4	2	3	3	2	3		2				2	2	3	3
O4.5CA102C01H.5	2	3	3	2	3		2				2	3	3	3

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

**Indian Knowledge System (IKS)**

**O4.5SBSS100C04**

**Credits** 2

**Maximum marks : 100**

**Continuous Assessment : 30**

**End Semester Examination: 70**

**Duration of theory examination: 2hrs.**

**Prerequisites: Nil**

**Course Type: AEC**

**Course Outcomes**

After completion of this course, the students will be able to:

**O4.5SBSS100C04.1:** Understanding the scientific value of the traditional knowledge of Bhārata.

**O4.5SBSS100C04.2:** Understand the contribution of Indian minds in various fields.

**O4.5SBSS100C04.3:** Know the contributions made by ancient Indians in the field of knowledge.

**O4.5SBSS100C04.4:** Link ancient wisdom in the current context

**O4.5SBSS100C04.5:** Develop a comprehensive understanding of various schools of thoughts.

**Module 1: Introduction to IKS**

- 1.1 What is Indian Knowledge System
- 1.2 Indian Culture & Civilization
- 1.3 Indian Architecture
- 1.4 Indian Philosophical System

**Module 2: Kalas and Vidyas of Ancient India**

- 2.1 64 Kalas
- 2.2 14 Vidyas (Vedas, UpaVedas, Vedangas)

**Module 3: Introduction to Health Regimen**

- 3.1 Understanding Swastha vritta
- 3.2 Healthy regimen to maintain state of wellbeing Dinacharya
- 3.3 Daily regimen including Daily detoxification, exercise, Intake of Food, Water, Air and Sunlight, work and ergonomics, Rest and sleep hygiene
- 3.4 Ritu charya, the seasonal regimen
- 3.5 Sadvritta and the concept of social wellbeing
- 3.6 Concept of Shadrassa in choosing appropriate nourishment to the body and mind.

**Module 4: Introduction to Indian Psychology**

- 4.1 Concept of Manas in Ayurveda and understanding Mind Body harmony
- 4.2 Triguna based Psychology in Ayurveda and Yoga
- 4.3 Influence of Tri dosha on Mind, Mind body intellect and consciousness complex

#### 4.4 Understanding Consciousness and solution to issues within Human Mind

### **Module 5: Engineering, Technology and Architecture**

5.1: Pre-Harappan and Sindhu Valley Civilization

5.2: Laboratory and Apparatus, Juices, Dyes

5.3: Paints and Cements

5.4: Glass and Pottery

#### **Text Books/ Reference Books:**

1. Mahadevan, B., Bhat Vinayak Rajat, Nagendra Pavana R.N. (2022), "Introduction to Indian Knowledge System: Concepts and Applications", PHI Learning Private Ltd. Delhi.
2. Pride of India: A Glimpse into India's Scientific Heritage, Samskrita Bharati, New Delhi.
3. Sampad and Vijay (2011). "The Wonder that is Sanskrit", Sri Aurobindo Society, Puducherry.
4. Acarya, P.K. (1996). Indian Architecture, Munshiram Manoharlal Publishers, New Delhi.
5. Kapoor Kapil, Singh Avadhesh (2021). "Indian Knowledge Systems Vol – I & II", Indian Institute of Advanced Study, Shimla, H.P.
6. Dasgupta, S. (1975). A History of Indian Philosophy- Volume 1, Motilal Banarsidass, New Delhi
7. P Lofker, K. (1963). Mathematics in India, Princeton University Press, New Jersey, USA"

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**NAAC 'A++' Grade University**

**Subject Code: O4.5CDC196C05**  
**Placement Competency Enhancement-I**

**Credits : 1**

**Max. Marks: 100**

**Internal Evaluation: 30**

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

**End Semester Examination: 70**

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

**O4.5CDC196C05.1:** develop an all-round personality by mastering interpersonal skills to function effectively in different circumstances.

**O4.5CDC196C05.2:** demonstrate effective communication through grammatically correct language.

**O4.5CDC196C05.3:** apply effective listening and speaking skills in real-life scenarios.

**O4.5CDC196C05.4:** solve problems based on the number system, Average & Progression.

**O4.5CDC196C05.5:** solve problems based on verbal reasoning & simplification.

**Unit 1: Attitudinal Communication**

1.1 Attitude and its Impact on Communication

1.2 Courtesy & Politeness in Communication

1.3 Diversity & Inclusion – Bullying, Cultural Sensitivity, Stereotypes, Sexual Harassment, LGBTQ, Respect, Chivalry, Racial & Gender Discrimination, Disability Harassment, Inclusion.

**Unit 2: Syntactical Communication - I**

2.1 Common errors in communication

2.2 Identification of word class

2.3 Errors & rectifications in

2.3.1 Article usage

2.3.2. Tenses usage - Present Perfect vs. Past Simple vs. Past Perfect

2.3.3 Subject Verb Agreement

**Unit 3: Phonetics**

3.1 Impact of First Language Influence

3.2 Tone

3.3 Intonation

3.4 Rate of Speech

3.5 Pronunciation: Vowels & Consonant sounds

#### **Unit 4: Developing Communication Skills -I (Listening & Speaking)**

4.1 Concept of LSRW: Importance of LSRW in communication.

4.2 Listening Skills: Real-Life challenges, Barriers to Listening

4.3 Speaking: Self Introduction, Interview, GD, Resume

### **Part B**

#### **Unit 5: Number System**

##### **5.1 Vedic Mathematics**

5.1.1 Basic mathematics

5.1.2 Addition and subtraction using Vedic Mathematics

5.1.3 Multiplication of two and three numbers.

##### **.2 Simplification**

5.2.1 BODMAS rule

5.2.2 Fractions and recurring decimals

5.2.3 Surds and indices

##### **5.3. Numbers**

5.3.1 Types of numbers and number tree

5.3.2 Divisibility Rule

5.3.3 HCF & LCM

5.3.4 Factors and Multiples

5.3.5 Unit Digits & Cyclicity

5.3.6 Remainders

5.3.7 Factorials

#### **Unit 6: Arithmetic 1**

6.1 Averages

6.2 Progressions

6.3 Logarithm

## Unit 7: Logical Reasoning 1

7.1 Direction Sense Test

7.2 Blood Relation Test

7.3 Ranking

### Recommended Texts and Readings:

1. Abrams, D. A. (2019). Diversity and inclusion: The big six formula for success (1st ed.). Da Abrams Books.
2. Wren, P. C., & Martin, H. (2017). High school English grammar and composition (Revised ed.). S. Chand & Company Pvt. Ltd.
3. Lewis, N. (2015). Word power made easy (1st ed.). Penguin Random House Pvt. Ltd.
4. Estrada, C. (2021). Soft skills for the rigid worker: How to authentically lead, effectively manage, and master interpersonal relationships (1st ed.). Anti Fragile Media Group.
5. Vyner, J. (2018). Mastering soft skills (1st ed.). Matador.
6. <https://www.mckinsey.com/featured-insights/mckinsey-explainers/what-is-diversity-equity-and-inclusion>

(Last accessed: May 9, 2024)

### Course Articulation Matrix:

Course Outcome (CO)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2
O4.5CDC196C05.1	-	-	-	-	-	-	3	-	2	-	3	3	-	-
O4.5CDC196C05.2	-	-	-	-	-	-	2	-	3	-	3	-	-	-
O4.5CDC196C05.3	-	-	-	-	-	-	2	-	3	-	3	-	-	-
O4.5CDC196C05.4	2	3	2	3	-	-	-	-	-	-	-	-	-	2
O4.5CDC196C05.5	2		2	3	-	-	-	-	-	-	-	-	-	2

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

**INTRODUCTION TO SUSTAINABLE DEVELOPMENT GOALS**

**COURSE CODE: O4.5QA100C04**

**Credits: 2**

**Max. Marks: 100**

**Continuous Evaluation: 30**

**End Semester Exam: 70**

**Duration of Examination: 3hrs**

**Course Outcomes:**

The student will be able to:

**CO1:** Describe the UN 17 Sustainable Development Goals (SDGs) and their importance.

**CO2:** Identify major Sustainability Challenges by understanding the Environmental, Social and Economic dimensions of SDGs.

**CO3:** Demonstrate an ability to participate in building Sustainable Communities by applying the concepts of Sustainable Development.

**CO4:** Recognize the global implications of their actions by understanding their social, environmental, and economic responsibility as future professionals and citizens.

**Unit 1: Introduction to Sustainable Development**

- 1.1 Introduction to sustainable development, aspects of sustainability, developments vs sustainable development
- 1.2 Transition from Millenium Development Goals (MDPs) to Sustainable Development Goals (SDGs), Development and adoption of SDGs by the United Nations, India and SDGs: A vision for 2030
- 1.3 SDGs overview: Goals and targets, Status (Global and Indian), overview of key global sustainability challenges (inequality, climate change, poverty) including modern world social, environmental and economic structures and crises.

**Sample Assignment/Case Study Topics:**

Short essay on the significance of sustainable development. Summary of each of the 17 SDGs and their importance.

**Unit 2: Overview of Goal 1: No Poverty, Goal 2: Zero Hunger and Goal 3: Good Health & Well Being**

- 2.1 Understanding SDG 1 and its targets, understanding poverty: absolute, relative and multidimensional, Causes of poverty, Key indicators of poverty, global and local perspectives: rural and urban poverty, eradication of poverty for access to basic services, role of community anti- poverty programmes and strategies for inclusive economic growth.

- 2.2** Understanding SDG 2 and its targets, types of hunger and malnutrition: global and local perspectives, the global hunger index, components of food security, food insecurity: barriers to food security, solutions to improve food access and support local farmers, emerging trends in sustainable agriculture and food security.
- 2.3** Understanding SDG 3 and its targets, means of implementation for the targets, sustainable health and lifestyle practices, global health trends, threats and challenges, public health strategies and systems for controlling communicable and non-communicable diseases, maternal and child health: reducing maternal and child mortality rates, mental health: awareness and access to care, occupational health: safety and work-life balance, reproductive health and rights, environmental health and protection, health education and promotion, policies for inclusive and equitable health access.

**Sample Assignment/Case Study Topics:**

Case study analysis on a successful poverty or hunger alleviation initiative. Campus  
 Rally on Zero Food Wastage  
 Analysis of Food Wastage across Campus: All Cafeterias, Hostels  
 Analysis of Current Health Initiatives in India  
 Awareness programmes on Mental Health

**Unit 3: Overview of Goal 4: Quality Education, Goal 5: Gender Equality and Goal 6: Clean Water & Sanitation**

- 3.1** Understanding SDG 4 and its targets, importance of quality education for sustainable development, strategies for inclusive and equitable education, role of digital education and e-learning in today's scenario, importance of vocational training and skills development, research and innovation in quality education.
- 3.2** Understanding SDG 5 and its targets, gender equality and its impact on sustainable development, basic concepts of gender, gender identity and gender roles, international conventions and frameworks supporting gender equality, indicators and metrics for measuring gender equality progress, role of community engagement and awareness training for gender equality.
- 3.3** Understanding SDG 6 and its targets, importance of water and sanitation for sustainable development, strategies to improve access to safe drinking water, factors affecting water quality, importance of sanitation and hygiene for health, water conservation: wastewater management & water resource management, sustainable agriculture practices to conserve water, role of digital tools for water management.

**Sample Assignment/Case Study Topics:**

Research paper on impact of quality education initiatives in India  
 Essay on the challenges and strategies for achieving gender equality or reducing inequality  
 Case studies on sustainable water and energy projects  
 Institution wide Pledge on Water Conservation

**Unit 4: Overview of Goal 7: Affordable & Clean Energy, Goal 8: Decent Work & Economic Growth, Goal 9: Industry, Innovation & Infrastructure and Goal 11: Sustainable Cities & Communities**

- 4.1 Understanding SDG 7 and its targets, types of energy sources & technologies, importance of clean energy and energy efficient technologies for sustainable development, sustainable energy management policies.
- 4.2 Understanding SDG 8 and its targets, economic growth & job creation for sustainable development, factors influencing economic growth, strategies for inclusive growth, global employment trends and challenges.
- 4.3 Understanding SDG 9 and its targets, role of innovation & infrastructure in sustainable development, strategies for sustainable industrialization, concept of industry 4.0, best practices for fostering innovation and technological advancements.
- 4.4 Understanding SDG 11 and its targets, trends & patterns of urbanization & sustainable city planning, social, economic & environmental challenges of urbanization, impact of rapid urbanization on infrastructure & services, importance of green & public spaces for urban quality of life.

**Sample Assignment/Case Study Topics:**

Analysis of ILO Reports on global employment trends

Examples of successful infrastructure and sustainable projects

Case study analysis on lessons learnt from successful urban initiatives Campus wide

Awareness on Energy conservation

**Unit 5: Overview of Goal 12: Responsible Consumption & Production, Goal 13: Climate Action, Goal 14: Life Below Water and Goal 15: Life on Land**

- 5.1 Understanding SDG 12 and its targets, importance of sustainable consumption & production for overall sustainability, strategies to promote sustainable consumption, challenges & importance of effective waste management practices (reduce, reuse, recycle), concept of green procurement practices and its benefits, strategies for raising awareness in promoting sustainable consumption.
- 5.2 Understanding SDG 13 and its targets, importance of combating climate change for sustainable development, evidence & indicators of climate change, impact of climate change in public health, strategies for climate resilient agriculture, importance of education in promoting climate action.
- 5.3 Understanding SDG 14 and its targets, importance of oceans, seas & marine resources/ diversity for global sustainability, sources & types of marine pollution, its Impact on ecosystems & human health, strategies for reducing & managing marine pollution, balancing economic development with marine conservation, importance of education & awareness in marine conservation.
- 5.4 Understanding SDG 15 and its targets, importance of terrestrial ecosystems & biodiversity for sustainable development, sustainable forest management & biodiversity conservation practices, combating desertification, strategies for wildlife conservation, role of technology in monitoring & conserving terrestrial ecosystems.

**Sample Assignment/Case Study Topics:**

Examples of successful sustainable consumption and production initiatives best practices followed by successful action initiatives

Examples of successful marine conservation and sustainable use initiatives

Case study analysis on successful conservation and sustainable land management initiatives

## **Unit 6: Overview of Goal 10: Reduced Inequalities, Goal 16: Peace, Justice & Strong Institutions, Goal 17: Partnership for the Goals**

- 6.1** Understanding SDG 10 and its targets, importance of reducing inequality for sustainable development, types of inequality (Economics, Social, Political), role of education in reducing inequality, best practices for implementing & scaling effective inequality reduction strategies.
- 6.2** Understanding SDG 16 and its targets, importance of peace, justice & strong institutions for sustainable development, strategies for conflict prevention, resolution & peace building, strategies for promoting fair & effective justice systems, strategies for strengthening democratic & inclusive institutions.
- 6.3** Understanding SDG 17 and its targets, importance of global partnerships for sustainable development, strategies for building and maintain effective partnerships, strategies for integrating the SDGs into national & local development plans. Role of governments, NGOs, and private sector in achieving SDGs.

### **Sample Assignment/Case Study Topics:**

Case study analysis on successful policies and programs for reducing inequality Examples of successful initiatives promoting peace, justice and strong institutions

Examples of successful global partnerships, successful initiatives & best practices in global partnerships

Group project on developing a partnership strategy for achieving a specific SDG

### **Suggested Readings:**

1. The Sustainable Development Goals in Higher Education: A Transformative Agenda? 1st ed. 2021 Edition, by Wendy Steele (Author), Lauren Rickards (Author)
2. SDGs, Transformation, and Quality Growth: Insights from International Cooperation (Sustainable Development Goals Series) 1st ed. 2022 Edition, by Akio Hosono (Author)
3. United Nations document on the 2030 Agenda for Sustainable Development
4. NPTEL course link: Education for Sustainable Development: [https://onlinecourses.nptel.ac.in/noc22\\_hs61/preview](https://onlinecourses.nptel.ac.in/noc22_hs61/preview)
5. Coursera Course: The Sustainable Development Goals – A global, transdisciplinary vision for the future: <https://www.coursera.org/learn/global-sustainable-development>
6. Coursera Course: The Age of Sustainable Development: <https://www.coursera.org/learn/sustainable-development>
7. Coursera Course: The Great Sustainability Transition: Global challenges, Local actions: <https://www.coursera.org/learn/sustainability-global-challenges-and-local-actions>
8. Coursera Course: Sustainable Development - Ideas and Imaginaries: <https://www.coursera.org/learn/sustainable-development-ideas-and-imaginaries>

# Second Semester

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

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

**O4.5CA200C00: MATHEMATICS FOUNDATION OF COMPUTER SCIENCE**

**Credits: 4**

**Max. Marks: 100**

**Continuous Evaluation: 30**

**Duration of Examination: 3Hrs**

**End Semester Examination: 70**

**Pre-Requisite:** Elements of Mathematics

**Course Type:** Foundation

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

O4.5CA200C00.1 Understand the knowledge of mathematical foundations of computer science.

O4.5CA200C00.2 Solve problems involving sets, functions, relations, Principle of Mathematical Induction and Lattices.

O4.5CA200C00.3 Evaluate Boolean functions and simplify expression using the properties of Boolean algebra; apply Boolean algebra to circuits and gating networks.

O4.5CA200C00.4 Demonstrate the knowledge about the recursive functions and their properties. Apply their working knowledge in Graph theory.

O4.5CA200C00.5 Appraise the Cartesian system and apply the principles and concept of coordinate Geometry in real-time problems

**Unit 1: Concepts of set, relation and functions**

1.1 Set: Cardinality

1.2 Set-operations

1.3 Relations

1.4 Posets

1.5 Matrix of Relation

1.6 Equivalence Relations

1.7 Operation Functions

**Unit 2: PMI, Pigeonhole Principle**

2.1 Principles of Mathematical Induction

2.2 Greatest Common Divisor (GCD)

2.3 Euclidean Algorithms

2.4 Application of Euclidean Algorithm

2.5 The Pigeonhole Principle

2.6 Application to solve problems based on Pigeonhole Principle

**Unit 3: Lattices and Boolean algebra**

3.1 Lattices

3.2 Definition of Lattices

- 3.3 Properties
- 3.4 Lattice isomorphism
- 3.5 Types of lattices
- 3.6 Boolean Algebra
- 3.7 Definition and basic properties
- 3.8 Representation Theorems
- 3.9 Boolean expressions
- 3.10 Boolean functions (Disjunctive Normal form (DNF) & Conjunctive Normal form (CNF))

#### **Unit 4: Recurrence Relations**

- 4.1 Definition
- 4.2 Order of the recurrence relation
- 4.3 Degree of the difference equation
- 4.4 Linear recurrence relations with constant coefficients
- 4.5 Linear homogeneous recurrence relations with constant coefficients
- 4.6 Particular solutions (Homogeneous equations)

#### **Unit 5: Co-ordinate Geometry**

- 5.1 Quadrant Planes
- 5.2 Distance Formula
- 5.3 Section Formula
- 5.4 Bisection Formula
- 5.5 Slope
- 5.6 Equation of Straight Line (One Point Form & Two Point Form)
- 5.7 Intercept Form
- 5.8 Normal form
- 5.9 Angle between two lines
- 5.10 Condition of Concurrency of Three Lines.

#### **Unit 6: Graph Theory**

- 6.1 Definition & Basic concepts
- 6.2 Properties
- 6.3 Types of graphs
- 6.4 Matrix representation of graphs
- 6.5 Minimum spanning graphs
- 6.6 Trees
- 6.7 Spanning tree of a graph and minimum distance trees
- 6.8 Minimum weight and minimum distance spanning trees

#### **Suggested Readings:**

1. Babu Ram, 2009, Engineering Mathematics, Pearson Education
2. Schaum Series, 2017, Discrete Mathematics, Tata McGraw Hill
3. R.C. Joshi, 2007, Discrete Mathematics for Computer Students, New Academic Publishing
4. Satinder Bal Gupta, 2008, Discrete Mathematics, Laxmi Publications

**Note: Only latest editions of the books are recommended.**

**Web links:**

<https://www.bu.edu/lernet/artemis/years/2011/slides/settheory.pdf><http://home.cc.umanitoba.ca/~thomas/Courses/InductionExamplesSolutions.pdf>  
<https://andromeda.rutgers.edu/~loftin/discfal06/sampletest2sol.pdf><http://faculty.uml.edu/klevasseur/ads2/c13/c13a.pdf>  
[http://www.schurzhs.org/ourpages/auto/2015/9/6/44741179/Chapter%208%20Coordinate%20Geometry%20pg\\_%20200%20-%20243.pdf](http://www.schurzhs.org/ourpages/auto/2015/9/6/44741179/Chapter%208%20Coordinate%20Geometry%20pg_%20200%20-%20243.pdf) (Last accessed: May 12, 2024)  
<http://nms.lu.lv/wp-content/uploads/2016/04/21-linear-recurrences.pdf>(Last accessed: May 12, 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:

(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%  
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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:**

CO-PO Statement	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
O4.5CA200C00.1	1	3	3	2	1		1						2	3
O4.5CA200C00.2	2	1	2				1						2	3
O4.5CA200C00.3	1	2	1				2	2	3	1			2	3
O4.5CA200C00.4	1	3	3	2										3
O4.5CA200C00.5	3	2	2	2	1								3	3

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

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

**O4.5CA200C01H: DATA STRUCTURES USING C**

**Credits: 5**

**Max. Marks: 100**

**Continuous Evaluation: 30**

**Duration of Examination: 3Hrs**

**End Semester Examination: 70**

**Pre-Requisite:** Introduction to IT and Programming in C

**Course Type:** Core

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

**O4.5CA200C01H.1** Define and explain the concepts of data structures, algorithms, dynamic memory management, data types, and their applications.

**O4.5CA200C01H.2** Apply linear data structures (arrays, records, stacks, queues, linked lists) to solve real-life problems.

**O4.5CA200C01H.3** Analyze the asymptotic performance and complexity of different data structures and algorithms using Big O notation.

**O4.5CA200C01H.4** Compare alternative implementations of data structures, including sorting algorithms, with respect to performance in best, average, and worst cases.

**O4.5CA200C01H.5** Design, develop, and demonstrate non-linear data structures such as trees and graphs, including different traversal methods.

**UNIT 1: Introduction to Data Structure**

1.1 Concept and Definition of Data and Information

1.2 Concepts of Data type –primitive and non-primitive

1.3 Performance analysis and measurement (Time and space analysis of algorithms-average; best- and worst-case analysis)

1.4 Types of Data Structures: Linear & nonlinear data structures

1.5 Array: Representation of one and multidimensional arrays in memory

1.6 Operations: traversing; insertion; deletion; reversing; searching; sorting; merging two arrays

1.7 Sparse matrices: representation

**UNIT 2: Linear Data Structure**

2.1 Stacks: Stack-definitions; concepts and representation

2.2 Operations of Stack

2.3 Applications: Matching Parenthesis; Recursion; Towers of Hanoi;

2.4 Polish Notation; infix to postfix notation; evaluating postfix expression

2.5 Queues: Representation

2.6 Operations on Queues: Insert; delete

2.7 Circular queues

2.8 Types of queues: Deque and Priority Queues

2.9 Applications of Queue

### **UNIT 3: Introduction to Linked List**

- 3.1 Linked List: Representation
- 3.2 Operations of Linked List
- 3.3 Circular Linked List
- 3.4 Polynomial Representation
- 3.5 Double Linked List and operations

### **UNIT 4: Trees**

- 4.1 Trees: Some definitions
- 4.2 Representing a general tree
- 4.3 Types of Trees
- 4.4 Representation of Binary Tree
- 4.5 Traversing Binary Tree
- 4.6 Convert general tree into binary tree
- 4.7 Threads
- 4.8 Operations on BST
- 4.9 AVL Tree
- 4.10 B tree
- 4.11B+ tree

### **UNIT 5: Graph Theory**

- 5.1 Graph Definition
- 5.2 Graph representation (Adjacency List and Adjacency Matrix)
- 5.3 Multi graphs
- 5.4 Directed Graphs
- 5.5 Sequential and Linked Representation of Graphs
- 5.6 Traversing a Graph: BFS; DFS
- 5.7 Spanning trees
- 5.8 Minimum Spanning Tree: Prim's method and Kruskal's method
- 5.9 Single source shortest path

### **Unit 6: File Organization**

- 6.1 Introduction to File Organization
- 6.2 Hashing Techniques
- 6.3 Collision Resolution Techniques
- 6.4 Sorting: Bubble sort; Selection sort; Quick sort; Merge sort; Insertion sort; Heap sort
- 6.5 Searching: Linear search and Binary search

### **Suggested Readings:**

1. Seymour Lipschutz, 2014, Data Structure, McGraw Hill Education
2. Jean-Paul Tremblay & Paul G. Sorenson, 2017, An Introduction to Data Structures with Applications, Tata McGraw Hill Publishing.
3. Rashmi Agrawal, Sachin Sharma, Seema Sharma, 2013, Data Structure, Manav Rachna Publishing House.
4. Ten Baum, 2015, Data Structures using C & C++, Prentice-Hall International.

**Note: Only latest editions of the books are recommended.**

### **List of Experiments:**

**BEGINNER LEVEL (NSQF LEVEL: 1-3)**

<b>S. No.</b>	<b>Name of the Program</b>	<b>Bloom level with Cognitive process</b>
1.	Write a program to perform various operations in the Array: <ul style="list-style-type: none"> <li>- Insertion</li> <li>- Deletion</li> <li>- Display</li> </ul>	Apply (Using basic list operations)/ L3
2	Write a program to find the arithmetic operations on matrices: <ul style="list-style-type: none"> <li>- Sum and Subtraction</li> <li>- Product of 2 matrices</li> <li>- Transpose of a matrix</li> </ul>	Apply (Performing arithmetic operations on matrices)/ L3
3	Write a Program to sort the list using: <ul style="list-style-type: none"> <li>- Bubble Sort</li> <li>- Quick Sort</li> <li>- Insertion sort</li> <li>- Merge Sort</li> <li>- Heap Sort</li> </ul> Also, find the comparison on the basis of time complexity.	Apply (Sorting algorithm) / L3
4	Write a program to search the element using: <ul style="list-style-type: none"> <li>- Linear Search</li> <li>- Binary Search</li> </ul> Also, find the comparison on the basis of time complexity.	Apply (Basic search algorithm) / L3
5	Write a program to perform all operations: <ul style="list-style-type: none"> <li>- For the Stack using an Array.</li> <li>- For the Queue using an Array.</li> <li>- For the Circular Queue using an Array.</li> </ul>	Apply (Array manipulation, stack & queue operations) / L3
6	Write a program to evaluate the Postfix Notation.	Apply (Expression evaluation) / L3
7	Write a program to convert infix notation into Postfix Notation.	Apply (Expression conversion) / L3

**INTERMEDIATE LEVEL (NSQF LEVEL: 4-6)**

<b>S.No</b>	<b>Name of the Program</b>	<b>Bloom level with Cognitive process</b>
8	Write a program to perform the operations of the linked list: - Insertion - Deletion - Display	Apply (Linked list operation)/ L3
9	Write a program to perform the operations of the Circular linked list: - Insertion - Deletion - Display	Apply (Circular linked list) / L3
10	Write a program to perform all operations: - For Stack using Linked List. - For Queue using Linked List - For Circular Queue using Linked List	Apply (Linked list manipulation)/ L3
11	Write a program to perform concatenation of two linked lists.	Apply (Linked list manipulation)/ L3
12	Write a program to perform the operations of the Double linked list: - Insertion - Deletion - Display	
13	Write a program to perform tree traversal methods.	Apply (Binary tree traversal) / L3
14	Write a program to perform insertion and deletion in the Binary Search Tree.	Apply (Binary Search Tree operations) / L3
15	Write a program to represent an undirected graph using the adjacency matrix to implement the graph and perform the operations with menu-driven options for the following tasks: 1. Create graph 2. Insert an edge 3. Print Adjacency Matrix 4. List all vertices that are adjacent to a specified vertex. 6. Exit program	Analyse (Graph operations, adjacency matrix) / L4

**ADVANCED LEVEL (NSQF LEVEL: 7-10)**

<b>S.No.</b>	<b>Name of the Program</b>	<b>Bloom level with Cognitive process</b>	<b>Programs mapped with Ability Enhancement Courses</b>
16	Kalnirnay: Conversion from Gregorian to Hindi calendar.	Analyse (Linked list manipulation) / L4	IKS

17	Create a basic system that recommends irrigation time based on soil type and crop, using linked lists to store crop data.	Analyse (Linked list manipulation)/ L4	SDG
18	Design and implement a queue-based appointment management system for a clinic that handles patients in the order of their arrival. The system should maintain a First-Come, First- Served (FCFS) queue for patients and provide options to add new patients, view the next patient to be treated, serve (remove) a patient once treated, and display the list of all waiting patients.	Analyse (Circular data structures)/ L4	IKS
19	A program that: -Uses efficient data structures to compute numerology -numbers for names. -Stores and organizes results in a structured way. -Analyses frequency and patterns in numerology data.	Analyse (Linked list operation) / L4	IKS
20	Create a list where students add species and their habitats, then display them grouped by pollution tolerance.	Analyse (Linked list operation)/ L4	EVS
21	System to track and visualize personal health metrics (e.g., step count, calories burned, sleep).	Analyse (Circular linked list) / L4	IKS
22	Design a system that organizes and preserves Vedic texts in digital form, ensuring easy access to verses, rituals, and philosophical content for future generations.	Create (Circular linked list) / L6	IKS
23	System that identifies and classifies common suffixes in Sanskrit words, which is essential for understanding word formation and grammar.	Analyse (Linked list operation) / L4	IKS
24	Case study on Improving Quality Education through Efficient Data Structures	L2/ L3/ L4/ L5/ L6	SDG
25	System that automates loan processing tasks, including loan eligibility checking, interest estimation, and repayment scheduling.	L2/ L3/ L4/ L5/ L6	FinTech

### 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 the latest editions of the books are recommended.**

### Software required/Web links:

Java/ Dev 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)

<https://digimat.in/nptel/courses/video/106102064/L01.html> (Last visited Date: 16 April 2025)

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categorization for the same is: MCQs 30%

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**COURSE ARTICULATION MATRIX:**

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<b>O4.5CA200C01H.2</b>	2	2	3	1	1		2					
<b>O4.5CA200C01H.3</b>	2	2	2	2	3		3				2	2
<b>O4.5CA200C01H.4</b>	3	3	3	2	2		1					
<b>O4.5CA200C01H.5</b>	2	2	2				2					

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

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

**O4.5CA201C01H: OBJECT ORIENTED PROGRAMMING USING JAVA**

**Credits: 2**

**Max. Marks: 100**

**Continuous Evaluation: 30**

**Duration of Examination: 3Hrs**

**End Semester Examination: 70**

**Pre-Requisite:** Introduction to IT and Programming in C

**Course Type:** Core

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

**O4.5CA201C01H.1** Explain the basic programming constructs, control structures, and object-oriented paradigms of Java Programming Language.

**O4.5CA201C01H.2** Apply concepts of flow control, exception handling, and object reusability to solve basic programming problems.

**O4.5CA201C01H.3** Analyze various AWT components and controls, and select appropriate ones based on user requirements.

**O4.5CA201C01H.4** Evaluate programming requirements and propose effective solutions using object-oriented principles and Java libraries.

**O4.5CA201C01H.5** Design and develop complex Graphical User Interfaces (GUIs) using Java AWT classes, event handling, and database programming.

**O4.5CA201C01H.6** Demonstrate the ability to integrate GUI-based applications to solve real-life business problems.

**Unit 1: Concepts of Java**

1.1 Introduction: C++ vs Java

1.2 Java and Internet

1.3 Java and WWW

1.4 Java support systems

1.5 Java environment

1.6 Java program structure

1.7 Tokens; Statements;

1.8 Java Virtual machine

1.9 Constant & Variables

1.10 Data Types;

1.11 Symbolic Constants

1.12 Type Casting Operators.

**Unit 2: Control Statements**

2.1 Simple if statement

2.2 If...else... statement

2.3 Nesting if...else... statement

2.4 else...if Ladder

- 2.5 Switch statement
- 2.6 Conditional Operator
- 2.7 Loops –While; Do; For
- 2.8 Jumps in Loops; Labelled Loops

### **Unit 3: Arrays and Classes**

- 3.1 Arrays: One Dimensional and two-Dimensional arrays
- 3.2 Classes: Fundamentals; objects; methods
- 3.3 Constructors: Method overloading; constructor overloading
- 3.4 Inheritance: Superclass; sub class;
- 3.5 This and super operator
- 3.6 Method overriding; use of final keyword
- 3.7 Abstract class
- 3.8 Interface.

### **Unit 4: Exception Handling and Packages**

- 4.1 Packages: Creation and implementation
- 4.2 Exception Handling: Exception Class
- 4.3 Built in checked and unchecked exceptions
- 4.4 User defined exceptions; Try; Catch; Throw; Throws; Finally.
- 4.5 Java Library: String handling (only main functions); String Buffer class.

### **Unit 5: Applet**

- 5.1 Applets: Introduction
- 5.2 Local and Remote Applets Vs Application
- 5.3 Writing Applet
- 5.4 Applet Life Cycle; Creating an Executable Applet
- 5.5 Designing a Web Page; Applet Tag
- 5.6 Adding Applet to HTML File; Running the Applet
- 5.7 Passing Parameters to Applets; Aligning the Display; HTML Tags & Applets
- 5.8 Getting Input from the User

### **Unit 6: AWT Controls**

- 6.1 AWT controls: Button; Label; TextField; TextArea; Choice lists; list; scrollbars; check boxes; Layout managers;
- 6.2 Elementary concepts of Event Handling
- 6.3 Delegation Event Model
- 6.4 Event classes and listeners
- 6.5 Adapter classes
- 6.6 Inner classes

### **Suggested Readings:**

1. Cay S. Horstmann, Gary Cornell, 2020, Core Java™, Volume I : Fundamentals, Pearson Education.
2. E. Balaguruswami, 2017, Core Java, TMH.
3. HebertSchild, C. S, Gray Cornel, 2013, Core Java Reference, TMH.
4. Brett Spell, 2015, Professional Java Programming, WROX Publication

**Note: Only latest editions of the books are recommended.**

**List of Experiments:****BEGINNER LEVEL (NSQF LEVEL: 1-3)**

S.No.	Name of the Program	Bloom level with Cognitive process
1	Write a program to find the factorial of n Number.	Understand (Basic operation) / L2
2	Write a program to find the sequence of Fibonacci series up to n terms.	Understand (Pattern recognition) / L2
3	Write a program to check whether given number is palindrome or not.	Apply (Control structure & logic)/L3
4	Write a program to find HCF of two numbers.	Apply (Iterative algorithm)/ L3
5	Write a Java Program that will display the sum of $1+1/2+1/3+\dots+1/n$ .	Apply (Loop and formula use)/ L3
6	Write a Java Program to find product of two matrices.	Apply (Nested loops, array logic)/ L3
7	Write a Java Program to find sum and subtraction of two matrices.	Apply (Array manipulation)/ L3
8	Write a Java Program to sort the list in ascending Order.	Apply (Sorting algorithm)/ L3
9	Write a Java Program to convert decimal into binary number.	Apply (Division & stack/array logic)/ L3
10	Write a Java Program to find largest and smallest of n numbers	Apply (Loop and comparison logic)/ L3

**INTERMEDIATE LEVEL (NSQF LEVEL: 4-6)**

S.No	Name of the Program	Bloom level with Cognitive process
11	Write a Java program that shows the application of constructors.	Apply (Constructor type)/ L3
12	Write a Java program to find the electricity bill using inheritance	Analyze (Inheritance)/ L4
13	Write a program to count the number of objects created for a class using static member function	Analyze (Override methods)/ L4
14	Create a class "Account" containing account No, and balance as an instance variable. Derive the Account class into two classes named "Savings" and "Current". The "Savings" class should contain instance variable named interest Rate, and the "Current" class should contain instance variable called overdraft Limit. Define appropriate methods for all the classes to enable functionalities to check balance, deposit, and withdraw amount in Savings and Current account.	Analyze (Abstraction)/ L4
15	Write a program to demonstrate the use of 'this' and 'static' keyword.	Apply (OOP concepts)/ L3

16	Describe abstract class called Shape which has three subclasses say Triangle, Rectangle, and Circle. Define one method area () in the abstract class and override this area () in these three subclasses to calculate for specific object i.e. area () of Triangle subclass should calculate area of triangle etc. Same for Rectangle and Circle.	Analyze (Override abstraction) L4
17	Write a java program to find the result sheet of a student using Interfaces.	Analyze (Encapsulation)/ L4
18	Write a java program which shows importing of classes from other packages.	Apply (Packages)/ L3
19	Assume that there are two packages, student and exam. A student package contains Student class and the exam package contains Result class. Write a program that generates mark sheet for students.	Evaluate (Packages)/ L5
20	Write a program to implement the concept of threading by implementing “Runnable” Interface.	Analyze (Multithreading)/ L4
21	Write a program that executes two threads. One thread displays “Thread1” every 2,000 milliseconds, and the other displays “Thread2” every 4,000 milliseconds.	Analyze (Concurrent execution)/ L4
22	Write a java program which use try and catch for exception handling.	Apply (Error handling)/ L3
23	Write a java program which use multiple catch blocks.	Analyze (Multiple exception)/ L4
24	Write a java program which shows throwing our own exception.	Evaluation (Runtime condition)/ L5
25	Write a program to handle Labels and Buttons using AWT Controls.	Apply (GUI Controls) L3
26	Write a program to handle Check Boxes using AWT Controls	Apply (Event handling)/ L3
27	Write a program to handle Lists and Scroll Bars using AWT Controls	Apply (User interface)/ L3

#### ADVANCED LEVEL (NSQF LEVEL: 7-10)

S.No.	Name of the Program	Bloom level with Cognitive process	Programs mapped with Ability Enhancement Courses
28	Java program that determines the astrological (zodiac) sign based on the given date of birth.	Apply (Date Handling) / L3	IKS
29	A Java-based application that calculates numerology numbers and provides descriptions based on user input.	Analyse (Character Position)/ L4	IKS

30	A Java GUI-based desktop application that takes a user's name and date of birth as input and shows astrological information such as Sun sign, Moon sign, Birthstone, etc..	Evaluate (GUI Design)/ L5	IKS
31	A sophisticated Java application designed to facilitate the management of voting processes in elections or organizational decision- making.	Evaluate (Data Validation)/ L5	SDG
32	Develop a Java-based application that collects, stores, and analyzes air quality data (PM2.5, PM10, CO2, NO2, O3, temperature, humidity) to help researchers and communities monitor environmental health.	Create (Visualization) / L6	EVS
33	Design a system that monitors water quality parameters such as pH, temperature, turbidity, dissolved oxygen, etc., and provides alerts if any parameter exceeds safe limits.	Create (sensor data system) / L6	SDG
34	Case Study on a Java-Based System for Personal Health Monitoring and Quality Improvement	L2/ L3/ L4/ L5/ L6	SDG
35	System that Automates loan eligibility checking, interest estimation, and repayment scheduling.	L3/ L4/ L6	FinTech

### 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/ NetBeans/ Eclipse

<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)

<https://archive.nptel.ac.in/courses/106/105/106105191/> (Last visited Date: 16 April 2025)

### 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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O4.5CA201C01H. 2	2	2	1						2	3	1	3	1	
O4.5CA201C01H. 3			2	2			3	1	1	2	1		2	1
O4.5CA201C01H. 4		1		2		2			2		3			
O4.5CA201C01H. 5			3					2	1	1		2	1	2
O4.5CA201C01H. 6	1			3	3		2			2	3			3

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

**O4.5SET100C04: ENVIRONMENTAL STUDIES**

**Credits: 4**

**Max. Marks: 100**

**Continuous Evaluation: 30**

**Duration of Examination: 3Hrs**

**End Semester Examination: 70**

**Pre-requisites:** Basic knowledge of Environment

**Course Type:** AEC

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

- O4.5SET100C04.1.** appreciate the historical context of human interactions with the environment.
- O4.5SET100C04.2.** understand the concept of natural resources and explain sustainable development, its goals, targets, challenges and global strategies for sustainable development.
- O4.5SET100C04.3.** develop a critical understanding of the environmental issues, pollution and its types.
- O4.5SET100C04.4.** understand the concepts of ecosystems, biodiversity and conservation.
- O4.5SET100C04.5.** gain a comprehensive knowledge of climate change, its science and response measures.
- O4.5SET100C04.6.** develop a critical understanding of the complexity of environmental management and learn about how the nations of the world work together for the environment.

**PART- A**

**Unit 1: Humans and the Environment**

- 1.1** The man-environment interaction, Great ancient civilizations and the environment; Industrial revolution and its impact on the environment; Population growth and natural resource exploitation.
- 1.2** Environmental Ethics and emergence of environmentalism.

**Unit 2: Natural Resources and Sustainable Development**

- 2.1** Overview and classification of natural resources
- 2.2** Biotic resources
- 2.3** Soil and mineral resources
- 2.4** Energy resources
- 2.5** Introduction to sustainable development: Sustainable Development Goals (SDGs)- targets and indicators, challenges and strategies for SDGs.

**Unit 3: Environmental Issues**

- 3.1** Local, Regional and Global level environmental issues.
- 3.2** Land use and Land cover change: land degradation, deforestation, desertification, urbanization. Biodiversity loss: past and current trends, impact.
- 3.3** Ozone layer depletion; Climate change. Disasters – Natural and Man-made (Anthropogenic).

#### **Unit 4: Conservation of Biodiversity and Ecosystems**

**4.1** Biodiversity and its distribution: Biodiversity as a natural resource; Levels and types of biodiversity; Biodiversity in India and the world; Biodiversity hotspots; Species and ecosystem threat categories.

**4.2** Ecosystems and ecosystem services

**4.3** Threats to biodiversity and ecosystems

**4.4** Major conservation policies

### **PART-B**

#### **Unit 5: Environmental Pollution and Health**

**5.1** Understanding pollution: Production processes and generation of wastes; Assimilative capacity of the environment; Definition of pollution; Point sources and non-point sources of pollution.

**5.2** Air pollution: Sources of air pollution; Primary and secondary pollutants; Indoor air pollution; Adverse health impacts of air pollutants; National Ambient Air Quality Standards.

**5.3** Water pollution: Sources of water pollution; River, lake and marine pollution, groundwater pollution; water quality Water quality parameters and standards; adverse health impacts of water pollution on human and aquatic life.

**5.4** Soil pollution and solid waste: Soil pollutants and their sources; Solid and hazardous waste; Impact on human health.

**5.5** Noise pollution: Definition of noise; Unit of measurement of noise pollution; Sources of noise pollution; Noise standards; adverse impacts of noise on human health.

**5.6** Thermal and Radioactive pollution: Sources and impact on human health and ecosystems.

#### **Unit 6: Climate Change: Impacts, Adaptation and Mitigation**

**6.1** Understanding climate change

**6.2** Impacts, vulnerability and adaptation to climate change

**6.3** Mitigation of climate change: Synergies between adaptation and mitigation measures; Green House Gas (GHG) reduction vs. sink enhancement

#### **Unit 7: Environmental Management**

**7.1** Introduction to environmental laws and regulation

**7.2** Environmental management system: ISO 14001 Concept of Circular Economy, Life cycle analysis; Cost-benefit analysis

**7.3** Environmental audit and impact assessment; Environmental risk assessment Pollution control and management; Waste Management- Concept of 3R (Reduce, Recycle and Reuse) and sustainability; Ecolabeling /Eco Mark scheme

#### **Unit 8: Environmental Treaties and Legislation**

**8.1** An overview of instruments of international cooperation; bilateral and multilateral agreements; conventions and protocols

**8.2** Major International Environmental Agreements

**8.3** Major Indian Environmental Legislations:

**8.4** Major International organizations and initiatives

#### **Case Studies and Field work\***

The students are expected to be engaged in some of the following or similar identified activities:

- Discussion on one national and one international case study related to the environment and sustainable development.

- Field visits to identify local/regional environmental issues, make observations including data collection and prepare a brief report.
- Participation in plantation drive and nature camps.
- Documentation of campus biodiversity.
- Campus environmental management activities such as solid waste disposal, water Management and sanitation, and sewage treatment.

### **Suggested Readings:**

1. Fisher, Michael H. (2018) *An Environmental History of India- From Earliest Times to the Twenty-First Century*, Cambridge University Press.
2. Headrick, Daniel R. (2020) *Humans versus Nature- A Global Environmental History*, Oxford University Press.
3. Hughes, J. Donald (2009) *An Environmental History of the World- Humankind's Changing Role in the Community of Life*, 2nd Edition. Routledge.
4. Perman, R., Ma, Y., McGilvray, J., and Common, M. (2003) *Natural Resource and Environmental Economics*. Pearson Education.
5. Simmons, I. G. (2008) *Global Environmental History: 10,000 BC to AD 2000*. Edinburgh University Press.
6. Chiras, D. D and Reganold, J. P. (2010) *Natural Resource Conservation: Management for a Sustainable Future*. 10th edition, Upper Saddle River, N. J. Benjamin/Cummins/Pearson.
7. John W. Twidell and Anthony D. (2015) *Renewable Energy Sources*, 3rd Edition, Weir Publisher (ELBS)
8. William P. Cunningham and Mary A. (2015) *Cunningham Environmental Science: A Global Concern*, Publisher (Mc-Graw Hill, USA)
9. Manahan, S.E. (2022). *Environmental Chemistry* (11th ed.). CRC Press.  
<https://doi.org/10.1201/9781003096238>
10. Varghese, Anita, Oommen, Meera Anna, Paul, Mridula Mary, Nath, Snehlata (Editors) (2022) *Conservation through Sustainable Use: Lessons from India*. Routledge.
11. Ahluwalia, V. K. (2015). *Environmental Pollution, and Health*. The Energy and Resources Institute (TERI).
12. Adenle A., Azadi H., Arbiol J. (2015) *Global assessment of technological innovation for climate change adaptation and mitigation in developing world*, *Journal of Environmental Management*, 161 (15): 261-275.
13. Richard A. Marcantonio, Marc Lame (2022) *Environmental Management: Concepts and Practical Skills*. Cambridge University Press.
14. Kanchi Kohli and Manju Menon (2021) *Development of Environment Laws in India*, Cambridge University Press.

### **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:**

CO Statement	PO 1	PO 2	PO 3	PO4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2
O4.5SET100C04.1	3	3	3	3	2	2	1	2	2	3		2		
O4.5SET100C04.2		3	3	2	3	2			1	3	1	2		
O4.5SET100C04.3		2	3	3	3	2						3		
O4.5SET100C04.4		2	2	2	2		2					2		

O4.5SET100C04.5		3	3	3	3	3	2			3		2		
O4.5SET100C04.6	3	3	3	3	2	2	1	2	2	3		2		

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

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

**O4.5CA200C05: DIGITAL EDITING AND MOTION GRAPHICS**

**Credits: 2**

**Max. Marks: 100**

**Continuous Evaluation: 30**

**Duration of Examination: 3Hrs**

**End Semester Examination: 70**

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

**O4.5CA200C05.1** Understand the principles of digital editing and motion graphics design.

**O4.5CA200C05.2.** Gain proficiency in using industry-standard software for video editing and motion graphics.

**O4.5CA200C05.3.** Develop skills in creating visually appealing animations and motion graphics

**O4.5CA200C05.4.** Apply digital editing and motion graphics techniques to multimedia projects

**Unit 1- Introduction to Digital Editing**

- 1.1 Overview of digital editing principles
- 1.2 Introduction to Adobe Premiere Pro
- 1.3 Importing, organizing, and
- 1.4 Editing video clips

**Unit-2: Basic Editing Techniques**

- 2.1 Cutting, trimming
- 2.2 Arranging clips
- 2.3 Adding transitions
- 2.4 Adding Other Effects

**Unit-3: Advanced Editing Techniques**

- 3.1 Working with audio: editing soundtracks and adding music
- 3.2 Color correction and grading
- 3.3 Creating titles and lower thirds
- 3.4 Key framing and animation basics

**Unit-4: Introduction to Motion Graphics**

- 4.1 Understanding Motion Graphics Principles
- 4.2 Introduction to Adobe After Effects
- 4.3 Creating basic animations and motion graphics
- 4.4 Working with text animations
- 4.5 Using shape layers and masks

**Unit-5: Advanced Motion Graphics Techniques**

- 5.1 Advanced animation techniques: expressions and scripting
- 5.2 Working with 3D layers and cameras
- 5.3 Integrating graphics with video footage

## 5.4 Creating visual effects and compositing

### **Unit-6: Project Development**

6.1 Planning and developing a digital editing and motion graphics project

6.2 Storyboarding and pre-production

6.3 Implementing editing and motion graphics techniques learned in the course

#### **Textbooks/Reference Books:**

1. Digital Editing and Motion Graphics Handbook

2. Adobe Creative Cloud handbook

3. Online tutorials:

#### **Software required/Web links:**

1. [griffinpictures.in/blog/motion-graphics-and-video-editing-whats-the-difference/](http://griffinpictures.in/blog/motion-graphics-and-video-editing-whats-the-difference/) lastUpdate 30<sup>th</sup> May 2024

2. Motion Graphics Notes - Akshansh Chaudhary | PDF (slideshare.net) last update 30<sup>th</sup> May 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:

(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%

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(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:**

CO-PO Statement	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO8	PO 9	PO 10	P O 11	PO 12	PSO1	PSO2
O4.5CA200C05.1	2	1	3	2	3		3						2	2
O4.5CA200C05.2	2	2	3	3	2		1		3				2	1
O4.5CA200C05.3	3	2	3	2	2	3				1			1	2
O4.5CA200C05.4	2	1	3	2	2		3				3		2	2

**MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH & STUDIES**  
(Deemed to be University under section 3 of the UGC Act 1956)  
**NAAC 'A++' Grade University**  
**Placement Competency Enhancement-II**  
**O4.5CDC296C05**

**Credits: 1**

**Max. Marks: 100**

**Duration of Examination: 3Hrs**

**Continuous Evaluation: 30**

**End Semester Examination: 70**

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

**O4.5CDC296C05.1:** exhibit compelling reading and writing skills in the workplace.

**O4.5CDC296C05.2:** learn grammatically correct formal writing skills.

**O4.5CDC296C05.3:** enhance their skills to effectively deliver formal and informal presentations to a variety of audiences in multiple contexts.

**O4.5CDC296C05.4:** solve problems based on non-verbal reasoning.

**O4.5CDC296C05.5:** solve complex problems based on Syllogism with mathematical operations

**O4.5CDC296C05.6:** apply short tricks on complex problems of Percentage, Ratio & interest.

**PART A**

**Unit 1: Developing Communication Skills- II (Reading & Writing)**

1.1 Reading Comprehension

1.2 Writing Skills: Introduction to Writing: Organizing Principles of Paragraph, Precise Writing, Punctuations

1.3 Social Media, Digital Ethics, and Cyber Security

1.4 Report Writing

1.5 Note Taking

**Unit 2: Syntactical English II**

2.1 Conditionals

2.2 Preposition of Time & Place

**Unit 3: Effective Communication**

3.1 Concepts of Chronemics: Interpretation of time with business environment

3.2 Monochronic vs. Polychronic Cultures

3.3 Non- Verbal Communication: Kinesics & Proxemics

3.4 Acing virtual (video) interviews

**Unit 4: Presentation Skills**

4.1 Opening & closing of Presentations

4.2 Audience Analysis

4.3 Structuring the Presentation

4.4 Best Practices in Presentations

## Part B

### Unit 5: Arithmetic II

- 5.1 Percentages,
- 5.2 Ratio & Proportion
  - 5.2.1. Proportionality
  - 5.2.2. Variations
  - 5.2.3 Partnership
  - 5.2.4 Problem on Ages & Numbers
- 5.3 Profit & Loss
  - 5.3.1. Basic terminology & Formulae
  - 5.3.2. Error in Weights
  - 5.3.3. Marked Price and Discounts
- 5.4 Mixtures & Allegations
- 5.5 Interest
  - 5.5.1 Simple Interest
  - 5.5.2 Compound Interest
  - 5.5.3 Relation between SI & CI

### Unit 6: Logical Reasoning II

- 6.1 Syllogism
- 6.2 Logical Deductions
- 6.3 Inequalities and Mathematical Operations

### Unit 7: Non-Verbal Reasoning

- 7.1 Pictorial Series
- 7.2 Missing Values
- 7.3 Analogy and Images

### Recommended Texts and Readings:

1. Gallo, C. (2015). Talk like TED. Macmillan.
2. Paul, D. S. (2022). Advanced writing skills. Goodwill Publishing House.
3. Vyner, J. (2018). Mastering soft skills. Matador.
4. Aggarwal, R. S. (2018). Quantitative aptitude for competitive exams (7th ed.). S. Chand & Company Pvt. Ltd.
5. Sharma, A. (2014). How to prepare for logical reasoning for CAT (4th ed.). McGraw Hill Education.
6. <https://www.cbs.de/en/blog/15-effective-presentation-tips-to-improve-presentation-skills/> (Last accessed - May 12, 2024)

### Course Articulation Matrix:

Course Outcome (CO)	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
<b>O4.5CDC296C0 5.1</b>	2	-	-	-	-	-	-	-	3	-	-	-	-	-

<b>O4.5CDC296C0 5.2</b>	-	-	-	-	-	-	-	-	-	3	-	-	-	-	-
<b>O4.5CDC296C0 5.3</b>	-	-	-	-	-	-	-	-	-	3	-	-	-	-	-
<b>O4.5CDC296C0 5.4</b>	2	-	-	3	-	-	-	-	-	-	-	-	-	-	-
<b>O4.5CDC296C0 5.5</b>	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<b>O4.5CDC296C0 5.6</b>	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-

# Third Semester

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

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

**O5.0CA100C01: Digital Logic and Computer System Architecture**

**Max. Marks: 100**

**Credits: 3**

**Continuous Evaluation: 30**

**Duration of Examination: 3**

**End Semester Examination: 70**

**Pre-Requisites:**

**Course Type: Core**

**NA**

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

**O5.0CA100C01.1** Understand the fundamental concepts of digital logic and computer system architecture.

**O5.0CA100C01.2** Apply knowledge of number systems and arithmetic to digital circuit design.

**O5.0CA100C01.3** Design and analyze digital logic circuits using logic gates and Boolean Algebra

**O5.0CA100C01.4** Explore the architecture and functioning of central processing units (CPU)

**O5.0CA100C01.5** Explain data paths, control units, and I/O systems in computer architecture.

**UNIT 1: Number Systems and Arithmetic**

- 1.1 Introduction to Number Systems: Binary, Octal, Decimal, and Hexadecimal
- 1.2 Conversion between Number Systems
- 1.3 Binary Arithmetic: Addition, Subtraction, Multiplication, Division
- 1.4 Signed Number Representations: Sign-Magnitude, 1's and 2's Complement
- 1.5 Arithmetic Circuits: Adders, Subtractors, Comparators

**UNIT 2: Boolean Algebra and Logic Gates**

- 2.1 Fundamentals of Boolean Algebra: Laws and Theorems
- 2.2 Logic Gates: AND, OR, NOT, NAND, NOR, XOR, XNOR
- 2.3 Simplification Techniques: Karnaugh Maps (K-Maps), Boolean Minimization
- 2.4 Implementation of Boolean Functions using Gates
- 2.5 Logic Families and Characteristics

**UNIT 3: Combinational and Sequential Circuits**

- 3.1 Combinational Circuits: Multiplexers, Demultiplexers, Encoders, Decoders
- 3.2 Design of Arithmetic Circuits: Half Adder, Full Adder, Subtractor
- 3.3 Sequential Circuits: Flip-Flops (SR, D, JK, T), Latches
- 3.4 Registers and Counters: Shift Registers, Ripple Counters, Synchronous Counters
- 3.5 Applications of Sequential Circuits

**UNIT 4: Data Path and Control Units**

- 4.1 Introduction to Data Paths and Control Units

- 4.2 ALU (Arithmetic Logic Unit): Design and Operations
- 4.3 Control Unit Design: Hardwired vs. Microprogrammed Control
- 4.4 Instruction Execution Cycle: Fetch, Decode, Execute
- 4.5 Case Study: Simple CPU Data Path and Control Signals

### **UNIT 5: Memory Systems**

- 5.1 Memory Types: RAM, ROM, Cache, and Virtual Memory
- 5.2 Memory Hierarchy and Characteristics: Access Time, Capacity, Cost
- 5.3 Cache Memory: Mapping Techniques, Replacement Algorithms
- 5.4 Memory Interfacing and Addressing
- 5.5 Error Detection and Correction in Memory Systems

### **UNIT 6: Input/Output and Advanced Topics**

- 6.1 I/O Interfaces: Parallel and Serial Communication, Buses
- 6.2 Interrupts and Direct Memory Access (DMA)
- 6.3 Overview of Modern CPU Architectures: RISC, CISC
- 6.4 Introduction to Pipeline Processing
- 6.5 Future Trends in Computer Architecture: Quantum Computing, Neuromorphic Computing

### **Suggested Readings:**

1. Digital Logic and Computer Design by M. Morris Mano
2. Computer Organization and Architecture by William Stallings
3. Digital Design by John F. Wakerly
4. Computer System Architecture by M. Morris Mano
5. Fundamentals of Digital Logic with VHDL Design by Stephen Brown and Zvonko Vranesic

**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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Subjective (Short/Long) 40%

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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:**

<b>CO-PO Statement</b>	<b>P O1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</b>	<b>PO10</b>	<b>PO11</b>	<b>PO12</b>	<b>PSO1</b>	<b>PSO2</b>
<b>O5.0CA100C01.1</b>	3	2	2	2	1				1	2			2	2
<b>O5.0CA100C01.2</b>	3	3	3	2	2				1		1		2	2
<b>O5.0CA100C01.3</b>	3	3	3	3	2							2	3	3
<b>O5.0CA100C01.4</b>	3	3	3	3	1	1					2		2	2
<b>O5.0CA100C01.5</b>	3	3	3	3	2							1	3	3

# MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

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

## O5.0CA101C01H: PYTHON PROGRAMMING

**Credits: 2**

**Max. Marks:100**

**Duration of Examination: 3 hrs**

**Continuous Evaluation:30**  
**End Semester Examination:70**

**Pre-Requisites: Introduction to IT and Programming in C**

**Course Type: Core**

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

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

- O5.0CA101C01H.1. Define the methodology, procedures, and basic programming constructs of Python.
- O5.0CA101C01H.2. Understand and implement object-oriented concepts in Python.
- O5.0CA101C01H.3. Apply Python data structures to analyze and solve complex problems.
- O5.0CA101C01H.4. Utilize various Python libraries and functions to solve real-life problems.
- O5.0CA101C01H.5. Develop applications using Python programming language.

### **UNIT 1: Introduction & Fundamentals of Python**

- 1.1 History of Python
- 1.2 Need of Python Programming
- 1.3 Application of Python Programming
- 1.4 Installation and Working with Python
- 1.5 Setting up path & Running Python Scripts
- 1.6 Tokens in Python
- 1.7 Keywords
- 1.8 Comments, Literals,
- 1.9 Indentation, Input and Print functions

### **UNIT 2: Python Operators & Data Types**

- 2.1 Python basic Operators
- 2.2 Declaring and using Numeric data types: int, float, complex
- 2.3 Using string data type and string operations
- 2.4 Python operators
- 2.5 Arithmetic operator, Relational operator, Logical or Boolean Operator
- 2.6 Assignment, Operator, Ternary operator, Bit wise operator
- 2.7 Increment or Decrement operator

### **UNIT 3: Python Control Structures**

- 3.1 Conditional blocks using if, else if
- 3.2 Nested If-else
- 3.2 if –elif ladder statements
- 3.3 While loop
- 3.4 For loop, Nested loop
- 3.5 Loop manipulation using pass, continue, break and else

### **UNIT 4: Python Strings, List and Dictionary Manipulations (Collections)**

- 4.1 List: Create, Access, Slicing, Negative Indices,
- 4.2 List Methods, and comprehensions
- 4.3 Tuples: Create, Indexing and Slicing,
- 4.4 Operations on tuples
- 4.5 Dictionary: Create, add, and replace values, operations on dictionaries.
- 4.6 Sets: Create and operations on set

**UNIT 5: Python Functions**

- 5.1 Functions: Types, parameters
- 5.2 Arguments: positional arguments, keyword arguments, parameters with default values
- 5.3 Arguments: functions with arbitrary arguments
- 5.4 Powerful Lambda function in Python

**UNIT 6: Exception Handling & File Handling**

- 6.1 Errors and Exceptions: Syntax Errors, Exceptions
- 6.2 Exception Handling
- 6.3 Raising Exceptions
- 6.4 Exception Chaining
- 6.5 User Defined Exceptions
- 6.7 Files: Open, Read, Write, Append and Close
- 6.8 Tell and seek methods

**Suggested Readings:**

1. Allen B. Downey, 2016, Think Python: 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., 2011.
3. Fundamentals of Python by Kenneth A. Lambert, published by Cengage Learning, 2011. ISBN-13: 978-1111822705
4. Timothy A. Budd, 2011, Exploring Python, Mc-Graw Hill Education (India) Private Ltd.

**Note: Only the latest editions of the books are recommended**

**Software required/ Web links:**

Python 3.6.4

<https://www.tutorialspoint.com/python/index.htm>

<https://www.programiz.com/python-programming/first-program>

**List of Experiments:**

**BEGINNER LEVEL (NSQF LEVEL: 1-3)**

S.No.	Name of the Program	Bloom level with Cognitive process
1	Write a Python program to calculate number of days between two dates. <i>Sample dates:</i> (2014, 7, 2), (2014, 7, 11) <i>Expected output:</i> 9 days.	Understand (Basic operation) / L2
2	Write a Python program that accepts an integer (n) and computes the value of n+nn+nnn	Understand (Pattern recognition) / L2

3	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?	Apply (Control structure & logic)/L3
4	Write a Python program which accepts a sequence of comma-separated numbers from user and generate a list and a tuple with those numbers.	Apply (Iterative algorithm)/ L3
5	Write a Python program to calculate the sum of three given numbers, if the values are equal then return thrice of their sum.	Apply (Loop and formula use)/ L3
6	Write a Python program to test whether a passed letter is a vowel or not	Apply (String manipulation)/ L3
7	Take a list, say for example this one: <code>a = [1, 1, 2, 3, 5, 8, 13, 21, 34, 55, 89]</code> 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.	Apply (Array manipulation)/ L3
8	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.)	Apply (Modulo Logic)/ L3
9	Take two lists, say for example these two: <code>a = [1, 1, 2, 3, 5, 8, 13, 21, 34, 55, 89]</code> <code>b = [1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13]</code> 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.	Apply (List Operations)/ L3
10	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.)	Apply (Slicing)/ L3
11	Let's say I give you a list saved in a variable: <code>a = [1, 4, 9, 16, 25, 36, 49, 64, 81, 100]</code> . 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.	Apply (Filtering)/ L3
12	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. ( <i>Hint: remember to use the user input lessons from the</i>	Apply (Random module)/ L3

	very first exercise)	
13	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.).	Apply (Loop and conditional logic)/ L3
14	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.	Apply (Uniqueness and conversion)/ L3
15	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.	Analyze (Logical Thinking)/ L4
16	Implement a function that takes as input three variables, and returns the largest of the three. Do this without using the Python max() function!	Analyze (Decomposition)/ L4

#### INTERMEDIATE LEVEL(NSQF LEVEL: 4-6)

S.No	Name of the Program	Bloom level with Cognitive process
17	Python program to perform read and write operations on a file.	Apply (File Operations)/ L3
18	Python program to copy the contents of a file to another file.	Apply (File Handling)/ L3
19	Python program to count frequency of characters in a given file.	Apply (String operations)/ L3
20	Python program to print each line of a file in reverse order.	Apply (String manipulation)/ L3
21	Python program to compute the number of characters, words and lines in a file.	Apply (Counting operations)/ L3
22	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.	Apply (Exception)/ L3
23	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.	Analyze (Data Validation)/ L4
24	Write a Regular Expression to represent all 10-digit mobile numbers. Rules: 1. Every number should contain 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?	Analyze (Regular Expressions)/ L4
25	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	Analyze (Words misspellings)/ L4

<p>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.</p>	
--	--

**ADVANCED LEVEL (NSQF LEVEL: 7-10)**

S.No.	Name of the Program	Bloom level with Cognitive process	Programs mapped with Ability Enhancement Courses
26	<p>A fitness coach wants to analyze the BMI of a group of people to assess their health status. The data includes the name, age, weight (kg), and height (m) of each person. The coach wants:</p> <ul style="list-style-type: none"> <li>To calculate BMI for each person.</li> <li>To categorize each person based on their BMI.</li> <li>To get a summary of how many people fall into each category.</li> </ul>	Apply (Conditional Logic)/ L3	SDG
27	<p>A numerologist wants a tool to help analyze the numerology number of people's names. Each alphabet is assigned a number, and the sum of these numbers, reduced to a single digit (unless it's a master number like 11 or 22), is considered their Name Number.</p> <p>The numerologist wants:</p> <ul style="list-style-type: none"> <li>To input names.</li> <li>To calculate their numerology number.</li> <li>To match the number to a basic personality meaning.</li> <li>To process multiple names and generate a report.</li> </ul>	Analyse (Patterns)/ L4	IKS

28	Develop a system that tracks air pollution levels (such as PM2.5, PM10, CO2) in different regions of a city. The system should: Collect pollution data from sensors deployed in various regions. Store and organize pollution data efficiently. Perform analysis to identify areas with the highest pollution levels over time.	Evaluate (Sensor Trends)/ L5	EVS
29	A system that automates loan eligibility checks, calculates EMI, and generates amortization.	Analyze (Logical breakdown of financial conditions)/ L4	FinTech
30	Detects anomalies in banking transactions using clustering and pattern recognition algorithms.	Create (Pattern Recognition) / L6	FinTech
31	A health monitoring system that tracks vitals (BP, sugar, heart rate), medication schedule, and alerts caregivers.	Evaluate (threshold conditions) / L5	SDG
32	Monitors water quality (pH, turbidity, temperature, TDS) in real time and flags contamination events.	Create (monitoring and alerting) / L6	SDG
33	Case Study: Secure Password Generator in Python	Apply (randomization and string operations) / L3	SDG
34	To develop an application that digitizes, organizes, and provides access to Indian scriptures, texts, traditional practices, and knowledge of Ayurveda, Yoga, Sanskrit grammar, and Vedic rituals in a structured, searchable, and accessible format.	L3/ L4/ L5/ L6	IKS
35	To create a digital system that incorporates ancient Indian mathematical techniques (Vedic Mathematics) to solve arithmetic problems more efficiently, particularly useful for students and competitive exam aspirants.	L2/ L3/ L4/ L6	IKS

### 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 Sedgewick, Kevin Wayne, Robert Dondero, 2015, Introduction to Programming in Python: An Interdisciplinary Approach, Pearson India Education Services Pvt. Ltd.
4. Python Programming using problem-solving approach, 2019, Reema Thareja, Oxford University Press.

**Note: Only the 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)
- [https://onlinecourses.nptel.ac.in/noc22\\_cs32/preview](https://onlinecourses.nptel.ac.in/noc22_cs32/preview) (Last visited Date: 17 April 2025)

**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

CO-PO Statement	P O1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
O5.0CA101C01H.1	3	2	2	2	1				1	2			2	2
O5.0CA101C01H.2	3	3	3	2	2				1		1		2	2
O5.0CA101C01H.3	3	3	3	3	2							2	3	3
O5.0CA101C01H.4	3	3	3	3	1	1					2		2	2
O5.0CA101C01H.5	3	3	3	3	2							1	3	3

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

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

**O5.0CA102C01: SOFTWARE ENGINEERING**

**Credits: 3**

**Max. Marks 100**

**Continuous Evaluation: 30**

**Duration of Examination: 3 hrs.**

**End Semester Examination: 70**

**Pre-Requisites: NA**

**Course Type: Core**

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

- O5.0CA102C01.1** Define the basic software engineering methods and practices, and their appropriate applications.
- O5.0CA102C01.2** Understand software process models and software requirements and the SRS documents.
- O5.0CA102C01.3** Implement project management planning, scheduling and risk management using real life applications.
- O5.0CA102C01.4** Classify different software architectural designs.
- O5.0CA102C01.5** Compare the various testing strategies at functional level and behavior level
- O5.0CA102C01.6** Asses software quality attributes and to integrate software quality control and software quality assurance.

**PART -A**

**UNIT 1: Software Engineering – An Introduction**

- 1.1 The evolving role of software
- 1.2 Software myths & Changing nature of software
- 1.3 Software engineering – a layered technology
- 1.4 A process framework & Capability maturity model integration (CMMI)
- 1.5 Process patterns & assessment
- 1.6 Personal and team process models
- 1.7 Process models: The waterfall model, incremental, evolutionary & the unified process

**UNIT 2: Requirement Analysis and Specification**

- 2.1 Functional & non-functional requirements
- 2.2 User & system requirements
- 2.3 Interface specification
- 2.4 Software requirements document
- Requirements engineering process**
- 2.5 Feasibility studies
- 2.6 Requirements elicitation & analysis
- 2.7 Requirements validation & management
- 2.8 System models: Context, behavioral, data, object & structured methods

**UNIT 3: Design Engineering**

- 3.1 Design process & design quality
- 3.2 Design concepts & design model

- 3.3 Software architecture
- 3.4 Data design
- 3.5 Architectural styles & patterns
- 3.6 Architectural design
- 3.7 Conceptual model of UML
- 3.8 Basic structural modeling & Diagrams- class, sequence, collaboration, use case & component

## **PART-B**

### **UNIT 4: Testing Strategies**

- 4.1 A strategic approach to software testing
- 4.2 Test strategies for conventional software
- 4.3 Blackbox & Whitebox testing
- 4.4 Validation & system testing
- 4.5 The art of debugging

#### **Product Metrics**

- 4.6 Software quality
- 4.7 Metrics for analysis model
- 4.8 Metrics for design model & source code
- 4.9 Metrics for testing & maintenance

### **UNIT 5: Risk Management**

- 5.1 Software measurement
- 5.2 Metrics for software quality
- 5.3 Reactive VS proactive risk strategies
- 5.4 Software risks
- 5.5 Risk identification, risk projection and refinement
- 5.6 RMMM & RMMM plan

### **UNIT 6: Software Quality Assurance and Maintenance**

- 6.1 Software Quality, Quality Assurance, Quality Standards like ISO 9001
- 6.2 SEI-Capability Maturity Model
- 6.3 Software reliability, measurements of reliability.
- 6.4 Reverse Engineering, Software Re-engineering
- 6.5 Software Configuration Management
- 6.6 Software Maintenance

#### **Suggested Readings:**

##### **Text Books**

1. Software Engineering, A practitioner's Approach- Roger S. Pressman, 6th edition, Mc Graw Hill International Edition.
2. Software Engineering- Sommerville, 7th edition, Pearson Education.
3. The unified modeling language user guide Grady Booch, James Rumbaugh, Ivar Jacobson, Pearson Education.

#### **REFERENCE BOOKS:**

1. Software Engineering, an Engineering approach- James F. Peters, Witold Pedrycz, John Wiley.
2. Software Engineering principles and practice- Waman S Jawadekar, The Mc Graw-Hill Companies.
3. Fundamentals of object-oriented design using UML Meiler page-Jones: Pearson Education.

**Note: Only latest editions of the books are recommended.**

**Weblinks:**

<https://www.tutorialspoint.com> <https://www.nptel.ac.in>

**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:**

	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2
O5.0CA102C01.1	3	2	2	2	1				1		1			2
O5.0CA102C01.2	2	3	2	3	2			1		1		1		2
O5.0CA102C01.3	2	2	3	3	2	1	1	2	1	2			1	3
O5.0CA102C01.4	2	2	3	2	2			1	1		1	1		2
O5.0CA102C01.5	3	3	2	3	2				1	1		1		3
O5.0CA102C01.6	3	3	3	3	3			1		1		1		3

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

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

**O5.0CA152C01: Minor Project-I**

**Credits: 2**

**Max. Marks 100**

**Duration of Examination: 3 hrs.**

**Continuous Evaluation: 30**  
**End Semester Examination: 70**

**Pre-Requisites: Java Programming Lab**

**Course Type: Core**

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

- O5.0CA152C01.1 Describe the System Development Life Cycle (SDLC)
- O5.0CA152C01.2 Construct and evaluate data flow diagrams.
- O5.0CA152C01.3 Design and evaluate system outputs.
- O5.0CA152C01.4 Construct and evaluate entity-relationship (ER) diagrams for real projects.
- O5.0CA152C01.5 Determine the various test cases and analyze the results.
- O5.0CA152C01.6 Develop soft-skills including writing formal reports and delivering oral presentations

**Minor Project-I** based on Java language provides the student with an opportunity to enhance the project development skills. The minor project-I provides insight to understand the real-life usage of the Java language for technical and societal problem solving. Each of the students is required to develop a project during the semester. Internal evaluation will be done by the respective mentors; the external evaluation will be carried out separately. Internal assessment will be done on the basis of following criteria:

The evaluation of the industrial training shall be made as per following:

**Continuous Evaluation during training:**

- 1. Evaluation by the Supervisor in the Industry : 15 marks
- 2. Synopsis, High Level Design and Low Level Design : 10 marks
- 3. Internal Seminar cum Presentation : 05 marks
- Total Internal Marks : **30**

**External Evaluation after training:**

- 1. Project Report : 20 marks
- 2. Seminar cum Presentation : 20 marks
- 3. Viva : 30 marks
- Total External marks : **70**

**COURSE ARTICULATION MATRIX**

<b>CO-PO Mapping</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</b>	<b>PO10</b>	<b>PO11</b>	<b>PO12</b>	<b>PSO1</b>	<b>PSO2</b>
O5.0CA152C01.1		2	3	2									1	2
O5.0CA152C01.2			2										2	
O5.0CA152C01.3			3											2
O5.0CA152C01.4			2										3	

O5.0CA152C01.5					3								2	3
O5.0CA152C01.6									3		2			2

**Note: Project guidelines are enclosed in Annexure-A**

**Annexure-A:**

➤ **Guidelines for submission of BCA Project**

All the students are required to submit a project report based on the work done by him/her during the project period based on any programming language. Presentation / viva will be based on the project work carried during the semester. The Project topics should be based on syllabus or beyond.

The project is evaluated on the basis of following heads:

1. Presentation
2. Viva
3. Project report
4. Documentation
5. Testing

➤ **Project Report Preparation Guidelines:**

Project report should consist the following:

- . Cover page as per the format (Annexure 1)
- . Declaration by the Student (Annexure 2)
- . Certificate from Department (Annexure 3)
- . Acknowledgement
- . Index (Table of Contents in tabular form)
- . Introduction
- . About Organization
- . Aims & Objectives
- . Manpower
- . System Study
- . Existing System along with limitations
- . Proposed System along with advantages
- VIII. Feasibility Study
  - . Technical
  - . Behavioral
  - . Economic
- VIII.
  - Project
  - Monitoring
  - System a
  - Gantt
  - Chart
- X. System Analysis
  - . Requirement Specification
  - . System Flowcharts
- . DFDs /ERDs (up to Level 2)
- XI. System Design
  - . File/ Data Design
- XII. Input / Output Form Design
  - . Screen Design (Screenshots of all screens In Color)
  - . Report Design
- XIII. System Testing
  - . Preparation of Test Data
  - . Testing With Live Data
  - . Test Cases with results

- XIV. System Implementation
  - . System Requirements (Hardware/Software)
- XV. Documentation
- XV. Scope of the Project
- XVI. Bibliography

### **Project Report Submission Guidelines**

- a. Make 3 copies of the project.
- b. Submit one original hard and one original soft copy of the project report to concerned guide.
- c. A photocopy of the complete Project should be retained by the student for future reference.
- d. Cover page should be properly formatted. (See Annexure 1)
- e. The project report must be about 80-100 pages.
- f. Source code or pseudo code should not be included in the project report
- f. Student will be giving a presentation of about 20 minutes, highlighting the project objective, summary and report and findings of the project at the time of viva.
- g. Project completed in all aspects with necessary enclosures should be submitted to the concerned Guide in specified time period.
- i. The dimension of the project report should be in A4 size.
- j. The project report should be bound using flexible cover of the thick plastic paper (Spiral Binding).
- k. Report should use Font Arial/ Times New Roman; Font Size: 14 (For Headings Bold) and 12 (For Paragraphs). Document can have maximum of 1.5 lines spacing.
- l. Project completed in all aspects with necessary enclosures should be submitted to the concerned Guide.
- m. Violation of the project guidelines will lead to the rejection of the project at any stage.
- n. A photocopy of the project report is not acceptable for submission.

### **Annexure 2**

#### **Declaration**

I do hereby declare that this project work entitled “\_\_\_\_\_” submitted by me for the partial fulfilment of the requirement for the award of BACHELOR OF COMPUTER APPLICATIONS (BCA) is a record of my own work. The report embodies the finding based on my study and observation and has not been submitted earlier for the award of any degree or diploma to any Institute or University.

SIGNATURE OF STUDENT

Name:

Roll No:

**Certificate from the Guide**

**Annexure 3**

This is to certify that the project report entitled “ \_\_\_\_\_ ” submitted in partial fulfilment of the degree of BACHELOR OF COMPUTER APPLICATIONS (BCA) to Manav Rachna International Institute of Research & Studies, Faridabad is an authentic and original work carried out by Mr./ Ms. \_\_\_\_\_ with Roll no. \_\_\_\_\_ under my guidance.

The matter embodied in this project is genuine work done by the student and has not been submitted whether to this University or to any other University / Institute for the fulfillment of the requirements of any course of study.

**Signature of the Student:**

**Date:**

Name:

Roll No:

**Signature of the Guide**

**Date:**

Name of the Guide:

Designation of the Guide:

**SIGNATURE OF HOD**

**Annexure 4:**

**Acknowledgement**

I gratefully acknowledge for the assistance, cooperation, guidance and clarification provided by Ms./Mr. \_\_\_\_\_ (Company Guide – If applicable) during the development of \_\_\_\_\_ (project title). My extreme gratitude to Dr. Anupriya Jain (Guide from Department) who guided us throughout the project. Without his willing disposition, spirit accommodation, frankness, timely clarification and above all faith in us, this project could not have been completed in due time. His readiness to discuss all important matters at work deserves special attention of. I would also like to thank all the faculty members of the computer application department for their cooperation and support.

I would like to extend my sincere gratitude to **Prof. (Dr.)** \_\_\_\_\_ for her valuable teaching and advice. I would like to thank **Prof. (Dr.)** \_\_\_\_\_ for motivating us. I would again like to thank all faculty members of the department for their cooperation and support. I would like to thank non-teaching staff of the department for their cooperation and support.

I perceive this opportunity as a big milestone in my career development. I will strive to use gained skills and knowledge in the best possible way, and I will continue to work on their improvement, in order to attain desired career objectives. Hope to continue cooperation with all of you in the future.

No signature required on this page.

**Annexure 5**

**Index (Table of Contents in tabular form)**

S.N.	Chapter	Page No

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

**O5.5CA100C06: INTERNSHIP**

**Credits: 1**

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

**Duration of Examination: 3 hrs.**

**End Semester Examination: --**

**Pre-Requisites: Knowledge of programming language and problem-solving skills**

**Course Type: Internship**

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

**O5.5CA100C06.1 Describe the system development life cycle (SDLC)**

**O5.5CA100C06.2 Construct and evaluate data flow diagrams.**

**O5.5CA100C06.3 Design and evaluate system outputs**

**O5.5CA100C06.4 Construct and evaluate entity-relationship (ER) diagrams for real projects**

**O5.5CA100C06.5 Determine the various test cases and analyze the results.**

**O5.5CA100C06.6 Develop soft-skills including writing formal reports and delivering oral presentations.**

Internship experience provides the student with an opportunity to enhance the knowledge in their respective subject areas. The internship provides insight to understand the actual behavior of the industry able to develop a greater understanding about the career option. Each of the students is required to develop a mini project during his/ her 2-week internship. Evaluation will be done by the respective mentors. Internal assessment will be done on the basis of following criteria:

- |                          |   |           |
|--------------------------|---|-----------|
| 1. Presentation          | - | 30 marks  |
| 2. Viva                  | - | 50 marks  |
| 3. Thesis/Project report | - | 20 marks. |

**COURSE ARTICULATION MATRIX**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
<b>O5.5CA100C06.1</b>		2	3	2									1	2
<b>O5.5CA100C06.2</b>			2										2	
<b>O5.5CA100C06.3</b>			3											2
<b>O5.5CA100C06.4</b>			2										3	
<b>O5.5CA100C06.5</b>					3								2	3
<b>O5.5CA100C06.6</b>									3		2			2

**Note: Project guidelines are enclosed in Annexure-A**

**Annexure-A:**

**1. Guidelines for submission of BCA Project**

All the students are required to submit a project report based on the work done by him/her during the project period based on any programming language. Presentation / viva will be based on the project work carried during the semester. The Project topics should be based on syllabus or beyond.

The project is evaluated on the basis of following heads:

1. Presentation
2. Viva
3. Project report
4. Documentation
5. Testing

**2. Project Report Preparation Guidelines:** Project report should consist the following:

- I. Cover page as per the format (Annexure 1)
- I. Declaration by the Student (Annexure 2)
- I. Certificate from Department (Annexure 3)
- I. Acknowledgement
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  - a. About Organization
  - a. Aims & Objectives
  - a. Manpower
- I. System Study
  - a. Existing System along with limitations
  - a. Proposed System along with advantages
- IX. Feasibility Study
  - a. Technical
  - a. Behavioral
  - a. Economic
- IX. Project Monitoring
  - System a Gantt Chart
- XI. System Analysis
  - a. Requirement Specification
  - a. System Flowcharts
- a. DFDs /ERDs (up to Level 2)
- XII. System Design
  - a. File/ Data Design
- XIII. Input / Output Form Design
  - a. Screen Design (Screenshots of all screens In Color)
- a. Report Design
- XIV. System Testing
  - a. Preparation of Test Data
  - a. Testing With Live Data
- a. Test Cases with results
- XV. System Implementation
  - a. System Requirements (Hardware/Software)

XI. Documentation

XVI. Scope of the Project

XVI. Bibliography

### Project Report Submission Guidelines

- Make 3 copies of the project.
- Submit one original hard and one original soft copy of the project report to concerned guide.
- A photocopy of the complete Project should be retained by the student for future reference.
- Cover page should be properly formatted. (See Annexure 1)
- The project report must be about 80-100 pages.
- Source code or pseudo code should not be included in the project report
- Student will be giving a presentation of about 20 minutes, highlighting the project objective, summary and report and findings of the project at the time of viva.
- Project completed in all aspects with necessary enclosures should be submitted to the concerned Guide in specified time period.
- The dimension of the project report should be in A4 size.
- The project report should be bound using flexible cover of the thick plastic paper (Spiral Binding).
- Report should use Font Arial/ Times New Roman; Font Size: 14 (For Headings Bold) and 12 (For Paragraphs). Document can have maximum of 1.5 lines spacing.
- Project completed in all aspects with necessary enclosures should be submitted to the concerned Guide.
- Violation of the project guidelines will lead to the rejection of the project at any stage.
- A photocopy of the project report is not acceptable for submission.

**Annexure 2**

### Declaration

I do hereby declare that this project work entitled “\_\_\_\_\_” submitted by me for the partial fulfilment of the requirement for the award of BACHELOR OF COMPUTER APPLICATIONS (BCA) is a record of my own work. The report embodies the finding based on my study and observation and has not been submitted earlier for the award of any degree or diploma to any Institute or University.

SIGNATURE OF  
STUDENT

Name:

Roll No:

**Annexure 3**

### Certificate from the Guide

This is to certify that the project report entitled “\_\_\_\_\_” submitted in partial fulfilment of the degree of BACHELOR OF COMPUTER APPLICATIONS (BCA) to Manav Rachna International Institute of Research & Studies, Faridabad is an authentic and original work carried out by Mr./Ms. \_\_\_\_\_ with Roll no. \_\_\_\_\_ under my guidance.

The matter embodied in this project is genuine work done by the student and has not been submitted whether to this University or to any other University / Institute for the fulfillment of the requirements of any course of study.

Signature of the Student:

Date:

Signature of the Guide

Date:

Name:  
Roll No:

Name of the Guide:  
Designation of the Guide

**SIGNATURE OF HOD**

**Annexure 4:**

**Acknowledgement**

I gratefully acknowledge for the assistance, cooperation, guidance and clarification provided by Ms./Mr. \_\_\_\_\_(Company Guide – If applicable) during the development of \_\_\_\_\_(project title). My extreme gratitude to Dr. Anupriya Jain (Guide from Department) who guided us throughout the project. Without his willing disposition, spirit accommodation, frankness, timely clarification and above all faith in us, this project could not have been completed in due time. His readiness to discuss all important matters at work deserves special attention of. I would also like to thank all the faculty members of the computer application department for their cooperation and support.

I would like to extend my sincere gratitude to **Prof. (Dr.)** \_\_\_\_\_ for her valuable teaching and advice. I would like to thank **Prof. (Dr.)** \_\_\_\_\_ for motivating us. I would again like to thank all faculty members of the department for their cooperation and support. I would like to thank non-teaching staff of the department for their cooperation and support.

I perceive this opportunity as a big milestone in my career development. I will strive to use gained skills and knowledge in the best possible way, and I will continue to work on their improvement, in order to attain desired career objectives. Hope to continue cooperation with all of you in the future.

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**Annexure 5:**

**Index (Table of Contents in tabular form)**

S.N.	Chapter	Page No

MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

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

**O5.0SBSS100C04: Universal Human Values**

**Credits: 2**

**Max. Marks 100**

**Continuous Evaluation: 30**

**Duration of Examination: 3 Hrs.**

**End Semester Examination: 70**

**Pre-Requisites: NA**

**Course Type: AEC**

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

- O5.0SBSS100C04.1 Understand the usefulness of values inputs in personal and professional lives**
- O5.0SBSS100C04.2 Acknowledge the importance of having harmonious relationships build on mutual respect and trust in both personal and professional lives.**
- O5.0SBSS100C04.3 Understand how human contribute to maintaining peace in both the environment and society.**
- O5.0SBSS100C04.4 Explore ways to integrate human values in happiness and material achievements.**
- O5.0SBSS100C04.5 Help to tackle various day-to-day situations in real life, or at least take a step in that direction.**

**Module 1: Understanding Human Values**

- 1.1 : Characteristics of Universal Human Values
- 1.2 Difference between value-based education and skill-based education.
- 1.3 Content of value education
- 1.4 Self-Exploration– Meaning and Process
- 1.5 Basic Human Aspirations – Meaning and Basic Requirements for fulfilling.
- 1.6 Measures to fulfil basic human aspirations in the current scenario.

**Module 2: Understanding Harmony: Self and other people**

- 2.1 Recognizing the human person as a coexistence of the material ‘Body’ and the conscious ‘I’
- 2.2 Understanding the requirements of one’s body and oneself or Sukh and Suvidha.
- 2.3 Recognizing the body as a tool of ‘I’ (the performer, observer, and admirer)
- 2.4 Recognizing the traits and pursuits of ‘I’ and harmony within ‘I’ realizing the balance between the body and the self—Sanyam and Swasthya—as well as the proper evaluation of one’s physical demands, the precise definition of prosperity, and programmes that uphold Sanyam and Swasthya.

**Module 3: Human-Human Relationships and in Families and Society:**

- 3.1 Understanding harmony in the Family- the basic unit of human interaction.
- 3.2 Understanding values in human-human relationship: ‘Respect’ is the proper attitude, and ‘trust’ is the fundamental value.
- 3.3 Justice, trust (Vishwas) and Respect (Samman) as the foundational values of relationship in human-to-human relationships.
- 3.4 Understanding social harmony (because society is a family): Samadhan, Samridhi, Abhay, and Sah-astitva as all-encompassing human goals.
- 3.5 Envisioning an unbroken, peaceful society (Akhand Samadhi), a universal order (Sarvabhaum Vyawastha), and moving from the family to the global family!

#### **Module 4: Harmony in nature and existence—the coexistence of all things**

4.1 Understanding the harmony in the Nature

4.2 Understanding Existence as Co-existence (Sah-astitva) of mutually interacting units in all- pervasive space

4.3 Holistic perception of harmony at all levels of existence

#### **Module 5: Implications of Harmony on Professional Ethics**

5.1 The universal order of humanism, the constitution, the universal order, the basis for education and the acceptance of human values

5.2 Proficiency in Corporate Ethics

#### **Books and Articles**

1. Gaur, R R, Asthana, R and Bagaria G P (2019), A Foundation Course in Human Values and Professional Ethic, Excel Books; New Delhi.
2. Gaur, R R, Asthana, R and Bagaria G P (2019), The Teacher's Manual for A Foundation Course in Human Values and Professional Ethics, Excel Books; New Delhi.
3. Nagaraj, A (1999), Jeevan Vidya: Ek Parichaya, Jeevan Vidya Prakashan: Amar kantak.
4. Tripathi, A, N (2004), Human Values, New Age International Publishers: New Delhi.
5. Donella H. Meadows, Dennis L. Meadows (eds.) 1972, Limits to Growth – Club of Rome's report, Universe Books.
6. P L Dhar, RR Gaur (1990), Science and Humanism, Commonwealth Publishers: New Delhi.
7. E G Seebauer & Robert L. Berry (2000), Fundamentals of Ethics for Scientists & Engineers, Oxford University Press: London.
8. Banerjee, B. P(2005), Foundations of Ethics and Management, Excel Books: New Delhi.
9. Bajpai, B L(2004), Indian Ethos and Modern Management, New Royal Book Company :Lucknow.

#### **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

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

**O5.0FLGR100E03: German-I**

**Credits: 2**

**Max. Marks: 100**

**Duration of Examination: 3 Hrs.**

**Internal: 30**

**External: 70**

**Prerequisites:** Basic knowledge of grammatical structure, syntax, and vocabulary of English and/or Hindi

**Course Type:** Generic Elective

**Course Outcomes:**

**O5.0FLGR100E03.1.** Students will be able to exchange greetings and introductions using formal and informal expressions. They will be able to ask and answer simple questions.

**O5.0FLGR100E03.2.** Students will be able to discuss everyday life and daily routines, using simple sentences and familiar vocabulary.

**O5.0FLGR100E03.3.** Students will be able to identify key details in short, highly-contextualized audio text dealing with a familiar topic, relying on repetition and extra linguistic support when needed.

**O5.0FLGR100E03.4.** Students will be able to discuss likes and dislikes, understand simple conversations about familiar topics (e.g., greetings, weather and daily activities,) with repetition when needed.

**O5.0FLGR100E03.5.** Students will be able to differentiate certain patterns of behavior in the cultures of the German-speaking world and the student's native culture.

**O5.0FLGR100E03.6.** Students will be able to describe various places, location, themselves using simple sentences and vocabulary.

**PART-A**

**Unit-1: Begrüßungen**

1.1 Salutations/Greetings

1.2 Introduction

1.3 Role play Activity

**Unit-2: sich vorstellen und Zahlen**

2.1 Introduction

2.2 Alphabets

2.3 Numbers 1-20

2.4 Project depicting German Culture

**Unit-3: Berufe/ Pronomen**

3.1 Personal pronouns

3.2 Hobbies and professions

**PART-B**

**Unit-4: Café**

4.1 Café related vocabulary and dialogues

4.2 Revision personal pronouns

4.3 Restaurant Role play

**Unit-5: Café dialog**

5.1 Café related vocabulary and dialogues

5.2 Common verbs and their conjugations

### Unit-6: Zeit und Monate

6.1 Time

6.2 Days

6.3 Months

6.4 Oktoberfest Activity

#### Text Books/Reference Books:

1. Studio D A1, Hermann Funk, Cornelson Publication
2. Tangaram Aktuell A1, Kursbuch & Arbeitsbuch, Hueber
3. Netzwerk, Stefanie Dengler, Paul Rusch et. Al, Klett

#### Weblinks:

<http://www.nthuleen.com/>

#### Evaluation Policy:

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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

CO Statement	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
O5.0FLGR100E03.1	-	-	-	-	-	-	-	-	3	-	-
O5.0FLGR100E03.2	-	-	-	-	-	-	-	-	3	-	2
O5.0FLGR100E03.3	-	-	-	-	-	-	1	1	3	-	-
O5.0FLGR100E03.4	-	-	-	-	-	-	-	1	3	-	2
O5.0FLGR100E03.5	-	-	-	-	-	-	-	-	3	-	1
O5.0FLGR100E03.6	-	-	-	-	-	-	-	3	2	-	1

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

**O5.0FLSP100E03: Spanish-I**

**Credits: 2**

**Max. Marks: 100**

**Duration of Examination: 3 Hrs**

**Internal: 30**

**External: 70**

**Course Outcomes:**

O5.0FLSP100E03.1. Students will be able to exchange greetings and introductions using formal and informal expressions and students will be able to ask and answer simple questions.

O5.0FLSP100E03.2. Students will be able to discuss everyday life and daily routines, using simple sentences and familiar vocabulary and students will be able to discuss likes and dislikes understand simple conversations about familiar topics.

O5.0FLSP100E03.3. Students will be able to identify key details in a short, highly-contextualized audio text dealing with a familiar topic, relying on repetition and extra linguistic support when needed and students will be able to offer basic descriptions of self, other people, familiar places and objects in short discourse using simple sentences and basic vocabulary.

O5.0FLSP100E03.4. Students will be able to provide basic information about familiar situations and topic of interest and students will be able to express or/and justify opinions using equivalents of different verbs.

O5.0FLSP100E03.5. Students will be able to differentiate certain patterns of behavior in the cultures of the Spanish-speaking world and student's native culture.

O5.0FLSP100E03.6. Students will be able to describe various places, location, themselves using simple Sentences and vocabulary.

**PART-A**

**Unit 1: Introduction to Spanish and SER**

**(4 Lectures)**

- 1.1 Presentation on Spanish language
- 1.2 Greetings and goodbyes
- 1.3 Spanish letters
- 1.4 Introduction of verb SER

**Unit 2: Nationality, Profession and Counting**

**(4 Lectures)**

- 2.1 Uses of verb SER
- 2.2 Adjectives related to verb SER.
- 2.3 Introduction of Nationality
- 2.4 Professions and vocabulary related to professions.
- 2.5 Counting till number 100.
- 2.6 Role play

**Unit 3: Articles and Interrogative**

**(4 Lectures)**

- 3.1 Introduction of Articles-definite and indefinite articles
- 3.2 Interrogatives
- 3.3 Singular-plural

**PART-B**

**Unit 4: Family, colors and Self-Introduction**

**(4 Lectures)**

- 4.1 Vocabulary of family members and adjectives related to it
- 4.2 Colors
- 4.3 Self – introduction

**Unit 5: My class, Adjective Possessive**

**(4 Lectures)**

- 5.1 My class
- 5.2 Uses of adjective possessive and demonstrative
- 5.3 Adverbs
- 5.4 Project based on culture

**Unit 6: Day, Month and Negation**

**(4 Lectures)**

- 6.1 Days, Months and Seasons
- 6.2 Closed ended questions
- 6.3 Negation

**Text Books/Reference Books:**

1. Vivos-I, Workbook and Textbook
2. Nuevo Español sin fronteras 1 + Workbook + CD, JesusSanchez Lobato and Isabel Santos Gargallo, Goyal Saab, ELE & SGEL

**Weblinks:**

<http://studyspanish.com/>

**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**

CO Statement	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
O5.0FLSP100E03.1	-	-	-	-	-	-	-	2	2	-	2
O5.0FLSP100E03.2	-	-	-	-	-	-	-	2	3	-	2
O5.0FLSP100E03.3	-	-	-	-	-	-	-	3	3	-	2
O5.0FLSP100E03.4	-	-	-	-	-	-	1	1	3	1	2
O5.0FLSP100E03.5	-	-	-	-	-	-	1	3	3	1	2
O5.0FLSP100E03.6	-	-	-	-	-	-	1	3	3	1	2

**MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES**  
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**5.0FLFR100E03: French-I**

**Credits: 2**

**Max. Marks: 100**

**Duration of Examination: 2 hrs.**

**Internal: 30**

**External: 70**

**Course Outcomes:**

**O5.0FLFR100E03.1** Exchange greetings and do introductions using formal and informal expressions. Understand and use interrogative and answer simple questions.

**O5.0FLFR100E03.2** Learn Basic vocabulary that can be used to discuss everyday life and daily routines, using simple sentences and familiar vocabulary. Express their likes and dislikes. Also, will have understanding of simple conversations about familiar topics (e.g. greetings, weather and daily activities) with repetition when needed.

**O5.0FLFR100E03.3** Identify key details in a short, highly-contextualized audio text dealing with a familiar topic, relying on repetition and extra linguistic support when needed. Describe themselves, other people, familiar places and objects in short discourse using simple sentences and basic vocabulary.

**O5.0FLFR100E03.4** Describe themselves, other people, familiar places and objects in short discourse using simple sentences and basic vocabulary. Provide basic information about familiar situations and topics of interest.

**O5.0FLFR100E03.5** Express or/and justify opinions using equivalents of different verbs. Differentiate certain patterns of behavior in the cultures of the French-speaking world and the student's native culture.

**O5.0FLFR100E03.6** Describe various places, location, themselves using simple sentences and vocabulary.

**PART-A**

**Unit - Saluer et épeler l'alphabet**

1.1 Les Salutations & forms of politeness

1.2 Alphabets

1.3 Taking leave expressions

**Unit 2- Usage de Vous et de Tu**

2.1 Les pronoms sujets

2.2 Basic Questions

2.3 Role Play

**Unit 3- Présentez-vous**

3.1 Les verbes ER

3.2 Self introduction

3.3 Les mois de l'année

3.4 Les jours de la semaine

**PART-B**

**Unit 4- Identifier un nombre, compter**

4.1 Verbes Avoir, Etre, Aller & Faire

4.2 Les nombres ordinaux et cardinaux

4.3 L'heure

## Unit 5- Demander/ donner l'explications

5.1 Les articles défini et indéfini

5.2 Les noms

5.3 Décrivez votre ami(e)

5.4 Project depicting French Culture

## Unit 6- Parler des saisons et demander l'heure

6.1 Time

6.2 Weather

6.3 Unseen Passage

### Text Books/Reference Books/ Suggested Readings:

1. Alter Ego Level One Textbook, Annie Berthet, Catherine Hugot, Veronique M Kizirian, Hachette Publications
2. Apprenons Le Français II & III, Mahitha Ranjit, Saraswati Publications

### Weblinks:

[www.isl.com](http://www.isl.com)

[www.françaisfacile.com](http://www.françaisfacile.com)

### Evaluation Policy:

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O5.0FLFR100E03.2	-	-	-	-	-	-	-	3	3	-	2
O5.0FLFR100E03.3	-	-	-	-	-	-	-	3	3	-	2
O5.0FLFR100E03.4	-	-	-	-	-	-	1	3	3	1	2
O5.0FLFR100E03.5	-	-	-	-	-	-	1	1	3	1	2
O5.0FLFR100E03.6	-	-	-	-	-	-	1	3	3	1	2

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

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

**O5.0CA100C05: RESEARCH INNOVATION CATALYST-I**

**Credits: 1**

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

**Pre-requisites: NA**  
**Course Type: Core**

**Course Outcomes:**

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

**O5.0CA100C05.1. Understand what is Research and Innovation.**

**O5.0CA100C05.2. Be in a position to describe the process and the procedure to carry out research/ innovation**

**O5.0CA100C05.3. Understand the research documentation that is needed for, journals publication, conferences etc.**

**O5.0CA100C05.4. Understand and adopt the ethical practice in the research / Innovation activities.**

**O5.0CA100C05.5. Comprehend the benefits obtained by means of systematic research/ Innovation**

**O5.0CA100C05.6. 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-Deepdive for research/ Innovation.
- 3.5 Usage of scholarly networking sites like Research Gate, Mendeley, and 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>

**Course Articulation Matrix:**

<b>CO-PO Statement</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</b>	<b>PO10</b>	<b>PO11</b>	<b>PO12</b>	<b>PSO1</b>
O5.0CA100C05.1	3	1		1	2		1				2	1	1
O5.0CA100C05.2	2	3		2	2		1	1		1	2	1	2
O5.0CA100C05.3	2		3				1	1			1	2	3
O5.0CA100C05.4		1		3	2	1				1		1	3
O5.0CA100C05.5	2	3		2			1	1		1		1	2
O5.0CA100C05.6	2		3		1			1				2	3

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

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

**NAAC 'A++' Grade University**

**Bachelor of Computer Applications & Bachelor of Science Information Technology**

**Placement Competency Enhancement-III**

**O5.0CDC196C05**

**Credits: 1**

**Max. Marks: 100**

**Internal Evaluation: 30**

**End Semester Examination: 70**

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

**O5.0CDC196C05.1: interpret data and hone their logical reasoning skills**

**O5.0CDC196C05.2: solve complex problems based on time, work, Speed, and Distance.**

**O5.0CDC196C05.3: enhance and expand word knowledge and construct simple and complex sentences accurately and develop reading and writing skills.**

**O5.0CDC196C05.4: enhance their ability to ace interviews, participate effectively and confidently in a Group Discussion**

**O5.0CDC196C05.5: apply problem-solving techniques for placement readiness, including mathematical algorithms, data structures, and OOP principles.**

**O5.0CDC196C05.6: analyze and optimize algorithms, fostering critical thinking essential for technical interviews and placements.**

**PART – A**

**Unit 1: Arithmetic III**

**1.1 Time & Work**

1.1.1. Time and Work, Chain Rule

1.2.2. Work & Wages

1.2.3. Pipes & Cisterns

**1.2 Time, Speed & Distance**

1.2.1 Basics Formulas & Proportionality

1.2.2 Average & Relative Speed

1.2.3 Trains and Boats & Streams

1.2.4 Circular Motion and Clocks

**Unit 2: Data Interpretation**

2.1 Table and Bar graph

2.2 Line and Pie Charts

2.3 Mixed Charts and Caselets

**Unit 3: Logical Reasoning III**

3.1 Coding-Decoding

3.2 Clocks & Calendar

3.3 Cubes and Dices

3.4 Venn Diagram

**PART – B**

#### **Unit 4: Communication Accuracy**

- 4.1 Relevance of Verbal Ability and preparatory guidelines
- 4.2 Functional Grammar – Subject Verb Agreement
- 4.3 Tenses – Perfect, Simple, Continuous
- 4.4 Common Errors and rectification, Idioms and Phrases

#### **Unit 5: Word Power Building Skills**

- 5.1 Words: Antonyms, Synonyms, Verbal Analogies
- 5.2 Root Word Technique for Prefixes & Suffixes
- 5.3 Word Power: 7 Tips for Learning New Words
- 5.4 Practice Vocabulary Exercises

#### **Unit 6: Reading & Writing Skills**

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

#### **Unit 7: Professional Writing**

- 7.1. Cover Letter/Emails
- 7.2. Resume Writing

#### **Unit 8: Group Discussions**

- 8.1. Do's and Don'ts of a Group Discussion
- 8.2. Roles played in a Group Discussion
- 8.3. Tips for Cracking a Group Discussion

#### **Unit 9: Professional Communication**

- 9.1 Professional communication
- 9.2 Corporate lingo
- 9.3 Navigating through company social media sites
- 9.4 Networking: LinkedIn etc.
- 9.5 Mock Interviews

### **PART – C**

#### **Unit 10: Problem Solving**

- 10.1. Mathematical Algorithm: Foundational problems (Factorial, HCF, GCD, LCM), Prime Number & Factorization, Sieve Algorithm.
- 10.2. Advance Patterns (based on Loops, Conditional statement)

#### **Unit 11: Array**

- 11.1. Array 1D & 2D: Static, Dynamic size, Kadane's algorithm
- 11.2. 2-pointer approach (same direction with same pace, same direction with different pace, and opposite direction)
- 11.3. Sliding window technique

#### **Unit 12: Searching & Sorting**

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

#### **Unit 13: Strings**

- 13.1. String ASCII codes, Anagram, Substring & Subsequence

13.2. Pattern searching (Naive Algorithm, KMP Algorithm, Z algorithm, Boyer Moore Algorithm)

13.3. Rabin Karp Algorithm

#### **Unit 14: OOPS & Bit Manipulation**

15.1. Class, objects, Constructors, Static members, Function overloading and related concepts, Abstraction, Encapsulation, Inheritance, Polymorphism

15.2. Bit Manipulation and Bit masking

#### **Recommended Texts and Readings:**

1. Karumanchi, N. (2016). Data structures and algorithms made easy (5th ed.). CareerMonk Publications.
2. Wren, P. C., & Martin, H. (2019). English grammar and composition (Revised ed.). S. Chand & Company Pvt. Ltd.
3. Lewis, N. (2014). Word power made easy (1st ed.). Penguin Random House Pvt. Ltd.
4. Aggarwal, R. S. (2018). Quantitative aptitude for competitive exams (7th ed.). S. Chand & Company Pvt. Ltd.
5. Sharma, A. (2021). How to prepare for logical reasoning for CAT (4th ed.). Tata McGraw Hill Education.
6. <https://testbook.com/english-grammar/synonyms-and-antonyms> (Last accessed: May 14, 2024)

#### **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:**

<b>Course Outcome (CO)</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</b>	<b>PO10</b>	<b>PO11</b>	<b>PO12</b>	<b>PSO1</b>	<b>PSO2</b>
<b>O5.0CDC196C05.1</b>	3	-	-	-	-	-	-	-	-	-	-	-	-	3
<b>O5.0CDC196C05.2</b>	-	3	-	-	-	-	-	-	-	-	-	-	-	-
<b>O5.0CDC196C05.3</b>	-	-	3	-	-	-	-	-	-	-	-	-	-	-
<b>O5.0CDC196C05.4</b>	-	-	-	3	-	-	-	-	-	-	-	-	-	-
<b>O5.0CDC196C05.5</b>	3	-	-	-	-	3	-	-	-	-	-	-	-	-
<b>O5.0CDC196C05.6</b>	-	-	-	-	3	-	-	-	-	-	-	-	-	-

# Fourth Semester

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

## **O5.0CA200C01: NUMERICAL ANALYSIS AND STATISTICAL TECHNIQUES**

**Credits: 4**

**Max. Marks: 100**

**Duration of Examination: 3**

**Continuous Evaluation: 30**  
**End Semester Examination: 70**

**Pre-Requisites: Elements of Mathematics**

**Course Type: Core**

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

**O5.0CA200C01.1** Understand the accuracy of numbers and types of errors

- O5.0CA200C01.2** Apply the knowledge of iterative methods to solve algebraic and transcendental equations.
- O5.0CA200C01.3** Acquire Knowledge of the finite differences, interpolation and numerical integration.
- O5.0CA200C01.4** Determine system of linear equations and can find best curve fitting for data.
- O5.0CA200C01.5** Use statistical techniques solve to analyze business problems.
- O5.0CA200C01.6** Apply probabilistic reasoning in resolving real life problems.

### **UNIT 1: Introduction to Numerical Analysis**

- 1.1 Introduction to Numerical Analysis
- 1.2 Errors: Definition, Types of Errors
- 1.3 Bisection method
- 1.4 Regula Falsi method
- 1.5 Newton Raphson method

### **UNIT 2: Interpolation**

- 1.1 Finite Difference Interpolation
- 1.2 Relation between Finite Difference
- 1.3 Newton's Forward interpolation
- 1.4 Newton's Backward interpolation
- 1.5 Lagrange's, interpolation
- 1.6 Newton Divided difference interpolation
- 1.7 Curve fitting: Least square line and parabola fitting

### **UNIT 3: Numerical Integration and Differential equation**

- 3.1 General Quadrature formula
- 3.2 Trapezoidal rule
- 3.3 Simpson's one-third rule
- 3.4 Simpson's three-eight rule.
- 3.5 Taylor series method
- 3.6 Euler method
- 3.7 Runga-Kutta method

### **UNIT 4: Statistical Techniques**

- 4.1 Measure of Central Tendency
- 4.2 Standard deviation and variance
- 4.3 Correlation Analysis: Karl Pearson's Coefficient of correlation, Spearman's rank correlation
- 4.4 Regression Lines

### **UNIT 5: Probability**

- 5.1 Basics of Probability
- 5.2 Addition Theorem on Probability
- 5.3 Conditional Probability
- 5.4 Multiplication Theorem on Probability
- 5.5 Independent Events

## 5.6 Baye's Theorem

### UNIT 6: Probability Distribution

- 6.1 Discrete Random Variable
- 6.2 Probability Distribution
- 6.3 Mean of Discrete Random Variable
- 6.4 Variance of a Discrete Random Variable
- 6.5 Binomial Distribution
- 6.6 Poisson Distribution
- 6.7 Normal Distribution

#### Suggested Readings:

1. [Richard L. Burden](#), 2010, Numerical analysis, Cengage Learning.
2. Babu Ram, 2009, Engineering Mathematics, Pearson Publication.
3. S.P Gupta and M.P Gupta, 2013, Business Statistics, Sultan Chand Publication
4. S.S. Sastry, 2005, Numerical Analysis, Prentice Hall of India
5. M.K.Jain, S.R.K.Iyengar, R.K. Jain, 2014, Numerical methods for Scientific and Engineering Computation, New Age International (P) Limited

#### Weblinks:

- [https://en.wikibooks.org/wiki/Introduction\\_to\\_Numerical\\_Methods/Interpolation](https://en.wikibooks.org/wiki/Introduction_to_Numerical_Methods/Interpolation)
- [https://ocw.mit.edu/courses/mathematics/18-330-introduction-to-numerical-analysis-spring-//lecturenotes/MIT18\\_330S12\\_Chapter2.pdf](https://ocw.mit.edu/courses/mathematics/18-330-introduction-to-numerical-analysis-spring-//lecturenotes/MIT18_330S12_Chapter2.pdf)
- [https://www.tutorialspoint.com/statistics/sampling\\_methods.htm](https://www.tutorialspoint.com/statistics/sampling_methods.htm)
- <https://books.lardbucket.org/books/beginning-statistics>

#### 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:**

	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</b>	<b>PO10</b>	<b>PO11</b>	<b>PO12</b>	<b>PSO1</b>	<b>PSO2</b>
<b>O5.0CA200C01.1</b>	1	1		2				3					1	2
<b>O5.0CA200C01.2</b>	1	1	1	1			2	3					1	2
<b>O5.0CA200C01.3</b>	1	2	2	3			2	3						
<b>O5.0CA200C01.4</b>	1	1		2				3					3	
<b>O5.0CA200C01.5</b>	1	1	2	2	3		2	3			3	3	1	1
<b>O5.0CA200C01.6</b>	1	1	2	1	2	2		3		3	2		2	

# MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

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

## O5.0CA201C01H: OPERATING SYSTEM

**Credits: 4**

**Max. Marks 100**

**Continuous Evaluation: 30**

**Duration of Examination: 3 hrs.**

**End Semester Examination: 70**

**Pre-Requisites: NA**

**Course Type: Core**

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

**O5.0CA201C01H.1 Describe the important computer system resources and the functions of operating system, and understand the basic Unix commands of shell programming.**

**O5.0CA201C01H.2 Understand the working of CPU scheduling algorithms and their implementation in Unix shell programming.**

**O5.0CA201C01H.3 Demonstrate various deadlock techniques, implementation of its algorithms, and understand the life cycle of processes.**

**O5.0CA201C01H.4 Distinguish and compare page replacement algorithms in memory management, and understand the need of process synchronization.**

**O5.0CA201C01H.5 Explain and analyze various structures and implement related algorithms in secondary storage management.**

### UNIT 1: Introduction

- 1.1 Introduction of Operating System
- 1.2 Operating System Architecture
- 1.3 Operating System Services
- 1.4 Types of Operating system: Batch, Multi-programmed, Time-sharing, Real-time, Distributed, Parallel
- 1.5 Concepts of Multitasking, Multiprogramming, Multiuser, Multithreading, Multiprocessing
- 1.6 System Programs and System calls.

### UNIT 2: Process Management

- 2.1 Concept of Process
- 2.2 Process Scheduling
- 2.3 Operations on Processes
- 2.4 Inter process Communication
- 2.5 Threading and Multithreading
- 2.6 Scheduling Criteria, Preemptive & Non-Preemptive Scheduling
- 2.7 Scheduling algorithms: First Come First Served (FCFS), Shortest-Job-First (SJF)
- 2.8 Priority Scheduling, Round Robin (RR), Multilevel Queue Scheduling

### UNIT 3: Process Synchronization and Deadlocks

- 3.1 Concepts of Process Synchronization
- 3.2 Critical Section Problem, Critical Region
- 3.3 Synchronization Hardware
- 3.4 Classical Problems of Synchronization
- 3.5 Semaphores
- 3.6 Basic Concepts of Deadlock

- 3.7 Deadlock Characterization
- 3.8 Deadlock Prevention
- 3.9 Deadlock Avoidance, Detection and Recovery

**UNIT 4: Memory Management**

- 4.1 Logical & Physical Address Space
- 4.2 Swapping
- 4.3 Contiguous Memory Allocation, Non-Contiguous Memory Allocation
- 4.4 Paging
- 4.5 Segmentation
- 4.6 Virtual Memory Management - Demand Paging
- 4.7 Page-Replacement Algorithms: First In First Out (FIFO), Least Recently Used (LRU), Optimal Page Replacement (OPT)
- 4.8 Demand Segmentation
- 4.9 Concept of Fragmentation, Internal and External Fragmentation

**UNIT 5: File and I/O System Management**

- 5.1 File System and its Functions
- 5.2 Different types of Files and their Access Methods
- 5.3 Directory Structures
- 5.4 File Allocation Methods
- 5.5 Disk Structure
- 5.6 Disk Scheduling Algorithms: First come First Serve (FCFS), Shortest Seek Time First (SSTF), Elevator (SCAN), Circular-SCAN(C-SCAN)
- 5.7 I/O Hardware
- 5.8 Application I/O Interface, Kernel
- 5.9 Transforming I/O requests

**UNIT 6: Case Studies**

- 6.1 Linux: Design Principles
- 6.2 Kernel Module
- 6.3 Process Management
- 6.4 Scheduling
- 6.5 Windows 7: Design Principles
- 6.6 System Components
- 6.7 File System
- 6.8 Case Study of Mobile OS

**Suggested Readings:**

1. Milenkovic M, 1992, Operating System: Concept & Design, McGraw Hill.
2. Colin Ritchie, 2003, Operating System Incorporating with Unix & Windows, TMH.
3. Mandrik & Donovan, 2005, Operating Systems, TMH.
4. Sibsankar Haldar, 2010, Operating Systems, Pearson.

**Note: Only latest editions of the books are recommended.**

**List of Experiments:**

**BEGINNER LEVEL (NSQF LEVEL: 1-3)**

S. No.	Name of the Program	Bloom level with Cognitive process
1.	Basics of UNIX commands and Implementation of Shell Programming	Apply (Analyse ( <b>functional code</b> ) / L4)/ L3
2	Write a C/C++ program for process creation and termination.	Apply (Analyse ( <b>functional code</b> ) / L4)/ L3

3	Write a C program to demonstrate the use of basic system calls.	Apply (Analyse (System call functional code) / L3
4	Write a program to take system resources as input and apply Banker's algorithm to avoid deadlock.	Apply ( Deadlock Functional Codes) / L3
5	Write a C/C++ program for thread creation and termination.	Apply (Array manipulation, stack & queue operations) / L3

#### INTERMEDIATE LEVEL (NSQF LEVEL: 4-6)

S.No	Name of the Program	Bloom level with Cognitive process
8	Write a C/C++ program to simulate HRRN CPU scheduling algorithms to find average turnaround time and average waiting time. (Take User input).	Apply (CPU scheduling algorithms)/ L3
9	Simulate First Come First Serve and Shortest Job First scheduling algorithms using arrays.	Apply (scheduling algorithms) / L3
10	Implement a Round Robin scheduling algorithm with user-defined time quantum. Show context switching simulation.	Apply (scheduling algorithms/ Switching Functional code)/ L3
11	Write a C/C++ program to simulate the following non preemptive CPU scheduling algorithms to find average turnaround time and average waiting time. (Provide user inputs) a) FCFS b) SJF c) SRTF d) Priority Based	Apply (scheduling algorithms functional code) / L3
12	Write a C/C++ program to simulate producer- consumer problem using semaphores.	Apply (semaphores functional code)/ L3
13	Write a C/C++ program to simulate reader-writer problem using semaphores	Apply (Binary tree traversal) / L3

#### ADVANCED LEVEL (NSQF LEVEL: 7-10)

S.No.	Name of the Program	Bloom level with Cognitive process	Programs mapped with Ability Enhancement Courses
16	Write a C program to implement and compare FIFO, LRU, and Optimal page replacement algorithms.	Apply (functional code) / L4	
17	Create a simple text-based file system that supports file creation, deletion, and search using indexed or linked allocation methods.	Apply (functional code)/ L4	
18	Write a program to read and display process information from the /proc directory in Linux.	Apply (functional code)/ L4	
19	Write a C/C++ program to simulate Multilevel Queue CPU scheduling algorithms to find the average turnaround time and average waiting time (Processes P0, P1, P4 in	Apply (functional code) / L4	

	Queue 1 and Processes P2, P3 in Queue 2).		
20	Write a C/C++ program to simulate Multilevel Feedback Queue CPU scheduling algorithms to find average turnaround time and average waiting time, where queues 1 and 2 follow round robin with time quantum 4 and 8, respectively and queue 3 follow FCFS.	Apply <b>(functional code)</b> / L4	

**Suggested Readings:**

4. Milenkovic M, 1992, Operating System: Concept & Design, McGraw Hill.
5. Colin Ritchie, 2003, Operating System Incorporating With Unix & Windows, TMH.
6. Mandrik & Donovan, 2005, Operating Systems, TMH.
7. Sibsankar Haldar, 2010, Operating Systems, Pearson.

**Note: Only the latest editions of the books are recommended. Software**

**required/Web links:**

1. <https://turbo-c.net/>
2. Visual Studio
3. [https://www.tutorialspoint.com/operating\\_system/os\\_overview.htm](https://www.tutorialspoint.com/operating_system/os_overview.htm)

**Evaluation Policy:**

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Discussion/Presentation 15%

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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:**

<b>COs / POs &amp; PSOs</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</b>	<b>PO10</b>	<b>PO11</b>	<b>PO12</b>	<b>PSO1</b>	<b>PSO2</b>
<b>O5.0CA201C01H.1</b>	3	2	0	0	1	0	0	0	0	0	0	0	2	1
<b>O5.0CA201C01H.2</b>	3	3	2	1	0	0	0	0	0	0	0	0	3	2
<b>O5.0CA201C01H.3</b>	3	2	2	0	0	0	0	0	0	0	0	0	2	3
<b>O5.0CA201C01H.4</b>	3	3	2	0	1	0	0	0	0	0	0	0	3	2
<b>O5.0CA201C01H.5</b>	3	2	2	0	0	0	0	0	0	0	0	0	2	3

# MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

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

## O5.0CA200E02: INTRODUCTION TO DATA SCIENCE

**Credits: 3**

**Max. Marks: 100**

**Continuous Evaluation: 30**

**Duration of Examination: 3 Hrs.**

**End Semester Examination: 70**

**Pre-Requisites:** Basic Knowledge of Mathematics and Python

**Course Type:** Discipline Elective

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

**O5.0CA200E02.1 Demonstrate Key concepts related to Data Science.**

**O5.0CA200E02.2 Apply data pre-processing techniques.**

**O5.0CA200E02.3 Students will be able to do exploratory data analysis on datasets.**

**O5.0CA200E02.4 Students will be able to apply regression techniques.**

**O5.0CA200E02.5 Apply data science concepts and methods to solve problems in real-world contexts and communicate these solutions effectively.**

### PART-A

#### **UNIT 1: Introduction to Data Science**

1.1 Definition, Data science in various field

1.2 Facets of data

1.3 The data science process

1.4 The big data eco system and data science

1.5 Data Science vs Data Analytics

#### **UNIT 2: Understanding Data and Pre-Processing**

2.1 Types of data – Numeric, Categorical, Ordinal

2.2 Classification of data: Structured, Semi-structured and Unstructured.

2.3 Sources of data: Time series, Transactional data, Spatial Data, Social Network data

2.4 Data cleaning- Handling Missing Data, Outliers, and Inconsistencies

2.5 Data Integration and Transformation.

2.6 Data Reduction

2.7 Data Discretization

#### **UNIT 3: Exploratory Data Analytics**

3.1 Descriptive Statistics – Mean

3.2 Standard Deviation, Skewness and Kurtosis, Box Plots

3.3 Pivot Table, Heat Map

3.4 ANOVA.

## **PART-B**

### **UNIT 4: Models**

4.1 Regression models: Simple linear regression

4.2 Least-squares principle.

4.3 MLR, Multiple regression

4.4 Logistic regression

### **UNIT 5: Languages of Data Science**

5.1 Introduction to Python for Data Science

5.2 Popular Data Science Libraries: NumPy, Pandas, and Scikit-learn

5.3 Introduction to R

5.4 Exploring RStudio for Data Science

5.5 Working with Datasets and Models

### **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. M 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
3. Davy Cielen, Arno D B Meysman, Mohamed Ali, "Introduction to Data Science", Dreamtech Press.
4. Gupta S.P. and Gupta M.P., Business Statistics, Sultan Chand & Sons.

### **Weblinks:**

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

### **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:

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Subjective (Short/Long) 40%

Discussion/Presentation 15%

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Minimum: 70 percent. Categorization for the same is:

Objective Type Questions: 30%

Short/Long Questions: 70%

**Assessment Tools:**

Assignment/Tutorials

Sessional tests

Surprise questions during lectures/Class Performance

Term end examination

**COURSE ARTICULATION MATRIX:**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
O5.0CA200E02.1	1			2				3					1	2
O5.0CA200E02.2	1	1	1	1			2	3					1	2
O5.0CA200E02.3	1	2	2	3			2	3						
O5.0CA200E02.4	1	1		2				3					3	
O5.0CA200E02.5	1	1	2	2	3		2	3			3	3	1	1

# MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

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

## O5.0CA201E02: FUNDAMENTALS OF ARTIFICIAL INTELLIGENCE & MACHINE LEARNING

Credits: 3

Max Marks: 100

Duration of Examination: 3 Hrs.

Continuous Evaluation: 30

End Semester Examination: 70

Pre-Requisites: Basic Mathematics

Course Type: Discipline Elective

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

- O5.0CA201E02.1 Describe the basic concepts of artificial intelligence and intelligent agents.
- O5.0CA201E02.2 Understand various search algorithms
- O5.0CA201E02.3 Understand fundamentals of knowledge representations and reasoning.
- O5.0CA201E02.4 Understand the basic concepts and techniques of machine learning.
- O5.0CA201E02.5 Understand various machine learning algorithms.

### PART-A

#### **UNIT 1: Introduction to Artificial Intelligence**

- 1.1 Introduction to Artificial Intelligence
- 1.2 Future of Artificial Intelligence
- 1.3 Applications of Artificial Intelligence
- 1.4 Intelligent Agents in Artificial Intelligence
- 1.5 Agent Environments
  - 1.1 PEAS representation for an agent
  - 1.2 Architecture of Intelligent Agents
  - 1.3 Characteristics of Intelligent Agents
  - 1.4 Typical Intelligent Agents

#### **UNIT 2: Problem-Solving and Search Strategies**

- 2.1 AI Problems
- 2.2 Problem formulation
- 2.3 Solving problems by searching techniques
- 2.4 Search issues in the design of Search programs
- 2.5 Uninformed Search- Breadth First Search, Depth First Search
- 2.6 Heuristic search- Generate and Test, Hill Climbing, Best First Search
- 2.7 Problem reduction
- 2.8 Constraint Satisfaction
- 2.9 Means-Ends Analysis

#### **UNIT 3: Knowledge Representation and Reasoning**

- 3.1 Representing Knowledge in Artificial Intelligence
- 3.2 Propositional logic
- 3.3 Predicate Logic

- 3.4 Inference rules
- 3.5 Reasoning techniques

## **PART-B**

### **UNIT 4: Machine Learning Fundamentals**

- 4.1 Introduction to Machine Learning
- 4.2 Applications of Machine Learning
- 4.3 Data Mining vs. Machine Learning vs. Big Data Analysis
- 4.4 Learning in Machine Learning
- 4.5 Supervised Learning
- 4.6 Unsupervised Learning
- 4.7 Reinforcement Learning

### **UNIT 5: Machine learning Algorithms**

- 5.1 Linear Regression
- 5.2 Logistic Regression
- 5.3 Decision Trees and Random Forests
- 5.4 Support Vector Machine (SVM)
- 5.5 Naïve Bayes Classifier
- 5.6 K-Means Clustering
- 5.7 Principal Component Analysis (PCA)

### **UNIT 6: Neural Networks**

- 6.1 Introduction to Neural Networks
- 6.2 Biological and Artificial Neural Networks
- 6.3 Working of Neural Networks
- 6.4 Types of Neural Networks: Feedforward, Convolutional, Recurrent

#### **Suggested Readings:**

1. M. Tin Jones, 2019, Artificial Intelligence: A Systems Approach, Jones and Barlett Publishers.
2. Nils J. Nilsson, 2020, The Quest for Artificial Intelligence, Cambridge University Press.
3. S. Russel and P. Norwig, 2015, Artificial Intelligence: A Modern Approach, Prentice Hall

**Note: Only latest editions of the books are recommended.**

#### **Weblinks:**

<https://www.coursera.org/articles/machine-learning-vs-ai> <https://stucor.in/notes-qp/cs3491-artificial-intelligence-and-machine-learning/>  
[https://www.poriyaan.in/paper/artificial-intelligence-and-machine-learning-78/#google\\_vignette](https://www.poriyaan.in/paper/artificial-intelligence-and-machine-learning-78/#google_vignette)

#### **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
<b>O5.0CA201E02.1</b>	1		2	2		1	2						2	3
<b>O5.0CA201E02.2</b>	1	2	2							1			3	2
<b>O5.0CA201E02.3</b>		1	1	1									2	
<b>O5.0CA201E02.4</b>	2	1			2		2		1		1		1	2
<b>O5.0CA201E02.5</b>	2	1	1		2		3			1				

# MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

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## **O5.0CA202E02: Introduction to Cyber Security, Law, and Acts**

**Credits: 3**

**Max. Marks: 100**

**Continuous Evaluation: 30**

**Duration of Examination: 3 Hrs.**

**End Semester Examination: 70**

**Pre-Requisites: NA**

**Course Type: Discipline Elective**

**Course Outcomes:** This course provides a foundational understanding of cyber security concepts, types of cybercrimes, and the legal framework to address them. Students will gain insight into various laws, acts, and ethical considerations in cyberspace.

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

- O5.0CA202E02.1** Understand the fundamental concepts of cyber security and its importance.
- O5.0CA202E02.2** Identify various types of cybercrimes and threats in cyberspace.
- O5.0CA202E02.3** Analyze the role of digital forensics in combating cybercrimes.
- O5.0CA202E02.4** Evaluate the importance of contemporary crimes on individuals and organizations.
- O5.0CA202E02.5** Interpret the Indian IT Act 2000 and its amendments.
- O5.0CA202E02.6** Apply ethical principles and legal provisions to ensure compliance in the cyber world.

### **UNIT 1: Fundamentals of Cyber Security**

- 1.1 Definition and Importance of Cyber Security
- 1.2 Key Concepts in Cyber Security: Confidentiality, Integrity, and Availability
- 1.3 Threats in Cyberspace: Malware, Phishing, and Social Engineering
- 1.4 Cyber Risk Management and Best Practices

### **UNIT 2: Types of Cybercrimes**

- 2.1 Overview of Cybercrimes: Fraud, Identity Theft, and Ransomware
- 2.2 Cybercrimes Against Individuals, Organizations, and Nations
- 2.3 Case Studies on Notable Cybercrime Incidents
- 2.4 Preventive Measures for Cybercrimes

### **UNIT 3: Digital Forensics**

- 3.1 Introduction to Digital Forensics and its Role in Cyber Security
- 3.2 Digital Evidence: Collection, Preservation, and Analysis
- 3.3 Tools and Techniques in Digital Forensics
- 3.4 Challenges in Digital Forensics and Legal Admissibility

### **UNIT 4: Contemporary Cybercrimes**

- 4.1 Emerging Trends in Cybercrime: Deepfakes, IoT Attacks, and AI Manipulations
- 4.2 Cybercrime in Social Media and Online Gaming
- 4.3 Cyberbullying and Harassment
- 4.4 Global Efforts in Combating Cybercrimes

## **UNIT 5: Indian IT Act 2000 and Amendments**

- 5.1 Overview of the IT Act 2000
- 5.2 Key Provisions of the IT Act
- 5.3 Amendments in IT Act: Data Protection and Privacy Laws
- 5.4 Legal and Ethical Implications of the IT Act

## **UNIT 6: Legal and Ethical Considerations**

- 6.1 Cyber Laws in India: Data Protection Bill, Digital India Framework
- 6.2 Intellectual Property Rights in Cyberspace
- 6.3 Cyber Ethics and Professional Practices
- 6.4 Global Standards and Policies for Cyber Security

### **Reference Books**

1. **Cyber Security: Understanding Cyber Crimes, Computer Forensics, and Legal Perspectives** by Nina Godbole & Sunit Belapure
2. **Introduction to Cyber Security** by Umesh Hodeghatta Rao & Umesh Kumar
3. **Digital Forensics and Cyber Crime: Principles and Practice** by Indrajit Ray and Sujata Ray

### **Text Books**

1. **Cyber Security Essentials** by James Graham, Richard Howard, and Ryan Olson
2. **Information Security and Cyber Laws** by Sarika Gupta

### **Suggested Readings**

1. Articles on emerging cyber threats from **IEEE Xplore** and **ACM Digital Library**.
2. Case studies on notable cybercrimes from **SANS Institute** reports.

### **Websites for Reference**

1. <https://www.cyberlawsindia.net/> – Comprehensive resources on Indian Cyber Laws.
2. <https://www.cert-in.org.in/> – Official Indian Computer Emergency Response Team website.
3. <https://www.nist.gov/cybersecurity> – U.S. National Institute of Standards and Technology's Cybersecurity Framework.
4. <https://www.csoonline.com/> – Insights into cybercrimes and prevention.

### **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

**COURSE ARTICULATION MATRIX:**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
<b>O5.0CA202E02-1</b>	2		1	1			2						3	3
<b>O5.0CA202E02-2</b>	1	3	1		1		1						2	2
<b>O5.0CA202E02-3</b>			2	2		2	1							
<b>O5.0CA202E02-4</b>	1	2					1							
<b>O5.0CA202E02-5</b>	2	3	2	2		2	2	1					2	2
<b>O5.0CA202E02-6</b>				1		1		1			1	1		

**O5.0FLFR200E03: French-II**

**Credits: 2**

**Max. Marks: 100**

**Duration of Examination: 3hrs**

**Internal: 30**

**External: 70**

**Course Outcomes:**

**O5.0FLFR200E03.1.** Use listening and speaking skills in a variety of small and large group activities.

**O5.0FLFR200E03.2.** Write basic descriptive paragraphs with clear topic sentences and supporting detail.

**O5.0FLFR200E03.3.** Analyze reading segments on a diverse number of cultural topics.

**O5.0FLFR200E03.4.** Use reflexive verbs to describe daily routine.

**O5.0FLFR200E03.5.** Learn the usage of appropriate grammatical structures which include beginning-level vocabulary, and verb conjugations.

**O5.0FLFR200E03.6.** Learn Basic vocabulary that can be used to discuss the weather and seasons.

**PART – A**

**Unit 1- Se présenter (1)**

1.1 Masculin et Feminin

1.2 Les pluriels

1.3 Adjectives to describe a person

**Unit 2- Se présenter (2)**

2.1 Professions

2.2 Short essay on family

2.3 Les Adjectifs possessifs

**Unit 3- Parler de ses habitudes quotidiennes**

3.1 Les verbes pronominaux

3.2 Décrivez votre journée

3.3 Exception cases of “er” ending verbs

3.3 Project on French Civilisation

**PART – B**

**Unit 4- Nommez et localiser des lieux dans la ville**

4.1 Prepositions

4.2 Asking & telling the way

4.3 Décrivez votre maison

**Unit 5- Informations simples sur le climat, la météo**

5.1 Les saisons

5.2 Les expressions de la saison

5.3 Comprehension

**Unit 6- Les Repas**

- 6.1 Les articles partitifs
- 6.2 Dialogue au restaurant
- 6.3 La carte de menu

**Text Books/Reference Books/ Suggested Readings:**

1. Alter Ego Level One Textbook, Annie Berthet, Catherine Hugot, Veronique M Kizirian, Hachette Publications
2. Apprenons Le Francais II & III, Mahitha Ranjit, Saraswati Publications

**Weblinks:**

www.isl.com

[www.françaisfacile.com](http://www.françaisfacile.com)

**Instructions for paper setting:** The paper shall be divided in four Sections-  
Section-A Reading, Section-B-Writing, Section-C Grammar and Section D- Culture and Civilization.

**Course Articulation Matrix**

CO Statement	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
O5.0FLGR00E03.1	-	-	-	-	-	-	-	3	2	-	2
O5.0FLGR00E03.2	-	-	-	-	-	-	-	3	3	-	2
O5.0FLGR00E03.3	-	-	-	-	-	-	-	3	3	-	2
O5.0FLGR00E03.4	-	-	-	-	-	-	1	3	3	1	2
O5.0FLGR00E03.5	-	-	-	-	-	-	1	1	3	1	2
O5.0FLGR00E03.6	-	-	-	-	-	-	1	3	3	1	2

**O5.0FLGR200E03: German-II**

**Credits: 2**

**Max. Marks: 100**

**Duration of Examination: 3hrs**

**Internal: 30**

**External: 70**

**Prerequisites:**

Students are expected to have basic knowledge of German grammar. They should know regular verbs and conjugations. They should be able to introduce themselves and make small sentences in German language.

**Course Outcomes:**

**O5.0FLGR200E03.1.** Students will be able to discuss about various directions, countries and languages they speak.

**O5.0FLGR200E03.2.** Students will be able to write short essays on family and friends. They will have knowledge of tenses.

**O5.0FLGR200E03.3.** Students will be able to identify classroom vocabulary in the German language.

**O5.0FLGR200E03.4.** Students will be able to speak ordinal and cardinal numbers and they will also learn months, days in German.

**O5.0FLGR200E03.5.** They will be able to express or/and justify opinions using equivalents of different verbs.

**O5.0FLGR200E03.6.** They will be able to describe themselves, other people, familiar places and objects in short discourse using simple sentences and basic vocabulary.

**PART – A**

**Unit 1: Ordinal und Kardinal Zahlen**

- 1.1 Ordinal & Cardinal numbers
- 1.2 Months, days, Feiertage and dates
- 1.3 Quiz about German Grammar topics

**Unit 2: Kasus**

- 2.1 Akkusativ
- 2.2 Modal verben
- 2.3 Vocabulary (Family) short essay on family, friends etc.

**PART – B**

**Unit 3: Gegenstände im Kursraum**

- 3.1 Vocabulary (classroom)
- 3.2 Definite and indefinite articles

**Unit 4: Länder, Sprachen**

- 4.1 Countries, languages, directions
- 4.2 Past of the verb 'to be'

## Unit 5: Pronomen

5.1 Possessive pronomen

5.2 Past of the verb haben

5.3 Describing past events Activity

## Unit 6: Preposition and verbs

6.1 um,am,von, bis,im

6.2 Separable verbs

### Text Books/Reference Books:

1. Rita Maria Niemann, Cornelsen, Studio d A1: Deutsch als Fremdsprache, Volume 6
2. Dallapiazza, Rosa-Maria and Jan, Eduard von. Tangram aktuell 1. Deutsch als Fremdsprache Tangram aktuell 1 - Lektion 1-4: Deutsch als. (Hueber Verlag, ).
3. Dallapiazza, Rosa-Maria and Jan, Eduard von. Tangram aktuell 1. Deutsch als Fremdsprache Tangram aktuell 1 - Lektion 5-8: Deutsch als. (Hueber Verlag, )
4. Paul Rusch,: Langenscheidt and Klett.

### Weblinks:

<http://www.nthuleen.com/>

**Instructions for paper setting:** The paper shall be divided in four Sections- Section-A Reading, Section-B-Writing, Section-C Grammar and Section D- Culture and Civilization.

### Course Articulation Matrix

CO Statement	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
O5.0FLGR200E03.1	-	-	-	-	-	-	-	-	3	-	2
O5.0FLGR200E03.2	-	-	-	-	-	-	-	-	3	-	2
O5.0FLGR200E03.3	-	-	-	-	-	-	-	-	2	-	1
O5.0FLGR200E03.4	-	-	-	-	-	-	-	-	2	-	1
O5.0FLGR200E03.5	-	-	-	-	-	-	1	-	3	-	-
O5.0FLGR200E03.6	-	-	-	-	-	-	-	-	3	-	1

**O5.0FLSP200E03: Spanish-II**

**Credits: 2**

**Max. Marks: 100**

**Duration of Examination: 3hrs**

**Internal: 30**

**External: 70**

**Course Outcomes:**

**O5.0FLSP200E03.1.** Students will be able to know how to describe a person in Spanish along with various vocabularies related to physical description.

**O5.0FLSP200E03.2.** Students will be able to differentiate between Ser and Estar verbs along with uses.

**O5.0FLSP200E03.3.** Students will be able to have knowledge of adjectives along with telling time.

**O5.0FLSP200E03.4.** Students will be able to write the daily routine of a person using time.

**O5.0FLSP200E03.5.** Students will be able to have knowledge of regular –ER and –IR verbs along with its various uses.

**O5.0FLSP200E03.6.** Students will be able to learn present continuous and near future tenses.

**PART-A**

**Unit 1: Auxiliary verbs and Preposition**

- 1.1 Uses of verb ESTAR and adjectives related to it
- 1.2 Prepositions related to the positioning of an object
- 1.3 Llamarse

**Unit 2: Regular and Irregular Verbs**

- 2.1 Introductions to AR, ER and IR verbs
- 2.2 Sentence structure
- 2.3 Introduction of open and closed ended questions

**Unit 3: Expressing likes and dislikes through verbs**

- 3.1 Introduction of verb gustar
- 3.2 Express likes and dislikes
- 3.3 Vocabulary of subjects

**PART – B**

**Unit 4: Expressing day to day life and usage of different tenses.**

- 4.1 Reflexive verbs
- 4.2 Relating time with daily routine
- 4.3 Free time activity

**Unit 5: Clothes and Present Continuous**

- 5.1 Introduction to present continuous tense
- 5.2 Role play
- 5.3 Comprehension

**Unit 6: Near future tense**

- 6.1 Introduction to near future tense
- 6.2 Paragraph writing
- 6.3 Role play

**Text Books/Reference Books:**

1. Vivos-II, Workbook and Textbook
2. Nuevo Español sin fronteras 1 + Workbook + CD, Jesus Sanchez Lobato and Isabel Santos Gargallo, Goyal Saab, ELE & SGEL

**Weblinks:**

<http://studyspanish.com/>

**Instructions for paper setting:** The paper shall be divided in four sections.

Section-A Reading Section B Writing Section C Grammar Section D Culture and Civilization.

**Course Articulation Matrix**

CO Statement	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
O5.0FLSP200E03.1	-	-	-	-	-	-	-	2	2	-	1
O5.0FLSP200E03.2	-	-	-	-	-	-	-	2	3	-	2
O5.0FLSP200E03.3	-	-	-	-	-	-	-	1	3	-	1
O5.0FLSP200E03.4	-	-	-	-	-	-	1	3	3	1	2
O5.0FLSP200E03.5	-	-	-	-	-	-	1	1	2	1	1
O5.0FLSP200E03.6	-	-	-	-	-	-	1	3	3	1	2

**MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES  
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**05.0CA200C05: Research and Innovation Catalyst-II**

**Credits: 1**

**Max. Marks: 100**

**Continuous Evaluation: 100**

**Pre-requisites:** Research and Innovation Catalyst-I

**Course Type:** SEC

**Course Outcomes:**

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

**05.0CA200C05.1.** Critically evaluate the work done by various researchers relevant to the research topic

**05.0CA200C05.2.** Integrate the relevant theory and practices followed in a logical way and draw appropriate Conclusions.

**05.0CA200C05.3.** Understand the research methodologies/approaches/techniques used in research/ Innovation domains.

**05.0CA200C05.4.** Structure and organize the collected information or findings through an appropriate abstract, headings, reference citations and smooth transitions between

**05.0CA200C05.5.** Learn the structuring of the paper/ concept in the form of Power Point Presentation

**05.0CA200C05.6.** Adapt working with group members and outside world.

**Unit 1: Literature Survey (LS)**

1.1 Collection of research papers related to previously identified gap/problem

1.2 Comprehend and arrange the literature based on the idea framed

1.1 Presenting the collected data and inferring it with the further scope of expansion

**Unit 2: Structuring of Review Paper**

2.1 Analysis of different approach/methodology adopted by various researchers.

2.2 Listing out the components of the paper w.r.t the problem.

2.3 Identification of suitable Journal or Conference

2.4 Formatting/Styling the paper according to the respective template.

**Unit 3: Presenting the findings.**

3.1 Structuring and preparation of PPT

3.2 Mock presentation

3.3 Review on presentation skills and content delivered both

3.4 Incorporating the review comments in the slides

**References:**

1. <http://www.sciencedirect.com/>
2. <https://www.ncbi.nlm.nih.gov/pubmed>
3. <https://www.elsevier.com/books-and-journals>
4. <https://www.plos.org/>
5. <https://www.deepdyve.com/>
6. <http://ieeexplore.ieee.org/Xplore/home.jsp>
7. <https://www.researchgate.net/>

8. <https://www.science.gov/>
9. <https://scholar.google.co.in/>
10. <http://www.popsoci.com/>

**Course Articulation Matrix:**

<b>CO-PO Statement</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</b>	<b>PO10</b>	<b>PO11</b>	<b>PO12</b>	<b>PSO1</b>	<b>PSO2</b>
<b>O5.0CA200C05.1</b>	<b>3</b>	<b>1</b>		<b>1</b>		<b>2</b>		<b>1</b>				<b>2</b>	<b>1</b>	<b>1</b>
<b>O5.0CA200C05.2</b>	<b>2</b>	<b>3</b>		<b>2</b>		<b>2</b>		<b>1</b>	<b>1</b>		<b>1</b>	<b>2</b>	<b>1</b>	<b>2</b>
<b>O5.0CA200C05.3</b>	<b>2</b>	<b>1</b>	<b>3</b>			<b>1</b>		<b>1</b>	<b>1</b>			<b>1</b>	<b>2</b>	<b>3</b>
<b>O5.0CA200C05.4</b>	<b>2</b>	<b>1</b>		<b>3</b>		<b>2</b>	<b>1</b>			<b>1</b>	<b>1</b>		<b>1</b>	<b>1</b>
<b>O5.0CA200C05.5</b>	<b>2</b>	<b>3</b>		<b>2</b>		<b>2</b>		<b>1</b>	<b>1</b>		<b>1</b>	<b>2</b>	<b>1</b>	<b>2</b>
<b>O5.0CA200C05.6</b>	<b>2</b>		<b>3</b>			<b>1</b>			<b>1</b>				<b>2</b>	<b>3</b>

**MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES**  
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**05.0CDC296C05: Placement Competency Enhancement-IV**

**Credits: 1**

**Max. Marks: 100**  
**Internal Evaluation: 30**  
**End Semester Examination: 70**

Course Outcomes: The students will be able to:

**05.0CDC296C05.1:** solve problems on Modern Mathematics and Mensuration.

**05.0CDC296C05.2:** develop their logical reasoning acumen.

**05.0CDC296C05.3:** develop advanced vocabulary to enhance their ability to read, comprehend, and communicate effectively.

**05.0CDC296C05.4:** proficient in resume building, drafting effective cover letters, and preparing for placements.

**05.0CDC296C05.5:** apply code complexity analysis and library utilization skills effectively for problem-solving in placement scenarios.

**05.0CDC296C05.6:** demonstrate proficiency in recursion and various data structures essential for technical interviews and placements.

**PART – A**

**Unit 1: Modern Mathematics**

**1.1 Permutation and Combination**

1.1.1 Principle of counting and basic formulas

1.1.2 Arrangements, Selection and Selection + Arrangement.

1.1.3 Linear/Circular arrangements, Digits, and Alphabetic Problems and Applications.

**1.2 Probability**

1.2.1 Events and Sample Space, Basic Formulas.

1.2.2 Problems on Coins, Cards and Dices.

1.2.3 Conditional Probability, Bayes' Theorem and their Applications.

**Unit 2: Mensuration**

**2.1 Mensuration I- Areas**

2.1.1 Different types of Triangles and their area and perimeter.

2.1.2 Different types of Quadrilaterals and their area and perimeter.

2.1.3 Circumference and Area of Circle, Area of Sector and length of Sector.

2.1.4 Mixed Figures and their Applications.

**2.2 Mensuration II- Surface Areas and Volumes**

2.2.1 Problems on Cubes & Cuboids, Cone, Cylinder and Sphere.

2.2.2 Mixed Figures and their Applications.

**Unit 3: Logical Reasoning IV**

3.1 Data Sufficiency

3.2 Linear Arrangement

3.3 Circular Arrangement

3.4 Puzzles

**Part - B**

**Unit 4: Advanced Vocabulary**

- 4.1 Synonym and Antonym
- 4.2 One Word Substitution
- 4.3 Ordering of Words

**Unit 5: Sentence Construction & Syntax**

- 5.1 Sentence Improvement
- 5.2 Spotting Errors
- 5.3 Ordering of Sentences
- 5.4 Change of Voice/ Direct & Indirect speech
- 5.5 Completing Statements/Sentences

**Unit 6: Reading Comprehension & Reasoning**

- 6.1 Strategic Reading, Eliminating Poor Reading Habits
- 6.2 Techniques to increase speed reading, comprehension and recall
- 6.3 Solving Sample RC Passages
- 6.4 Cloze Test
- 6.5 Para Jumbles

**Unit 7: Managing Interviews -**

- 7.1. Developing the employability mindset
- 7.2. Preparing for Self -Introduction, professional attire, dressing, body language, resume check
- 7.3. Researching the employer
- 7.4. Portfolio Management
- 7.5 Types of Interviews & Interview etiquettes
- 7.6 Answering Difficult questions in an interview and mock Interviews

**Unit 8: Professional Competencies -**

- 8.1. Design Thinking
- 8.2. Entrepreneurship skills
- 8.3. Managing Personal Finance

**PART – C**

**Unit 9: Code complexity, Libraries**

- 9.1. Asymptotic Analysis, Time and Space Complexity
- 9.2. Order of Growth, Best, Average and Worst cases of various algorithms
- 9.3. STL/ HashSet, HashMap, ArrayList

**Unit 10: Recursion**

- 10.1. Boundary/Corner base case condition, Tail recursion
- 10.2. Recursion using arrays and strings

**Unit 11: LinkedList**

- 11.1. Introduction to LL, traversal, insert-deletion of node, Singly, Doubly and Circular Linked List

**Unit 12: Stack, Queue**

- 12.1. Stack - Introduction and Operations, array and LL Implementation of Stack
- 12.2. Queue - Introduction and operations, array and LL Implementation of Queue

**Unit 13: Tree, BST**

- 13.1 Introduction to Binary Tree, Traversal (In, Pre, Post & Level order), Tree height, problems: Burn a Binary tree from a leaf, Serialize and Deserialize a Binary Tree, etc.

### 13.2. BST – Introduction, Search, Insert and Delete operations

#### Recommended Texts and Readings:

1. Karumanchi, N. (2016). Data structures and algorithms made easy (5th ed.). CareerMonk Publications.
2. Desarda, S. (2020). Mastering group discussion and personal interview (1st ed.). Buzzingstock Publishing House.
3. Wren, P. C., & Martin, H. (2019). English grammar and composition (Revised ed.). S. Chand & Company Pvt. Ltd.
4. Lewis, N. (2014). Word power made easy (1st ed.). Penguin Random House Pvt. Ltd.
5. Aggarwal, R. S. (2018). Quantitative aptitude for competitive exams (7th ed.). S. Chand & Company Pvt. Ltd.
6. Sharma, A. (2021). How to prepare for logical reasoning for CAT (4th ed.). Tata McGraw Hill Education.

#### Course Articulation Matrix:

Course Outcome (CO)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2
<b>O5.0CDC296C05.1</b>	3	-	-	-	-	-	-	-	-	-	-	-	-	2
<b>O5.0CDC296C05.2</b>	-	3	-	-	-	-	-	-	-	-	-	-	-	2
<b>O5.0CDC296C05.3</b>	-	-	3	-	-	-	-	-	-	-	-	-	-	-
<b>O5.0CDC296C05.4</b>	-	-	-	3	-	-	-	-	-	-	-	-	-	-
<b>O5.0CDC296C05.5</b>	-	-	-	-	3	3	-	-	-	-	-	-	-	-
<b>O5.0CDC296C05.6</b>	-	-	-	-	-	3	-	-	-	-	-	-	-	3

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**O5.0SAHS100C09: SPORTS AND YOGA**

**Audit Pass**

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

**Duration of Examination: 3 Hrs.**

**Pre-requisite: None**  
**Course Type: Audit pass**

**Course Outcomes:** The course will enable the student to

**O5.0SAHS100C09.1:** Explain the importance of health and wellness and the role of physical activity and yoga.

**O5.0SAHS100C09.2:** Perform basic fitness exercises to improve strength, flexibility, and endurance.

**O5.0SAHS100C09.3:** Apply foundational yoga techniques for physical and mental well-being.

**O5.0SAHS100C09.4:** Assess BMI and participate in sports for overall health and teamwork.

**Unit 1: Understanding Health: A Holistic Approach**

1.1 Concept, Definition, and Significance of Health and Wellness

1.2 Role of Physical Activities in Promoting Health and Wellness

1.3 Contribution of Sports, Games, Yoga, Recreation, and Leisure Activities to Well-being

1.4 Common Causes of Stress and the Role of Exercise and Yoga in Stress Management

**Unit 2: Exercises for Health and Wellness**

2.1 Warm-Up and Cool Down - General & Specific Exercises

2.2 Physical Fitness Activities

2.3 Stretching Exercises

2.4 Strengthening Exercises

2.5 Cardiovascular Exercises

2.6 Flexibility and Agility Exercises

2.7 Assessment of BMI

2.8 Relaxation techniques

**Unit 3: Elements of Yoga**

3.1 Introduction about Asanas, Pranayama, Mudra Bandha

3.2 Meditation & Relaxation Practice

3.3 Different branches and utility of yoga

### 3.4 Practical implications of Yoga in modern life

## **Unit 4: On the Field: Learning through Sports**

### 4.1 Indoor Sports Activities

### 4.2 Outdoor Sports Activities

#### **TextBooks/References:**

1. Ajmer, R. N. S., Bains, J., Brar, R., Rathee, N. K., & Gill, J. S. (2008). *Essentials of physical education*. Ludhiana.
2. Iyengar, B. K. S. (2015). *Yoga for Sports: A Journey Towards Health and Healing*. Westland.
3. Kisner, C., Colby, L. A., & Borstad, J. (2017). *Therapeutic exercise: foundations and techniques*. Fa Davis.

# **FIFTH SEMESTER**

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

**O5.5CA100C001H: COMPUTER NETWORKS**

**Credits: 4**

**Duration of Examination: 3 Hrs.**

**Max. Marks: 100**

**Continuous Evaluation: 30**

**End Semester Examination: 70**

**Pre-Requisite: NA**

**Course Type: Core**

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

**O5.5CA100C001H.1** Understand various network components and standards used in data communication.

**O5.5CA100C001H.2** Describe the basic concepts of data communication.

**O5.5CA100C001H.3** Illustrate the layered architecture and data flow.

**O5.5CA100C001H.4:** Summarize the processes and protocols applied in data communication.

**UNIT 1: Introduction to Computer Networks**

- 1.1 Components of Computer Network
- 1.2 Classification and Network Type
- 1.3 Computer Network Architecture
- 1.4 OSI reference model
- 1.5 TCP/IP Model

**UNIT 2: Physical Layer**

- 2.1 Transmission Media
- 2.2 Guided Media
- 2.3 Un-Guided Media
- 2.4 Multiplexing
- 2.5 Frequency Division Multiplexing
- 2.6 Wavelength Division Multiplexing
- 2.7 Time Division Multiplexing

**UNIT 3: Data Link Layer**

- 3.1 Framing
- 3.2 Error Detection
- 3.3 Error Correction
- 3.4 Flow control & Error Control Protocol
- 3.5 Multiple Access Protocols
- 3.6 CSMA/CD & CSMA/CA

**UNIT 4: Network Layer**

- 4.1 Switching Techniques
- 4.2 Classful Addressing
- 4.3 IPv4 and IPv6
- 4.4 NAT
- 4.5 Address mapping - ARP
- 4.6 DHCP-Delivery
- 4.7 Routing

**UNIT 5: Transport Layer**

- 5.1 User Datagram Protocol (UDP)

- 5.2 Transmission Control Protocol (TCP)
- 5.3 Congestion control algorithms
- 5.4 Leaky Bucket and Token Bucket Algorithm
- 5.5 Leaky Bucket and Token Bucket Algorithm

**UNIT 6: Application Layer**

- 6.1 Domain Name System
- 6.2 World Wide Web and Hypertext Transfer Protocol
- 6.3 TELNET
- 6.4 Firewalls
- 6.5 Electronic Mail
- 6.6 Network Management
- 6.7 Cryptography-Basic Concepts

**Suggested Readings:**

1. Forouzan, B.A. “Data Communication and Networking”, 4th Ed., 2006 Tata McGraw-Hill.
2. Tanenbaum, A.S, “Computer Networks”, 4th Ed., Pearson 2003 Education.
3. Et Stallings, W. (2010), Data and Computer Communications, 10/E, Prentice Hall,
4. Kurose, J.F. and Ross, K.W., "Computer Networking: A Top-Down Approach Featuring the Internet", 3rd 2004 Ed., Addison Wesley.

**Note: Only latest editions of the books are recommended.**

**List of Experiments:**

**BEGINNER LEVEL (NSQF LEVEL: 1-3)**

S.No	Name of the Program	Bloom level with Cognitive process
1.	Introduction to Networking Tools and Hardware - Identify and demonstrate the use of networking devices: switches, routers, hubs, and Cables. - Introduction to networking tools like Wireshark, Packet Tracer, and Nmap.	Apply (Using Network Devices)/ L3
2.	Implement the appropriate use of crossover and straight-through cables to connect similar and dissimilar devices in Cisco Packet Tracer.	Apply (Using cables for same & different devices)/ L3
3.	Simulate and implement different network topologies: bus, star, ring, and mesh.	Apply (Network Topologies)/ L3
4.	Learn to use commands like tcpdump, netstat, ifconfig, nslookup and traceroute. Capture ping and traceroute PDUs using a network protocol analyzer and examine.	Apply (Perform Commands)/ L3
5.	Capture and analyze packets to study protocols like HTTP, TCP, and UDP.	Apply (Study of Basic Protocols)/ L3

**INTERMEDIATE LEVEL (NSQF LEVEL: 4-6)**

S.No	Name of the Program	Bloom level with Cognitive process
6.	Implement and test a basic LAN configuration using a network simulation tool to demonstrate understanding	Apply (Connectivity of Local Area Network devices)/ L3

	of IP addressing and device connectivity.	
7.	Implement the configuration of two LANs interconnected through a router using a network simulation tool to apply concepts of IP addressing and routing.	Apply (LAN connectivity with router)/ L3
8.	IP Addressing and Subnetting - Configure static and dynamic IP addresses. - Perform subnetting and super netting using examples.	Apply (IP Addressing & Subnetting)/ L3
9.	Execute a program to simulate the ARP and RARP protocols	Apply (ARP & RARP)/ L3
10.	Implement the DHCP onto the Network Topology using Simulation tool.	Apply (Dynamic Host Configuration Protocol)/ L3

**ADVANCED LEVEL (NSQF LEVEL: 7-10)**

S.No.	Name of the Program	Bloom level with Cognitive process	Programs mapped with Ability Enhancement Courses
11	File Transfer Protocol (FTP) and Telnet - Demonstrate the use of FTP for file transfer. - Configure and connect to a remote system using Telnet.	Analyse (FTP & Telnet) / L4	SDG
12	Simulation of DNS using UDP sockets.	Analyse (Domain Name System) / L4	SDG
13	Implement the Email Services in the Network using Simulation tool.	Analyse (Using Email Services)/ L4	SDG
14	Implement static routing in a network simulation tool by identifying network paths and configuring routing tables to enable inter-network communication.	Analyse (Static Routing)/ L4	SDG

**Suggested Readings:**

1. Michael P., “Hands-On Networking Fundamentals”, Cengage Learning
2. Tanenbaum, A .S, “Computer Networks”, 4th Ed., Pearson Education.
3. Forouzan, B .A. “Data Communication and Networking”, Tata McGraw-Hill. S

**Note: Only the latest editions of the books are recommended. Software**

**required/Web links:**

Cisco Packet Tracer

[https://www.tutorialspoint.com/data\\_communication\\_computer\\_network/index.htm](https://www.tutorialspoint.com/data_communication_computer_network/index.htm)

(Last visited Date: 21 February 2024)

<https://nptel.ac.in/courses/106105183> (Last visited Date: 09 May 2025)

**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:**

PO-CO statement	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
O5.5CA100C0 01H.1		2		1		1	3						2	1
O5.5CA100C0 01H.2	2	2	2				3			1			3	2
O5.5CA100C0 01H.3		3		1			2						2	
O5.5CA100C0 01H.4	2	3			1		2		1		1		1	2

**05.5CA101C01H: COMPUTER GRAPHICS**

**Credits: 4**

**Duration of Examination: 3 Hrs.**

**Pre-Requisite: NA**

**Course Type: Core**

**Max. Marks: 100**

**Continuous Evaluation: 30**

**End Semester Examination: 70**

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

**05.5CA101C001H.1:** Describe the fundamental concepts of computer graphics and its applications in day-to-day life.

**05.5CA101C001H.2:** Summarize, interpret, and implement basic computer graphics algorithms using programming environments and tools.

**05.5CA101C001H.3:** Apply various scan conversion and clipping algorithms for creating, manipulating, and detecting graphic objects.

**05.5CA101C001H.4:** Perform and analyze 2D and 3D transformations, projections, and viewing techniques.

**05.5CA101C001H.5:** Demonstrate skills in advanced rendering and real-time graphics techniques for professional development.

**05.5CA101C001H.6:** Integrate multiple computer graphics concepts to design and develop cohesive projects and real-life applications.

**UNIT 1: Introduction to Computer Graphics**

- 1.1 Basic Concepts of Computer Graphics
- 1.2 Computer Graphics Hardware, Software, and Standards
- 1.3 User Interface: Console User Interface (CUI) and Graphical User Interface (GUI)
- 1.4 Applications of Computer Graphics
- 1.5 Input-Output Devices
- 1.6 Modern Display Technologies: LCD, OLED, and Touchscreens
- 1.7 Graphics Processors and Frame Buffers
- 1.8 Introduction to Virtual Reality (VR) and Augmented Reality (AR)

**UNIT 2: Scan Conversion**

- 2.1 Scan Conversion of Point, Line, and Circle
- 2.2 Line Drawing Algorithms: Slope Intercept, DDA, and Bresenham's
- 2.3 Circle Drawing Algorithms: Mid-Point and Bresenham's
- 2.4 Ellipse Drawing Algorithm
- 2.5 Antialiasing Techniques
- 2.6 Advanced Rasterization Techniques

**UNIT 3: Curve drawing and Polygon filling Algorithms**

- 3.1 Introduction to Curve Hierarchy
- 3.2 Bezier Curve and B-Spline Curve
- 3.3 Area Fill Attributes: Fill Style, Pattern Fill, Soft Fills
- 3.4 Solid Modeling Techniques: Sweep Representation, Constructive Solid Geometry, Octree, BSP Tree
- 3.5 Filling Curved Boundaries: Boundary Fill Algorithm, Flood Fill Algorithm
- 3.6 Character Generation and Advanced Text Rendering
- 3.7 Subdivision Curves and Surfaces

## Part-B

### UNIT 4: Transformation & Projection

- 4.1 2D and 3D Graphics Concepts
- 4.2 Introduction to Basic Matrix Operations
- 4.3 2D Transformations: Translation, Scaling, Rotation, Reflection, Shearing
- 4.4 Composite Transformations
- 4.5 3D Transformations: Translation, Scaling, Rotation
- 4.6 Numerical Implementation of 2D and 3D Transformations
- 4.7 Introduction to Projection
- 4.8 Types of Projections: Parallel and Perspective
- 4.9 Real-Time Rendering Techniques
- 4.10 Introduction to Physically Based Rendering (PBR)

### UNIT 5: Clipping

- 5.1 Introduction to Window and Viewport
- 5.2 Viewing Pipeline
- 5.3 Viewing Coordinate Reference Frame
- 5.4 Window to Viewport Mapping
- 5.5 Introduction to Clipping
- 5.6 Point Clipping Algorithm
- 5.7 Line Clipping Algorithms: Cohen-Sutherland, Liang-Barsky
- 5.8 Polygon Clipping Algorithms: Sutherland-Hodgman, Weiler-Atherton
- 5.9 Advanced Clipping Techniques

### UNIT 6: Visible Surface Detection Methods

- 6.1 Concept of Hidden Lines and Surfaces
- 6.2 Classification of Visible Surface Detection Algorithms
- 6.3 Back Face Detection
- 6.4 Depth Buffer Method
- 6.5 Depth Sorting Method
- 6.6 Wireframe Methods
- 6.7 Visibility Detection Functions
- 6.8 Ray Tracing and Global Illumination
- 6.9 Introduction to Real-Time Ray Tracing

### Suggested Readings:

1. D. Hearn & P. M. Baker, "Computer Graphics," Prentice Hall, Latest Edition
2. J. D. Foley & A. Van Dam, "Fundamentals of Interactive Computer Graphics," Addison-Wesley, Latest Edition
3. Schaum's Outline Series, "Computer Graphics," Tata McGraw-Hill, Latest Edition
4. Pradeep K. Bhatia, "Computer Graphics," I.K. International, Latest Edition

**Note: Only latest editions of the books are recommended.**

### List of Experiments:

#### BEGINNER LEVEL (NSQF LEVEL: 1-3)

S. No.	Name of the Program	Bloom level with Cognitive process
1.	Lab 1: Introduction to Computer Graphics <ul style="list-style-type: none"><li>o Overview of the lab course</li><li>o Introduction to graphics programming environments and tools (e.g., OpenGL, WebGL, or DirectX)</li><li>o Course Outcome: Develop practical skills in using graphics programming environments and tools.</li></ul>	Understanding / Applying/ L3

2	Lab 2: Basic Drawing with OpenGL o Setting up the graphics environment o Drawing basic shapes (points, lines, and circles) o Course Outcome: Implement and experiment with basic computer graphics algorithms.	Remembering / Understanding/ L3
3	3. Lab 3: Line Drawing Algorithms o Implementation of DDA and Bresenham's line drawing algorithms o Course Outcome: Apply various scan conversion algorithms to create and manipulate graphic objects.	Applying / Creating/ L3
4	Lab 4: Circle and Ellipse Drawing Algorithms o Implementation of Midpoint and Bresenham's circle drawing algorithms o Implementation of ellipse drawing algorithm o Course Outcome: Apply various scan conversion algorithms to create and manipulate graphic objects.	Applying / Creating/ L3
5	Lab 5: Antialiasing Techniques o Implementing basic antialiasing techniques to smoothen lines and shapes o Course Outcome: Implement and experiment with basic computer graphics algorithms.For the Queue using an Array.	Remembering / Understanding/ L3
6	Lab 6: Advanced Rasterization Techniques o Introduction to advanced rasterization methods and their implementation o Course Outcome: Develop practical skills in using graphics programming environments and tools.	Understanding / Applying / L3
7	Lab 7: Bezier Curves o Drawing and manipulating Bezier curves o Course Outcome: Implement and experiment with basic computer graphics algorithms.	Understanding / Applying / L3

#### INTERMEDIATE LEVEL (NSQF LEVEL: 4-6)

S.No	Name of the Program	Bloom level with Cognitive process
8	Lab 8: B-Spline Curves o Drawing and manipulating B-Spline curves o Course Outcome: Implement and experiment with basic computer graphics algorithms.	Applying / Creating/ L3
9	Lab 9: Polygon Filling Algorithms o Implementation of boundary fill and flood fill algorithms o Course Outcome: Develop practical skills in using graphics programming environments and tools.	Apply/ L3
10	Lab 10: Sweep Representation o Implementing sweep representation for 3D modeling o Course Outcome: Apply various scan conversion algorithms to create and manipulate graphic objects.	Apply / L3

11	Lab 11: Constructive Solid Geometry (CSG) o Creating and manipulating objects using CSG o Course Outcome: Apply various scan conversion algorithms to create and manipulate graphic objects.	Creation/ L3
12	Lab 12: Octree and BSP Tree o Understanding and implementing Octree and BSP Tree structures o Course Outcome: Develop practical skills in using graphics programming environments and tools.	
13	Lab 13: 2D Transformations o Implementing translation, scaling, rotation, reflection, and shearing transformations in 2D o Course Outcome: Perform transformations and projections on 2D and 3D objects.	Apply / L3
14	Lab 14: Composite 2D Transformations o Combining multiple 2D transformations o Course Outcome: Perform transformations and projections on 2D and 3D objects.	Apply / L3
15	Lab 15: 3D Transformations o Implementing translation, scaling, and rotation transformations in 3D o Course Outcome: Perform transformations and projections on 2D and 3D objects.	Analyse / L4

**ADVANCED LEVEL (NSQF LEVEL: 7-10)**

S.No.	Name of the Program	Bloom level with Cognitive process	Programs mapped With Ability Enhancement Courses
16	Lab 16: Numerical Implementation of 2D and 3D Transformations o Practical exercises on numerical implementations of transformations o Course Outcome: Perform transformations and projections on 2D and 3D objects.	Analyse/ L4	IKS
17	Lab 17: Introduction to Projections o Understanding different types of projections (parallel and perspective) o Course Outcome: Perform transformations and projections on 2D and 3D objects.	Analyse /L4	SDG
18	Lab 18: Implementation of Projections o Implementing parallel and perspective projections o Course Outcome: Perform transformations and projections on 2D and 3D objects.	Analyse / L4	IKS
19	Lab 19: Point and Line Clipping o Implementing Cohen-Sutherland and Liang-Barsky line clipping algorithms	Analyse / L4	IKS

	o Course Outcome: Implement clipping algorithms for points, lines, and polygons.		
20	Lab 20: Polygon Clipping o Implementing Sutherland-Hodgman and Weiler-Atherton polygon clipping algorithms o Course Outcome: Implement clipping algorithms for points, lines, and polygons.	Analyse / L4	EVS
21	Lab 21: Hidden Line and Surface Removal o Implementing basic hidden line and surface removal techniques o Course Outcome: Develop practical skills in using graphics programming environments and tools.	Analyse / L4	IKS
22	Lab 22: Depth Buffer Method o Implementing the depth buffer (z-buffer) method o Course Outcome: Develop practical skills in using graphics programming environments and tools.	Create / L6	IKS
23	Lab 23: Depth Sorting Method o Implementing the depth sorting (painter's algorithm) method o Course Outcome: Develop practical skills in using graphics programming environments and tools.	Analyse / L4	IKS
24	Lab 24: Wireframe Models o Creating and manipulating wireframe models o Course Outcome: Develop skills in advanced rendering techniques and real-time graphics.	L2/ L3/ L4/ L5/ L6	SDG
25	Lab 25: Introduction to Ray Tracing o Basics of ray tracing and its implementation o Course Outcome: Develop skills in advanced rendering techniques and real-time graphics.	L2/ L3/ L4/ L5/ L6	FinTech

### Suggested Readings:

1. "Computer Graphics with OpenGL" by Donald Hearn and Pauline Baker
2. "Fundamentals of Computer Graphics" by Peter Shirley, Michael Ashikhmin, and Steve Marschner
3. "Interactive Computer Graphics: A Top-Down Approach with WebGL" by Edward Angel and Dave Shreiner
4. "Computer Graphics: Principles and Practice" by John F. Hughes, Andries van Dam, Morgan McGuire, David Sklar, James D. Foley, Steven K. Feiner, and Kurt Akeley
5. "OpenGL Programming Guide: The Official Guide to Learning OpenGL" by Dave

Shreiner, Graham Sellers, John Kessenich, and Bill Licea-Kane  
6. "Mathematics for 3D Game Programming and Computer Graphics" by Eric Lengyel

**Note: Only the latest editions of the books are recommended.**

**Web Links:**

some useful web links for resources related to computer graphics:

1. Computer Graphics Programming Resources - GitHub Gist: A comprehensive list of free resources to study computer graphics programming, including tutorials, books, and articles.
2. A Virtual Lab for Learning Concepts Related to Computer Graphics: A virtual lab project initiated by the Ministry of Human Resource Development (MHRD), Government of India, offering interactive experiments and simulations.
3. Computer Graphics Lab - IIIT Hyderabad: A virtual lab for learning concepts related to computer graphics, including 3D coordinate systems, transformations, hierarchical modeling, and cameras.

**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:**

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS O1	P S O 2
<b>O5.5CA101C01H.1</b>	3	2	-	-	1	-	-	-	-	1	-	2	2	1
<b>O5.5CA101C01H.2</b>	3	3	2	2	2	-	-	-	-	2	-	2	3	2
<b>O5.5CA101C01H.3</b>	3	3	3	2	2	-	-	-	-	2	-	2	3	2
<b>O5.5CA101C01H.4</b>	3	3	3	3	2	-	-	-	-	2	-	2	3	3
<b>O5.5CA101C01H.5</b>	3	2	3	3	3	-	-	-	-	2	-	3	3	3
<b>O5.5CA101C01H.6</b>	3	3	3	3	3	-	-	-	-	3	-	3	3	3

**O5.5CA100E02 Data Visualization Using Python**

**Credits: 3**

**Duration of Examination: 3 Hrs.**

**Max. Marks: 100**

**Continuous Evaluation: 30**

**End Semester Examination: 70**

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

**O5.5CA100E02.1.** Understand the fundamentals of data visualization and its importance in data analytics.

**O5.5CA100E02.2** Analyze complex datasets and extract meaningful insights through visualization.

**O5.5CA100E02.3** Apply Data Cleaning and Preprocessing Techniques to solve workplace problems.

**O5.5CA100E02.4** Demonstrate techniques to create visually appealing and informative charts, graphs.

**PART -A**

**UNIT 1: Introduction**

- 1.1 Basics of Data Visualization: Definitions, Importance, and Applications
- 1.2 Types of Data: Structured, Unstructured, and Semi-structured Data
- 1.3 Principles of Effective Visualization
- 1.4 Data Visualization Tools: Tableau, Power BI, and Python
- 1.5 Introduction of basics of Python
- 1.6 Python Libraries: Matplotlib, Seaborn, Plotly, Pandas

**UNIT 2: Getting Started with Pandas:**

- 2.1 Introduction to pandas: Data Structures and operations. Summarizing and Computing Descriptive Statistics.
- 2.2 Data Loading, Storage and File Formats
- 2.3 Reading and Writing Data in Text Format.
- 2.4 Web Scraping, Handling Binary Data Formats

**UNIT 3: Data Pre-processing**

- 3.1 Web APIs : Interacting with External Data Sources
- 3.2 Interacting with Databases
- 3.3 Data Cleaning and Preparation
- 3.4 Handling Missing Data
- 3.5 Data Transformation
- 3.6 String Manipulation for text data

**PART-B**

**Unit 4: Data Wrangling and Visualization**

- 4.1 Data Wrangling: Hierarchical Indexing for Multi- Dimensional Data
- 4.2 Combining and Merging Data Sets Reshaping and Pivoting
- 4.3 Data Visualization matplotlib: Basics of matplotlib
- 4.4 Plotting with pandas and seaborn
- 4.5 Overview of other python visualization tools

#### **Unit-5: Data Aggregation and Group operations**

- 5.1 Data Aggregation and Group operations
- 5.2 General split-apply-combine: Pivot tables and cross tabulation
- 5.3 Date and Time Data Types and Tools
- 5.4 Time series Basics, date Ranges, Frequencies and Shifting, Time Zone Handling
- 5.5 Advanced Time- Series Techniques: Resampling and Frequency conversion, Moving Window Functions

#### **Unit-6: Advanced Pandas**

- 6.1 Advanced Pandas
- 6.2 Categorical Data
- 6.3 Advanced Group By Use
- 6.4 Techniques for Method Chaining

#### **Suggested Readings:**

1. McKinney, W.(2017). Python for Data Analysis: Data Wrangling with Pandas, NumPy and IPython. 2<sup>nd</sup> edition. O'Reilly Media.
2. O'Neil, C., & Schutt, R. (2013). Doing Data Science: Straight Talk from the Frontline O'Reilly Media.
3. C.O. Wilke, Fundamentals of Data Visualization. O'Reilly Media, Inc., 2019

**Note: Only latest editions of the books are recommended.**

#### **Software required/ Web links:**

Python3  
www.3schools.com

**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%

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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	PSO1	PSO2
<b>O5.5CA100E02</b>	2		2		2	2		2		2		
<b>O5.5CA100E02</b>	2	2	2						2	2		
<b>O5.5CA100E02</b>	2		2	2		2	2				2	
<b>O5.5CA100E02</b>	2		2		2	2		2	2		2	

**05.5CA101E02 : INTRODUCTION TO BLOCKCHAIN**

**Credits: 3**

**Duration of Examination: 3 Hrs.**

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

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

**05.5CA101E02.1.** Understand the concepts of Blockchain

**05.5CA101E02.2.** Know about usage of the protocols

**05.5CA101E02.3.** Understand the hyper ledger fabric

**05.5CA101E02.4.** Learn the implementation of the blockchain

**05.5CA101E02.5.** Learn about application of Blockchain in Financial Systems

**05.5CA101E02.6.** 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**

4.1 Decomposing the consensus

4.2 Hyperledger fabric components

4.3 Design and Implementation of Hyperledger Fabric

4.4 fabric SDK and Front End

4.5 Hyperledger composer tool



**COURSE ARTICULATION MATRIX:**

	PO 1	PO 2	PO 3	PO 4	P O 5	P O 6	P O 7	PO 8	PO 9	P O 10	P O 11	P O 12	P S O 1	P S O 2
<b>O5.5CA101E02.1</b>	2		1	2	1		2			1			3	1
<b>O5.5CA101E02.2</b>	1			1			3	1		1	2	1	2	
<b>O5.5CA101E02.3</b>	2		2		1	1			1		2		2	
<b>O5.5CA101E02.4</b>	1		1	2			3	1	3		2		3	2
<b>O5.5CA101E02.5</b>		1	1		2		3	1			2		1	
<b>O5.5CA101E02.6</b>	2		3		1		3		2		3		1	3

**O5.5CA102E02: Full Stack Development**

**Credits: 3**

**Duration of Examination: 3 Hrs.**

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

**Pre-Requisite:** Basics of Web Development

**Course Type:** Discipline Elective

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

**O5.5CA102E02.1.** Understand the core concepts of front-end, back-end, and database technologies used in Full Stack Development.

**O5.5CA102E02.2.** Design responsive and dynamic front-end interfaces using HTML, CSS, and JavaScript.

**O5.5CA102E02.3.** Implement server-side logic using Node.js and Express.js. **O5.5CA102E02.4.** Manage and manipulate databases effectively using MongoDB or SQL.

**O5.5CA102E02.5.** Integrate front-end and back-end components for building full-stack applications.

**O5.5CA102E02.6.** Develop and deploy full-stack web applications using industry-standard tools and platforms.

**UNIT 1: Introduction:**

- 1.1 Overview of Full Stack Development
- 1.2 Components: Front-end, Back-end, and Databases
- 1.3 Development Environments and Tools (VS Code, Node.js)
- 1.4 Client-Server Architecture
- 1.5 RESTful APIs and HTTP Protocol
- 1.6 Understanding MVC Architecture
- 1.7 Introduction to Agile Development Methodology

**Unit 2: Front-End Development**

- 2.1 HTML5: Structure and Semantic Elements
- 2.2 CSS3: Selectors, Box Model, Flexbox, and Grid Layouts
- 2.3 JavaScript ES6: Variables, Functions, and Events
- 2.4 DOM Manipulation and Event Handling
- 2.5 Introduction to Front-end Frameworks (React.js Basics)
- 2.6 Responsive Web Design using Bootstrap
- 2.7 Introduction to TypeScript for Front-End Development
- 2.8 Working with APIs in the Front-End (Fetch and Axios)

**UNIT 3: Back-End Development**

- 3.1 Introduction to Node.js and Express.js
- 3.2 Setting up a Back-End Server
- 3.3 Middleware Functions in Express.js
- 3.4 Routing and RESTful API Development

- 3.5 Error Handling and Debugging
- 3.6 Introduction to Microservices Architecture
- 3.7 File Upload and Management in Back-End
- 3.8 Real-Time Communication using WebSockets

#### **UNIT 4: Database Management Android Application Components**

- 4.1 Database Fundamentals: SQL vs NoSQL
- 4.2 Introduction to MongoDB: CRUD Operations
- 4.3 SQL Concepts: Tables, Joins, and Query Optimization
- 4.4 Connecting Databases with Back-End (Mongoose/Sequelize ORM)
- 4.5 Database Security and Transactions
- 4.6 Introduction to Firebase Realtime Database
- 4.7 Implementing Caching Mechanisms (Redis Basics)
- 4.8 Backup and Recovery Strategies for Databases

#### **UNIT 5: Full Stack Integration**

- 5.1 Integrating Front-End and Back-End Using RESTful APIs
- 5.2 Authentication and Authorization (JWT, OAuth)
- 5.3 State Management (Redux/Context API Basics)
- 5.4 Testing and Debugging Full Stack Applications
- 5.5 Deployment on Cloud Platforms (Heroku/Netlify/AWS Basics)
- 5.6 Introduction to Serverless Architecture (AWS Lambda/Google Functions)
- 5.7 Implementing Role-Based Access Control (RBAC)
- 5.8 Logging and Monitoring Full Stack Applications

#### **UNIT 6: Advanced Topics and Best Practices**

- 6.1 Version Control Systems (Git and GitHub)
- 6.2 CI/CD Pipelines and Automated Testing
- 6.3 Performance Optimization Techniques
- 6.4 Progressive Web Applications (PWA)
- 6.5 Future Trends in Full Stack Development

#### **Suggested Readings:**

1. Robin Nixon, 2020, Learning PHP, MySQL & JavaScript, O'Reilly Media.
2. Ethan Brown, 2019, Web Development with Node.js and Express, O'Reilly Media.
3. Brad Dayley, 2020, Node.js, MongoDB, and Angular Web Development, Addison-Wesley.
4. Flavio Copes, 2021, The Complete Guide to Full Stack Development, Leanpub.

**Note: Only latest editions of the books are recommended.**

#### **Software Required/Weblinks:**

- o Visual Studio Code
- o Node.js and npm
- o MongoDB Community Server
- o Git and GitHub

**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:**

CO-PO Statement	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
<b>O5.5CA102E02.1</b>			2		1		1	1				1	1	
<b>O5.5CA102E02.2</b>		2	1		1			1	1		1	1	1	2
<b>O5.5CA102E02.3</b>	1	1					1	2	1		1	1		2
<b>O5.5CA102E02.4</b>		3			2		1	2	1		1	1	1	2
<b>O5.5CA102E02.5</b>	1	1	2		1				1				1	
<b>O5.5CA102E02.6</b>		1					1		2		2	1		1

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

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

**O5.5CA103E02: DATA WAREHOUSING AND DATA MINING**

**Credits: 3**

**Duration of Examination: 3 Hrs.**

**Max. Marks: 100**

**Continuous Evaluation: 30**  
**End Semester Examination: 70**

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

**O5.5CA103E02.1** Define the fundamental concepts of Data Warehouse.

**O5.5CA103E02.2.** Describe the difference between data base management system, data warehouse and data mining.

**O5.5CA103E02.3.** Demonstrate the architecture of a Data Warehouse

**O5.5CA103E02.4** Apply data mining techniques on different kinds of data.

**O5.5CA103E02.5** Compare various data mining techniques and their applications.

**PART-A**

**Unit 1: Introduction to Data Warehousing**

- 1.1 Evolution of data warehousing
- 1.2 Difference between data warehousing and data warehouse
- 1.3 Data Warehousing characteristics
- 1.4 Benefits of data warehousing
- 1.5 Comparison of OLTP and OLAP
- 1.6 Problems of data warehousing

**Unit 2: Data Model**

- 2.1 Data Mart
- 2.2 Data Cube
- 2.3 Multidimensional Data Model
- 2.4 Characteristics of OLAP System
- 2.5 OLAP operations on MDDM
- 2.5 Schemas for data model: Star, Snowflake and Fact constellation
- 2.6 Conversion of schemas using DMQL

**Unit 3: Data Warehousing Architecture**

- 3.1 Data Warehouse components
- 3.2 Three-Tier Data Warehouse architecture
- 3.3 Types of OLAP Servers
- 3.4 ROLAP versus MOLAP versus HOLAP
- 3.5 Distributed and Virtual data warehouse

**PART-B**

**Unit 4: Introduction to Data Mining**

- 4.1 Basic concepts of data mining
- 4.2 Data mining steps, data mining functionalities
- 4.3 Architectures of data mining

- 4.4 Knowledge Discovery in Data mining versus data mining
- 4.5 Applications of data mining
- 4.6 Classification of Data Mining Systems
- 4.7 Data Mining primitives
- 4.8 Data preprocessing
- 4.9 Integration of Data Mining System with a Data Warehouse

#### **Unit 5: Data Mining Techniques**

- 5.1 Support and confidence
- 5.2 Frequent Item set Mining methods
- 5.3 Multi-Level Association Rules
- 5.4 Multi-Dimensional Association Rules : Apriori algorithm
- 5.5 Correlation analysis

#### **Unit 6: Classification and Cluster Analysis**

- 6.1 Difference between Classification and Prediction
- 6.2 Decision Tree Induction
- 6.3 Bayesian Classification
- 6.4 Prediction techniques
- 6.5 Cluster Analysis
- 6.6 Categorization of Clustering Methods
- 6.7 Partitioning Methods
- 6.8 Hierarchical Methods
- 6.9 Data Mining Applications

#### **Suggested Readings:**

1. Jawei Han & Micheline Kamber, Data Mining- Concepts & Techniques, Morgan Kaufmann
2. Berry Michael, Linoff Gordon, Mastering Data Mining, John Wiley & Sons
3. Pudi Vikram, Data Mining, Oxford University Press
4. Thareja Reema, Data Warehousing, Oxford University Press

**Note: Only latest editions of the books are recommended.**

#### **Softwares required:**

Weka Tanagra

**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
<b>O5.5CA103E02.1</b>	1	1	1	1	1								1	1
<b>O5.5CA103E02.2</b>	1	1	1	1	1								1	1
<b>O5.5CA103E02.3</b>	1	1	1	1	1								1	1
<b>O5.5CA103E02.4</b>	2	1	1	1	1								1	1
<b>O5.5CA103E02.5</b>	2	2	2	2	2		2						2	2

# MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH AND STUDIES

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

## O5.5CA104 E02 Fundamentals of Open Source Software

**Credits: 3**

**Duration of Examination: 3 Hrs.**

**Max. Marks: 100**

**Continuous Evaluation: 30**

**End Semester Examination: 70**

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

**O5.5CA104E02.1** Analyze the architecture and functionality of open-source software systems

**O5.5CA104E02.2** Implement and deploy open-source solutions for web and database applications

**O5.5CA104E02.3** Utilize open-source technologies in cloud and containerized environments.

**O5.5CA104E02.4** Explore emerging open-source innovations and evaluate their applications

**O5.5CA104E02.5** Analyze real-world applications and emerging innovations in open-source technologies

### PART -A

#### UNIT 1: Foundations of Open Source Software

- 1.1 History, Evolution, and Importance of Open Source
- 1.2 Characteristics and Principles of Open Source Software
- 1.3 Difference Between Open Source and Proprietary Software
- 1.4 Open-Source Development Models and Collaboration
- 1.5 Tools for Open Source Development: Git, GitHub, GitLab
- 1.6 Open-Source Licensing

#### UNIT 2: Advanced Open Source Operating Systems and System Programming

- 2.1 Linux Internals: Kernel, Boot Process, File System Hierarchy
- 2.2 Advanced Linux Administration: User Management, Process Control, Networking
- 2.3 Bash Shell Scripting
- 2.4 System-Level Programming in Linux
- 2.5 Virtualization and Containerization: Docker, Podman, and Kubernetes Basics

#### Unit-3: Open Source Web and Database Technologies

- 3.1 Open Source Web Servers
- 3.2 Backend Development with PHP and Python
- 3.3 MySQL vs. PostgreSQL
- 3.4 Advanced SQL: Stored Procedures, Indexing, Query Optimization
- 3.5 NoSQL Databases: MongoDB
- 3.6 Database Replication and Sharding Techniques

## PART-B

### Unit 4: Open Source Cloud Computing and DevOps

- 4.1 Open-Source Cloud Platforms
- 4.2 Infrastructure as Code (IaC)
- 4.3 CI/CD Pipelines
- 4.4 Kubernetes Orchestration
- 4.5 Monitoring and logging
- 4.6 Serverless Computing

### Unit-5: Open Source Cybersecurity and Ethical Hacking

- 5.1 Open-Source Security Tools
- 5.2 Linux Security Hardening
- 5.3 Cryptography in Open Source Vulnerability Assessment
- 5.4 Web Application Security
- 5.6 Security in DevOps (DevSecOps)

### Unit-6: Open Source in Emerging Technologies

- 6.1 Fundamentals of TensorFlow and PyTorch
- 6.2 Model Deployment Using ONNX
- 6.3 Advanced Group By Use
- 6.4 Techniques for Method Chaining

#### Suggested Readings:

1. Rao, M. N. (2015). *Fundamentals of Open Source Software*. PHI Learning Pvt. Ltd.
2. Saha, D. (2018). *Introduction to Open Source Software*. S. Chand Publishing.

**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.

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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	PSO1	PSO2
<b>O5.5CA100E02</b>	2		2		2	2		2		2		
<b>O5.5CA100E02</b>	2	2	2						2	2		
<b>O5.5CA100E02</b>	2		2	2		2	2				2	
<b>O5.5CA100E02</b>	2		2		2	2		2	2		2	

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

**O5.5CA105E02: SYSTEM PROGRAMMING**

**Credits: 3**

**Max. Marks: 100**

**Duration of Examination: 3 Hrs.**

**Continuous Evaluation: 30**  
**End Semester Examination: 70**

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

**O5.5CA105E02.1:** Develop a clear understanding of system software components like assemblers, linkers, loaders, and the role of compilers in transforming high-level code into machine-level instructions.

**O5.5CA105E02.2:** Demonstrate the ability to write and debug code using system-level languages such as C and Assembly, focusing on efficiency, memory management, and hardware interaction.

**O5.5CA105E02.3:** Gain hands-on experience with operating system APIs for managing system resources such as processes, memory, and file systems, and utilize system calls for efficient system-level programming.

**O5.5CA105E02.4:** Learn how to create custom system utilities or tools such as shell scripts, compilers, debuggers, and performance analyzers, enhancing understanding of the internal workings of systems.

**O5.5CA105E02.5:** Analyze and implement efficient process scheduling, memory allocation, and management techniques, understanding concepts like virtual memory, paging, and segmentation.

**Part-A**

**Unit 1: Introduction to System Programming**

- 1.1 System Software vs. Application Software
- 1.2 Assemblers, Loaders, Linkers, and Compilers
- 1.3 Operating System as System Software

**Unit 2: Assemblers**

- 2.1 Introduction to Assembly Language
- 2.2 Design of Assemblers
- 2.3 Loader and Linker
- 2.4 Types of loaders: Absolute loader, Relocating loader, Dynamic linking

**Unit 3: Compilers**

- 3.1 Compiler Structure
- 3.2 Lexical Analysis
- 3.3 Regular expressions
- 3.4 Parsing Techniques
- 3.5 Top-down parsing, bottom-up parsing
- 3.6 Semantic Analysis
- 3.7 Syntax-directed translation
- 3.8 Intermediate code generation

#### **Unit 4: Linkers and Loaders**

4.1 Introduction to Linkers and Loaders

4.3 Linking Process

4.3 Loading Process

4.4 Types of loaders: Compile-and-go loader, Absolute loader, Relocating loader

#### **Unit 5: Debuggers and Profilers**

5.1 Introduction to Debuggers

5.2 Profilers

5.3 Use of profilers in performance tuning

5.5 Time profiling, space profiling

#### **Unit 6: Operating System as System Software**

6.1 System Calls

6.2 Memory Management

6.3 I/O Management and Scheduling

6.4 Tools for System Programming

Case Studies Study of system programming tools for specific platforms (Unix/Linux, Windows) Reference Books:

- System Software: An Introduction to Systems Programming by Leland L. Beck
- Compilers: Principles, Techniques, and Tools by Aho, Ullman, and Sethi
- Operating Systems Concepts by Abraham Silberschatz and Peter B. Galvin

**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:

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

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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:**

CO – PO Statement	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO1 2	PSO1	PSO2
<b>O5.5CA105E02.1</b>	1		2	1	1		3						2	1
<b>O5.5CA105E02.2</b>	2	1		3			2		2				3	2
<b>O5.5CA105E02.3</b>		2		1	2				2		1		2	1
<b>O5.5CA105E02.4</b>	1	3	2	3	2		3						3	2
<b>O5.5CA105E02.5</b>	2	1		3			2		2				3	2

# MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH & STUDIES

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

## O5.5CA100C06: SUMMER INTERNSHIP

**Credits: 3**

**Max. Marks: 100**

**Duration of Examination: 3 Hrs.**

**Continuous Evaluation: 30**  
**End Semester Examination: 70**

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

**O5.5CA100C06.1** Describe the Systems Development Life Cycle (SDLC).

**O5.5CA100C06.2** Construct and evaluate data flow diagrams.

**O5.5CA100C06.3** Design and evaluate system outputs

**O5.5CA100C06.4** Construct and evaluate entity-relationship (ER) diagrams for real projects

**O5.5CA100C06.5** Determine the various test cases and analyze the results.

**O5.5CA100C06.6** Develop soft-skills including writing formal reports and delivering oral presentations.

Summer Internship experience provides the student with an opportunity to enhance the knowledge in their respective subject areas. This training provides insight to understand the actual behaviour of the industry able to develop a greater understanding about the career option. Each of the students is required to develop a mini project during his/ her 4 week internship. Evaluation will be done by the respective mentors. Internal assessment will be done on the basis of following criteria:

1. Presentation - 30 marks
2. Viva - 20 marks
3. Thesis/Project report - 20 marks.

### COURSE ARTICULATION MATRIX

	PO1	PO2	PO3	PO4	PO5	P O 6	P O 7	P O 8	P O 9	PO 1 0	PO11	PO 1 2	PS O 1	PS O 2
<b>O5.5CA100C06.1</b>		2	3	2									1	2
<b>O5.5CA100C06.2</b>			2										2	
<b>O5.5CA100C06.3</b>			3											2
<b>O5.5CA100C06.4</b>			2										3	
<b>O5.5CA100C06.5</b>					3								2	3
<b>O5.5CA100C06.6</b>									3		2			2

**Note: Project guidelines are enclosed in Annexure-A**

## **Annexure-A:**

### **1. Guidelines for submission of BCA Project**

All the students are required to submit a project report based on the work done by him/her during the project period based on any programming language. Presentation / viva will be based on the project work carried during the semester. The Project topics should be based on syllabus or beyond.

The project is evaluated on the basis of following heads:

1. Presentation
2. Viva
3. Project report
4. Documentation
5. Testing

### **2. Project Report Preparation Guidelines:** Project report should consist the following:

- I. Cover page as per the format (Annexure 1)
- II. Declaration by the Student (Annexure 2)
- III. Certificate from Department (Annexure 3)
- IV. Acknowledgement
- V. Index (Table of Contents in tabular form)
- VI. Introduction
  - (a) About Organization
  - (b) Aims & Objectives
  - (c) Manpower
- VII. System Study
  - (a) Existing System along with limitations
  - (b) Proposed System along with advantages

VIII. Feasibility Study

- (a) Technical
- (b) Behavioural
- (c) Economic

IX. Project Monitoring System

- (a) Gantt Chart

X. System Analysis

- (a) Requirement Specification
- (b) System Flowcharts
- (c) DFDs /ERDs (up to Level 2)

XI. System Design

- (a) File/ Data Design

XII. Input / Output Form Design

- (a) Screen Design (Screenshots of all screens In Color)
- (b) Report Design

XIII. System Testing

- (a) Preparation of Test Data
- (b) Testing With Live Data
- (c) Test Cases with results

XIV. System Implementation

- (a) System Requirements (Hardware/Software)

XV. Documentation

XVI. Scope of the Project

XVII. Bibliography

**3. Project Report Submission Guidelines**

- a) Make 3 copies of the project.

- b) Submit one original hard and one original soft copy of the project report to concerned guide.
- c) A photocopy of the complete Project should be retained by the student for future reference.
- d) Cover page should be properly formatted. (See Annexure 1)
- e) The project report must be about 80-100 pages.
- f) Source code or pseudo code should not be included in the project report
- g) Student will be giving a presentation of about 20 minutes, highlighting the project objective, summary and report and findings of the project at the time of viva.
- h) Project completed in all aspects with necessary enclosures should be submitted to the concerned Guide in specified time period.
- i) The dimension of the project report should be in A4 size.
- j) The project report should be bound using flexible cover of the thick plastic paper (Spiral Binding).
- k) Report should use Font Arial/ Times New Roman; Font Size: 14 (For Headings Bold) and 12 (For Paragraphs). Document can have maximum of 1.5 lines spacing.
- l) Project completed in all aspects with necessary enclosures should be submitted to the concerned Guide.
- m) Violation of the project guidelines will lead to the rejection of the project at any stage.
- n) A photocopy of the project report is not acceptable for submission.

**Annexure 1**

Title of the Project

(Organization: For Whom Developed)

Submitted to:

ManavRachna International Institute of Research & Studies,  
Faridabad (Haryana)

In Partial Fulfillment of

Bachelor of Computer Applications (BCA)

Session:

Under the Supervision of:

(Name of Project Guide, Designation

By

Name: ( )

Roll No: ( )



**School of Computer Applications**  
**Manav Rachna International Institute of Research & Studies**

Secto-r43, Aravalli

Faridabad 121001

## **Annexure 2**

### **Declaration**

I do hereby declare that this project work entitled “\_\_\_\_\_” submitted by me for the partial fulfilment of the requirement for the award of BACHELOR OF COMPUTER APPLICATIONS (BCA) is a record of my own work. The report embodies the finding based on my study and observation and has not been submitted earlier for the award of any degree or diploma to any Institute or University.

**SIGNATURE OF STUDENT**

Name:

Roll No:

### **Annexure 3**

#### **Certificate from the Guide**

This is to certify that the project report entitled “ \_\_\_\_\_ ” submitted in partial fulfilment of the degree of BACHELOR OF COMPUTER APPLICATIONS (BCA) to Manav Rachna International Institute of Research & Studies, Faridabad is an authentic and original work carried out by Mr./Ms.\_\_\_\_ with Roll no. \_\_\_\_\_ under my guidance.

The matter embodied in this project is genuine work done by the student and has not been submitted whether to this University or to any other University / Institute for the fulfillment of the requirements of any course of study.

Signature of the Student:  
Date:

Signature of the Guide  
Date:

Name:  
Roll No:

Name of the Guide:  
Designation of the Guide

**SIGNATURE OF HOD**

#### **Annexure 4:**

### **Acknowledgement**

I gratefully acknowledge for the assistance, cooperation, guidance and clarification provided by Ms./Mr. \_\_\_\_\_ (*Company Guide – If applicable*) during the development of \_\_\_\_\_ (*project title*). My extreme gratitude to Dr. Anupriya Jain (*Guide from Department*) who guided us throughout the project. Without his willing disposition, spirit accommodation, frankness, timely clarification and above all faith in us, this project could not have been completed in due time. His readiness to discuss all important matters at work deserves special attention of. I would also like to thank all the faculty members of the computer application department for their cooperation and support.

I would like to extend my sincere gratitude to **Prof. (Dr.) Suhail Javed Quraishi – HOD** for her valuable teaching and advice. I would like to thank **Prof. (Dr.) Brajesh Kumar – Dean** for motivating us. I would again like to thank all faculty members of the department for their cooperation and support. I would like to thank non-teaching staff of the department for their cooperation and support.

I perceive this opportunity as a big milestone in my career development. I will strive to use gained skills and knowledge in the best possible way, and I will continue to work on their improvement, in order to attain desired career objectives. Hope to continue cooperation with all of you in the future.

*No signature required on this page.*

XVIII. Index (Table of Contents in tabular form)

S.N.	Chapter	Page No

**O5.5SCA100C05: Research and Innovation Catalyst-III**

Credits : 1

Max. Marks: 100

Continuous Evaluation: 100

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

**O5.5SCA100C05.1.** Compare the various research methodologies and thereupon choosing the appropriate one.

**O5.5SCA100C05.2.** Apply the contextual knowledge in designing and conducting the experiments

**O5.5SCA100C05.3.** Analyze and interpret the research/ innovation outcomes

**O5.5SCA100C05.4.** Analyze the further scope of research/ innovation

**O5.5SCA100C05.5.** Gain hands on experience in techniques/technologies/ case studies etc

**O5.5SCA100C05.6.** Adapt working with group members in cohesive temperament.

**Unit 1: Setting up the simulation/experiment environment**

1. Deciding the hypothesis or direction to carry out simulation/experiments / case study
2. Identifying the set of experiments/simulations/ case study for designing the model or analysing the data
3. Finding the resources for performing experiments/simulations / case study
4. Choosing the appropriate research methodology/ business model

**Unit 2: Planning of experiments/ case study**

1. Formulate experimental procedures and case study approach
2. Procurement of materials and secondary data
3. Modification of the experimental set-up / case study approach, if required

**Unit 3: Execution of experiments/simulations/ case study**

1. Conduct experiments/ build prototype / case study
2. Tabulating and recording data
3. Analysis and interpretation of the data
4. Interpreting convolution between experimental data and hypothesis/simulation
5. Comparison of the results for discrepancies
6. Listing and analysing the observations to get the further research direction

### COURSE ARTICULATION MATRIX:

CO-PO Statement	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1
<b>O5.5SCA100C05.1</b>		√	√		√								
<b>O5.5SCA100C05.2</b>		√		√							√		
<b>O5.5SCA100C05.3</b>	√	√	√	√							√		
<b>O5.5SCA100C05.4</b>													
<b>O5.5SCA100C05.5</b>													
<b>O5.5SCA100C05.6</b>													

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

Criteria	Evaluation parameters	Weightage (Marks)	
Online and offline Attendance	Percentage of classes attended by the students ☒	3+2	5
Group participation	<ul style="list-style-type: none"> <li>Judge individual student's participation in the experiments</li> <li>Proper experimental planning</li> <li>Collecting evidences substantiating to the experiments</li> <li>Time bound completion of experiments</li> </ul>	5 2 3 5	15
Execution of experiments	<ul style="list-style-type: none"> <li>Finding available resources</li> <li>Usage of Scientific Literature Databases. e.g., Scopus/ Web of Science/ etc. for theoretical guidance</li> <li>Understanding the technique/technology used</li> <li>Analysis and interpretation of results</li> <li>Percentage of reproducibility</li> </ul>	2 2 3 2 3	12
Report and Presentation	<ul style="list-style-type: none"> <li>Presentation of slides</li> <li>Experimental findings and content (Graph, Tables, Diagrams, Real time videos etc.)☒Report</li> </ul>	6 6 6	18

#### References:

1. [www.originlab.com](http://www.originlab.com)

2. <http://www.cambridgesoft.com/software>
3. <http://www.synergy.com/>
4. [www.mathworks.com/products/matlab.html](http://www.mathworks.com/products/matlab.html)

# SIXTH SEMESTER

**O5.5CA200E02H: CLOUD COMPUTING**

**Credits: 4**

**Duration of Examination: 3 Hrs.**

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

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

**O5.5CA200E02H.1:** Define cloud computing, its deployment models, services, and related tools such as Git and Docker.

**O5.5CA200E02H.2:** Describe the importance of virtualization and implement virtualization using platforms like VMware, AWS, and Azure.

**O5.5CA200E02H.3:** Use and examine different cloud computing services including Amazon EC2 and Google App Engine.

**O5.5CA200E02H.4:** Analyze and compare cloud platforms such as AWS, Microsoft Azure, and extend their services for desktop and mobile applications.

**O5.5CA200E02H.5:** Determine the services and features of Hadoop and other open-source cloud platforms.

**O5.5CA200E02H.6:** Design and develop cloud-based business applications with appropriate security mechanisms.

**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

#### **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 App Engine
- 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, Wile
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)

<http://ptgmedia.pearsoncmg.com/images/9780133387520/samplepages/0133387526.pdf> (Last visited Date: 21 February, 2024)

<http://www.buyya.com/MasteringClouds/ToC-Preface-TMH.pdf> (Last visited Date: 21 February, 2024)

#### **List of Experiments:**

##### **BEGINNER LEVEL(NSQF LEVEL: 1-3)**

<b>S.No.</b>	<b>Name of the Program</b>	<b>Bloom Level with Cognitive Process</b>
1	Introduction to Cloud Computing and setting up VirtualBox or VMware for virtualization.	Understand / L2
2	Creating and managing virtual machines using VirtualBox/KVM.	Apply / L3

3	Deploy a simple web application on AWS EC2 instance.	Apply / L3
4	Explore S3 buckets: Create, upload, and manage data.	Apply / L3
5	Set up and configure a basic Azure Virtual Machine and install a service (e.g., Apache).	Apply / L3

#### INTERMEDIATE LEVEL(NSQF LEVEL: 4-6)

S.No.	Name of the Program	Bloom Level with Cognitive Process
6	Introduction to Docker: Install and run containers.	Apply / L3
7	Create a Dockerfile and build custom images.	Apply / L3
8	Deploy a multi-container application using Docker Compose.	Apply / L3
9	Study cloud storage services: Google Drive API integration using Python.	Analyse / L4
10	Use AWS Lambda to create a serverless function triggered by S3 events.	Analyse / L4

#### ADVANCED LEVEL(NSQF LEVEL: 7-10)

S.No.	Name of the Program	Bloom Level with Cognitive Process	Programs mapped with Ability Enhancement Courses
11	Setup Kubernetes on local machine using Minikube.	Analyse / L4	SDG
12	Deploy a containerized app using Kubernetes (with scaling and self-healing).	Analyse / L4	SDG
13	Implement Identity and Access Management (IAM) in AWS for secure resource access.	Analyse / L4	IKS
14	Configure and monitor cloud resources using AWS CloudWatch.	Analyse / L4	FinTech
15	Case study: Cloud solutions to improve healthcare service delivery (using cloud tools).	Evaluate / L5	SDG

#### Suggested Readings:

- Rajkumar Buyya, Christian Vecchiola, and Thamarai Selvi, *Mastering Cloud Computing*, McGraw Hill.
- Thomas Erl, *Cloud Computing: Concepts, Technology & Architecture*, Pearson Education.
- Amazon Web Services documentation: <https://docs.aws.amazon.com>
- Microsoft Azure documentation: <https://learn.microsoft.com/en-us/azure>
- Docker documentation: <https://docs.docker.com>

#### Software Required/Web Links:

- VirtualBox, VMware, Docker, Minikube
- AWS Free Tier, Azure Student Account
- GitHub: <https://github.com>

- Tutorialspoint Cloud Computing: [https://www.tutorialspoint.com/cloud\\_computing](https://www.tutorialspoint.com/cloud_computing)

**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:**

CO-PO Statement	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
O5.5CA200E02H.1	3	2	1	–	–	–	–	–	–	2	–	1	3	2
O5.5CA200E02H.2	2	3	2	1	–	–	–	–	–	–	–	2	3	3
O5.5CA200E02H.3	2	2	3	2	1	–	–	–	–	1	–	2	3	3
O5.5CA200E02H.4	1	2	3	3	2	–	–	–	–	2	2	3	3	3
O5.5CA200E02H.5	2	1	2	2	–	–	–	–	–	1	–	2	2	3
O5.5CA200E02H.6	1	2	3	3	3	2	–	–	–	3	2	3	3	3

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

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

**O5.5CA201E02H: SOFT COMPUTING**

**Credits: 3**

**Duration of Examination: 3 Hrs.**

**Max. Marks: 100**

**Continuous Evaluation: 30**

**End Semester Examination: 70**

**Course Outcomes:**

**O5.5CA201E02H.1** Explain Intelligent Systems, Expert Systems, Knowledge-Based Systems, and Fuzzy Logic.

**O5.5CA201E02H.2** Describe Semantic Networks, Crisp/Fuzzy Logic, hierarchical models, reasoning methods, and linguistic representations.

**O5.5CA201E02H.3** Analyze Fuzzy Control architecture, fuzzification, defuzzification, and soft computing techniques.

**O5.5CA201E02H.4** Apply Artificial Neural Networks (models, learning rules, simulations) for problem-solving.

**O5.5CA201E02H.5** Use Genetic Algorithms and population-based learning for optimization.

**O5.5CA201E02H.6** Integrate fuzzy logic, neural networks, and genetic algorithms in hybrid intelligent systems.

**PART - A**

**Unit-1: Overview of Soft Computing**

- 1.1. Concept of Intelligent Systems and their applications.
- 1.2. Knowledge-Based Systems and their architecture.
- 1.3. Production Systems and Expert Systems.
- 1.4. Knowledge representation techniques and processing.
- 1.5. Semantic networks and their applications.
- 1.6. Crisp logic, Fuzzy Systems, and logical reasoning.
- 1.7. Overview of Soft Computing Paradigm: Fuzzy logic, Artificial Neural Networks, and Genetic Algorithms.
- 1.8. Applications of Soft Computing in real-world scenarios.

## **Unit-2: Fundamentals of Fuzzy Logic**

- 2.1. Overview of classical sets and their limitations.
- 2.2. Introduction to Fuzzy sets and fuzzy arithmetic.
- 2.3. Fuzzy numbers, Fuzzy operations, and fuzzy equations.
- 2.4. Extension principle and its applications.
- 2.5. Fuzzy relations and fuzzy selection.

## **Unit-3: Fuzzy Logic**

- 3.1. Fuzzy propositions and fuzzy quantifiers.
- 3.2. Linguistic hedges and their significance.
- 3.3. Composition and inference laws in fuzzy logic.
- 3.4. Conditional fuzzy propositions and quantified propositions.
- 3.5. Fuzziness of fuzzy sets, fuzzy resolution, and applications.
- 3.6. Fuzzification and defuzzification techniques.

## **PART - B**

### **Unit-4: Fuzzy Systems**

- 4.1. Fuzzy expert systems and approximate reasoning.
- 4.2. Basics of fuzzy control and its applications.
- 4.3. Fuzzy Control Architecture: hierarchical fuzzy systems and models.
- 4.4. Decision table approach to fuzzy systems and their implementation.
- 4.5. Introduction to Neuro-Fuzzy Systems and their architecture.
- 4.6. Applications of Neuro-Fuzzy Networks in intelligent systems.

### **Unit-5: Artificial Neural Networks**

- 5.1. History and development of Neural Networks.
- 5.2. Mathematical Models of Neurons and ANN architecture.
- 5.3. Activation functions and their impact.
- 5.4. Learning Rules: Supervised, Unsupervised, and Reinforcement Learning.
- 5.5. Features and training algorithms of Neural Networks.
- 5.6. Perceptrons and multi-layered networks.
- 5.7. Back-Propagation Algorithm and its applications.
- 5.8. Applications of Artificial Neural Networks in various domains.

### **Unit-6: Genetic Algorithms**

- 6.1. Overview of evolutionary computing and strategies.
- 6.2. Genetic algorithms and optimization techniques.
- 6.3. Genetic Schema theorem and algorithm operators.
- 6.4. Integration of genetic algorithms with fuzzy logic and hybrid systems.
- 6.5. Population-based incremental learning techniques.
- 6.6. Applications of Genetic Algorithms in real-world problem-solving.

**Textbooks/Reference Books:**

1. Bart Kosko, 1997, Neural Networks and Fuzzy Systems: Illustrated Edition, PHI.
2. Jyh-Shing Roger Jang, Chuen-Tsai Sun, Eiji Mizutan, 1997, Neuro-Fuzzy and Soft Computing: A Computational Approach to Learning and Machine Intelligence, Prentice Hall.
3. Karray F.O. and Silva C.D., 2009, Soft Computing and Intelligent Systems, Pearson Education Edition, Pearson.
4. Klir, G.J. and Yuan, 2001, Fuzzy Sets and Fuzzy Logic: Theory and Applications, PHI.

**List of Experiments:****BEGINNER LEVEL(NSQF LEVEL: 1-3)**

<b>S. No.</b>	<b>Name of the Program</b>	<b>Bloom's level with Cognitive process</b>
1.	Write a program to perform the following operations on fuzzy sets. - Union - Intersection - Complement	Apply (Basic Fuzzy set operation)/ L3
2	Implement a fuzzy membership function and plot its graph.	Apply (Basic Fuzzy set operation)/ L3
3	Develop a program to simulate basic fuzzy operations using matrices.	Apply (Basic Fuzzy set operation)/ L3
4	Create a fuzzy rule-based system for temperature control.	Apply (Basic Fuzzy set operation)/ L3
5	Implement fuzzification and defuzzification techniques.	Apply (fuzzy Techniques) / L3
6	Write a program to simulate a fuzzy logic system for decision-making in a washing machine.	Apply (Fuzzy logic) / L3
7	Implement the perceptron learning algorithm for binary classification.	Apply (Fuzzy Algorithm) / L3

**INTERMEDIATE LEVEL(NSQF LEVEL: 4-6)**

<b>S.No</b>	<b>Name of the Program</b>	<b>Bloom level with Cognitive process</b>
8	Simulate a simple feed-forward neural network using a programming environment.	Apply (Feed Forward Neural Network) / L3
9	Write a program to perform forward and backward propagation in a neural network.	Apply (forward and backward propagation in a neural network.) / L3
10	Implement a Hopfield neural network for solving optimization problems.	Apply (Hopfield neural network)/ L3
11	Simulate the XOR problem using a multilayer perceptron with backpropagation.	Apply (Multilayer Perceptron)/ L3
12	Develop a radial basis function (RBF) network for function approximation	Apply (Radial Basis Function)/ L3
13	Create a program to train and test a neural network using	Apply (Supervised Learning) / L3

	supervised learning.	
14	Write a program to implement genetic algorithm operations: selection, crossover, and mutation.	Apply (Genetic Algorithm) / L3
15	Develop a program to solve the traveling salesman problem using a genetic algorithm.	Analyse (Genetic Algorithm) / L4
16	Simulate fuzzy clustering using the Fuzzy C-Means algorithm.	Analyse (Fuzzy C-Means) / L4

**ADVANCED LEVEL(NSQF LEVEL: 7-10)**

<b>S.No.</b>	<b>Name of the Program</b>	<b>Bloom level with Cognitive process</b>	<b>Programs mapped with Ability Enhancement Courses</b>
17	Create a program to implement K-means clustering for a dataset.	Analyse (Supervised Learning) / L4	SDG
18	Design a neuro-fuzzy system and simulate its behaviour for a simple dataset.	Analyse (Neuro Fuzzy System)/ L4	SDG
19	Implement a hybrid system combining fuzzy logic and genetic algorithms for an optimization problem.	Analyse (Fuzzy Logic)/ L4	SDG
20	Write a program to simulate particle swarm optimization for a given function.	Analyse (Particle Swarm Optimization) / L4	SDG
21	Develop a program to implement the Ant Colony Optimization algorithm for path finding.	Analyse (Ant Colony Optimization)/ L4	SDG
22	Simulate a fuzzy inference system for medical diagnosis.	L2/ L3/ L4/ L5/ L6	SDG
23	Write a program to optimize a function using the genetic algorithm.	Create (Genetic Algorithm) / L6	SDG
24	Develop a program to implement reinforcement learning for a maze navigation problem.	Analyse (Reinforcement Learning) / L4	SDG
25	Simulate a fuzzy logic controller for an inverted pendulum problem	L2/ L3/ L4/ L5/ L6	SDG
26	Implement a Kohonen self-organizing map for unsupervised learning.	L2/ L3/ L4/ L5/ L6	SDG
27	Create a program to perform image compression using neural networks.	Analyse (Image Compression) / L4	SDG
28	Write a program to solve an optimization problem using hybrid	L2/ L3/ L4/ L5/ L6	SDG

	soft computing techniques.		
29	Develop a program for spam email classification using a fuzzy inference system.	L2/ L3/ L4/ L5/ L6	SDG
30	Simulate a neural network model for handwritten digit recognition.	L2/ L3/ L4/ L5/ L6	SDG

### Suggested Readings:

4. Bart Kosko, 1997, Neural Networks and Fuzzy Systems: A Dynamical Systems Approach to Machine Intelligence, PHI.
5. Jyh-Shing Roger Jang, Chuen-Tsai Sun, Eiji Mizutani, 1997, Neuro-Fuzzy and Soft Computing: A Computational Approach to Learning and Machine Intelligence, Prentice Hall.
6. Karray F.O. and Silva C.D., 2009, Soft Computing and Intelligent Systems Design, Pearson Education.

**Note: Only the latest editions of the books are recommended.**

### Software required/Web links:

- MATLAB or Octave for simulation tasks.
- Python libraries: scikit-fuzzy, TensorFlow, Keras, and PyTorch.
- Online resources:  
GeeksforGeeks  
Towards Data Science

**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:**

CO Code	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
O5.5CA201E02C01H.1	3	2	1	2	1	–	–	–	–	2	–	1	3	2
O5.5CA201E02C02H.2	3	2	1	2	–	–	–	–	–	1	–	1	3	2
O5.5CA201E02C03H.3	2	2	3	3	2	–	–	–	–	2	–	1	3	3
O5.5CA201E02C04H.4	3	2	3	3	2	–	–	–	–	2	–	1	3	3
O5.5CA201E02C05H.5	2	3	3	3	2	–	–	–	–	2	–	1	3	3
O5.5CA201E02C06H.6	2	2	3	3	3	–	–	–	–	2	–	1	3	3

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

**O5.5CA202E02: MOBILE APPLICATION DEVELOPMENT**

**Credits: 3**

**Max. Marks: 100**

**Duration of Examination: 3 Hrs.**

**Continuous Evaluation: 30**

**End Semester Examination: 70**

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

**O5.5CA202E02.1** Describe the fundamentals of Android development.

**O5.5CA202E02.2** Analyze the architecture and components of the Android platform.

**O5.5CA202E02.3** Develop and deploy basic Android applications.

**O5.5CA202E02.4** Design user interfaces for Android applications using standard frameworks.

**O5.5CA202E02.5** Integrate remote data sources into Android applications using HTTP web services.

**O5.5CA202E02.6** Implement local data storage and retrieval in Android applications using XML and SQLite databases.

**UNIT 1: Introduction:**

- 1.1 Introduction to Android
- 1.2 Android Framework
- 1.3 Comparison of Java and C#
- 1.4 Android Development Tools
- 1.5 Installing Java and ADT Bundle
- 1.6 Overview of Android SDK and API Levels
- 1.7 Introduction to Gradle and Build Tools
- 1.8 Setting up Android Studio IDE
- 1.9 Understanding Emulator vs Physical Device Testing

**UNIT 2: Android Architecture Overview and its Application**

- 2.1 The Android Software Stack Android Libraries
- 2.2 Creating an Activity
- 2.3 Running Applications in the AVD
- 2.4 Understanding Android Runtime (ART)
- 2.5 Core Building Blocks: Activities, Services, Broadcast Receivers, Content Providers
- 2.6 Introduction to the Application Lifecycle
- 2.7 Activity Lifecycle and Callbacks

### **UNIT 3: Android Software Development Platform**

- 3.1 Java SE and Dalvik Virtual Machine
- 3.2 The Directory Structure of an Android Project
- 3.3 Leveraging Android XML
- 3.4 Launching Your Application: The AndroidManifest.XML File
- 3.5 Creating Your First Android Application
- 3.6 Introduction to Gradle Files and Configurations
- 3.7 Understanding Android Resource Files: Drawables, Strings, Styles
- 3.8 Debugging Applications with Logcat

### **UNIT 4: Android Framework Overview**

- 4.1 Android Application Components
- 4.2 Defining the User Interface
- 4.3 Developing Android UI
- 4.4 Working with Layouts (Linear, Relative, Constraint, Table, Frame)
- 4.5 Android Manifest XML
- 4.6 Introduction to View Binding and Data Binding
- 4.7 Handling Events: Click Listeners, Touch Listeners
- 4.8 Working with RecyclerView and Adapters

### **UNIT 5: An Overview of Content Providers, Database and Android Threads**

- 5.1 SQLite Database Implementation
- 5.2 Using Content Providers
- 5.3 Tabs and Custom Adapters
- 5.4 Understanding Android Threads and Handlers
- 5.5 Implementing a Thread Handler
- 5.6 Managing Background Tasks with AsyncTask

### **UNIT 6: Location-Based Services**

- 6.1 Working with Locations and Maps
- 6.2 Using Web Services in Android
- 6.3 Configuring the Android Emulator for Location-Based Services
- 6.4 Geocoding and Map-Based Activities
- 6.5 Deploying an Android App to Google Play Store
- 6.6 Testing and Debugging Android Apps with Profiler Tools
- 6.7 Introduction to Firebase for Location Tracking
- 6.8 Handling Permissions for Location-Based Services

#### **Suggested Readings:**

1. Reto Meier, 2018, Professional Android Development, Wrox Publications.
2. Mark L. Murphy, 2020, The Busy Coder's Guide to Android Development, CommonsWare.
3. Joseph Annuzzi Jr., Lauren Darcey, Shane Conder, 2014, Introduction to Android Application Development, Addison-Wesley.

**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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Short/Long Questions: 70%

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**COURSE ARTICULATION MATRIX:**

CO-PO Statement	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
<b>O5.5CA202E02.1</b>			2		1		1	1			1	1	1	
<b>O5.5CA202E02.2</b>		2	1		1			1	1		1	1	1	2
<b>O5.5CA202E02.3</b>		1					1	2	1		1	1		2
<b>O5.5CA202E02.4</b>		3			2		1	2	1		1	1	1	2
<b>O5.5CA202E02.5</b>		1	2						2					
<b>O5.5CA202E02.6</b>		1				1	1	2	2		2	1		

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

**O5.5CA203E02: ADVANCED WEB TECHNOLOGIES**

**Credits: 3**

**Max. Marks: 100**

**Duration of Examination: 3 Hrs.**

**Continuous Evaluation: 30**  
**End Semester Examination: 70**

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

**O5.5CA203E02.1:** Understand PHP framework and various advance concepts of PHP to develop Applications

**O5.5CA203E02.2:** Analyze different concepts of XML to design dynamic web pages.

**O5.5CA203E02.3:** Analyze different concepts of AJAX to design dynamic web pages.

**O5.5CA203E02.4:** Understand the data representation using JSON

**O5.5CA203E02.5:** Outline different web extensions and web services standards.

**Unit-1: PHP Framework**

- 1.1 Introduction
- 1.2 Features, Applications
- 1.3 Essential concepts of Drupal
- 1.4 User Interface
- 1.4 Storing and Retrieving Data

**Unit-2: Advanced PHP**

- 2.1 Web scrapping using cURL
- 2.3 Regular expression
- 2.3 Mail function
- 2.4 APIs.

**Unit-3: XML DOM**

- 3.1 XML DOM
- 3.2 XML XSLT
- 3.3 XML XQuery
- 3.4 XML Xlink
- 3.5 XML Validator
- 3.6 XML DTD
- 3.7 XML Schema
- 3.8 XML Server

**UNIT 4: AJAX**

- 4.1 Introduction
- 4.2 AJAX from User's Perspective
- 4.3 AJAX from Developer's Perspective

- 4.4 Applications of AJAX
- 4.5 AJAX web application model
- 4.6 Performing AJAX validation
- 4.7 Handling XML data using PHP and AJAX
- 4.8 Connecting database using PHP and AJAX

#### **UNIT 5: JSON**

- 5.1 What is JSON
- 5.2 JSON Syntax
- 5.3 JSON Data Types
- 5.4 JSON Objects
- 5.5 JSON Schema
- 5.6 JSON versus XML
- 5.7 JSON with PHP
- 5.8 JSON with AJAX

#### **UNIT 6: Web Services**

- 6.1 Introduction
- 6.2 Characteristics of web service
- 6.3 Web services – Architecture
- 6.4 Web services - Components: XML-RPC, SOAP, WSDL, UDDI
- 6.5 Web services – Security, Standards
- 6.6 Application of web services using PHP

#### **Suggested Readings:**

1. Sai Srinivas Sriparsa, Javascript and JSON Essentials, ISBN: 9781783286034, packt publishing, 2013.
2. Head First Ajax By Rebecca M. Riordan (O'Reilly), 2008.
3. Sas Jacobs, Beginning XML with DOM and Ajax: From Novice to Professional Paperback, Apress, 2006.
4. Erban Cerami, Web services Essentials, O'Reilly, 2002.

**Note: Only latest editions of the books are recommended**

#### **Software required/ Web links:**

Web Server: Apache HTTP Server 2.2

Database Server: MySQL Server 5.0

<https://www.phptpoint.com/software-requirement/> (Last visited date: 8 March,2024)

<https://www.javatpoint.com/php-tutorial> (Last visited date: 8 March,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:

(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:

CO – PO Statement	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
<b>O5.5CA203E02.1</b>	3		1		1	2							2	2
<b>O5.5CA203E02.2</b>	3	3		1	3								1	1
<b>O5.5CA203E02.3</b>		2	2		2		1						1	3
<b>O5.5CA203E02.4</b>	3		2		2		2						1	3
<b>O5.5CA203E02.5</b>		3		2	3		1						2	3

# MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH & STUDIES

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

## O5.5CA204E02H: DIGITAL IMAGE PROCESSING

**Credits: 3**

**Max. Marks: 100**

**Duration of Examination: 3 Hrs.**

**Continuous Evaluation: 30**  
**End Semester Examination: 70**

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

**O5.5CA204E02H.1:** Understand the fundamental concepts of digital image processing, its applications, and basic image transformations.

**O5.5CA204E02H.2:** Evaluate image enhancement and restoration techniques in both spatial and frequency domains.

**O5.5CA204E02H.3:** Examine image compression, segmentation, and morphological processing techniques for efficient analysis and storage.

**O5.5CA204E02H.4:** Implement and simulate image processing algorithms using suitable programming environments.

**O5.5CA204E02H.5:** Analyze and apply advanced image processing methods to solve real-world and complex image-related problems.

**O5.5CA204E02H.6:** Integrate multiple image processing techniques into hybrid systems for advanced image analysis and practical applications.

### PART - A

#### Unit-1: Introduction to Digital Image Processing

- 1.1. Definition and origins of digital image processing.
- 1.2. Components and applications of digital image processing.
- 1.3. Image sensing and acquisition techniques.
- 1.4. Image sampling and quantization.
- 1.5. Relationship between pixels: adjacency, connectivity, and distance measures.

#### Unit-2: Image Transformation Techniques

- 2.1. Introduction to the Fourier Transform in image processing.
- 2.2. Discrete Fourier Transform (DFT) and its properties.
- 2.3. Fast Fourier Transform (FFT) and its implementation.
- 2.4. Other transformations: Walsh, Hadamard, and Discrete Cosine Transform (DCT).
- 2.5. Applications of image transformation in real-world scenarios.

#### Unit-3: Image Enhancement

- 3.1. Basics of image enhancement in the spatial domain.
- 3.2. Point processing operations: contrast stretching, thresholding, and intensity transformations.
- 3.3. Spatial filtering techniques: smoothing and sharpening filters.
- 3.4. Basics of image enhancement in the frequency domain.
- 3.5. Homomorphic filtering for illumination and reflectance separation.

## **PART - B**

### **Unit-4: Image Restoration**

- 4.1. Model of the image degradation/restoration process.
- 4.2. Noise models and their characteristics.
- 4.3. Restoration techniques: mean filters, Wiener filters, and inverse filtering.
- 4.4. Constrained least squares and iterative restoration techniques.
- 4.5. Applications of image restoration in medical and satellite imaging.

### **Unit-5: Image Compression and Segmentation**

- 5.1. Fundamentals of image compression: redundancy and coding.
- 5.2. Lossless compression techniques: Run-length, Huffman, and arithmetic coding.
- 5.3. Lossy compression techniques: JPEG and MPEG standards.
- 5.4. Introduction to image segmentation: edge detection, region-based segmentation.
- 5.5. Thresholding techniques and active contours for segmentation.

### **Unit-6: Morphological Image Processing and Representation**

- 6.1. Basics of morphological image processing: erosion, dilation, opening, and closing.
- 6.2. Boundary extraction and region filling.
- 6.3. Skeletonization and thinning algorithms.
- 6.4. Image representation schemes: chain codes, polygonal approximation, and signature.
- 6.5. Applications of morphological processing in object recognition and pattern analysis.

### **Textbooks/Reference Books:**

1. Rafael C. Gonzalez and Richard E. Woods, 2018, Digital Image Processing, 4th Edition, Pearson.
2. Anil K. Jain, 1995, Fundamentals of Digital Image Processing, PHI.
3. Milan Sonka, Vaclav Hlavac, and Roger Boyle, 2015, Image Processing, Analysis, and Machine Vision, Cengage Learning.
4. S. Jayaraman, S. Esakkirajan, and T. Veerakumar, 2011, Digital Image Processing, TMH.

### **Software Required/Web Links:**

- MATLAB or Octave for image processing tasks.
- Python libraries such as OpenCV, NumPy, and scikit-image.

- Online resources: Tutorials and examples from GeeksforGeeks and OpenCV documentation.

**List of Experiments:**

**BEGINNER LEVEL(NSQF LEVEL: 1-3)**

S.No.	Name of the Program	Bloom Level with Cognitive Process
1	Write a program to perform basic image operations: Load, display, and save an image.	Apply (Basic image manipulation) / L3
2	Implement image resizing and scaling using nearest-neighbour and bilinear interpolation.	Apply (Interpolation techniques) / L3
3	Write a program to convert an image to grayscale and display the histogram of intensity levels.	Apply (Image histogram analysis) / L3
4	Implement image enhancement techniques such as contrast adjustment and histogram equalization.	Apply (Enhancement techniques) / L3
5	Write a program to perform image smoothing using filters (e.g., mean filter, Gaussian filter).	Apply (Filtering algorithms) / L3
6	Implement edge detection algorithms: Sobel, Prewitt, and Canny edge detection.	Apply (Edge detection methods) / L3
7	Write a program for image thresholding using global and adaptive thresholding techniques.	Apply (Thresholding methods) / L3

**INTERMEDIATE LEVEL(NSQF LEVEL: 4-6)**

S.No	Name of the Program	Bloom level with Cognitive process
8	Simulate image dilation and erosion using morphological operations.	Apply (Morphological transformations) / L3
9	Implement image segmentation techniques such as region growing and k-means clustering.	Apply (Segmentation algorithms) / L3
10	Write a program for image transformation: Affine and perspective transformations.	Apply (Geometric transformation) / L3
11	Simulate image compression using JPEG or Huffman coding.	Analyse (Compression techniques) / L4
12	Write a program to perform object detection using template matching.	Apply (Object detection algorithms) / L3

13	Implement feature extraction techniques such as Hough Transform for line detection.	Analyse (Feature extraction) / L4
14	Simulate image restoration techniques using inverse filtering and Wiener filtering.	Apply (Image restoration methods) / L3
15	Write a program for geometric transformations: Rotation, scaling, and translation.	Apply (Geometric manipulation) / L3

**ADVANCED LEVEL(NSQF LEVEL: 7-10)**

S.No	Name of the Program	Bloom level with Cognitive process
16	Develop a program to perform color image processing: RGB to HSV conversion and vice versa.	Analyse (Color models) / L4
17	Simulate face detection and recognition using Haar cascades or deep learning.	Analyse (Face recognition methods) / L4

18	Implement edge-preserving smoothing using bilateral filtering.	Analyse (Edge-aware smoothing) / L4
19	Write a program to detect and analyze contours in images using OpenCV.	Apply (Contour detection) / L3
20	Simulate optical character recognition (OCR) using neural networks or template-based approaches.	Create (OCR system) / L6
21	Write a program to apply deep learning-based image classification using pre-trained models.	Create (Image classification models) / L6
22	Simulate texture analysis using GLCM (Gray-Level Co-occurrence Matrix).	Analyse (Texture analysis methods) / L4
23	Implement an image-based watermarking algorithm for copyright protection.	Apply (Image security techniques) / L3
24	Write a program to perform color image segmentation using clustering techniques.	Analyse (Segmentation approaches) / L4
25	Develop a program for image fusion: Combining multiple images into one enhanced image.	Create (Fusion algorithms) / L6
26	Implement a program for panoramic image stitching.	Create (Image merging techniques) / L6
27	Simulate image denoising using deep learning approaches such as autoencoders.	Analyse (Denoising methods) / L4
28	Write a program for image super-resolution using machine learning techniques.	Create (Super-resolution models) / L6
29	Develop a program for medical image processing: Enhancing and analyzing X-ray or MRI images.	Analyse (Medical imaging techniques) / L4
30	Simulate facial emotion recognition using convolutional neural networks (CNN).	Create (Emotion detection using AI) / L6

### Suggested Readings:

1. Rafael C. Gonzalez, Richard E. Woods, 2018, Digital Image Processing, 4th Edition, Pearson.
2. Anil K. Jain, 2010, Fundamentals of Digital Image Processing, Prentice Hall.
3. John C. Russ, 2011, The Image Processing Handbook, CRC Press.
4. Williem K. Pratt, 2007, Digital Image Processing, 4th Edition, Wiley-Interscience.

### Software Required/Web Links:

- MATLAB or Octave for simulation tasks.
- Python libraries: OpenCV, Pillow, scikit-image, TensorFlow, Keras.
- Online resources: o GeeksforGeeks o Towards Data Science o OpenCV Documentation

**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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(i) Continuous or formative assessments (in the form of end semester examination or term examination.

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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%

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Minimum: 70 percent. Categorization for the same is:

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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:**

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
O5.5CA204E02H.1	3	2	2	1	2	1	1	1	1	2	1	2	3	2
O5.5CA204E02H.2	3	3	2	2	2	1	1	1	1	2	1	2	3	2
O5.5CA204E02H.3	3	2	2	2	3	1	2	1	1	2	1	2	3	2
O5.5CA204E02H.4	3	2	3	2	3	1	1	1	2	2	1	2	3	3
O5.5CA204E02H.5	3	3	3	3	3	2	2	1	2	2	1	2	3	3
O5.5CA204E02H.6	3	3	3	3	3	2	2	1	2	2	1	2	3	3

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

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

**O5.5CA205E02H: Mobile Computing**

**Credits: 3**

**Max. Marks: 100**

**Duration of Examination: 3 Hrs.**

**Continuous Evaluation: 30**

**End Semester Examination: 70**

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

**O5.5CA205E02H.1:** Understand the evolution, architecture, and fundamental concepts of mobile computing systems and wireless communication protocols.

**O5.5CA205E02H.2:** Explain and analyze key technologies, standards, and routing protocols in mobile and wireless networks, including mobile ad-hoc and emerging technologies such as UAV networks.

**O5.5CA205E02H.3:** Apply knowledge of wireless networks and protocols (Wi-Fi, RFID, Bluetooth, GPS) to real-world mobile computing applications.

**O5.5CA205E02H.4:** Develop and deploy mobile applications using platform-specific tools, integrating advanced features like location-based services, cloud support, and user interaction.

**O5.5CA205E02H.5:** Explore and implement security mechanisms in mobile environments to ensure secure communication and data integrity in application development.

**Unit 1: Introduction to Mobile Computing**

- 1.1 Mobile computing features and characteristics
- 1.2 Key issues (security, power, 5G adoption)
- 1.3 Novel applications (IoT, AR/VR, autonomous vehicles)
- 1.4 Wireless architectures (edge computing, Wi-Fi 6)
- 1.5 Cellular concepts and 5G evolution
- 1.6 Air-interface advancements
- 1.7 Channel structure and OFDMA techniques
- 1.8 Dynamic channel allocation in modern systems
- 1.9 GSM, LTE, 5G architecture, call routing, and CDMA relevance
- 1.10 GPRS/LTE/5G operations, services, and 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
- 2.7 Evolution to 3G, 4G, and 5G technologies

### **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 Drone Networking and Multi-UAV Architectures

### **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.**

**List of Experiments:**

**BEGINNER LEVEL(NSQF LEVEL: 1-3)**

<b>S. No.</b>	<b>Name of the Program</b>	<b>Bloom level with Cognitive process</b>
1.	Implementation a Bluetooth network with application as transfer of a file from one device to another.	Apply (Using bluetooth)/ L3
2	To implement a basic function of Code Division Multiple Access (CDMA).	Apply (Perform data transfer using CDMA)/ L3
3	Implementation of GSM security algorithms (A3/A5/A8)	Apply (Perform data transfer using GSM) / L3
4	To setup & configuration of Wireless Access Point (AP). Analyze the Wi-Fi communication range in the presence of the access point (AP) and the base station (BS). Consider BS and AP are static. Find out the maximum distance to which two way communications is possible. Try multiple iterations by adjusting its distance in the code and test it.	Apply (Create GSM Architecture) / L3
5	Implement security tools (like Kismet,Netstumbler)	Apply (Use Netstumbler for data security) / L3
6	To develop a Simple Android Application that uses GUI components, Font and Colors	Apply (Develop Android application) / L3
7	To develop a Simple Android Application that draws basic Graphical Primitives on the screen.	Apply (Develop Android application) / L3

**INTERMEDIATE LEVEL(NSQF LEVEL: 4-6)**

S.No	Name of the Program	Bloom level with Cognitive process
8	To develop a Simple Android Application that makes use of Database.	Apply (Linked list operation)/ L3
9	Develop a native application that uses GPS location information.	Apply (Develop Android application) / L3
10	Implementation of income tax/loan EMI calculator and deploy the same on real devices (Implementation of any real-time application)	Apply (Develop Android application for loan)/ L3
11	Network simulator installation of wireless sensor network.	Apply (Develop simulator)/ L3
12	Write a program for transmission between mobile nodes.	Apply (Transfer Data)/ L3
13	Write a program for sensor nodes with different parameters.	Apply (Transfer Data)/ L3
14	Write a program for UDP and CBR traffic in WSN nodes.	Apply (Transfer Data using UDP protocol) / L3
15	Write a program for TCP and CBR traffic in WSN nodes.	Analyse (Transfer Data using TCP protocol) / L4

**ADVANCED LEVEL(NSQF LEVEL: 7-10)**

S.No.	Name of the Program	Bloom level with Cognitive process
16	Implementation of routing protocol in NS3 for ADDV protocol.	Analyse (Implement NS3 for ADDV) / L4
17	Implementation of routing protocol in NS3 for DSR protocol.	Analyse (Implement NS3 for DSR) / L4
18	Implementation of routing protocol in NS3 for TORA protocol.	Analyse (Implement NS3 for TORA)/ L4
19	Study other wireless sensor network simulators (Mannasim, Contiki).	Analyse (Analyze Simulator)/ L4
20	Design wireless sensor network topologies and experiment data sending and reception at various power levels.	Analyse (Analyze power consumption)/ L4
21	Design, develop, and implement, different wireless sensor network algorithms for grouping the nodes.	Analyse (Analyze synchronization algorithm) / L4
22	Design, develop and implement different time synchronization algorithms for wireless sensor networks and study its real world characteristics.	Analyse (Analyze synchronization algorithm) / L6
23	Wireless Sensor Network Data Collection Frequency and transmission vs. Analysis of Power Consumption.	Analyse (Analyze power consumption) / L4
24	Wireless Sensor Network Duty Cycle Implementation.	Analyse (Analyze power consumption) / L4
25	Wireless Sensor Network Duty Cycle Implementation and Analysis of Power.	Analyse (Analyze power consumption) / L4

**Suggested Readings:**

1. Yan Zhang, 2021, Mobile Edge Computing, Springer.

2. Raj Kamal, 2018, Mobile Computing, Oxford University Press.
3. Dr. G.T. Thampi, 2014, Mobile Communication and Computing (Includes Lab Exercises), Dreamtech Press.

**Note: Only the latest editions of the books are recommended.**

**Software required/Web links:**

- <https://www.coursera.org/learn/smart-device-mobile-emerging-technologies> (Last visited Date: 09 May 2025)
- <https://www.codingconnect.net/android-application-makes-use-database/> (Last visited Date: 09 May 2025)
- <https://archive.nptel.ac.in/noc/courses/noc16/SEM2/noc16-cs13/> (Last visited Date: 09 May 2025)

**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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(i) Continuous or formative assessments (in the form of end semester examination or term examination.

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Assessment Tools:

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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	PSO1	PSO2
<b>O5.5CA205E02H.1</b>	3	2	1	1	2	1	1	–	2	2	1	3	2
<b>O5.5CA205E02H.2</b>	3	3	2	2	2	–	1	–	2	2	1	3	3
<b>O5.5CA205E02H.3</b>	2	3	3	2	3	–	2	–	2	2	2	3	3
<b>O5.5CA205E02H.4</b>	2	2	3	2	3	–	2	2	2	3	2	2	3
<b>O5.5CA205E02H.5</b>	2	3	2	2	3	2	1	–	2	3	2	2	3

**MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH & STUDIES**  
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**O5.5CA206E02H: ETHICAL HACKING**

**Credits: 4**

**Max. Marks: 100**

**Duration of Examination: 3 Hrs.**

**Continuous Evaluation: 30**

**End Semester Examination: 70**

**Pre-Requisite:** Basic knowledge of Cyber Security

**Course Type:** Discipline Elective

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

**O5.5CA206E02H.1** Understand Ethical Hacking concepts and perform penetration testing in a controlled environment.

**O5.5CA206E02H.2** Analyze and solve different types of attacks, security threats, and vulnerabilities present in computer systems.

**O5.5CA206E02H.3** Examine social engineering techniques used by attackers to gain access to useful and sensitive confidential data.

**O5.5CA206E02H.4** Demonstrate understanding of cryptography and perform basic web application attack analysis.

**O5.5CA206E02H.5** Implement tools, techniques, and address ethical issues and responsibilities in the domain of ethical hacking..

**Unit 1: Introduction to Ethical Hacking**

- 1.1 Introduction
- 1.2 Different types of hackers, Five phases of hacking
- 1.3 Scope of Ethical Hacking, Brush up Linux, Brush up networking
- 1.4 Information Gathering: Passive Information Gathering, Active Information Gathering

**Unit 2: System Hacking**

- 2.1 Scanning
- 2.2 System Hacking: Introduction to Metasploit Framework,
- 2.3 Exploit MS17-010 Vulnerability,
- 2.4 Reverse TCP Connection

**Unit 3: Introduction to Android hacking**

- 3.1 Privileged Escalation using post exploit bypassuac and getsystem,

- 3.2 Reverse connection in different network using port forwarding
- 3.3 Android hacking using reverse TCP connection

**Part-B**

**Unit 4: Software based vulnerabilities (Badblue/ice blaster)**

- 4.1 Introduction
- 4.2 Types of Software Vulnerabilities
- 4.3 Common Vulnerable Components
- 4.4 Attack Vectors and Exploitation Techniques
- 4.5 Impact and Consequences:

**Unit 5: Introduction to Active Directory**

- 5.1 Introduction
- 5.2 OU, DC, TREE, FOREST
- 5.3 LDAP, AD working,
- 5.4 SMB and SPN

**Unit 6: Introduction to Kerberos and Cryptography**

- 6.1 Introduction, Kerberos working (Authentication Server, Ticket Granting Server, TGT)
- 6.2 Kerberoasting attack, Mention, ASREPROASTING, Golden Ticket.
- 6.3 Cryptography: Symmetric Encryption Algorithm, Asymmetric Encryption Algorithm,
- 6.4 Hash Algorithm, Steganography, Prevention

**Suggested Readings:**

1. Jon Erickson, 2008, Hacking: The art of Exploitation, No Starch Press.
2. Peter Kim, 2013, The Hacker Playbook 2, Syngress

**Note: Only latest editions of the books are recommended.**

**List of Experiments:**

**BEGINNER LEVEL(NSQF LEVEL: 1-3)**

S. No.	Name of the Program	Bloom level with Cognitive process
1.	Overview of Ethical Hacking Objective: Understand the core concepts, responsibilities, and ethics involved in ethical hacking.	Learn and Apply (Using basics)/ L3
2	Types of Hackers and Their Roles Objective: Identify various types of hackers (white, black, gray hat) and discuss ethical boundaries.	Learn and Apply (Using basics)/ L3
3	The Five Phases of Hacking Objective: Examine the five phases of hacking (reconnaissance, scanning, gaining access, maintaining access, covering tracks).	Learn and Apply (Using basics)/ L3
4	Introduction to Linux Commands for Hacking Objective: Familiarize with basic Linux commands essential for ethical hacking.	Learn and Apply (Using basics)/ L3
5	Networking Basics for Ethical Hacking Objective: Review network fundamentals, IP addressing, and subnetting for hacking	Learn and Apply (Using basics)/ L3

6	Passive Information Gathering Techniques Objective: Use passive reconnaissance techniques, such as WHOIS and Google Dorking	Learn and Apply (Using basics)/ L3
7	Active Information Gathering with Nmap Objective: Practice scanning networks with Nmap to identify	Learn and Apply (Using basics)/ L3
	hosts and open ports.	

#### INTERMEDIATE LEVEL(NSQF LEVEL: 4-6)

S.No	Name of the Program	Bloom level with Cognitive process
8	Using Shodan for Information Gathering Objective: Use Shodan to find information about vulnerable devices and services on the internet.	Apply (Shodan)/ L3
9	Network Scanning with Advanced Tools Objective: Use tools like Nmap, Netdiscover, and Zenmap for in- depth scanning.	Apply (Scanning Tools) / L3
10	Introduction to Metasploit Framework Objective: Navigate Metasploit, understand modules, and exploit a vulnerable system.	Apply (Metasploit)/ L3
11	Exploiting MS17-010 (EternalBlue Vulnerability) Objective: Exploit the MS17-010 vulnerability using Metasploit to gain unauthorized access.	Apply (Metasploit)/ L3
12	Setting Up Reverse TCP Connections Objective: Create and manage a reverse TCP connection between attacker and victim machines.	Apply (Reverse TCP Connection)/ L3
13	Network Analysis with Wireshark Objective: Capture and analyze network traffic for vulnerabilities and attack traces.	Apply (Wireshark) / L3
14	Password Cracking using Hashcat and John the Ripper Objective: Use password-cracking tools to demonstrate the importance of secure passwords.	Apply (Hashcat and John the Ripper) / L3
15	Privilege Escalation with Bypass UAC and GetSystem Objective: Perform privilege escalation on Windows using Metasploit's post-exploitation modules.	Apply and Analyse(Metasploit)/ L3
16	Creating a Reverse TCP Connection on Android Objective: Use Metasploit to establish a reverse TCP connection to an Android device.	Apply (Metasploit)/ L3
17	Android Port Forwarding for Reverse Connection Objective: Use port forwarding techniques to connect to Android devices on different networks.	Apply (Metasploit)/ L3
18	Using Drozer for Android Vulnerability Scanning Objective: Discover vulnerabilities in Android applications using the Drozer tool.	Analyse(Drozer)/ L4
19	Introduction to Software Vulnerabilities Objective: Understand common software vulnerabilities and their causes.	Apply (OpenVAS) / L3
20	Analyzing Software Vulnerabilities using OpenVAS Objective: Use OpenVAS to scan for known vulnerabilities in software.	Analyse (OpenVAS) / L4

#### ADVANCED LEVEL(NSQF LEVEL: 7-10)

<b>S.No.</b>	<b>Name of the Program</b>	<b>Bloom level with Cognitive process</b>	<b>Programs mapped with Ability Enhancement Courses</b>
16	Exploiting Software Vulnerabilities with Ice	Analyse (Ice	-

	Blaster Objective: Test exploitation techniques on a vulnerable Ice Blaster installation.	Blaster) / L4	
17	Understanding Exploit Payloads and Attack Vectors Objective: Explore different payloads and attack vectors, focusing on Badblue vulnerabilities.	Analyse (Ice Blaster) / L4	SDG
18	Impact of Software Vulnerabilities on Systems Objective: Evaluate the impact of software vulnerabilities on system security and stability.	Analyse (Ice Blaster) / L4	-
19	Introduction to Active Directory Components Objective: Set up an Active Directory environment and understand its components (OU, DC, Tree, Forest).	Analyse (Active Directory) / L4	SDG
20	Exploring LDAP Queries in Active Directory Objective: Query Active Directory with LDAP to retrieve user and group information.	Analyse (LDAP) / L4	SDG
21	Understanding SMB and SPN in Active Directory Objective: Examine SMB and SPN functions within AD and understand their security implications.	Analyse (Active Directory) / L4	SDG
22	Privilege Escalation in Active Directory Using Kerberos Objective: Perform basic privilege escalation techniques in an Active Directory environment.	Analyse (Active Directory) / L4	IKS
23	Introduction to Kerberos Authentication Mechanism Objective: Understand Kerberos authentication and simulate a basic authentication scenario.	Analyse (Kerberos Authentication Mechanism) / L4	IKS
24	Kerberoasting and ASREPROASTING Attacks Objective: Execute Kerberoasting and ASREPROASTING attacks on vulnerable AD environments.	L2/ L3/ L4/ L5/ L6	IKS
25	Exploring Cryptography Techniques Objective: Use symmetric and asymmetric encryption, hashing, and steganography on sample data.	L2/ L3/ L4/ L5/ L6	IKS

#### Suggested Readings:

- A comprehensive guide for beginners covering fundamental penetration testing steps and tools.
- "The Basics of Hacking and Penetration Testing" by Patrick Engebretson
- "Hacking: The Art of Exploitation" by Jon Erickson
- Explains hacking techniques with detailed examples and offers practical insights into exploitation.
- "Metasploit: The Penetration Tester's Guide" by David Kennedy et al.
- Detailed introduction to Metasploit, from the basics to advanced exploitation techniques.
- "Gray Hat Hacking: The Ethical Hacker's Handbook" by Allen Harper et al. **Note: Only the latest editions of the books are recommended.**

#### Software required/Web links:

- TryHackMe Labs, Relevant Rooms: "Linux Fundamentals," "Metasploit: Intermediate," "Kerberos Exploitation," and "Active Directory Basics" TryHackMe Labs
- Hack The Box Academy, Relevant Modules: "Introduction to Linux," "Windows Fundamentals," "Metasploit Basics," and "Kerberos Attacks"

- HTB Academy,PortSwigger Web Security Academy

**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	PSO1	PSO2
<b>O5.5CA206E02H.1</b>	3	3	2	2	3	–	1	–	2	2	1	3	2
<b>O5.5CA206E02H.2</b>	3	3	2	3	3	–	1	–	2	2	1	3	3
<b>O5.5CA206E02H.3</b>	2	3	2	2	2	–	2	–	2	2	2	2	2
<b>O5.5CA206E02H.4</b>	3	2	2	3	3	–	1	–	2	2	2	3	2
<b>O5.5CA206E02H.5</b>	2	3	2	2	3	3	2	1	2	3	2	2	3

# MANAV RACHNA INTERNATIONAL INSTITUTE OF RESEARCH & STUDIES

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

## O5.5CA200C07: Major Project

Credits: 6

Max. Marks: 100

Continuous Evaluation: 30

Duration of Examination: 3 Hrs

End Semester Examination: 70

**Pre-Requisite:** Knowledge of Programming Language

**Course Type:** Dissertation

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

**O5.5CA200C07.1** Describe the Systems Development Life Cycle (SDLC).

**O5.5CA200C07.2** Construct and evaluate data flow diagrams.

**O5.5CA200C07.3** Design and evaluate system outputs

**O5.5CA200C07.4** Construct and evaluate entity-relationship (ER) diagrams for real projects

**O5.5CA200C07.5** Determine the various test cases and analyze the results.

**O5.5CA200C07.6** Develop soft-skills including writing formal reports and delivering oral presentations.

Major Project provides the student with an opportunity to enhance the project development skills. The major project provides insight to understand the real-life usage of the programming language / various SDKs for technical and societal problem solving. Each of the students is required to develop a project during the semester. Internal evaluation will be done by the respective mentors, the external evaluation will be carried out separately. Internal assessment will be done on the basis of following criteria:

### Continuous Evaluation during training:

1. Evaluation by the Supervisor in the Industry	:	15 marks
2. Synopsis, High Level Design and Low Level Design	:	10 marks
3. Internal Seminar cum Presentation	:	05 marks
Total Internal Marks	:	<b>30</b>

### External Evaluation after training:

1. Project Report	:	20 marks
2. Seminar cum Presentation	:	20 marks
3. Viva	:	30 marks
Total External marks	:	<b>70</b>

## COURSE ARTICULATION MATRIX

	PO1	PO2	PO3	PO4	PO5	P O 6	P O 7	P O 8	P O 9	PO 1 0	PO11	PO 1 2	PS O 1	PS O 2
<b>O5.5CA200C07.1</b>		2	3	2									1	2
<b>O5.5CA200C07.2</b>			2										2	
<b>O5.5CA200C07.3</b>			3											2
<b>O5.5CA200C07.4</b>			2										3	
<b>O5.5CA200C07.5</b>					3								2	3
<b>O5.5CA200C07.6</b>									3		2			2

**Note: Project guidelines are enclosed in Annexure-A**

## **Annexure-A:**

### **1. Guidelines for submission of BCA Project**

All the students are required to submit a project report based on the work done by him/her during the project period based on any programming language. Presentation / viva will be based on the project work carried during the semester. The Project topics should be based on syllabus or beyond.

The project is evaluated on the basis of following heads:

1. Presentation
2. Viva
3. Project report
4. Documentation
5. Testing

### **2. Project Report Preparation Guidelines:** Project report should consist the following:

- I. Cover page as per the format (Annexure 1)
- II. Declaration by the Student (Annexure 2)
- III. Certificate from Department (Annexure 3)
- IV. Acknowledgement
- V. Index (Table of Contents in tabular form)
- VI. Introduction
  - (a) About Organization
  - (b) Aims & Objectives
  - (c) Manpower
- VII. System Study
  - (a) Existing System along with limitations
  - (b) Proposed System along with advantages

VIII. Feasibility Study

- (a) Technical
- (b) Behavioural
- (c) Economic

IX. Project Monitoring System

- (a) Gantt Chart

X. System Analysis

- (a) Requirement Specification
- (b) System Flowcharts
- (c) DFDs /ERDs (up to Level 2)

XI. System Design

- (a) File/ Data Design

XII. Input / Output Form Design

- (a) Screen Design (Screenshots of all screens In Color)
- (b) Report Design

XIII. System Testing

- (a) Preparation of Test Data
- (b) Testing With Live Data
- (c) Test Cases with results

XIV. System Implementation

- (a) System Requirements (Hardware/Software)

XV. Documentation

XVI. Scope of the Project

XVII. Bibliography

**3. Project Report Submission Guidelines**

- a) Make 3 copies of the project.
- b) Submit one original hard and one original soft copy of the project report to concerned guide.
- c) A photocopy of the complete Project should be retained by the student for future reference.
- d) Cover page should be properly formatted. (See Annexure 1)
- e) The project report must be about 80-100 pages.
- f) Source code or pseudo code should not be included in the project report
- g) Student will be giving a presentation of about 20 minutes, highlighting the project objective, summary and report and findings of the project at the time of viva.
- h) Project completed in all aspects with necessary enclosures should be submitted to the concerned Guide in specified time period.
- i) The dimension of the project report should be in A4 size.
- j) The project report should be bound using flexible cover of the thick plastic paper (Spiral Binding).
- k) Report should use Font Arial/ Times New Roman; Font Size: 14 (For Headings Bold) and 12 (For Paragraphs). Document can have maximum of 1.5 lines spacing.
- l) Project completed in all aspects with necessary enclosures should be submitted to the concerned Guide.
- m) Violation of the project guidelines will lead to the rejection of the project at any stage.

n) A photocopy of the project report is not acceptable for submission.

**Annexure 1**

~~Title of the Project~~

(Organization: For Whom Developed)

Submitted to:

ManavRachna International Institute of Research & Studies,  
Faridabad (Haryana)

In Partial Fulfillment of

Bachelor of Computer Applications (BCA)

Session:

Under the Supervision of:

(Name of Project Guide, Designation

By

Name: ( )

Roll No: ( )



**School of Computer Applications**  
**Manav Rachna International Institute of Research & Studies**

Sector-43, Aravalli

Faridabad 121001

## **Annexure 2**

### **Declaration**

I do hereby declare that this project work entitled “\_\_\_\_\_” submitted by me for the partial fulfilment of the requirement for the award of BACHELOR OF COMPUTER APPLICATIONS (BCA) is a record of my own work. The report embodies the finding based on my study and observation and has not been submitted earlier for the award of any degree or diploma to any Institute or University.

**SIGNATURE OF STUDENT**

Name:

Roll No:

### **Annexure 3**

#### **Certificate from the Guide**

This is to certify that the project report entitled “\_\_\_\_\_” submitted in partial fulfilment of the degree of BACHELOR OF COMPUTER APPLICATIONS (BCA) to Manav Rachna International Institute of Research & Studies, Faridabad is an authentic and original work carried out by Mr./ Ms.\_\_\_\_ with Roll no. \_\_\_\_\_under my guidance.

The matter embodied in this project is genuine work done by the student and has not been submitted whether to this University or to any other University / Institute for the fulfillment of the requirements of any course of study.

Signature of the Student:

Date:

Name:

Roll No:

Signature of the Guide

Date:

Name of the Guide:

Designation of the Guide

#### **Annexure 4:**

### **Acknowledgement**

I gratefully acknowledge for the assistance, cooperation, guidance and clarification provided by Ms./Mr. \_\_\_\_\_ (*Company Guide – If applicable*) during the development of \_\_\_\_\_ (*project title*). My extreme gratitude to Dr. Anupriya Jain (*Guide from Department*) who guided us throughout the project. Without his willing disposition, spirit accommodation, frankness, timely clarification and above all faith in us, this project could not have been completed in due time. His readiness to discuss all important matters at work deserves special attention of. I would also like to thank all the faculty members of the computer application department for their cooperation and support.

I would like to extend my sincere gratitude to **Prof. (Dr.) Suhail Javed Quraishi – HOD** for her valuable teaching and advice. I would like to thank **Prof. (Dr.) Brajesh Kumar – Dean** for motivating us. I would again like to thank all faculty members of the department for their cooperation and support. I would like to thank non-teaching staff of the department for their cooperation and support.

I perceive this opportunity as a big milestone in my career development. I will strive to use gained skills and knowledge in the best possible way, and I will continue to work on their improvement, in order to attain desired career objectives. Hope to continue cooperation with all of you in the future.

*No signature required on this page.*

XVIII. Index (Table of Contents in tabular form)

S.N.	Chapter	Page No