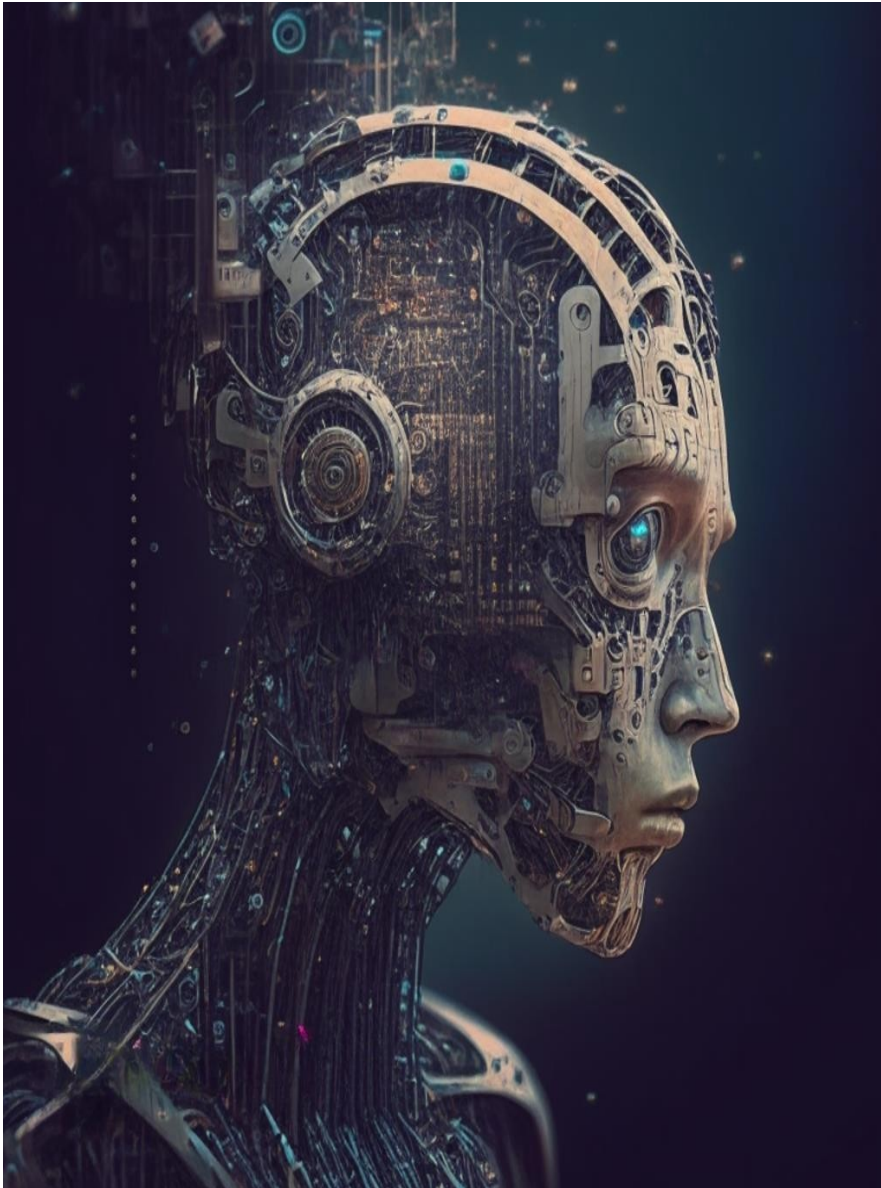


Learning Outcomes-based Curriculum
Framework (LOCF) for
Post-Graduate Programme



Master of Computer Applications

(Affiliated Colleges)

2024

www.keralauniversity.ac.in

Preamble

The role of higher education is vital in securing gainful employment and providing further access to higher education comparable to the best available in world-class institutions elsewhere. The improvement in the quality of higher education, therefore, deserves to be given top-most priority to enable the young generation of students to acquire skills, training and knowledge to enhance their thinking, comprehension and application abilities and prepare them to compete, succeed and excel globally. Sustained initiatives are required to reform the present higher education system to improve and upgrade the academic resources and learning environments by raising the quality of teaching and standards of achievements in learning outcomes across all undergraduate programs in science, humanities, commerce and professional streams of higher education.

One of the significant reforms in undergraduate education is introducing the Learning Outcomes-based Curriculum Framework (LOCF), which makes it student-centric, interactive and outcome-oriented with well-defined aims, objectives and goals to achieve. The University Grants Commission (UGC) implemented the LOCF in the country's Colleges and Universities. Accordingly, the University of Kerala has decided to implement the LOCF in all its departments and Affiliated Colleges under the auspices of the Internal Quality Assurance Cell (IQAC). A series of teacher training workshops were organised by IPG Board of Studies (Computer Science) with Teachers and have revised the syllabus accordingly through workshops and in consultation with academic and Industrial experts in the field.

Graduate Attributes

The Graduate Attributes (GAs) reflect particular qualities and abilities of an individual learner, including knowledge, application of knowledge, professional and life skills, attitudes and human values that are required to be acquired by the graduates of the University of Kerala. The graduate attributes include capabilities to strengthen one's professional abilities for widening current knowledge and industry-ready skills, undertaking future studies for global and local application, performing creatively and professionally in a chosen career and ultimately playing a constructive role as a socially responsible global citizen. The Graduate Attributes define the characteristics of learners and describe a set of competencies that are beyond the study of a particular area and programme.

The Graduate Attributes of the University of Kerala

- Continue life-long learning as an autonomous learner.
- Continuously strive for excellence in education.
- Apply and nurture critical and creative thinking.
- Promote sustainable development practices.
- Promote co-operation over competition.
- Balance rights with responsibilities.
- Understand and respect diversity and differences. Do Not be prejudiced by gender, age, caste, religion, or nationality.
- Use education as a tool for the emancipation and empowerment of humanity.

1. About the Master of Computer Application Programme

MCA, which expands to Master of Computer Applications, is a full-time academic program that imparts education related to computers, their programming, and applications. This academic degree is a

stepping stone to a great professional journey that will lead you to a better future. MCA is a two-year professional post-graduate course for candidates wanting to delve deeper into the world of Computer Application development with the help of learning modern programming language. The programme is a blend of both theoretical and practical knowledge.

MCA can provide a student with in-depth knowledge of programming languages, software development, database management, and computer networks. It can open up career opportunities as software developers, system analysts, database administrators, and more. Moreover, it is designed to meet the shortage of qualified professionals in the IT (Information Technology) industry in India.

This regulation may be named as University of Kerala, Regulations for MCA, 2024 and is subject to the provisions of the Kerala University Act, 1974 and the statutes and ordinances if any issued in the subject is applicable from time to time. This regulation shall be applicable for students admitted from 2024 onwards.

2. General Information

2.1 Eligibility: Candidates should have passed BCA/Bachelor Degree in Computer Science /Engineering or equivalent Degree recognized by the University of Kerala.

OR

Passed B.Sc./B.Com/BA with Mathematics at 10 + 2 level or at Graduation level or any equivalent degree recognized by the University of Kerala with additional bridge course as per the norms of the University of Kerala, to apply for the programme and obtained at least 50% marks (45% marks in case of candidates belonging to reserved category) in the qualifying examination.

Candidates seeking admission must ensure the eligibility of their qualifying degrees/ programmes/ courses by the University of Kerala prior to admission.

2.2 Bridge Courses

Students who haven't undergone Computer Science as a core or complementary course for their undergraduate program has to study these courses in first semester itself and appear for the exam conducted by the University. A minimum pass in these courses are required for such candidate to register for the 3rd semester of the program and also for the publishing 1st&2nd semester result. The student will get one chance in both the first and second semester of the program to attend the examination for the bridge courses. But, these marks will not be counted for finding class for the MCA programme. Institutions must ensure the conduct of the Bridge course suggested in the regular mode.

Course Code	Bridge Courses	Credits
MCA-BC-101	Basic Mathematics for Computer Science	3
MCA-BC-102	Digital Logic and Computer Architecture	3
MCA-BC-103	Programming C Lab	2
	Total	8

Question Paper Pattern (Bridge courses): The maximum mark for the theory examinations will be 50 and the time duration will be 2 hours. The minimum pass mark will be 40% for individual courses and 50% for consolidated marks of 3 courses. The question paper shall contain Part-A and Part-B. Part-A shall be for 10 marks and contains 10 compulsory questions (MCQ/One-word/etc.), of 1 mark, 2 questions from each module. Part-B shall be for 40 marks and shall contain 10 short answer questions with equal marks. The lab examination will be for 50 marks, conducted internally by the institution monitored by the head of the

Institution/Department, evaluating the skill of candidate.

2.3 Examinations

University Examinations will be conducted at the end of each semester as per the scheme included in this document. Pass Requirements and provisions for classification of successful candidates.

1. A candidate shall be declared to have passed the semester examination in full if the candidate secures not less than 40% marks in written examination and not less than 50% marks in written (University) plus sessional marks put together in each paper. This rule applies to practical also. For the courses which have only sessional marks, a minimum of 50% is required for a pass; otherwise the student has to repeat that semester.
2. For a pass in main project the student has to obtain minimum 50% marks in internal evaluation and 50% marks in external evaluation. Otherwise the candidate has to repeat the 4th semester.
3. If a student fails in one or more courses, he/she needs to reappear only in those courses. The rules for supplementary examinations will be same as that of the existing regulations. Question Paper Pattern (Other than Bridge courses): The maximum mark for the theory examinations will be 100 and the time duration will be 3 hours. The question paper shall contain two parts; Part-A and Part-B. Part-A shall be for 40 marks and shall contain 10 compulsory short answer questions, with 4 marks. Part B shall be for 60 marks and shall contain 12 questions, the student has to answer one question from each module, all question has equal marks.

Each student has to successfully complete one MOOC course in the first semester and fourth semester from the topics related to (Communicative English, Research Methodology, Technical Writing, Entrepreneurship, Environmental studies, Cyber law or any new topic/technology introduced recently. etc.) with a minimum period of four weeks offered through E-learning platforms like SWAYAM, Coursera, etc.

2.4 Programme Duration

MCA programme shall be a period of two academic years comprising four semesters; each academic year shall be organised into two semesters with a group of courses as given in the curriculum and scheme of examination. The programme shall be offered with different courses, each with an assigned credit.

2.5 Expected Outcome

Objectives

1. Comprehend fundamental concepts and hands-on knowledge of state-of-the-art Computer Application methodologies.
2. Design and Build real-world Computer systems for complex planning, decision-making and learning, solving application-specific problems, and reasoning about them.
3. Conceive, Design and Develop intelligent multi-modal multi-sensory Man- Machine interfaces.
4. Design, Develop and Deploy Software applications using structured methodologies.
5. Understand and assess the reliability, dependability and trustworthiness of Software-based systems.
6. Design and develop Computer applications for resource-constrained environments.
7. Adhere to evolving ethics and privacy laws across various domains and territories.
8. Plan, manage and execute technical projects.

Learning Outcome

1. Develop the skill set for R&D and industry-ready professionals to join the Information Technology field.
2. Prepare and motivate students to do research in Computer Science, and Engineering, and its interdisciplinary fields.
3. Demonstrate advanced skills in designing, developing and implementing software that communicates effectively.
4. Develop cutting-edge developments in computing technology and contemporary research for society.
5. Develop application skillset in algorithm design, optimisation, and improved performance in computing.
6. Develop advanced knowledge for Machine learning systems with Big data systems, and Data Analytics.

2.6 Evaluation

Candidates in each semester shall be evaluated by Continuous Assessment (CA) and End Semester Examinations (ESE). The maximum marks allotted for continuous assessment and University examination for each subject are as prescribed by the scheme of study.

Continuous Assessment: An internal evaluation will be carried out during each semester's progress. The main purpose is to provide students with learning effectiveness and individual profundness in their curriculum. The evaluation and award of CA marks differ for each course. Guidelines on conducting the continuous assessment of each course and comprehensive evaluation shall be approved by the Department Council and communicated effectively to the students.

End Semester Examinations: There will be University examinations at the end of the first academic year and the end of every semester onwards in courses as prescribed under the respective scheme of examinations. Every taught course shall be assessed through a written end-semester exam of a maximum of 3 hours' duration. As stated in the syllabus, the end-semester exams shall be summative and aimed at attesting to achieving course outcomes.

Letter Grades: Students' performance in individual courses shall be evaluated and assigned grades to indicate the achievement of objectives. The grading scale shall be the same as the national pattern recommended by the UGC. Each grade shall be indicated by a letter as in the table below:

Letter Grade	Grade Point (GP)	Marks
O (Outstanding)	10	90 to 100
A +(Excellent)	9	85 to less than 90
A (Very Good)	8.5	80 to less than 85
B+ (Good)	8	70 to less than 80
B (Above Average)	7	60 to less than 70
C (Average)	6	55 to less than 60
D (Pass)	5	50 to less than 55
F (Fail)	0	Less than 50
Ab (Absent)	0	Absent
CI (Course Incomplete)	0	Course Incomplete

Each grade shall have a corresponding grade point which serves as a means of aggregating letter grades and is not marks or scores.

Induction Programme: There will be at least two-week induction program for first-semester students. It is a unique three-week immersion Foundation Programme designed specifically for the newly admitted students, which includes a wide range of activities, workshops, lectures and seminars to social works and much more. The programme is designed to mould students into well-rounded individuals, aware and sensitized to local and global conditions and foster their creativity, teach values and ethics, and help students to discover their passion. Foundation Programme also serves as a platform for the freshers to interact with their batch mates and seniors and start working as a team with them. The program is structured around the following five themes:

The programme is designed keeping in mind the following objectives:

- *Values and Ethics*: Focus on fostering a strong sense of ethical judgment and moral fortitude.
- *Creativity*: Provide channels to exhibit and develop individual creativity by expressing themselves through art, craft, music, singing, media, dramatics, and other creative activities.
- *Leadership, Communication and Teamwork*: Develop a teamwork and group communication culture.
- *Social Awareness*: Nurture a deeper understanding of the local and global world and our place in it as concerned citizens of the world.
- *Coding skills*: Students can develop programming skills to improve their values and standards.

3. Programme Structure

Every course of MCA Programme shall be placed in the following categories.

Sl. No	Category	Code	Credits
1	Core Course (Theory)	CC	39
2	Core Course (Laboratory)	CC	12
4	Core Course (Dissertation)	CC	12
5	Discipline-specific Electives	DE	09
6	Course Viva	CC	06
Total Mandatory Credits			78
8	Skill Enhancement course	SE	12 (pass only)

Semester-wise credit distribution shall be as below:

Semester	1	2	3	4	Total
Credits	20	20	20	18	78

3.1 Programme Code: MCA

Core Course (CC): Course offered by a Department to the students in their Postgraduate programme, closely related to the area of specialisation. The assessment of the course will be per the regulations of the University for the Teaching and Learning Departments.

Laboratory Course (CC): The laboratory aims to develop and apply effective theory based on realistic practice; it is the primary way to train students properly in the rapidly advancing courses offered by the department. Each semester offers a laboratory course with at least 6 hours of weekly practices. The laboratory has two levels of programming exercises- basic and advanced. The basic level gives an awareness of the course through programming exercises. At the advanced level, a mini project/case study/advanced programming exercises are given to understand the application level of the course. Evaluation of Mini Project/Case Study/Advanced programming exercises and semester viva is performed by a panel of teachers in the department approved by the Department Council. Laboratory report submission is mandatory for each student and is to be submitted to the faculty in charge of the laboratory.

Skill Enhancement course (SE): A course that provides value-based or skill-based knowledge should contain theory and laboratory/ hands-on/ training/ fieldwork. The main purpose of these courses is to provide students with life skills in the hands-on mode to increase their skill development and employability. The assessment of the course will be per the regulations of the University for the Teaching and Learning Departments.

Discipline-specific Electives (DE): Courses offered under the main discipline/subject of study, primarily offered to the students of the same discipline each semester. The departments can modify such electives or add fresh electives from time to time based on the changing academic paradigms related to the course. The assessment of the course will be per the regulations of the University for the Teaching and Learning Departments.

Case Study: Each student is required to undertake the Case Study during the third semester under the guidance of a faculty member. The students are expected to select an emerging area/industrial problem in Computer Science.

Internship: During the fourth semester (it can be done during the vacation or semester break period), the students must complete the internship programme from the industry or R&D organisations. The students can identify industries and undergo industry training or workshop. A minimum of two weeks of internship is compulsory to complete Semester II successfully. Each student should submit an internship certificate along with a detailed study report. The Department council will select industry/ R&D organisations from the student's choice.

MOOC: Massive Open Online Courses (MOOCs) bring knowledge to students in selected disciplines through online platforms. Each student must take a minimum of 30 hours' duration MOOC. It is compulsory to complete Semester I and III successfully. The Department council will announce the source of MOOCs from time to time.

Dissertation: Dissertation (Project work) is intended to challenge students' intellectual and innovative abilities. It allows students to synthesize and apply the knowledge and analytical skills learned in the different disciplines. All the students must do a project on a problem with industry or research potential as part of this course. The project work can be done in any of the following - R&D institutions, MNCs - IT companies and departments. At the end of the course, all the students should submit a project report with the details of the work done, findings and suggestions for evaluation. There will be internal and external evaluations of the work.

3.2 Programme Outcome (PO)

PO1: Computational Knowledge	Apply knowledge of computing fundamentals, computing specialisation, mathematics, and domain knowledge appropriate for the computing specialisation to the abstraction and conceptualisation of computing models from defined problems and requirements.
PO2: Problem Analysis	Identify, formulate, research literature, and solve <i>complex</i> computing problems, reaching substantiated conclusions using fundamental principles of mathematics, computing sciences, and relevant domain disciplines.
PO3: Design /Development of Solutions	Design and evaluate solutions for <i>complex</i> computing problems, and design and evaluate systems, components, or processes that meet specified needs with appropriate public health and safety, cultural, societal, and environmental considerations.
PO4: Conduct Investigations of Complex Computing Problems	Use research-based knowledge and research methods, including design of experiments, data analysis and interpretation, and information synthesis to provide valid conclusions.
PO5: Modern Tool Usage	Create, select, adapt and apply appropriate techniques, resources, and modern computing tools to <i>complex</i> computing activities, with an understanding of the limitations.
PO6: Professional Ethics	Understand and commit to professional ethics and cyber regulations, responsibilities, and norms of professional computing practices.
PO7: Life-long Learning	Recognise the need and have the ability to engage in independent learning for continual development as a computing professional.
PO8: Project management and finance	Demonstrate knowledge and understanding of computing and management principles and apply these to one's work as a member and leader in a team to manage projects and in multidisciplinary environments.
PO9: Communication Efficacy	Communicate effectively with the computing community and society about <i>complex</i> computing activities by comprehending and writing effective reports, designing documentation, making effective presentations, and giving and understanding clear instructions.
PO10: Societal and Environmental Concerns	Understand and assess societal, environmental, health, safety, legal, and cultural issues within local and global contexts and the consequential responsibilities relevant to professional computing practices.
PO11: Individual and Team Work	Function effectively as an individual, member, or leader in diverse teams and multidisciplinary environments.
PO12: Innovation and Entrepreneurship	Identify a timely opportunity and use innovation to pursue that opportunity to create value and wealth for the betterment of the individual and society at large.

3.3 Programme Specific Outcome (PSO)

PSO1: Able to analyse, design, develop, test and apply mathematical foundations and technical knowledge in developing computational solutions by employing modern computer languages, environments and platforms that can solve complex problems.

PSO2: Anticipate the changing direction of computational technology, evaluate it, and communicate its likely utility for building software systems that would perform tasks related to industry, research, and education.

PS03: Inculcate knowledge of engineering and management principles to manage projects effectively and create innovative career paths.

PS04: Students can adapt the skills to implement effective solutions for need-based problems by applying knowledge gained through different programming languages, tools, and software covered in the program curriculum.

PS05: Pursue life-long learning in practice and contribution through socially relevant concern, positive attitude and ethics.

PS06: Demonstrate the ability to solve complex problems in making decisions in computer science to mould the students into industry-ready professionals.

PS07: Acquire concepts relating to knowledge engineering practices in real-time software project development using an open-source programming environment or commercial environment to deliver quality products for the organisation's success.

PS08: Explore research gaps, analyse and carry out research-oriented projects in the specialised/emerging areas and develop the skillset to work in an R&D institution.

PS09: Demonstrate technical competency to analyse, comprehend, design and develop solutions in technologies used in the Software industry to develop interactive applications.

3.3 Mapping of PO to PSO

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9
P01	√	√	√		√				√
P02	√		√	√		√		√	
P03		√		√		√			
P04		√		√	√	√	√		
P05	√			√					√
P06			√	√	√				
P07			√	√	√	√		√	
P08			√						√
P09	√				√		√	√	√
P010	√				√		√	√	√
P011	√	√	√	√					√
P012				√			√	√	

3.4 Scheme

Semester	Course Code	Name of the course	Credits
I	Core courses (CC)		
	MCA-CC-511	Mathematical Foundations for Computing	4
	MCA-CC-512	Datastructures in Java	3
	MCA-CC-513	Web Programming	3
	MCA-CC-514	Advanced Operating System	3
	MCA-CC-515	Software Engineering	3
	MCA-CC-516	Datastructures laboratory	2
	MCA-CC-517	Web Technology laboratory	2
	Skill Enhancement course (SE)		
	MCA-SE-4B1	Professional Development	2

	MCA-SE-4B2	MOOC	2
II	Core courses (CC)		
	MCA-CC-521	Algorithm Analysis and Design	4
	MCA-CC-522	Machine learning	3
	MCA-CC-523	DBMS	3
	MCA-CC-524	Python Programming	3
	MCA-CC-525	Elective 1	3
	MCA-CC-526	DBMS laboratory	2
	MCA-CC-527	Machine learning laboratory	2
	Discipline-specific Electives (DE)		
	MCA-DE-525(i)	Software Testing	3
	MCA-DE-525(ii)	Blockchain Technology	3
	MCA-DE-525(iii)	Bioinformatics	3
	MCA-DE-525(iv)	Social Network Analysis	3
	MCA-DE-525(v)	Theory of Computation	3
	Skill Enhancement course (SE)		
	MCA-SE-4B3	IT Act	2
MCA-SE-4B4	Industry Internship	2	
III	Core Courses (CC)		
	MCA-CC-531	Advanced Computer Networks	4
	MCA-CC-532	Smart application development	3
	MCA-CC-533	Bigdata analytics	3
	MCA-CC-534	Elective 2	3
	MCA-CC-535	Elective 3	3
	MCA-CC-536	Mini Project	2
	MCA-CC-537	Application development laboratory	2
	Discipline-specific Electives (DE)		
	MCA-DE-534(i)	Cloud Computing	3
	MCA-DE-534(ii)	Management Information System	3
	MCA-DE-534(iii)	Internet of Things	3
	MCA-DE-534(iv)	Cyber Security and Cyber Law	3
	MCA-DE-534(v)	Cryptography and Network Security	3
	MCA-DE-535(i)	Digital Marketing	3
	MCA-DE-535(ii)	Deep Architectures	3
	MCA-DE-535(iii)	Software Project Management	3
	MCA-DE-535(iv)	Functional Programming	3
	MCA-DE-535(v)	Wireless Sensor Networks	3
	Skill Enhancement course (SE)		
	MCA-SE-4B5	Case Study	2
	MCA-SE-4B6	MOOC	2
IV	Core Courses (CC)		
	MCA-CC-541	Dissertation Work	12
	MCA-CC-542	Comprehensive Course Viva	6

Course Code: MCA-BC-101

Bridge Course

BASIC MATHEMATICS FOR COMPUTER SCIENCE

Preamble: This course encompasses a comprehensive study of essential mathematical concepts crucial for building a strong foundation in various fields, particularly in engineering and applied sciences. The modules have been designed to progressively advance from fundamental topics to more intricate mathematical principles, ensuring a holistic grasp of the subject matter.

Prerequisite: Students should have a basic understanding of fundamental mathematical concepts, including arithmetic operations, algebraic expressions, and elementary geometry. Proficiency in basic mathematical operations and a foundational knowledge of high school mathematics will greatly facilitate comprehension and engagement with the content of this syllabus.

COURSE OUTCOMES & TAGGING

Course Outcomes	PO	PSO	CL	KC
C01 Understand the fundamentals of Computers Work with memberships of sets, the relations between sets and to perform the operations of union, intersection, complement, and difference on sets using proper notation and Venn diagram.	PO1	PSO1	U, Ap	C, P
C02 Work with mappings and functions	PO1	PSO1	U	C
C03 To plot a vector in 2D, understand the basic operations on vectors.	PO1	PSO 1	U	C,P
C04 Work with Trigonometric ratios and functions.	PO1	PSO1	U	C,P
C05 Work with matrices and determine if a given square matrix is invertible. Find the rank of a given matrix. Learn to solve systems of linear equations and application problems requiring them	PO1	PSO1	U	C,P
C06 To understand the continuity and limits of a function, to know about the meaning of derivative and integrals of a function	PO1	PSO1	U, An	C, P
C07 To understand the difference between linear equations, non-linear equations and systems of linear equations and their solutions	PO1	PSO1	U	C, P

(CL- Cognitive Level: R-remember, U-understand, Ap- Apply, An-Analyse, E- Evaluate, Cr- Create, KC - Knowledge Category: F- Factual, C- Conceptual, P-Procedural, M- Metacognitive)

COURSE CONTENT

MODULE I

Sets, relations & functions: Definition of sets and subsets: Set operations – Union intersection, Compliments, Laws of Sets Theory, Relations-equivalence relations and partitions.

MODULE II

Venn Diagrams, Mappings- one-one, one-two, countable and uncountable sets. Scalars & Vectors, addition, subtraction, multiplication of a vector by a scalar, vector equation of joining two points, Section Formulae, Position vector, dot product, application of dot product.

MODULE III

Trigonometric ratios and functions, Trigonometric identities, Trigonometric ratios of standard angles.

MODULE IV

Matrices: types, addition, subtraction, multiplication, transpose and inverse of matrix, determinants, Rank of a matrix, Application of matrix in solving Linear Equations

MODULE V

Limits & Derivatives: Limits, continuity, derivative as rate of change. Graphical treatment of derivative, Derivatives of simple functions, Integration, area under the graph, definite and indefinite integrals, Integrals of basic simple functions.

MODULE VI

Quadratic equations, solution of quadratic equation, nature of roots, relation between roots and coefficients, polynomial, synthetic division method, value of a polynomial, roots of a polynomial linear and non-linear equations.

LEARNING RESOURCES

References

- K. Mukhopadhyay, "A Course in Vector and Matrix Analysis for Engineers and Physicists, I K International Publishing House Pvt. Ltd
- Handbook of Mathematics by Amit Rastogi, Arihant Publications Ltd.
- Erwin Kreyszig, "Advanced Engineering Mathematics", 10th ed., Wiley.
- College Mathematics, Schaum's Series, TMH.

Online Resources

- www.britannica.com/science/matrix-mathematics
- <https://www.aicte-india.org/sites/default/files/final%20maths.pdf>

Bridge Course**DIGITAL LOGIC AND COMPUTER PROGRAMMING**

Preamble: The digital logic serves as the foundation for designing and understanding how computers and digital systems operate. The course covers the fundamental concepts and principles that govern the representation, manipulation, and processing of information in digital form. This course will provide students with the basic concepts of a programming language typically refer to the introductory statements or declarations that set up the environment for the program.

Prerequisite: Basic Computer Knowledge

COURSE OUTCOMES & TAGGING

CO	Course Outcome	PO	PSO	CL	KC
CO1	Identify the organization of computer memory and peripherals	PO2	PSO1	An	P
CO2	Explain the data transfer and control mechanisms in digital computers	PO1	PSO2	R	F
CO3	Understanding of Operating System Concepts	PO1	PSO1	U	C
CO4	Proficiency in Basic Syntax	PO3	PSO4	E,R	C
CO5	Understanding of Data Types and Variables, Mastery of Control Structures	PO1	PSO4	U	F
CO6	Proficiency in Functions	PO4	PSO1	E,R	C
CO7	Object-Oriented Programming (OOP) Concepts	PO5	PSO4	U	C
CO8	Understanding of Classes and Objects, Memory Management	PO4	PSO6	U	F

(CL- Cognitive Level: R-remember, U-understand, Ap- Apply, An-Analyse, E- Evaluate, Cr- Create, KC - Knowledge Category: F-Factual, C- Conceptual, P-Procedural, M- Metacognitive)

COURSE CONTENT**MODULE I**

Memory organization: Memory hierarchy – Main memory – Auxiliary memory –Associative memory – Cache memory – Virtual memory, *Input-output organization:* Peripheral Devices – I/O interface – Asynchronous data transfer-DMA-Input/output processor (IOP)

MODULE II

CPU: Register and stack organization – Instruction formats – Addressing modes- Data transfer and manipulation Operating Systems -OS structure – batch processing – multiprogramming – time sharing – OS operations. Operating system services – User OS interface, System calls – types, System programs, OS structure – simple – layered, virtual machine – introduction only, system boot.

MODULE III

Introduction to programming languages – types of programming languages – high level – assembly language – low level language – Compilers and interpreters. Problem solving concepts- flow charts and algorithms – Features of C language. Introduction to C programming – variables and arithmetic expressions- Formatted output- printf()

MODULE IV

The For statement- Symbolic constants - Character input and output - Arrays - Types, Operators and Expressions - Formatted input-scanf - Control Flow. Functions and program structure - function definition - function prototypes - function call - recursion. Structures - structures and functions - Array of structures - Unions .

MODULE V

Fundamentals of object-oriented Design: Data Abstraction, Encapsulation, classes, Inheritance and Polymorphism, class Hierarchies. C++ enhancements to C : Default Function Arguments, Placement of variable declarations, the scope resolution operation, the “Const” Qualifier

MODULE VI

References: References as Aliases, references and pointers similarities and differences, references as function parameters, references as return values. Introduction to classes: Declaring and using classes, class members, Creation and destruction of objects, constructors and destructors- accessing data members Returning a reference, “Const” objects and member function., inline functions, Classes and dynamic memory allocation: New, delete operators, “this” pointer. Static members, friends, array of class objects. Function overloading, constructor overloading, Operator overloading.

LEARNING RESOURCES

References

- M. Morris Mano, “Computer System Architecture”, Pearson Education.
- A. Silberchatz. et.al., Operating System Concepts, A John Wiley, 2009
- 3. Balagurusamy - Programming in ANSI C - 5th ed- TMH
- 4. Robert Lafore., Object Oriented Programming in Microsoft C++- Pearson Education, 4th Edition.
- Bartee T, Digital Computer Fundamentals, Mc Graw Hill.
- Dhamdhare - Operating System, A Concept based approach- 2nd edition, TMH
- Keringhan, Ritchie. The C Programming language
- Balaguruswamy., Object Oriented Programming with Microsoft C++, TMH, 4th Edition

MCA MODEL QUESTION PAPER
Bridge Course
MCA_BC-102: Digital Logic and Computer Programming
(2024 Scheme)

Time : 3 Hours

Max. Marks : 50

Part A

Answer all questions. Each carries 1 Mark

1. Logic gates are electronic circuits that perform logical operations on one or more
Inputs [CO1]
2. Counters are circuits that produce a sequence of binary numbers in response to
clock pulses. [CO2]
3.s a specialized processor that manages input/output operations in a computer
system. [CO2]
4. In operating system, each process has its own _____ [CO3]
5. When was the first operating system built? [CO3]
6. What is the difference between C and C++? [CO7]
7. The function used to concatenate two strings is [CO6]
8. An array index starts with----- [CO5]
9. The default parameter passing mechanism is----- [CO6]
10. Address stored in the pointer variable is of type _____. [CO8]

Part B

Answer all questions. Each carries 4 Marks

11. What are logic gates? [CO1]
12. What are sequential circuits? [CO1]
13. What are the benefits of a multiprocessor system? [CO2]
14. What are features of operating systems? [CO3]
15. What are the key features in the C programming language? [CO4]
16. What are the basic concepts of OOPs? [CO7]
17. Describe the difference between = and == symbols in C programming? [CO5]
18. What are the general description for loop statements and available loop types in C?
[CO5]
19. What is a nested loop? [CO5]
20. Explain the concepts of parameter passing methods in C? [CO6]

Course Code: MCA-BC-103

Bridge Course

PROGRAMMING IN C LAB

Preamble: This course act as a foundation to the programming concepts. This course will provide students with the concepts of a programming language and they can develop programming skills can be helpful in the study any other programming languages.

Prerequisite: Foundation of Developing Programming skills

COURSE OUTCOMES AND TAGGING

CO	Course Outcome	PO	PSO	CL	KC
CO1	Awareness about Compilation and Execution of programs, Pre-processor commands, syntax, data types, storage class, built in functions in C, Working with Formatted Input and Output.	PO1	PSO1	U	F
CO2	Develop program skills to implement different operators in C- Arithmetic, Logical, Assignment, bit wise, size of () and conditional operator.	PO7	PSO2	Ap	P
CO3	Develop program skills for decision making- using if, if...else, nested if, Conditional operator, switch, and skills for using loop structures, nested loops, and loop control statements-break, continue	PO3	PSO4	Ap	P
CO4	Develop C program for defining and calling function, Concept of call by value, call by reference	PO4	PSO4	Ap	P
CO5	Demonstrate the difference between iteration and recursion in terms of C programming	PO2	PSO2	U	C
CO6	Implementation of arrays, structures & pointers	PO4	PSO4	Ap	P
CO7	String handling and File Management concepts	PO3	PSO6	U, Ap	P

(CL- Cognitive Level: R-remember, U-understand, Ap- Apply, An-Analyse, E- Evaluate, Cr- Create, KC - Knowledge Category: F-Factual, C- Conceptual, P-Procedural, M- Metacognitive)

COURSE CONTENT

Laboratory exercises related with the following should be implemented in this course.

Lab Cycle 1: Introduction to Basic Concepts

Lab Introduction: Including writing simple programs using variables, arithmetic operations, and basic input/output.

Programming Tasks: Students write a program to calculate the area of a rectangle given its length and width. Students implement a program to convert temperature from Celsius to Fahrenheit. Students practice using if statements to check conditions and control program flow.

Lab Cycle 2: Loops and Arrays

Writing programs using loops and arrays to solve common problems. Students write a program to find the factorial of a given number using a for loop. Students implement a program to compute the sum and average of elements in an array. Students practice using nested loops to print patterns such as triangles and squares.

Lab Cycle 3: 2D Arrays

Implement programs on 2D arrays such as matrix addition, matrix multiplication etc.

Lab Cycle 4: Functions, Structures and Unions



Implement programs on functions with return value, no return value, passing arguments etc. Students practice programs on Structures, arrays using structures etc. Implement programs on Union.

Lab Cycle 5: Pointers

Implement programs on pointers, pointers in arrays, structures using pointers, function and pointers Implement programs on File operations like reading from the file, writing into the file Students practice programs on management of data with file like student's data file, employer data management with file etc.

LEARNING RESOURCES

References

- Ashok N.Kamthene, Programming in C, Pearson Education, Third edition.
- E Balaguruswamy , Programming in ANSI C, Mc Graw hill, Eighth Edition

MCA MODEL QUESTION PAPER
Bridge Course: Programming in C Lab
(2024 Scheme)

Time: 1hr

Marks:50

Write a menu driven program to create a two dimensional array and find- row total, column total, diagonal total and total of all elements

Semester 1

Course Code: MCA-CC-511

Credits: 3

MATHEMATICAL FOUNDATIONS FOR COMPUTING

Preamble: This course is designed to equip students with a solid understanding of fundamental mathematical concepts and their applications in the realm of computing. From elementary combinatorics and algebraic structures to linear algebra, numeric analysis, probability, and optimization, this course offers a comprehensive toolkit for computational problem-solving. Delve into the principles of inclusion-exclusion, matrices, eigen values, and numerical techniques, providing a robust foundation for tackling real-world challenges.

Pre-requisite: A basic course in set theory and statistics.

COURSE OUTCOMES & TAGGING

Course Outcomes	PO	PSO	CL	KC
CO1 Solve combinatorial problems. Apply the inclusion/exclusion principle.	PO1, PO2, PO3, PO4	PSO1, PSO3	Ap	C
CO2 Understand matrices and solve eigen value problems and operations of vectors.	PO1, PO2, PO3	PSO1	Ap	C
CO3 Knowledge of different linear and non-linear methods used to solve the system of equations.	PO1, PO2, PO3, PO4	PSO1, PSO4	E	P
CO4 Understand unconstrained and constrained optimization and apply Linear Programming Problems.	PO1, PO2, PO3, PO4, PO5, PO9	PSO1, PSO2, PSO4, PSO7	Cr	P
CO5 Solve assignment and transportation problems. Understand the basic techniques in network analysis.	PO1, PO2, PO3, PO4, PO5, PO7	PSO1, PSO2, PSO4, PSO6, PSO7	E	P
CO6 Understand the basic concepts of probability and the usage of 2D transformations.	PO1, PO2, PO4, PO7, PO12	PSO1, PSO2, PSO4, PSO6, PSO8, PSO9	U	C

(CL - Cognitive Level: R- remember, U - understand, Ap - Apply, An - analyse, E - Evaluate, Cr - Create; KC - Knowledge Category: F - Factual, C - Conceptual, P - Procedural, M - Metacognitive)

COURSE CONTENT

MODULE I

Elementary Combinatorics: Basis of computing, Combinations & Permutation, with repetitions, Constrained repetitions, Binomial Coefficients, Binomial Multinomial theorems. Principles of Inclusion - Exclusion.

MODULE II

Linear algebra: System of Linear Equations using matrices - Cramer's Rule, Eigen values, Eigen vectors, Eigen value problems, Vector Differential Calculus - Inner product, Cross product, gradient of a scalar field, divergence of a vector field and curl of a vector field.

MODULE III

Numeric analysis: Solution of non-linear equations: Newton-Raphson, Fixed point iteration method. Linear Systems: Gauss Elimination, Gauss Siedel, LU factorization, matrix inversion. Least squares method.



MODULE IV

Optimization: Basic concepts, Unconstrained Optimization – method of steepest Descent. Constrained Optimization: Linear Programming – Formulation - Standard, Canonical and Dual form – Graphical method, Simplex method, Big M method.

MODULE V

Transportation problem: Vogel's approximation, MODI method. Assignment Problem – Unbalanced. Network Analysis – CPM, PERT.

MODULE VI

Probability: Introduction, Random Events, Conditional Probabilities, Independence, Bayes Rule. 2D Transformations: Basic transformations – Scaling, Rotation, Translation, Reflection - Homogenous representation. Basic Pigeon Hole Principle.

LEARNING RESOURCES

References:

- Discrete Mathematical Structures Theory and application-Malik &Sen, Course Technology, 2004
- Ernest Davis, Linear Algebra and Probability for Computer Science Applications, CRC Press,978-1-4665-0159-1
- Erwin Kreyszig, Advanced Engineering Mathematics (10th Edition), 2011 John Wiley & Sons, ISBN-13: 978-0-571-72897-9
- Michael Baron, Probability and statistics For computer scientists(2nd edition), Chapman and Hall/CRC, ISBN 978-0-570-55836-5
- C.R. Kothari, An Introduction to Operational Research, 3/e, Vikas Publishing.
- T. Veerarajan - Probability, Statistics and Random Processes (3rd Edition) - Tata McGraw-Hill Education (2008)
- Sastry S. S., Numerical Analysis, Prentice-Hall India (5th edition)

Online References:

- <https://www.javatpoint.com/discrete-mathematics-tutorial>
- <https://www.geeksforgeeks.org/discrete-mathematics-tutorial/>
- https://www.tutorialspoint.com/discrete_mathematics/index.htm
- https://cnx.org/contents/_VPq4foj@6.61:MYP1-SMN@10/Counting-Principles
- <https://www.ece.mcmaster.ca/~xwu/part4.pdf>
- <https://web.mit.edu/lpsolve/doc/LPBasics.htm>
- <https://www.gurobi.com/resources/lp-chapter-2-introduction-to-linear-programming/>
- https://math.libretexts.org/Courses/Highline_College/Math_111%3A_College_Algebra/03%3A_Linear_Programming/3.04%3A_Simplex_Method

Semester 1

Course Code: MCA-CC-512

Credits: 3

DATA STRUCTURES USING JAVA

Preamble: This course explores the foundational concepts of computer science, including algorithms, problem-solving techniques, and computational thinking. Masters the advanced concepts in Java like Multithreading, Applets, Exception Handling etc. Grasp the importance of data structures and implement linear and non-linear structures in Java. Implements and analyze searching algorithms (Linear Search, Binary Search) and sorting algorithms. Learns the representation and implementation of stack and queue operations in Java programs. Explores the world of linked lists, including linear, doubly, and circular variations, and their applications. Apply hashing techniques, including hash functions, hash tables, and chaining in Java programs. Understand tree and graph representation and performing operations on tree and graph.

Pre-requisite: Basic Understanding of Programming

COURSE OUTCOMES & TAGGING

Course Outcomes	PO	PSO	CL	KC
CO1 Understand the principles of Object-Oriented Programming (OOP) and explore the basic programming concept of Java	PO1, PO2	PSO1	U	F,C
CO2 Explain the advanced programming capabilities of Java	PO1, PO2, PO3, PO4	PSO1	U	F,C
CO3 Understanding data structures and Implementing searching and sorting algorithms	PO1,PO2, PO3, PO4	PSO1, PSO3, PSO4,PSO6, PSO9	U,Ap	C,P
CO4 Explore the algorithms of Stack and Queue operations in Java.	PO1,PO2, PO3, PO4	PSO1, PSO3,PSO4,P SO6,PSO9	U,Ap	C,P
CO5 Implementing Linked Lists and Hashing and understanding their applications.	PO1,PO2, PO3, PO4, PO5	PSO1, PSO4,PSO6, PSO9	U,Ap	C,P
CO6 Outline the representations and operations of Trees and Graphs	PO1,PO2, PO3,PO4, PO5,PO7	PSO1,PSO4,P SO5,PSO6, PSO9	U,Ap	C,P

(CL-Cognitive Level, : Remember,U-Understand, Ap-Apply,An-Analyse,E-Evaluate,Cr-Create; KC- Knowledge Category : F-Factual,C-Conceptual,P-Procedural,M-Metacognitive)

COURSE CONTENT

MODULE I

Basic Concepts of Java: Object Oriented Programming, Features of Java, Classes, Interfaces, Constructors and Finalizers, Packages.

MODULE II

Advanced Concepts in Java: Exception Handling, Multithreading: Methods for creating multiple threads,AWT,Life Cycle of Applet.

MODULE III

Data Structures: Introduction, Linear and Non Linear DataStructures, Searching: Linear Search, Binary Search, Implementation in Java, Sorting: Insertion Sort, Bubble sort, Selection Sort, Merge Sort, Quick Sort, Implementation in Java.



MODULE IV

Stacks: Representation, Implementation of Stack Operations in Java Expressin Evaluation: Infix to postfix conversion alg, postfix evaluation alg, *Queues*: Representation, Implementation of Queue Operations in Java.

MODULE V

Linked Lists: Representations, Linear Linked List, Doubly Linked List, Circular Linked List, Implementation of operations on Linked Lists in Java, *Hashing*: Hash functions, Hash Tables, Chaining.

MODULE VI

Trees: Representation, Traversals on Trees, BST, B-Trees, Implementation of Trees in Java, *Graphs*: Representation, Traversals on Graphs: DFS, BFS; *Spanning Trees*: Kruskal's Algorithm, Prim's Algorithm, implementation of Graphs in Java.

LEARNING RESOURCES

Text books

- John Hubbard, Data Structures with Java, 2ed (Schaum's Outlines)
- Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, "Introduction to Algorithms", MIT Press
- Paul J. Deitel and Harvey Deitel , Java How to Program
- Schildt Herbert, Java: The Complete Reference
- Michael T. Goodrich, Data Structures and Algorithms in Java

Additional and Web -Resources

- https://onlinecourses.nptel.ac.in/noc20_cs85/preview
- <https://enos.itcollege.ee/~jpoial/algorithms/GT/Data%20Structures%20and%20Algorithms%20in%20Java%20Fourth%20Edition.pdf>

Semester 1

Course Code: MCA-CC-513

Credits: 3

WEB PROGRAMMING

Preamble: This course is a journey through the intricacies of web programming, encompassing both the fundamental building blocks and the cutting-edge technologies shaping the modern web. From understanding the evolution of the Internet to mastering server-side scripting and exploring advanced MERN stack concepts, this course equips you with the knowledge and skills necessary to thrive in the dynamic world of web development.

Prerequisites: Basic concepts of web, HTML and Javascript.

COURSE OUTCOMES & TAGGING

Course Outcomes	PO	PSO	CL	KC
CO1 Demonstrate Proficiency in Web Technology.	PO1	PSO1	U, Ap	C, P
CO2 Create Responsive and Interactive Web Interfaces.	PO3,PO2	PSO2,PSO3	U, Ap	C,P
CO3 Develop Dynamic Web Applications with PHP.	PO3,PO4	PSO3,PSO4	U,Ap	C,P
CO4 Implement Database Connectivity and JSON	PO5,	PSO3,PSO	U,Ap	C,P
CO5 Apply Full Stack Development Principles.	PO5, PO7,PO8	PSO2,PSO7	U,Ap	C,P
CO6 Utilize MERN Stack for Modern Web Applications.	PO7,PO11	PSO2,PSO9	U, An	C, P
CO7 Implement RESTful APIs and State Management.	PO11	PSO1,PSO9	U, Cr	C, P

(CL- Cognitive Level: R-remember, U-understand, Ap- Apply, An-Analyse, E- Evaluate, Cr- Create, KC - Knowledge Category: F-Factual, C- Conceptual, P-Procedural, M- Metacognitive)

COURSE CONTENT

MODULE I: Web Technology Fundamentals (WWW, HTML)

Introduction to Internet & WWW: Explore the evolution of the Internet and the World Wide Web, covering Web Basics, URI's & URL, and MIME. *HTML5 Basics:* Learn the essentials of HTML5, including structuring a document, working with headings, hyperlinks, images, lists, tables, forms, and multimedia elements.

MODULE II: CSS and JavaScript

Stylesheets Basics: Delve into Cascading Style Sheets (CSS), covering syntax, selectors, positioning, backgrounds, and responsive CSS for optimal design. *JavaScript Fundamentals:* Gain proficiency in JavaScript, covering basics, user input handling, decision-making, functions, Document Object Model (DOM), and form processing.

MODULE III: PHP Basics

PHP Basics: Master the fundamentals of PHP, including language structure, variables, data types, control statements, arrays, objects, and functions.

MODULE IV: PHP-MySQL, JSON

Advanced PHP: Explore advanced PHP concepts for form processing, cookies, sessions, MySQL integration, and dynamic content generation. *JSON Basics:* Understand the JSON data interchange format, covering syntax, data types, and manipulation with PHP.

MODULE V: MERN Stack Basics

MERN Overview: Introduction to the MERN (MongoDB, Express.js, React, Node.js) stack, including setting up a development environment, application structure, routing, and middleware.

MODULE VI: MERN Stack Advanced Concepts

MongoDB: Explore MongoDB basics, including creating databases, collections, document structure. *Express.js* RESTful APIs. *React.js:* Understand React.js components, state and props, event handling, form usage, *Node.js:* building servers, asynchronous programming, and npm package management.

LEARNING RESOURCES

Textbooks:

- Jon Duckett, "JavaScript and JQuery: Interactive Front-End Web Development", Wiley.
- Matt Stauffer, "LARAVEL up and Running, A framework for building modern PHP apps" 1 ed., O'REILLY.
- "Web Technologies: A Computer Science Perspective" by Jeffrey C. Jackson.
- "HTML and CSS: Design and Build Websites" by Jon Duckett.
- "PHP and MySQL Web Development" by Luke Welling and Laura Thomson.
- "Modern PHP: New Features and Good Practices" by Josh Lockhart.
- "Agile Web Development with Rails" by Sam Ruby, Dave Thomas, and David Heinemeier Hansson.
- "MERN Quick Start Guide" by Daniel Gaspar and Shama Hoque.

Web Resources:

- URL: <https://developer.mozilla.org/en-US/docs/Web>
- URL: <https://www.w3.org/2003/glossary/>
- URL: <https://css-tricks.com/>
- URL: <https://javascript.info/>
- URL: <https://www.php.net/manual/en/>
- URL: <https://www.codecademy.com/learn/learn-php>
- URL: https://developer.mozilla.org/en-US/docs/Web/API/Document_Object_Model/Introduction
- URL: <https://docs.mongodb.com/>

Semester 1

Course Code: MCA - CC - 514

Credits: 3

ADVANCED OPERATING SYSTEMS

Preamble: This course is designed to explore pivotal areas such as process management, interposes communication, memory allocation, file system structuring, and the advent of distributed operating systems. This comprehensive curriculum aims to equip learners with a robust understanding of the core principles of operating systems and their evolution into distributed, real-time, and cloud-based systems.

Pre-requisite: Basic understanding of computer architecture.

COURSE OUTCOMES & TAGGING

Course Outcomes	PO	PSO	CL	KC
CO1 Familiarize with the basic concepts of operating systems	PO1, PO7	PSO1, PSO2	U	F
CO2 To implement various process scheduling algorithms.	PO1, PO2, PO3	PSO1, PSO2, PSO3	U	P
CO3 To design programs to avoid the synchronization problems	PO2, PO3	PSO1, PSO2, PSO3	Ap	P
CO4 To gain knowledge about memory management and virtual memory concepts and to tackle the problems related with deadlocks and deadlock handling	PO1, PO2, PO4	PSO1, PSO2, PSO3	An	P
CO5 To analyze various security and protection mechanisms in file system implementation	PO2, PO4, PO6, PO10	SO1, PSO2, PSO3	C	M
CO6 To compare different types of advanced operating systems	PO5, PO7, PO12	PSO3, SO6, PSO11	E	M

(CL - Cognitive Level: R- remember, U - understand, Ap - Apply, An - analyse, E - Evaluate, Cr - Create; KC - Knowledge Category: F - Factual, C - Conceptual, P - Procedural, M - Metacognitive)

COURSE CONTENT

MODULE I

Functions of operating systems, Computer System organization Computer System architecture - OS structure - batch processing - multiprogramming - time sharing OS operations. Process management - process concept - states - PCB- process scheduling, Operations on processes - process creation and termination.

MODULE II

Memory Management- Detailed design of Process Structure: Kernel Data structures for process. Context of a Process: Static and Dynamic. Parallel Systems and computing- Shared memory machines, Synchronization, Communication, Shared memory multiprocessor OS.

MODULE III

Distributed Operating system concepts- Goals, Distributed Computing Models, Hardware and Software Concepts, Architecture of DOS. Distributed communication, shared memory, synchronization.

MODULE IV



Multiprocessor Operating System- Introduction, Basic multiprocessor system architectures, design issues, Process synchronization: the test and set instruction, the swap instruction, implementation of the process wait. Processor scheduling: Issues, Co- scheduling, Smart scheduling, Affinity Based scheduling

MODULE V

Real Time OS- Characteristics of Real Time operating Systems, Classification of Real Time Operating Systems, Scheduling in RTOS: Clock driven: cyclic, Event driven: EDF and rate monotonic scheduling.

MODULE VI

Mobile OS- Architecture, Android OS, iOS, Virtual OS, Cloud OS and their design issues.

LEARNING RESOURCES

References:

- Silberschatz, P.B. Galvin, G. Gagne, Operating System Concepts, Wiley-India, 9th Edition, 2015.
- Stallings (2006), Operating Systems, Internals and Design Principles, 5th edition, Pearson Education, India.
- Andrew S. Tanenbaum (2007), Modern Operating Systems, 2nd edition, Prentice Hall of India, India.
- Deitel & Deitel (2008), Operating systems, 3rd edition, Pearson Education, India.
- Mukesh Singhal and Niranjana Shivarathri, Advanced Concepts in Operating Systems, McGraw-Hill Series in Computer Science, 1993.
- Pradeep K Sinha, "Distributed Operating Systems: Concepts and design", PHI, 2007.

Online References:

- <https://www.studytonight.com/operating-system/>
- <https://www.mygreatlearning.com/operating-system/tutorials>

Semester 1

Course Code: MCA-CC-515

Credits: 3

SOFTWARE ENGINEERING

Preamble: This course guides students through essential principles of modern software development, process models, object-oriented methodologies, and the pivotal realm of service-oriented architecture. This is thoughtfully designed to equip students with a profound understanding of software engineering concepts and methodologies, fostering the skills required for successful software development in today's dynamic and competitive landscape.

Prerequisite: Familiarity with object-oriented programming and data structures

COURSE OUTCOMES & TAGGING

Course Outcomes	PO	PSO	CL	KC
CO1 To learn and understand the Concepts of Software Engineering	PO1, PO2, PO4	PSO1, PSO2, PSO3	U	F
CO2 Knowledge of Software process models	PO1, PO8	PSO1, PSO6	R, U	C
CO3 Explains object orientation and different object-oriented methodologies.	PO1, PO2, PO8	PSO1, PSO2	U	F
CO4 Create and interpret Unified Modeling Language and diagrams.	PO1, PO2, PO8, PO12	PSO1, PSO3, PSO4	CR, E	P, M
CO5 Illustrate the concept of agility and different stages in Extreme programming.	PO1, PO2, PO3, PO9	PSO1, PSO7, PSO9	AP	M
CO6 Develop a comprehensive understanding of the importance of Service Oriented Architecture.	PO1, PO2, PO6, PO10	PSO1, PSO2, PSO8	U, APC	P

(CL – Cognitive Level: R- remember, U - understand, Ap – Apply, An – analyse, E – Evaluate, Cr – Create; KC – Knowledge Category: F – Factual, C – Conceptual, P – Procedural, M – Metacognitive)

COURSE CONTENT

MODULE I

Overview of Software Engineering, Software components, Software Characteristics, Attributes of good software Software, software applications, legacy software, Software engineering: a layered approach, Software Processes.

MODULE II

Software process models: The waterfall model, The incremental models, The evolutionary process models, The spiral model, Concurrent models, Component based development.

MODULE III

Why Object Orientation, Procedural Programming and Object Oriented Programming - Object Oriented Systems development life Cycle. Object oriented Methodologies- Booch, Jacobson and Rumbaugh methodologies.

MODULE IV

UML diagrams: static versus dynamic diagrams. Use case diagram, Class diagram, UML interaction diagrams - Sequence and collaboration diagrams, Activity diagram, State Chart Diagram, Implementation diagrams.

MODULE V



Agility-agility and the cost of change, agile process, agile principles, Overview of agile frameworks- Scrum versus Extreme programming , Extreme programming(XP)- XP team, XP concept, XP Values, The XP Process, Industrial XP, The XP Debate.

MODULE VI

Introduction to Service Oriented Architecture, Evolution and history of SOA, Key principles and characteristics of SOA. Service oriented computing- Understanding services and their characteristics, Web services and their importance in SOA.

LEARNING RESOURCES

References:

- Roger S. Pressman, Software Engineering: A Practitioner's Approach, McGraw-Hill Education, 8th edition, 2014.
- Rajib Mall, Fundamentals of Software Engineering, PHI Publication.
- Ian Sommerville, Software Engineering, Pearson Publishers, 10th Edition, 2015.
- Alistair Cockburn, Agile Software development-The cooperative game, Second Edition.
- Ali Bahrami, Object Oriented Systems Development, Tata McGraw-Hill, 1999.
- Teach Yourself UML in 24 Hours, Joseph Schmuller, 3rd Edition, ISBN 81-297-0609-1, Pearson Education, 2004.
- Grady Booch, James Rumbaugh, Ivar Jacobson, "UML User Guide", Addison Wesley, 2002.

Online References

- <https://www.computer.org/publications/tech-news/trends>
- <https://www.educative.io/blog/software-process-model-types>
- <https://www.educba.com/software-development/software-development-tutorials/software-engineering-tutorial/>
- <https://archive.nptel.ac.in/courses/106/105/106105182/>
- <https://www.techtarget.com/searchapparchitecture/definition/service-oriented-architecture-SOA>.

Semester 1

Course Code:MCA-CC-516

Credits: 2

DATA STRUCTURES LABORATORY

Preamble: This syllabus equips learners with essential skills in object-oriented programming, advanced Java features, algorithm design, data structures implementation, debugging techniques, real-world application development

Prerequisite: Any programming language

COURSE OUTCOMES & TAGGING

Course Outcomes	PO	PSO	CL	KC
CO1 Acquire knowledge in the object oriented programming concept	PO1,PO5	PSO1,PSO4	U	F,C
CO2 Design the algorithms to match with the given problem specifications	PO2,PO5	PSO1,PSO6	U	F,C
CO3 Implement linear and non linear data structures using the advanced features of Java	PO1,PO5	PSO1,PSO4	U, Ap	P
CO4 Familiarize the debugging concept in Java Code	PO5,PO9	PSO1,PSO9	U, Ap	P
CO5 Formulate real world applications with the help of appropriate algorithms	PO2, PO5	PSO2,PSO4	U, Ap	P
CO6 Generate different test cases for testing the validity of the developed programs	PO4, PO6	PSO5,PSO9	U, Ap	P
CO7 Write technical report based on the results of the experiments	PO7,PO9	PSO3,PSO5	U, Ap	P

(CL-Cognitive Level, : R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, Cr-Create; KC- Knowledge Category : F-Factual, C-Conceptual, P-Procedural, M-Metacognitive)

COURSE CONTENT

List of Experiments:

1. Searching: Implement Linear and binary search
2. Sorting: Implement Insertion Sort, Bubble sort, Selection Sort, Merge Sort, Quick Sort
3. Stacks: Perform stack operations
4. Applications of Stacks: Perform evaluation of expressions
5. Queues: Perform queue operations.
6. Application of queues: Simulate a queue in a real life situation
7. Linked List: Implementation of linked lists
8. Hashing: Apply hashing functions for searching
9. Trees: Familiarize the different operations on Trees
10. BST: Implement a BST
11. AVL Trees: Implement an AVL tree
12. B-Trees: Generate B-Trees and perform the operations
13. Graphs - Perform the graph traversals
14. Spanning Trees: Implementation of Spanning trees

LEARNING RESOURCES

References:

Text books



- Lab manual for Data structures through Java, V V Muniswami
- Java Lab Manual by Madhu Mathi
- Data Structures in Java A laboratory Course, Sandra Andersen

Additional and Web -Resources

- <https://www.udemy.com/course/data-structures-and-algorithms-in-java/>
- https://onlinecourses.nptel.ac.in/noc20_cs85/preview
- [3https://enos.itcollege.ee/~jpoial/algorithms/GT/Data Structures and Algorithms in Java Fourth Edition.pdf](https://enos.itcollege.ee/~jpoial/algorithms/GT/Data%20Structures%20and%20Algorithms%20in%20Java%20Fourth%20Edition.pdf)

Semester 1

Course Code:MCA-CC-517

Credits: 2

WEB TECHNOLOGY LABORATORY

Preamble: The main objective of this laboratory is to impart the ability to develop a web application using HTML5, Javascript, PHP and MySQL.

Prerequisites – Basic concepts of programming such as sequence, selection and iteration

COURSE OUTCOMES & TAGGING

Course Outcomes	PO	PSO	CL	KC
CO1 Acquire knowledge in the PHP Basics	PO1	PSO1	Ap	P
CO2 Acquire skills in handling Decisions and Loops in PHP	PO1,PO3	PSO1	Ap	P
CO3 Implementing functions and Arrays	PO3	PSO1	Ap	P
CO4 Develop programs which handle Forms with CSS and Javascript	PO5,PO3	PSO1,PSO3	Ap	P
CO5 Formulate real world applications with the help of Sessions	PO7,PO8	PSO3,PSO6, PSO7	Ap	M
CO6 Generate different programs implementing CRUD operations with MySQL using PHP	PO8	PSO3,PSO4, PSO5,PO9	Ap, Cr	P
CO7 Write programs that handles exceptions	PO1,PO3,PO5	PSO1,PSO3	Ap	P

(CL- Cognitive Level: R-remember, U-understand, Ap- Apply, An-Analyse, E- Evaluate, Cr- Create, KC - Knowledge Category: F-Factual, C- Conceptual, P-Procedural, M- Metacognitive)

COURSE CONTENT

List of Experiments:

1. PHP Basics Experiments
2. Decisions and Loops
3. Functions
4. Arrays
5. Handling HTML forms with PHP, CSS and Javascript
6. Working with Session
7. Data base connectivity with MySQL
8. Exception Handling

LEARNING RESOURCES

References:

- Learning PHP, MySQL, books by ' O ' riley Press3. Data Structures in Java A laboratory Course, Sandra Andersen

Additional and Web -Resources

- <https://www.udemy.com/course/learn-php-and-mysql-for-web-application-and-web-development/>
- https://www.w3schools.com/php/php_mysql_intro.asp
- <https://www.simplilearn.com/tutorials/php-tutorial/php-with-sql>

Semester 1

Course Code: MCA-SE-4B1

Credits: 2

PROFESSIONAL DEVELOPMENT

Preamble: This programme aims to inspire students and help them imbibe an entrepreneurial mindset. The students will learn what entrepreneurship is and how it has impacted the world and their country. They will be introduced to the critical traits of an entrepreneur and be allowed to assess their strengths and identify gaps that need to be addressed to become a successful entrepreneur.

Prerequisite: Nil

COURSE OUTCOMES & TAGGING

Course Outcomes	PO	PSO	CL	KC
CO1 Develop communication competence in prospective students	PO2	PSO3	Ap	C, P
CO2 Demonstrate the ability to plan, organize, and execute a project or new venture with the goal of bringing new products and service	PO3	PSO10	Ap	C, P
CO3 Possess the professional skills including learning skills and career skills	PO4	PSO3, PSO4	U, Ap	C,P
CO4 Provide critical thinking process within students	PO4	PSO5	Ap	P, M
CO5 Inculcate the soft skills competence in prospective students	PO2	PSO11	App	P, C
CO6 Equip the students to face interview and Group Discussion	PO4	PSO3	Ap, An, E	P
CO7 Able to work in Group and Teams	PO6	PSO3	Ap	C, P
CO8 Prepare the students to become an entrepreneur	PO1	PSO1	Ap, E	C, P
CO9 Promote Brain Storming and Idea Generation to solve real life problems	PO2	PSO4	Ap, An	C, P

(CL- Cognitive Level: R-remember, U-understand, Ap- Apply, An-Analyse, E- Evaluate, Cr- Create, KC - Knowledge Category: F-Factual, C- Conceptual, P-Procedural, M- Metacognitive)

COURSE CONTENT

MODULE I

Entrepreneurship: Definition of Entrepreneurship, Entrepreneurship and Enterprise, Phases of Entrepreneurship Development, Role of Entrepreneurship, Characteristics of Entrepreneurship, Entrepreneurial Process: Venture Life Cycle and Product Life Cycle- Business Life Cycle.

MODULE II

Entrepreneurship skills: Types of Entrepreneurship Skills: Business management skills, Teamwork and leadership skills, Problem-solving skills, Critical thinking skills, Strategic thinking and planning skills, Time management and organizational skills- Entrepreneurial Imagination and Creativity.

MODULE III

Interpersonal Skills: Communication skills- Verbal and Nonverbal Communication- Brain storming- Leadership skills- Team Building Skills- Team Work - Public Speaking.

MODULE IV

Learning Skills: Principles of study skills- Memory Techniques- Pomodoro technique- Improving your memory for studying- 3 Rs of memory- Mind Mapping.

MODULE V

Life Skills: SWOC Analysis- Self Awareness- Stress Management- Time management- Procrastination- Making Schedules - Interview Skills -Preparation for the Interview - Planning and Goal Setting.

MODULE VI

Career Skills: CV and Resume Writing, Brain Storming- Idea generation, Group Discussion, Facing Interviews - Long Term and Short-Term Goal Setting - Portfolio Preparation.

LEARNING RESOURCES

References

- Jonsthan Hancock, Cheryl Buggy, "Effective Memory techniques in a week", Hodder and Stoughton, 2003
- Cecile Niewwenhuizen, "Entrepreneurial Skills", 2ed., JUTA, 2008
- J. W. Bames - "Statistical Analysis for Engineers and Scientists", Tata McGraw-Hill, New York, 1994
- Katherine Carpenter, "Introduction to Entrepreneurship", University of Victoria, 2021
- Michael Laverty, Global Chris Littel, "Entrepreneurship" OpenStax, 2019

Semester 1

Course Code: MCA-SE-4B2

Credits: 2

MASSIVE ONLINE OPEN COURSE (MOOC)

Preamble: MOOCs enable access to quality education for as many students as possible and contribute to the continuous education of various social groups. MOOCs can be addressed to the unemployed, helping them develop skills needed for employability.

Prerequisite: Nil

COURSE CONTENT

Massive Open Online Courses (MOOCs) are free online courses for anyone to enroll. MOOCs provide an affordable and flexible way to learn new skills, advance your career and deliver quality educational experiences at scale. Millions of people worldwide use MOOCs to learn for various reasons, including career development, changing careers, college preparations, supplemental learning, lifelong learning, corporate eLearning and training, and more. For instance, SWAYAM or Coursera provides an integrated platform for online courses, using information and communication technology (ICT) and covering courses for post-graduate subjects, including skill sector courses, to ensure that every student benefits from learning material through ICT.

The Department Council will announce the sources of MOOC at the time of the semester beginning. Students can choose their course from MOOC as per their choice and inform the course coordinator before they join. Each student must submit a report on what MOOC has completed during their MCA programme to complete their Semester III.

LEARNING RESOURCES

On-line Sources

- https://www.ugc.gov.in/pdfnews/8449573_Intruction-Manual.pdf

MCA MODEL QUESTION PAPER
MCA-CC-511: Mathematical Foundations for Computing

Time:3 Hours

Maximum Marks: 100

Part A

(Answer all questions. All questions carry 4 marks)

- How many arrangements are there if all the letters of the word 'SOCIOLOGICAL' are used? In how many arrangements A and G are adjacent? In how many ways all the vowels are adjacent? [CO1]
- Determine the coefficient of $x^5 y^3 z^2 w^7$ in the expansion of $(3x-5y-z+2w-3)^{21}$. [CO1]
- How do you solve a system of equations using elementary matrix operations? [CO2]
- Find the gradient of ϕ at $(2, 1, 3)$ where $\phi(x, y) = 5x^2yz + y^2z - z^2$ [CO2]
- Perform the first iterations in the Gauss Seidal method to find an approximate solution to the following systems of equations with initial approximations $x^{(0)} = y^{(0)} = z^{(0)} = 0$. [CO3]

$$45x + 2y + 3z = 58$$

$$-3x + 22y + 2z = 47$$

$$5x + y + 20z = 67$$
- Find the equation $y = ax + b$ of the least squares line that best fits the data points $(2, 0), (3, 4), (4, 10), (5, 16)$ [CO3]
- What are slack and surplus variables? Why is it used in LPP? [CO4]
- From a simplex table how will you identify whether it has an unbounded solution, alternative solution or infeasible solution? [CO4]
- Find an initial basic feasible solution of the following problem using north west corner rule. [CO5]

	D1	D2	D3	D4	SUPPLY
O1	5	3	6	2	19
O2	4	7	9	1	37
O3	3	4	7	5	34
DEMAND	16	18	31	25	

- Differentiate between PERT and CPM [CO5]

(4marks x 10 = 40 marks)

Part B

(Answer any ONE question from each module. Each question carries 10 marks).

MODULE I

- Using Principle of inclusion and exclusion find the number of positive integers n where $1 \leq n \leq 100$ and n is not divisible by 2, 3 and 5. [CO1]
- (a) In a small village, there are 87 families, of which 52 families have at most 2 children. In a rural development programme, 20 families are to be chosen for assistance, of which at least 18 families must have at most 2 children. In how many ways can the choice be made?
 (b) A group consists of 4 girls and 7 boys. In how many ways can a team of 5 members be selected if the team has
 - no girls
 - at least one boy and one girl
 - at least three girls

[CO1]

MODULE II

- Find the Eigen values and all Eigen vectors of the matrix

$$A = \begin{vmatrix} -3 & -7 & -5 \\ 2 & 4 & 3 \\ 1 & 2 & 2 \end{vmatrix}$$

[CO2]



14 (a) Find, using elementary operations, given that matrix $M = \begin{bmatrix} a & 9 & -9 \\ -158 & -29 & 25 \\ 46 & 7 & -8 \end{bmatrix}$ and M is singular. [CO2]

(b) Find the curl and divergent of V where $V = xyi + yzj + xzk$ at point (1,1,1). [CO2]

MODULE III

15. Solve the system of equation using Dolittle method. [CO3]

$$3x + 5y + 2z = 8$$

$$8y + 2z = -7$$

$$6x + 2y + 8z = 26$$

16. Find the inverse of the matrix A using Gauss Jordan method [CO3]

$$\begin{bmatrix} 0 & 1 & 2 \\ 1 & 2 & 3 \\ 3 & 1 & 1 \end{bmatrix}$$

MODULE IV

17. Apply the method of Steepest Descent to determine a minimum of $f = x_1^2 + 3x_2^2$ starting from (6, 3). [CO4]

18. Apply Simplex method to solve the following LPP. [CO4]

$$\text{Max } Z = 3x + 2y$$

Sub to

$$2x - y \leq -2$$

$$x + 2y \leq 8$$

$$x, y \geq 0$$

MODULE V

19. Solve the following assignment problem. Cell values represent cost of assigning job A, B, C and D to the machines I, II, III and IV. [CO5]

		MACHINES			
		1	2	3	4
JOBS	A	10	12	19	11
	B	5	10	7	8
	C	12	14	13	11
	D	8	15	11	9

20. Solve the following transportation problem using MODI method. (Use Vogels' approximation method or Least cost cell method to find the initial feasible solution.) [CO5]

	D1	D2	D3	D4	SUPPLY
O1	3	1	7	4	250
O2	2	6	5	9	350
O3	8	3	3	2	400
DEMAND	200	300	350	150	

MODULE VI

21. Two dice are numbered 1, 2, 3, 4, 5, 6 and 1, 1, 2, 2, 3, 3, respectively. They are thrown, and the sum of the numbers on them is noted. Find the probability of getting each sum from 2 to 9 separately. [CO6]

22. Explain 2D transformation and its corresponding Homogeneous representation of Scaling, Rotation, Reflection and Translation. [CO6]

(10marks x 6 = 60 Marks)

MCA MODEL QUESTION PAPER
MCA-CC-512 : Data Structures using Java

Time:3 Hours

Maximum Marks: 100

Part A*(Answer all questions. All questions carry 4 marks)*

- | | |
|--|-------|
| 1. List the features of Java. | [CO1] |
| 2. Explain how multiple inheritance is implemented in Java. | [CO1] |
| 3. Explain is AWT? | [CO2] |
| 4. Write notes on the lifecycle of applets. | [CO2] |
| 5. Differentiate between linear and nonlinear data structures. | [CO3] |
| 6. Write an algorithm for Bubble Sort. | [CO3] |
| 7. Distinguish between stack and queue. | [CO4] |
| 8. Write notes on stack operations. | [CO4] |
| 9. How do you insert an element in a circular linked list? | [CO5] |
| 10. Explain is hashing? | [CO5] |

(10 x 4=40 Marks)**Part B***(Answer any one question from each module. Each question carries 10 marks).***MODULE I**

- | | |
|--|-------|
| 11. Explain Object Oriented Programming features. | [CO1] |
| 12. Write notes on different types of methods in Java? | [CO1] |

MODULE II

- | | |
|---|-------|
| 13. Discuss Exception handling in Java. | [CO2] |
| 14. Explain how multithreading is done in Java. | [CO2] |

MODULE III

- | | |
|--|-------|
| 15. Explain the binary search with an example. | [CO3] |
| 16. Write a Java code to implement selection sort. | [CO3] |

MODULE IV

- | | |
|---|-------|
| 17. Write the procedure to convert infix expression to postfix expression . | [CO4] |
| 18. Evaluate the postfix expression 3,4,5,+,* ,10,/ ,1,- | [CO4] |

MODULE V

- | | |
|--|-------|
| 19. Write notes on different types of linked list. | [CO5] |
| 20. Explain chaining . | [CO5] |

MODULE VI

- | | |
|--|-------|
| 21. Explain the traversal operations on a tree. | [CO6] |
| 22. Explain Kruskal's algorithm for minimum spanning tree. | [CO6] |

MCA MODEL QUESTION PAPER
MCA-CC-513 Web Programming

Time:3 Hours

Maximum Marks: 100

Part A*(Answer all questions. All questions carry equal marks)*

1. Provide a brief overview of the evolution of the Internet, emphasizing its role in shaping the modern World Wide Web. [CO1]
2. Discuss elements of HTML5, focusing on its ability to structure documents and handle multimedia [CO1]
3. Write a concise explanation of Cascading Style Sheets (CSS), focusing on its syntax and its role in defining styles for web elements. [CO2]
4. Briefly discuss the fundamental aspects of DOM. [CO3]
5. Write a PHP program which will find the factorial of a number using function. [CO3]
6. Discuss the role of arrays and functions in PHP, highlighting their importance in programming. [CO3]
7. Write a brief overview of advanced PHP concepts, including form processing, cookies, sessions, MySQL integration, and dynamic content generation. JSON Data Interchange: [CO4]
8. Write on session management in PHP. [CO6]
9. Write short notes on the importance of MERN stack architecture. [CO6]
10. How REST API is advantageous in web application development. [CO7]

(10 x 4=40 Marks)**Part B***(Answer any one question from each module. Each question carries 10 marks).***Module I**

11. Explain the profound impact of the Internet's evolution on global communication and the emergence of the WWW. Analyze key technological advancements and their implications for modern society. [CO1]
12. In a comprehensive essay, discuss the significance of HTML5 in contemporary web development. Explore its features, such as document structuring, hyperlinks, and multimedia integration, and explain how HTML5 has contributed to the dynamic nature of the modern web. [CO1]

Module II

13. Write in detail CSS. Explore its syntax, selectors, and how it facilitates optimal web design. [CO2]
14. Explain the fundamentals of JavaScript and its crucial role in web development. Discuss how JavaScript handles user input, decision-making, functions, and its interaction with the DOM. [CO2]

Module III

15. Explain the basics of PHP, covering language structure, variables and data types. Discuss the significance of each element in PHP programming and how they collectively contribute to creating dynamic web applications. [CO3]
16. Explain the importance of functions in PHP. With an example show how functions can be created and invoked in a web application. [CO3]

Module IV

17. Write in detail dynamic content generation using MySQL integration. [CO4]
18. Explain the syntax and data types associated with JSON, and discuss how PHP can manipulate and utilize JSON for efficient data interchange. Provide examples of scenarios where JSON is particularly beneficial in web development [CO4]

Module V

19. Write an essay exploring the structure of applications built using the MERN stack. Discuss how MongoDB, Express.js, React, and Node.js contribute to the overall architecture. Cover topics such as application structure, routing, and the role of middleware in ensuring efficient functioning. [CO5]
20. Explain in detail the critical aspects of setting up a development environment using MERN stack. Explore the significance of an efficient development environment, the role of routing in managing application flow, and the impact of middleware in enhancing functionality and security. [CO5]

Module VI

21. Explain the foundational aspects of MongoDB, focusing on database creation and document structures. [CO7]
22. Explain the key concepts in React.js, covering components, state, props, event handling, and form usage. Also write on npm package management. [CO7]

MCA MODEL QUESTION PAPER
MCA-CC-514 ADVANCED OPERATING SYSTEMS

Time:3 Hours

Maximum Marks: 100

Part A*(Answer all questions. All questions carry equal marks)*

- | | | |
|--|-----|-----|
| 1. Briefly explain the components of the operating system. | CO1 | |
| 2. Explain various file attributes and operations. | | CO5 |
| 3. Explain the difference between internal and external fragmentation. | CO4 | |
| 4. Give a short account of the message passing system. | CO3 | |
| 5. Describe the actions taken by a kernel to context switch between processes. | CO2 | |
| 6. Explain the Belady's anomaly with an example page reference string. | CO3 | |
| 7. Explain FCFS disk scheduling. | | CO2 |
| 8. What are the conditions that must be present for a deadlock to be possible? | CO4 | |
| 9. Discuss SSTF, SCAN, C-LOOK and C-SCAN disc scheduling algorithms. | CO2 | |
| 10. List different types of Mobile operating systems. | CO6 | |

(10 x 4=40 Marks)**Part B***(Answer any ONE question from each module. Each question carries 10 marks).***MODULE I**

- | | | |
|--|-----|--|
| 11. Compare and contrast the following types of operating systems:
1)Batch processing 2)Multiprocessing 3)Time-sharing systems. | CO1 | |
| 12. Explain: a) Acyclic graph directory structures b) File operations | CO5 | |

MODULE II

- | | | |
|--|--|-----|
| 13. Briefly explain the different operations on processes. | | CO2 |
| 14. Discuss the different process scheduling algorithms. | | CO2 |

MODULE III

- | | | |
|---|--|------|
| 15. Briefly explain the following classic problems of synchronization.
1) the bounded buffer problem 2) the readers-writers problem | | CO3 |
| 16. Explain the deadlock. Not every unsafe state leads to a deadlock. Give an example to show that the processes in an unsafe state complete their execution without entering a deadlock state. | | CO 4 |

MODULE IV

- | | | |
|--|--|------|
| 17. Explain different page replacement policies assuming the page reference request
3 2 3 0 8 4 2 5 0 9 8 3 2 and page frame size of 3. | | CO 4 |
| 18. Explain the different schemes of logical and physical address space Swapping. | | CO 4 |

MODULE V

- | | | |
|--|--|------|
| 19. Requests for disc tracks, give the sequence of disc addresses visited by the disc. | | CO 5 |
| 20. Discuss the different file allocation methods in detail. Outline the advantages and disadvantages of each. | | CO 5 |

MODULE VI

- | | | |
|---|--|------|
| 21. Describe and characterize Distributed operating systems. | | CO 6 |
| 22. Discuss in detail different cloud based operating systems and services. | | CO 6 |

(10x6=60 Marks)

MCA MODEL QUESTION PAPER
MCA-CC-515 SOFTWARE ENGINEERING

Time:3 Hours

Maximum Marks: 100

Part A*(Answer all questions. All questions carry equal marks)*

- | | |
|---|-----|
| 1. List and elaborate on four key attributes that define good software. | CO1 |
| 2. Identify any four fundamental characteristics of good software. | CO1 |
| 3. Write down the stages in the spiral development model. | CO2 |
| 4. Write on component based development. | CO2 |
| 5. Differentiate procedural oriented programming and object oriented programming. | CO3 |
| 6. Define a use case. | CO3 |
| 7. Explain the purpose of a use case diagram in UML. | CO4 |
| 8. Write down the representation of classes, associations, and attributes in a class diagram. | CO4 |
| 9. Explain the concept of agility in software development. | CO5 |
| 10. How does the XP team structure contribute to the success of an XP project? | CO5 |

(10 x 4=40 Marks)**Part B***(Answer any ONE question from each module. Each question carries 10 marks).***MODULE I**

- | | |
|---|-----|
| 11. Describe the layered approach in software engineering. Explain the significance of having different layers in the software development process. | CO1 |
| 12. Discuss the importance of software processes in the context of software engineering. | CO1 |

MODULE II

- | | |
|---|-----|
| 13. Explain the waterfall system development process. | CO2 |
| 14. Explain the incremental model as an evolutionary process model. | CO2 |

MODULE III

- | | |
|--|-----|
| 15. Describe Booch system development methodology. | CO3 |
| 16. Explain the concept of object Modeling techniques. | CO3 |

MODULE IV

- | | |
|---|-----|
| 17. Explain the purpose of a state chart diagram in UML. Provide an example scenario and create a state chart diagram representing the different states and transitions of an object. | CO4 |
| 18. Create an activity diagram for a common process, highlighting actions, decisions, and control flows. | CO4 |

MODULE V

- | | |
|--|-----|
| 19. Explain the phases of the Extreme Programming (XP) process. | CO5 |
| 20. How can organisations address concerns raised in the XP debate while adopting agile practices? | CO5 |

MODULE VI

- | | |
|--|-----|
| 21. Identify and explain the key principles that underlie Service-Oriented Architecture. | CO6 |
| 22. Discuss the role of web services in the context of Service-Oriented Architecture. | CO6 |

(10x6=60 Marks)

Semester 2

Course Code : MCA-CC-521

Credits: 4

ALGORITHM ANALYSIS AND DESIGN

Preamble: The course offers a comprehensive exploration into the fundamental principles, techniques, and applications of algorithms in modern computing. Through a structured syllabus spanning six modules, students delve into the intricacies of algorithm analysis, mastering time and space complexities using asymptotic notations and tackling problems through various techniques. Through theoretical concepts students emerge from the course equipped with the knowledge and skills to analyze, design, and implement efficient algorithms to address real-world challenges across diverse domains.

Prerequisite: Basic Programming Skills, Data Structures, Basic Understanding of Algorithms, Problem-Solving Skills

COURSE OUTCOMES & TAGGING

Course Outcomes	PO	PSO	CL	KC
CO1 Analyse the asymptotic performance of algorithms	PO1	PSO7,PSO9	U, Ap	F
CO2 Solve recurrences problems using Recursion tree method -Master method	PO2	PSO7,PSO1	U, Ap	C
CO3 Demonstrate a familiarity with major algorithms and data structures	PO3	PSO 11	U	C,P
CO4 Apply important algorithmic design paradigms and methods of analysis	PO4	PSO4, PSO7	Ap	C,P
CO5 Mastering Graph Algorithms and Minimum Spanning Trees.	PO3	PSO6, PSO7	U	C,P
CO6 Proficiency in String Matching and Dynamic Programming	PO4	PSO4, PSO7	U, An	C, P
CO7 Sorting and Priority Queue Operations	PO4, PO3	PSO7 PSO9	U,Ap	C, P

(CL- Cognitive Level: R-remember, U-understand, Ap- Apply, An-Analyse, E- Evaluate, Cr- Create, KC - Knowledge Category: F- Factual, C- Conceptual, P-Procedural, M- Metacognitive)

COURSE CONTENT

MODULE I

Algorithm Analysis: Time Space Tradeoff – Asymptotic Notations. Divide and Conquer method , maximum subarray problem, Strassen’s algorithm for matrix multiplication.
Recurrence equations: Solving recurrence equations - Substitution method, Recursion tree method -Master method for solving recurrences.

MODULE II

Heap sort, Maintaining the heap property, building a heap, Algorithm, Priority queues, Quick sort, Insertion Sort-Sorting in Linear time, Lower bounds for sorting, Counting Sort, Radix sort, Bucket Sort-Medians and order statistics, Minimum and Maximum.

MODULE III

Hash tables: Direct address tables, Hash functions, Open addressing, Perfect hashing.



Binary search trees-Querying a binary search tree, Insertion and Deletion. Red-Black tree- Properties, Insertion, Deletion. B-Trees-Definition of B Trees, Basic operations on B Trees. Fibonacci Heaps.

MODULE IV

Graph algorithms: BFS, DFS, Topological sort, strongly connected components. Minimum spanning tree- Growing a minimum spanning tree, Kruskal's and Prim's Algorithm. Bellman-Ford algorithms, Single source shortest paths in DAGs, Dijkstra's algorithm, Floyd-Warshall algorithm

MODULE V

Flow networks: The Ford Fulkerson method, Maximum bipartite matching, Push-relabel algorithms. Greedy Algorithms-Container Loading, Knapsack Problem. Backtracking - General Method - 8 Queens problem

MODULE VI

String-Matching: Naïve String Matching algorithm, Rabin-Karp algorithm, The Knuth-Morris-Pratt algorithm. Dynamic programming- Rod cutting, Matrix chain multiplication, Longest common subsequence.

LEARNING RESOURCES

References

- Cormen, Thomas H, Leiserson, Charles E & Rivest, Ronald L, 'Introduction to Algorithms', Prentice Hall of India Private Limited, New Delhi, Third Edition, 2009
- EllizHorowitz, Sahni & Rajasekharan, 'Computer Algorithms- Silicon press, 2nd edition, 2008
- Aho, Hopcroft, Ullman, 'Design & Analysis of Computer Algorithms'
- Robert Sedgewick, Kevin Wayne, 'Algorithms', Pearson Education, 2011
- Sahni, 'Data Structures, Algorithms and Applications in C++', Silicon Press, 2nd edition, 2004
- John Kleinberg and Eva Tardos, 'Algorithm Design' AW[2005]
- Anany C. Levitin. 'Introduction to the Design & Analysis of Algorithms'
- Second edition
- Dasgupta, Papadimitrou and Vazirani, 'Algorithms' McGraw-Hill Education, 2006.

Online Resources

- <https://www.coursera.org/specializations/algorithms>
- <https://ocw.mit.edu/courses/6-006-introduction-to-algorithms-fall-2011/>
- <https://www.khanacademy.org/computing/computer-science/algorithms>
- <https://www.youtube.com/watch?v=0IAPZzGSbME>
- https://www.youtube.com/channel/UCZLJf_R2sWyUtXSKiKlyvAw

Semester 2

Course code :MCA-CC-522

Credits : 3

MACHINE LEARNING

Preamble: In this course, we embark on a comprehensive journey through the realm of Machine Learning, where we delve into the fundamental concepts and motivations behind Machine Learning. We explore the problems it can effectively solve, ranging from predictive analytics to pattern recognition, while also scrutinizing its potential misuses. Moreover, we examine the mechanisms by which machines learn and acquaint ourselves with various types of machine learning algorithms. It begins with an exploration of the motivations and applications of Machine Learning, followed by a deep dive into supervised, unsupervised and reinforcement learning algorithms and concepts. The final module focuses on the intricacies of Deep Learning, including neural networks and their applications

Prerequisite: Mathematics, Programming Skills, Data Analysis, Critical Thinking and Problem-Solving Skills

COURSE OUTCOMES & TAGGING

Course Outcomes	PO	PSO	CL	KC
CO1 Foundations of Machine Learning Understanding.	PO3	PSO1,PSO3,PSO2	U	C
CO2 Comprehensive Knowledge of Supervised , Unsupervised and reinforcement learning	PO4	PSO3,PSO4,PSO7	U	C
CO3 Gain expertise in Preprocessing Techniques and clustering algorithms	PO5	PSO1, PSO4, PSO6, PSO9	Ap	P
CO4 Designing solution for real-world applications using Machine Learning algorithms	PO4	PSO2, PSO6, PSO9	Cr	P
CO5 Understand the structure and workings of deep learning neural networks	PO1	PSO1, PSO2, PSO6, PSO9	U	C
CO6 Apply machine learning algorithms to solve classification and regression problems	PO3	PSO1, PSO4, PSO6, PSO9	Ap, Ap	P
CO7 Utilize support vector machines for binary and multi-class classification tasks	PO2	PSO1, PSO4, PSO6, PSO9		P

(CL- Cognitive Level: R-remember, U-understand, Ap- Apply, An-Analyse, E- Evaluate, Cr- Create, KC - Knowledge Category: F- Factual, C- Conceptual, P-Procedural, M- Metacognitive)

COURSE CONTENT

MODULE 1

Introduction to Machine Learning: Why Machine Learning, Problems Machine Learning Can solve, Examples of machine learning applications, Uses and abuses of machine learning, how machines learn, Types of machine learning algorithms.

MODULE II

Supervised Learning: Classification and Regression, Generalization, Overfitting, and Underfitting. Supervised Machine Learning Algorithms - k-Nearest Neighbor, Linear



Models, Naive Bayes Classifiers, Decision Trees, Random Forest, The C5.0 decision tree algorithm.

MODULE III

Understanding classification rules-Separate and conquer, The 1R algorithm, The RIPPER algorithm Support Vector Machines- Learning a maximum hyperplane, Kernel functions and Non-linear SVM, Multi class classification with SVM.

MODULE IV

Unsupervised Learning and Pre-processing: Types of Unsupervised Learning, Challenges in Unsupervised Learning, Preprocessing and Scaling, Different Kinds of Preprocessing, Dimensionality Reduction, Feature Extraction, and Manifold Learning, Principal Component Analysis (PCA) , Non-Negative Matrix Factorization (NMF), Clustering -k-Means Clustering , Agglomerative Clustering, DBSCAN

MODULE V

Reinforcement Learning: Basic architecture, Elements of Reinforcement Learning, Approaches to implementing Reinforcement Learning, Working, The Bellman Equation, Types of Reinforcement Learning, Reinforcement Learning Algorithm, Markov Decision Process, Q-Learning.

MODULE VI

Deep Learning: How deep learning works, Deep learning methods, Deep learning neural network, Benefits, Examples

LEARNING RESOURCES

References

- Andreas C. Müller and Sarah Guido , Introduction to Machine Learning with Python A Guide for Data Scientists, -Published by O'Reilly Media, Inc
- Brett Lantz, "Machine Learning with R", *Second Edition*, Packt Publishing
- Vinod Chandra S S, Anand H S, "Machine Learning: A Practitioners Approach", Prentice Hall of India, New Delhi, 2020
- C. Bishop, "Pattern Recognition and Machine Learning", Springer, 2007.
- K. Murphy, "Machine Learning: A Probabilistic Perspective", MIT Press, 2012.
- Tom M. Mitchell, "Machine Learning", McGraw-Hill Education (India) Private Limited.
- Vinod Chandra S S, Anand H S, "Artificial Intelligence and Machine Learning", Prentice Hall of India, New Delhi, 2014

Online Resources

- <https://www.kaggle.com/learn/intro-to-machine-learning>
- <https://www.coursera.org/specializations/machine-learning-introduction>
- <https://towardsdatascience.com/machine-learning/home>
- <https://scikit-learn.org/stable/>

Semester 2

Course Code: MCA-CC-523

Credits: 3

DATABASE MANAGEMENT SYSTEMS

Preamble: Emphasizes the importance of maintaining data accuracy, consistency, and security within the database environment. Discusses the mechanisms employed by the DBMS to process and optimize queries for efficient data retrieval and manipulation, including query parsing, optimization, and execution. It covers relational database systems, still a mainstay in data management systems, and the so-called "NoSQL" systems.

Prerequisite: Basic computer science, Knowledge in programming language

COURSE OUTCOMES & TAGGING

Course Outcomes	PO	PSO	CL	KC
CO1 Explore the fundamental concepts of databases	PO1	PSO1	U	F
CO2 Construct an Entity-Relationship (E-R) model from requirement specifications.	PO2	PSO3	Ap	C
CO3 Perform the transformation of the conceptual model into corresponding logical data structures.	PO4	PSO2	An	P
CO4 Model and design a relational database following the design principles of normalization.	PO3	PSO4	U, Ap	P
CO5 Develop queries for relational database in the context of practical applications	PO7	PSO5	Cr,Ap	C
CO6 Estimate the storage size of the database and design appropriate storage techniques	PO2	PSO3	E	P
CO7 Explain the basic requirements for Backup and recovery	PO3	PSO1	U,An	F
CO8 Explain various types of NoSQL databases	PO5	PSO6	U	P

(CL- Cognitive Level: R-remember, U-understand, Ap- Apply, An-Analyse, E- Evaluate, Cr- Create, KC - Knowledge Category: F-Factual, C- Conceptual, P-Procedural, M- Metacognitive)

COURSE CONTENT

MODULE I

Introduction to Database Management System: The file system, Limitations of file system, The Database Approach, Schema, Instance, The Logical DBMS Architecture, Data Abstraction, Three level architecture of DBMS , Mappings between levels, Data independence, Physical DBMS Architecture, DML Pre-compiler, DDL Compiler, File Manager, Database Manager, Query Processor, Data files indices and Data Dictionary, Database Administrator, Database Users, Data Models.

MODULE II

The Relational Model: Domains, Attributes, Tuple and Relation, Super keys Candidate keys and Primary keys for the Relations, Relational Constraints, Domain Constraint, Key Constraint, Integrity Constraint, Update Operations and Constraint Violations. Relational Algebra-Basic Set Operation, Cartesian product, Relational Operations, extended operations. Entity Relationship (ER) Model, Entities, Attributes, Relationships, Mapping constraints, Conversion of E-R Diagram to Relational

Database.

MODULE III

Relational Database Integrity: The Keys, Referential Integrity, Entity Integrity; Functional Dependency, Transitive dependency, partial dependency, Multi-valued dependency, Normalization-1NF, 2NF, 3NF,4NF, 5NF, Boyce Codd Normal Form, Inference axioms, Desirable Properties of Decomposition, Lossy and Lossless decomposition, Attribute Preservation, Dependency Preservation, Lack of redundancy, Rules of Data Normalization, Eliminate Repeating Groups, Eliminate Redundant Data, Eliminate Columns Not Dependent on Key.

MODULE IV

The Structured Query Language: SQL; DDL, DML, DCL, Database Objects: Views, Sequences, Indexes and Synonyms, Table Handling Assertion and views, Cursors, triggers and stored procedures, Functions & Packages, Embedded SQL, dynamic SQL, Storage and File Structure, Indexing & Hashing, Transactions and Database Recovery -Transactions, Properties of a transaction, Concurrent Transactions, The Locking Protocol, Serializable Schedules, Locks, Two Phase Locking (2PL), Deadlock and its Prevention, Optimistic Concurrency Control, Recovery-Kinds of failures, Failure controlling methods, Database errors, Recovery Techniques, Security & Integrity.

MODULE V

Enhanced Database models: Object Oriented Database-Limitations of Relational databases, The need of Object oriented databases, Complex Data Types, Structured Types and Inheritance in SQL, Object-Oriented versus Relational databases

MODULE VI

Introduction to NoSQL Databases: Main characteristics of Key-value DB (examples from: Redis), Document DB (examples from: MongoDB) Main characteristics of Column - Family DB (examples from: Cassandra) and Graph DB(examples from : ArangoDB)

LEARNING RESOURCES

References

- Ramon A. Mata-toledo and Pauline K. Cushman, Database Management Systems Schaum's Outlines, Tata McGraw Hill
- Henry F. Korth, Sudarshan and Abraham Silbershatz- Database System Concepts-6thEdn, McGraw Hill, 2010.
- C.J.Date, Longman, Dr.S.Swamynathan, Introduction to Database Systems, Pearson Education – 2010
- Thomas Connolly and Carolyn Begg - Database systems, 4th edition – Pearson Education, 2009
- R. Narang – Database Management System, PHI4. Hansen and Hansen – Database Management and Design, 2nd edition, PHI
- Atul Kahate, Introduction to Data Base Management Systems, Pearson Education

- Ramez Elmasri, Shamkant B. Navathe - Fundamentals of Database Systems Fifth Edition - Addison Wesley Higher Education - 2010
- Hoffer, Prescott & McFadden - Modern Database Management - Eighth Edition - Prentice Hall - 2010
- Kifer, Bernstein & Lewis - Database Systems: An Application Oriented Approach, Complete Version - Second Edition - Addison Wesley Higher Education - 2010
- Adam Fowler, NoSQL for Dummies, John Wiley & Sons, 2015
- -NoSQL Data Models: Trends and Challenges (Computer Engineering: Databases and Big Data), Wiley, 2018

Semester 2

Course Code:MCA-CC-524

Credits: 3

PYTHON PROGRAMMING

Preamble: Throughout this course, students will embark on a journey to explore the core concepts of Python programming. By the end of this course, students will emerge as proficient Python programmers capable of designing and implementing sophisticated applications, ranging from simple scripts to complex GUIs, database-driven applications, and data analysis tools. Whether pursuing a career in software development, data science, or any other field requiring programming expertise, this course will provide students with a solid foundation to excel in their endeavours.

Prerequisite: Basic Understanding of Computer Programming, Concepts, Familiarity with a Text Editor or Integrated Development Environment (IDE), Basic Knowledge of Command-Line Interface (CLI)

COURSE OUTCOMES & TAGGING					
Course Outcomes		PO	PSO	CL	KC
CO1	Explore the programming skills of students by imparting both procedural and object oriented concepts	PO5	PSO4, PSO6	Ap	P
CO2	Analyse how to find solutions to real world problems using Python	PO4	PSO1,PSO4	An	C
CO3	Implement exception handling and file management in python	PO6	PSO1,PSO6	Ap	P
CO4	Perform complete software development including GUI programming	PO3	PSO1,PSO2, PSO7	Ap	P
CO5	Explore the packages and modules in Python	PO5	PSO1, PSO7	U	C
CO6	Manipulate Data using NumPy, Matplotlib, and Pandas	PO5	PSO1, PSO8, PSO9	Ap	P
CO7	Apply Regular Expressions and Database Programming	PO9	PSO1,PSO7	Ap	P

(CL- Cognitive Level: R-remember, U-understand, Ap- Apply, An-Analyse, E- Evaluate, Cr- Create, KC - Knowledge Category: F-Factual, C- Conceptual, P-Procedural, M- Metacognitive)

COURSE CONTENT

MODULE I :.Introduction to Python: Features of Python - Identifiers - Reserved Keywords,comments in python, Python Data Types- Strings, Lists, Dictionaries, Tuples and Sets, Mutable and immutable objects, Data Type Conversion, operators, Expressions, Execution Control Structures, Python Standard Library

MODULE II: User-Defined Functions, Parameter Passing, Input and Output Functions Two Dimensional Lists, Iterating through Two Dimensional Lists, Character Encoding and Strings, Errors and Exception Handling-Exception Types, Exception Handling using Try & Except. User Defined Exceptions.

MODULE III: Objects and Classes, Defining a Class in Python, Constructors. Inheritance: Multiple and Multilevel Inheritance, Modifying Built in Classes Using Inheritance, Operator Overloading, Built-in Modules - Creating Modules - Import

statement - Locating modules - Namespaces and Scope - The dir() function - The reload function - Packages in Python.

MODULE IV: GUI Programming- Introduction – Tkinter Widgets – Label – Message Widget –Entry Widget – Text Widget – tk Message Box – Button Widget – Radio Button- Check Button- Listbox Frames _ Toplevel Widgets – Menu Widget-event based Tkinter widgets.

MODULE V:

Pattern Matching Using Regular Expressions. Database Programming in Python- Creating Tables, Querying (Inserting Tuples, Selecting Rows and Updating Tuples) Using Cursor to Iterate over Selected Tuples, Files: Opening and Closing a File, Opening Modes, Various Read and Write Methods.

MODULE VI

NumPy: Creating Arrays (array() and arange), reshape(), sum(), min() and max() methods, Item wise arithmetic operations. Matplotlib - Basic plot, Ticks, Labels, and Legends. Working with CSV files. - Pandas - Reading, Manipulating, and Processing Data.

LEARNING RESOURCES

References

- “Taming PYTHON By Programming”, Jeeva Jose Khanna Publications 4.2
- Kenneth A. Lambert, “Fundamentals of Python: First Programs”, CENGAGE
- Learning, 2012.
- Paul Gries, Jennifer Campbell and Jason Montojo, “Practical Programming: An
- Timothy A. Budd, “Exploring Python”, Mc-Graw Hill Education (India) Private Ltd
- Beazley, D. M. (2009). Python essential reference. Addison-Wesley Professional.
- Barry, P. (2010). Head First Python. “ O’Reilly Media, Inc.”.
- Punch, W. F., & Enbody, R. (2010). The practice of computing using python. Addison-
- Wesley Publishing Company.
- Mark, S. (2009). Programming in Python 3. Pearson Education India.
- JubomirPerkovic, “Introduction to Computing Using Python: An Application
- Development Focus”, Wiley, 2012.
- Charles Dierbach, “Introduction to Computer Science Using Python: A
- Computational
- Allen B Downey, “Think Python” ,Oreilly, 2012
- Dr.Varghese Paul, Dr.AnjanaS.Chandran, “Introduction To Computing And
- Problem
- Solving Using Python”, Educational Publishers And Distributors, 2016

Online Resources

- <https://realpython.com/>
- <https://docs.python-guide.org/>

Semester 2

Course Code: MCA-CC-526

Credits: 3

DBMS LABORATORY

Preamble: The aim of this course is to understand the implementation procedures for advanced database concepts using SQL. Students are expected to create databases using NOSQL database

Prerequisite: Foundation in SQL queries

COURSE OUTCOMES & TAGGING

Course Outcomes	PO	PSO	CL	KC
CO1 Design a database for a given problem using database design principles	PO1	PSO1	U,Ap	C, P
CO2 Implement stored programming concepts(PL-SQL) using cursors and Triggers	PO2	PSO2	An,Ap	C, P
CO3 Identify the relationship between tables	PO2	PSO2	U,Ap	C, P
CO4 Implement privileges to different categories of database users	PO3	PSO2	An,Ap	C, P
CO5 Create procedures, functions, packages, views and assertions	PO4	PSO4	An,Ap	C, P
CO6 Apply transaction control using commands	PO4	PSO4	An,Ap	C, P
CO1 Design a database for a given problem using database design principles	PO1	PSO1	U,Ap	C, P
CO2 Implement stored programming concepts(PL-SQL) using cursors and Triggers	PO2	PSO2	An,Ap	C, P

(CL- Cognitive Level: R-remember, U-understand, Ap- Apply, An-Analyse, E- Evaluate, Cr- Create, KC - Knowledge Category: F-Factual, C- Conceptual, P-Procedural, M- Metacognitive)

COURSE CONTENT

It is advised to complete the problems to be given under each of the following cycles. There may be a set of experiments in each cycle, and all cycles are mandatory. The faculty in charge will give the list of exercises as and when you have completed the minimum experiments in each cycle. The students can suggest new and innovative exercises in the second cycle, provided it can be implemented with the available lab infrastructure.

- Creation of a database using DDL commands, altering and dropping of tables (use constraints while creating tables)
- Performing DML commands like Insertion, Deletion, Modifying, Updating and selecting records based on conditions.
- Queries (along with sub Queries) using ANY, ALL, IN, EXISTS, NOT EXISTS, UNION, INTERSECT, Constraints.
- Implementation of Built in functions in RDBMS
- Implementation of various aggregate functions in SQL
- Implementation of Order By, Group By & having clause.
- Implementation of set operators, nested queries and Join queries
- Implement the usage of keys



- Implement Queries with column alias and conversion functions
- Implement Queries with sub string comparison
- Implement SQL functions (String, Numeric, Date functions)
- Implement relationship between tables
- Implement various constraints.
- Practice of SQL TCL commands like Rollback, Commit, Savepoint.
- Practice of SQL DCL commands for granting and revoking user privileges.
- Creation of Views and Assertions
- Implementation of various control structures using PL/SQL
- Creation of Procedures and Functions
- Creation of Packages
- Creation of database Triggers and Cursors

LEARNING RESOURCES

References

- ORACLE PL/SQL by example. Benjamin Rosenzweig, Elena Silvestrova, Pearson Education 3rd Edition
- ORACLE DATA BASE LOG PL/SQL Programming SCOTT URMAN, Tata Mc- Graw Hill.
- SQL & PL/SQL for Oracle 10g, Black Book, Dr.P.S. Deshpande

Semester 2

Course Code:MCA-CC-527

Credits: 2

MACHINE LEARNING LABORATORY

Preamble: This course is meticulously crafted to provide with a solid foundation in both Python and ML disciplines, empowering to harness the power of data-driven insights and develop efficient, scalable solutions using one of the most versatile programming languages in the world.

Prerequisite: Basic Programming Knowledge, Problem-Solving Skills, Data Analysis Tools

COURSE OUTCOMES & TAGGING

Course Outcomes	PO	PSO	CL	KC
CO1 Implement simple Python Programs with conditions, loops and functions	PO1	PSO4	Ap	P
CO2 Represent compound data using Python lists, tuples and dictionaries.	PO5	PSO1	Ap	P
CO3 Read and write data from/to text files in Python.	PO4	PSO1, PSO7	Ap	P
CO4 Implement GUI and database programming	PO3	PSO4, PSO7	Ap	P
CO5 Implement Programs involving a variety of Exception Handling situations	PO2	PSO4, PSO6	Ap	P
CO6 Use python to implement machine learning programs	PO12	PSO4, PSO8	Ap	P
CO7 Understand how to evaluate machine learning models generated from the given data classifications	PO10	PSO9, PSO1	An	C

(CL- Cognitive Level: R-remember, U-understand, Ap- Apply, An-Analyse, E- Evaluate, Cr- Create, KC - Knowledge Category: F- Factual, C- Conceptual, P-Procedural, M- Metacognitive)

COURSE CONTENT

This course provides a comprehensive introduction to both machine learning principles and Python programming fundamentals. Through a series of lab sessions, students will learn to implement basic Python programs. Additionally, students will gain hands-on experience with machine learning algorithms. By the end of the course, students will be equipped with essential programming skills and a solid foundation in machine learning concepts, preparing them for more advanced studies.

Python Basics and Decision Making Cycle

Implement simple Python programs using decision-making statements (if, elif, else).

Implement programs using looping control structures (for loop, while loop).

Functions and Recursion Cycle

Implement programs using user-defined functions.

Implement programs using recursion.

Data Types and Operations Cycle

Perform operations using string, tuple, list, dictionary, set data type (concatenation, slicing, formatting, accessing).



Exception Handling and Inheritance Cycle

Demonstrate exception handling in Python.

Implement inheritance in Python classes.

GUI Programming and NumPy Cycle

Implement GUI programming using all widgets in Tkinter or PyQt.

Demonstrate the usage of NumPy for numerical computations and array manipulation.

Database Programming and File Handling Cycle

Implement database programming by creating tables and querying tuples.

Implement file handling operations such as reading from and writing to files in Python.

Introduction to Machine Learning Algorithms Cycle

Implement the SVM classification, random forest, decision tree, KNN classifier

Introduction to Clustering Algorithms Cycle

Implement the K-Means clustering algorithm

LEARNING RESOURCES

References

- Andreas C. Müller and Sarah Guido , Introduction to Machine Learning with Python A Guide for Data Scientists, -Published by O'Reilly Media, Inc
- Brett Lantz, "Machine Learning with R" , *Second Edition*, Packt Publishing
- Vinod Chandra S S, Anand H S, "Machine Learning: A Practitioners Approach" , Prentice Hall of India, New Delhi, 2020
- C. Bishop, "Pattern Recognition and Machine Learning" , Springer, 2007.
- K. Murphy, "Machine Learning: A Probabilistic Perspective" , MIT Press, 2012.
- Tom M. Mitchell, "Machine Learning" , McGraw-Hill Education (India) Private Limited.
- Vinod Chandra S S, Anand H S, "Artificial Intelligence and Machine Learning" , Prentice Hall of India, New Delhi, 2014

Semester 2

Course Code: MCA-SE-4B3

Credits: 2

IT ACT

Preamble: It covers the entire Information Technology Act, its amendments, and applicable rules. Apart from the statutory provisions related to cyberspace, this syllabus also emphasizes the social and intellectual property issues and legal analysis of emerging cyberspace technologies.

Prerequisite: Basic information about technology, Computer Applications

COURSE OUTCOMES AND TAGGING

Course Outcome	PO	PSO	CL	KC
CO1 Knowledge in Information Technology and its use	PO1	PSO1	An	F
CO2 Understand cyber space and cybercrimes	PO10	PSO5	U	C
CO3 Understand and explain Technology act	PO2	PSO2	U	C
CO4 Knowledge in Cybercrimes and Offenses	PO6	PSO5	An	F
CO5 Understand Data Protection and Privacy	PO4	PSO1	U	P
CO6 Regulation of Intermediaries	PO3	PSO2	Ap	P
CO7 Generalize the impact based on the Risk assessment, plan suitable security controls, audit and compliance in network	PO7	PSO9	Ap	C

(CL- Cognitive Level: R-remember, U-understand, Ap- Apply, An-Analyse, E- Evaluate, Cr- Create, KC - Knowledge Category: F-Factual, C- Conceptual, P-Procedural, M- Metacognitive)

COURSE CONTENT**MODULE I**

Information Technology (use of computers to store, retrieve, transmit and manipulate data); understanding cyberspace (cyberspace is a notional environment in which communication over computer network occurs; borderless environment), scope and regulation; internet, e-mail and world wide web; use- academics, e-commerce (B2B, B2C, C2C), social networking by individuals.

MODULE II

Current challenges- mobiles, cyber security, cloud computing and data privacy, misuse of social media.

MODULE III

Cyber Crimes- financial frauds (money laundering, credit card frauds, social crimes -cyber stalking, pornography, identity theft, IPR related crimes, cyber terrorism, defamation.

MODULE VI

Technology Act, 2000 (to facilitate e- commerce to remove major hurdles of writing and signature requirement for legal recognition, providing regulatory regime for to supervise certifying authorities and digital signature certificates, to create civil and criminal liabilities for contravention of provisions, and consequential amendments in other Acts.

MODULE V

The Concept of Cyberspace E-Commerce, The Contract Aspects in Cyber Law, The Security Aspect of Cyber Law, The Intellectual Property Aspect in Cyber Law, The Evidence Aspect in Cyber Law

MODULE VI

The Criminal Aspect in Cyber Law, Global Trends in Cyber Law, Legal Framework for Electronic Data Interchange Law Relating to Electronic Banking, The Need for an Indian Cyber Law.

LEARNING RESOURCES

References

- Talat Fatima, "Cyber Law in India", Wolters Kluwer, 2017.
- amath Nandan, "Law Relating to Computers Internet & E-commerce - A Guide to Cyberlaws & The Information Technology Act, Rules, Regulations and Notifications along with Latest Case Laws", 2012.
- Karnika Seth, "Computers Internet and New Technology Laws", 2013.

Online Resources

- https://www.indiacode.nic.in/bitstream/123456789/13116/1/it_act_2000_updated.pdf
- <https://www.youtube.com/watch?v=5pL2zX7cEZk>

Semester 2

Course Code : MCA-SE-4B4

Credits :2

INDUSTRY INTERNSHIP

Preamble: The Internship course provides students with the opportunity to intern in the professional setting of a company, and help develop their abilities as a professional.

Prerequisite: Nil.

COURSE OUTCOMES AND TAGGING

Course Outcome	PO	PSO	CL	KC
CO1 Apply classroom and laboratory concepts and principles in an industry work environment	PO2	PSO9	U,Ap	C,P
CO2 Establish goals by working with supervision to define work objectives for the internship experience	PO1	PSO1	An,Ap	C, P
CO3 Demonstrate time and project management skills by completing the work objectives within the specified time limits	PO3	PSO6	An	P
CO4 Demonstrate the ability to work as a team member to successfully complete the assigned work objectives in an assigned company work group.	PO4	PSO9	An,Ap	P
CO5 Demonstrate the ability to effectively present ideas and solutions in the context of written, oral, and electronic media	PO5	PSO6	U,An, Ap	C, P
CO6 Demonstrate and promote a proper work ethic	PO4	PSO3	U,Ap	P

(CL- Cognitive Level: R-remember, U-understand, Ap- Apply, An-Analyse, E- Evaluate, Cr- Create, KC - Knowledge Category: F-Factual, C- Conceptual, P-Procedural, M- Metacognitive)

COURSE CONTENT

Internships are educational and career development opportunities, providing practical experience in a field or discipline. They are structured, short-term, supervised placements focused on particular tasks or projects with defined timescales. An internship may be compensated, non-compensated, or sometimes may be paid. The internship has to be meaningful and mutually beneficial to the intern and the organization. The internship program's objectives and activities must be clearly defined and understood. The following are the intended objectives of internship training.

- Will expose students to the industrial environment, which cannot be simulated in the classroom, creating competent professionals for the industry.
- Provide possible opportunities to learn, understand and sharpen the real-time technical/managerial skills required on the job
- Exposure to the current technological developments relevant to the subject area of training
- Experience gained from the 'Industrial Internship' in the classroom will be used in classroom discussions.
- Create conditions conducive to the quest for knowledge and its applicability on the job.

LEARNING RESOURCES**Online resources**

- https://www.ugc.gov.in/pdfnews/8449573_Intruction-Manual.pdf



Semester 2

Course Code : MCA-DE-525(i) Credits 3

SOFTWARE TESTING

Preamble: Aim of the course is to study the creation of test cases for white-box, black-box, and grey-box approach. The course describes the various techniques for test case design used to test software artifacts, including requirements and code. The course includes different techniques for test case design based on graphs, programming languages and inputs. The course also covers symbolic execution using PEX tool.

Prerequisite: Software Engineering for Industry.

COURSE OUTCOMES & TAGGING

Course Outcomes	PO	PSO	CL	KC
CO1 Understand the fundamental concepts in software testing, including software testing objectives, process, criteria, strategies, and methods	PO2 PO3 PO7	PSO2, PSO6	U	F,C
CO2 Discuss various software testing issues and the test methods like unit test; integration, regression, and system testing	PO3, PO5 PO8 PO9	PSO1, PSO3, PSO5, PSO7	Ap	C
CO3 Understand the different types of testing and essential characteristics of tool used for test automation	PO3 PO5 PO7	PSO4, PSO5, PSO7	U	C
CO4 Understand the functional and system testing methods	PO2, PO5, PO7	PSO1, PSO5, PSO7	U	F,C
CO5 Understand important concepts of complexity metrics	PO4, PO5	PSO2, PSO6, PSO7	E	F,C
CO6 Understand the process of applying tests to software and the methods for defining test cases	PO4, PO9, PO11	PSO4, PSO6, PSO7	An	P

(CL- Cognitive Level: R-Remember, U-Understand, Ap- Apply, An-Analyse, E- Evaluate, Cr-Create, KL - Knowledge Category: F-Factual, C- Conceptual, P-Procedural, M- Metacognitive)

COURSE CONTENT

MODULE I

Software Testing Principles: The Tester's Role in a Software Development Organization–Origins of Defects–Cost of defects–Defect Classes. Testing Process- Level 0 thinking, Level 1 thinking, Level 2 thinking, Level 3 thinking, Level 4 thinking. Software Testing Terminologies - Verification, Validation and Testing, Faults, Error and Bug, Test cases, Coverage Criteria.

MODULE II

Structured approach to Testing: Developing Testing methodologies–Levels of Testing, Acceptance Testing–Special Tests–Testing Tools. Test planning- Test strategy-Test plan templates(System testing)–Guidelines for developing test plan. Building Test data and Test cases.



MODULE III

Test case Design Strategies: Black Box testing, White Box testing, Grey Box testing- Using Black Box Approach to Test Case Design - Boundary Value Analysis, Equivalence Class Partitioning, Cause-effect. Using White Box Approach to Test design -static testing vs. structural testing, code functional testing, Control Flow Graphs, Path coverage testing. Gray Box Methodology- Techniques of Grey Box Testing.

MODULE IV

Mutation testing: Mutation and Mutants, Mutation operators, Mutation score. Test metrics and Test reports - categories of the product/project test metrics, defect density- defect leakage ratio test case efficiency, guidelines for writing and using test report, benchmarking. Testing OO systems.

MODULE V

Software test automation: Skills needed for automation -scope of automation -design and architecture for automation - requirements for a test tool - challenges in automation - Test metrics and measurements - project, progress and productivity metrics.

MODULE VI

Applications: JUnit, Mutation testing using Junit and Muclipse, Graph Based testing using Junit Framework, Black Box testing approaches using JUnit, Parameterized Unit Testing(PEX),Load testing ,GUItesting ,Web site testing.

LEARNING RESOURCES

- **References**
- Srinivasan Desikanand Gopaldaswamy Ramesh, "Software Testing -Principles and Practices", Pearson Education, 2006.
- RonPatton,"SoftwareTesting",2ed.,Sams Publishing, Pearson Education, 2007.
- Pau l Ammann and JeffOffutt,"Introduction to Software Testing".
- Kshirasagar Naikand Priyadarshi Tripathy, Software Testing And Quality Assurance: Theory And Practice.
- King,JamesC,"Symbolic Execution and Program Testing", Association for Computing Machinery, July 1976.
- "Software Testing, Principles, Techniques and Tools"-MGLimaye,TMHB.
- Introducing Software Testing-Louise Tamres,Pearson.
- **On-lineResources**
- <https://www.csc.ncsu.edu/academics/undergrad/honors/thesis/muclipsebinder.pdf> - Muclipse tutorial.

Semester 2

Course Code: MCA-DE-525(ii)

Credits: 3

BLOCKCHAIN TECHNOLOGY

Preamble: This course aims to empower students with a profound knowledge of Blockchain, enabling them to navigate the complexities of decentralised systems, cryptographic foundations, and cutting-edge applications in the digital era. This curriculum also serves as a foundational guide to develop blockchain applications using the Ethereum blockchain.

Pre-requisite: Familiarity with operating systems.

COURSE OUTCOMES & TAGGING

Course Outcomes	PO	PSO	CL	KC
CO1 To learn and understand the history, technology, and applications of Blockchain.	PO1, PO2, PO3	PSO1, PSO2, PSO4	U	F
CO2 Understand Consensus and emerging abstract models for Blockchain Technology.	PO1, PO2, PO5	PSO1, PSO2, PSO4	U, R	F, C
CO3 Understand the concept of cryptographic hashing, signature and encryption of secure cryptocurrency systems.	PO1, PO2, PO5, PO9	PSO1, PSO3, PSO6, PSO7	U	F
CO4 Understand the foundational principles of Bitcoin, including its architecture, key components such as wallets and blocks.	PO1, PO2, PO3, PO4, PO5, PO9	PSO1, PSO2, PSO4	U, R	C, P
CO5 Illustrate the working of Ethereum Virtual Machine.	PO1, PO2, PO3	PSO1, PSO3, PSO6, PSO8	Ap, An	C
CO6 Analyse advanced cryptographic techniques.	PO1, PO2, PO9, PO12	PSO1, PSO3, PSO7, PSO9	An	C, M

(CL - Cognitive Level: R- remember, U - understand, Ap - Apply, An - analyse, E - Evaluate, Cr - Create; KC - Knowledge Category: F - Factual, C - Conceptual, P - Procedural, M - Metacognitive)

COURSE CONTENT**MODULE I**

Overview of Blockchain: Evolution and Technology of Blockchain, Core technological components of blockchain, Blockchain architecture and structure, Cryptographic principles in blockchain, Use Cases and Applications of Blockchain Technology, Overview of various industries adopting blockchain, Real-world applications, Comparison of Private and Public Blockchain Networks.

MODULE II

Consensus Mechanisms and Abstract Models: The Consensus Problem, Challenges in achieving consensus, Solutions for decentralised consensus, Nakamoto Consensus, Exploration of the Nakamoto consensus algorithm, Abstract Models for Blockchain, GARAY Model, Proof of Work (PoW) as a random oracle, Proof of Stake (PoS) based Chains, Hybrid models (PoW + PoS).

MODULE III

Cryptographic Foundations for Cryptocurrency, Overview of Cryptographic Basics: Hashing, Signature schemes, Encryption schemes, Elliptic Curve Cryptography.

MODULE IV

Bitcoin - Wallet - Blocks - Merkle Tree - hardness of mining - transaction verifiability - anonymity - forks - double spending - mathematical analysis of properties of Bitcoin. Smart Contracts and Ethereum: Introduction to Ethereum, Ethereum Virtual Machine (EVM), Smart Contracts Development in Solidity, Ethereum Wallets.

MODULE V

Ethereum - Ethereum Virtual Machine (EVM) - Wallets for Ethereum - Solidity - Smart Contracts - some attacks on smart contracts -(Trends and Topics) - Zero Knowledge proofs and protocols in Blockchain - Succinct non interactive argument for Knowledge (SNARK) - pairing on Elliptic curves - Zcash.

MODULE VI

Advanced Topics in Blockchain: Zero Knowledge Proofs and Protocols, Overview and Applications, Succinct Non-Interactive Argument for Knowledge (SNARK), Pairing on Elliptic Curves, Zcash and Privacy-focused Cryptocurrencies.

LEARNING RESOURCES

References

- R.Pass et al, Fruitchain, a fair blockchain, PODC 2017 (eprint.iacr.org/2016/916).
- R.Pass et al, Analysis of Blockchain protocol in Asynchronous networks , EUROCRYPT 2017,(eprint.iacr.org/2016/454) . A significant progress and consolidation of several principles).
- Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller, and Steven Goldfeder. Bitcoin
- and cryptocurrency technologies: a comprehensive introduction. Princeton University Press, 2016.
- Blockchain by Melanie Swa, O'Reilly
- Mastering Bitcoin: Unlocking Digital Cryptocurrencies, by Andreas Antonopoulos
- Zero to Blockchain - An IBM Redbooks course, by Bob Dill, David Smits

Online References

- <https://www.redbooks.ibm.com/Redbooks.nsf/RedbookAbstracts/crse0401.html>
- <https://www.hyperledger.org/projects/fabric>

Semester 2

Course Code:MCA-DE-525(iii)

Credits:

BIOINFORMATICS

Preamble: This syllabus is meticulously designed to provide a comprehensive understanding of fundamental principles in life science, molecular biology, and their intersection with the dynamic field of bioinformatics. Over the course of five modules, we will explore the characteristics of life, the organization of biological systems, the structure of cells, and delve into the intricacies of DNA and RNA. Additionally, the course will venture into the history, definition, and practical applications of bioinformatics, incorporating various analytical tools and databases.

Prerequisites : Basic knowledge about human DNA and Biology

COURSE OUTCOMES & TAGGING

Course Outcomes	PO	PSO	CL	KC
CO1 Demonstrate the basic knowledge in Life science	PO1	PSO1	U, Ap	F
CO2 Compare RNA and DNA	PO1,PO2,	PSO1	U, An	P
CO3 Analyse the DNA sequence and perform matching	PO2	PSO2,PSO3,PSO6	U,An	P
CO4 Illustrate the working of pair wise alignment method	PO4	PSO1	U,Ap	P
CO5 Identify the bioinformatics databases	PO5	PSO2	U	P
CO6 Perform sequence alignment in DNA sequences	PO2	PSO2	U, Ap	P
CO7 Understand the significance of Bioinformatics as a multidisciplinary research area	PO7,PO8, PO10,PO11	PSO1,PSO2, PSO4,PSO5,PSO8	U, Cr	MC

(CL- Cognitive Level: R-remember, U-understand, Ap- Apply, An-Analyse, E- Evaluate, Cr- Create, KC - Knowledge Category: F-Factual, C- Conceptual, P-Procedural, M- Metacognitive)

COURSE CONTENT**MODULE I**

Introduction to life Science: Characteristics of life, Levels of biological Organization, cell as basic MODULE of life, cell theory, structure of Prokaryotic cell and Eukaryotic cell, Primary and secondary structure of DNA, Chargaff's Rules, Different forms of DNA, RNA, structural organization of DNA, Gene and genetic information

MODULE II

Bioinformatics: History of Bioinformatics, Definition of Bioinformatics, Bioinformatics versus Computational Biology, Goals of Bioinformatics analysis, Bioinformatics technical tool box, Biological data, File format, conversion of file format, Data retrieval system, Genome browsers.

MODULE III

Analyzing DNA sequence, IUPAC code for DNA sequence, ORF, palindromes in DNA sequence, RNA sequence analysis; FASTA format. Sequence analysis/Alignment: DNA sequence, RNA sequence

MODULE IV

Protein sequence, sequence alignment classifications, Scoring Matrices – PAM, BLOSUM; Sequence Alignment: Introduction to Sequence Comparison - Pairwise Alignment Method (DOT PLOT method) and Multiple Analyses of Protein Structures



MODULE V

Databases: Bioinformatics databases, Types of databases, Nucleotide sequence databases, Primary nucleotide sequence databases-EMBL, Gene Bank, DDBJ; Secondary nucleotide databases, Protein sequence databases- SwissProt/TrEMBL, Protein structure databases-Protein Data Bank

MODULE VI

Human Genome Project, Importance of Perl language in Bioinformatics, Applications of Bioinformatics in Biodiversity, Human Genetics, Gene Therapy, Agriculture, Computer-Aided Drug Design, DNA Fingerprinting.

LEARNING RESOURCES

References

- P S Verma, V K Agarwal, Cell Biology, genetics, Molecular Biology, Evolution and Ecology, S. Chand Publications.
- S C Rastogi, N Mendiratta, P Rastogi, Bioinformatics Methods and Applications, PHI
- Jin Xiong, Essential Bioinformatics, Cambridge University Press
- Jean-Michel Claverie, Cedric Notredame, Bioinformatics: A Beginner's Guide, Wiley, 2006
- Dr. K Mani & N Vijayaraj, Bioinformatics: A practical approach, Aparna Publications

Additional and Web -Resources

- <https://nptel.ac.in/courses/102/106/102106065>
- <https://nptel.ac.in/courses/102103044>

Semester 2

Course Code: MCA-DE-525 (iv)

Credits: 3

SOCIAL NETWORK ANALYSIS

Preamble: This course is designed to unveil the fundamental concepts, measures of centrality, and models that underpin the study of social networks. Through a blend of theoretical insights and practical applications, students gain proficiency in analyzing network structures, detecting communities, and uncovering insights from data. By bridging theory with real-world applications, this course equips students with the knowledge and skills to navigate and leverage the complexities of social networks in diverse domains.

Pre-requisite: A basic knowledge in Web concepts.

COURSE OUTCOMES & TAGGING

Course Outcomes	PO	PSO	CL	KC
CO1 Explain basic concepts, evolution and related applications of social network analysis.	PO2, PO10	PSO1	U	F, C
CO2 Identify the basic concepts of semantic web and Ontology.	PO2, PO10	PSO3	U	F, C
CO3 Understand the basic concepts and measures of Social Network. Apply software tools for social network analysis.	PO1, PO2, PO3, PO5, PO10	PSO2, PSO4, PSO7	U, Ap	C, P
CO4 Discuss the basic metrics used in Social network analysis.	PO1, PO3, PO4	PSO2	U, Ap	P
CO5 Understand the network communities and analyze the affiliation networks, graphs and partitioning techniques.	PO2, PO4, PO9, PO11	PSO2, PSO6, PSO9	U, An	U, P
CO6 Extract and mine communities in web social networks.	PO2, PO4, PO6, PO7, PO8, PO12	PSO1, PSO2, PSO5, PSO8	U, An	C, M

(CL - Cognitive Level: R- remember, U - understand, Ap - Apply, An - analyse, E - Evaluate, Cr - Create; KC - Knowledge Category: F - Factual, C - Conceptual, P - Procedural, M - Metacognitive)

COURSE CONTENT

MODULE I

Introduction to Social Network Analysis (SNA): Characteristic features of social networks, Key concepts, development, and applications of social network analysis. Electronic sources for network analysis: Electronic discussion networks, Blogs and online communities - applications in web-based networks.

MODULE II

Introduction of Semantic Web: limitations of current web, emergence of social web, Ontology and Semantic Web-Ontology based knowledge Representation; Resource Description Framework.

MODULE III

Networks- structure: Measures of centrality, Degree centrality, Betweenness centrality, Closeness centrality, Eigenvector centrality, Page rank, Transitivity and Reciprocity. Computing network metrics using software tool Gephi and R language.

MODULE IV

Basic metrics for Social Network Analysis: Degree distribution, clustering coefficient, Cliques, k-cores, k-clans, k-plexes, F-groups, Frequent patterns - Network motifs.

MODULE V

Network Communities: Divisive methods, Graph partitioning and cutmetrics. Edge betweenness. Modularity clustering. Affiliation network and bipartite graphs.

MODULE VI

Application of Data Mining in Social Networks: Overview on Data Mining and its various techniques, Overview on web mining.

LEARNING RESOURCES

References:

- Networks, Crowds, and Markets: Reasoning about a Highly Connected World, - David Easley and Jon Kleinberg, Cambridge University Press, 2010 2.
- Social Media Mining: An Introduction, - Zafarani, Abbasi and Liu, Cambridge University Press, 2014
- Networks, an Introduction. - Newman MEJ Oxford University Press 2010
- Social information Retrieval Systems: Emerging Technologies and Applications for Searching the Web Effectively - Dion Goh and Schubert Foo, IGI Global Snippet, 2008
- Collaborative and Social Information Retrieval and Access: Techniques for Improved user Modelling Max Chevalier, Christine Julien and Chantal Soulé-Dupuy, IGI Global Snippet, 2009.
- The Social Semantic Web John G. Breslin, Alexandre Passant and Stefan Decker, Springer, 2009.
- Web Mining and Social Networking Techniques and applications Xu, Yanchun Zhang and Lin Li, First Edition Springer, 2011.
- Dion Goh and Schubert Foo, "Social information Retrieval Systems: Emerging Technologies and Applications for Searching the Web Effectively", IGI Global Snippet, 2008.

Online References:

- <https://gephi.org/users>
- derekgreene.com/slides/derekgreene_gephi_slides.pdf
- https://www.worldscientific.com/doi/abs/10.1142/9789814277327_0010
- <https://cran.r-project.org/web/packages/igraph/igraph.pdf>
- <https://www.sciencedirect.com/science/article/pii/S2352352218300586>
- <http://library.uc.edu.kh/userfiles/pdf/18.Models%20and%20Methods%20in%20Social%20Network%20Analysis.pdf>

Semester 2

Course Code: MCA-DE- 525 (v)

Credits: 3

THEORY OF COMPUTATION

Preamble: This course explores the theoretical aspects and practical applications of finite state systems, regular expressions, context-free grammars, Linear Bound automata, Turing machines, and complexity theory. With a focus on understanding the equivalence between different automata models, designing machines for specific tasks, this curriculum equips learners with a comprehensive toolkit for tackling problems in theoretical computer science.

Pre-requisite: Solid understanding of discrete mathematics, particularly in the areas of sets, relations, and functions, as well as basic knowledge of formal languages and automata theory.

COURSE OUTCOMES & TAGGING

Course Outcomes	PO	PSO	CL	KC
CO1 To develop a formal notation for strings, languages and machines and to design finite automata to accept a set of strings of a language.	PO1, PO2, PO3	PSO1, PSO2, PSO3	R,U Ap	F, C
CO2 To analyze and generate regular expressions for any structure and demonstrate that a given language is regular or not.	PO2, PO3, PO4	PSO1, PSO2, PSO4	U, Ap, An	C, P
CO3 To design context free grammars to generate strings from a context free language and create Push Down Automata for any context free grammar.	PO2, PO3	PSO1, PSO2, PSO3	Ap	C,P
CO4 To prove equivalence of languages accepted by Linear Bound Automata and languages generated by Context sensitive grammars.	PO1, PO3, PO4	PSO3, PSO4, PSO6	An, E	P,M
CO5 To study the concept of Turing machines and analyze how various problems are solved using digital computers.	PO1, PO2, PO3, PO4, PO5, PO7	PSO4, PSO5, PSO6, PSO9	U, An	C, P
CO6 To Distinguish between computability and non computability and Decidability and undecidability.	PO4, PO6, PO7, PO8, PO9	PSO3, PSO2	An, E	C,M

(CL - Cognitive Level: R- remember, U - understand, Ap - Apply, An - analyse, E - Evaluate, Cr - Create; KC - Knowledge Category: F - Factual, C - Conceptual, P - Procedural, M - Metacognitive)

COURSE CONTENT

MODULE I

Concepts of Automata Theory: Strings, Alphabet, Language, Grammar- Finite state systems: NFA, DFA, Definitions, Equivalence of NFA and DFA, NFA to DFA conversion, NFA with epsilon transitions, Minimisation of DFA, Designing Moore and Mealy machines.

MODULE II

Regular expressions, Finite Automata & Regular Expression operations, Conversion of Finite Automata to Regular expressions. Converting Regular Expressions to Automata - Arden's Theorem - Algebraic Laws for Regular Expressions. Pumping Lemma for Regular Languages, Application of Regular Expressions.



MODULE III

Context free grammar, Definition, Derivation. Parse Trees and Ambiguity in Grammars - Conversion to Normal Forms: Chomsky normal form, Greibach normal form - Pumping Lemma for Context Free Languages - Properties of Context Free Language - Pushdown Automata: Definition, Acceptance of PDA, Deterministic PDA, Equivalence of PDA and CFG.

MODULE IV

Turing Machines: Definition , Transition diagram, Design & Roles of Turing machine, Church-Turing Thesis, Modular Construction of complex Turing machines, Types of Turing machines, Extensions of Turing machines, Universal Turing machines, Recursive and recursively enumerable languages, halting problem of TM.

MODULE V

Decidable and Undecidable problems. Introduction to Linear Bounded Automata Definition - Context-sensitive languages(CSL) - Context-sensitive grammars (CSG), LBA and equivalence with CSG. Chomsky Hierarchy, Relation between languages.

MODULE VI

Complexity Theory: Time and Space complexity. Polynomial time hierarchy - Undecidability and Reducibility in TOC, Intractable Problems: Definition of P and NP problems, NP complete and NP hard problems. Problem reduction, NP-completeness of SAT and other problems.

LEARNING RESOURCES

References:

- Hopcroft J. E., Motwani,R. and Ullman J. D., Introduction to Automata Theory, Languages, and Computation, 3rd Edition, ISBN : 978-03-214-5536-9.
- Padma Reddy, A.M., Finite Automata and Formal Languages, 1st Edition, Pearson Education,ISBN 978-81-317-6047-5.
- Mishra, K.L.P. and Chandrasekaran, N, Theory of Computer Science, Automata , Languages and Computation, 3 rd Edition, PHI, 2014, ISBN 978-81-203-2968-3.
- Peter Linz, An Introduction to Formal Languages and Automata, 4th Edition, Narosa Publishing Co., ISBN 978-81-7319-781-9
- John.C. Martin, Introduction to Languages and the theory of computation, 3rd Edition, Tata McGraw Hill, ISBN 978-0-07-066048-9.

Online References:

- <https://ocw.mit.edu/courses/18-404j-theory-of-computation-fall-2020/pages/lecture-notes/>

MCA MODEL QUESTION PAPER
MCA-CC-521:ALGORITHM ANALYSIS AND DESIGN
 (2024 Scheme)

Time : 3 Hours

Max. Marks : 100

PART A**Answer all questions. Each question carries 4 marks.**

1. Explain the concept of time-space tradeoff in algorithm analysis. [CO1]
2. Discuss the maximum subarray problem and outline an algorithm to solve it. [CO3]
3. Describe the process of building a heap and maintaining the heap property. [CO3]
4. Compare and contrast quick sort and insertion sort algorithms [CO7]
5. Explain the concept of binary search trees and how to query and insert elements in them. [CO5]
6. Define red-black trees and explain their properties. [CO3]
7. Explain the Floyd-Warshall algorithm for finding all-pairs shortest paths
 1. in a graph. [CO5]
8. Discuss the process of finding strongly connected components in a graph. [CO5]
9. Describe the Ford-Fulkerson method for finding maximum flow in a network [CO4]
10. Describe the concept of dynamic programming and its application in solving the rod cutting problem [CO6]

PART B*(Answer any ONE questions from each module. Each question carries 10 marks.)***Module 1**

11. Discuss the Master method for solving recurrence equations and provide examples [CO2]
12. Explain Strassen's Matrix Multiplication Problem. [CO3]

Module 2

13. Compare and contrast counting sort, radix sort, and bucket sort algorithms. [CO7]
14. Discuss the lower bounds for sorting and how they are derived [CO7]

Module 3

15. Explain the process of insertion and deletion in red-black trees [CO3]
16. Discuss the concept of perfect hashing and its application [CO4]

Module 4

17. Discuss the Bellman-Ford algorithm for finding single source shortest paths in a graph. [CO5]
18. Explain the concept of topological sorting and its application. [CO4]

Module 5

19. Discuss the push-relabel algorithm for finding maximum flow in a network. [CO4]
20. Explain the concept of backtracking and its application in solving the 8 Queens problem. [CO4]

Module 6

21. Compare and contrast the Knuth-Morris-Pratt algorithm and the Boyer-Moore algorithm for string matching. [CO7]
22. Discuss the application of dynamic programming in solving the matrix chain multiplication problem [CO7]

MCA MODEL QUESTION PAPER
MCA-DE-522: MACHINE LEARNING
(2024 Scheme)

Time : 3 Hours

Max. Marks : 100

PART A

(Answer all questions. Each question carries 4 marks.)

1. Provide two examples of machine learning applications in real-world scenarios. [CO1]
2. Discuss the concept of overfitting and underfitting in machine learning Model. [CO1]
3. Define classification and regression in the context of supervised learning. [CO2]
4. Discuss the advantages and disadvantages of using decision trees for classification tasks. [CO6]
5. Compare and contrast the 1R and RIPPER algorithms for rule-based classification. [CO6]
6. Discuss the concept of separate and conquer in the context of classification rules. [CO2]
7. Discuss the differences between k-Means and Agglomerative clustering algorithms. [CO3]
8. Discuss different types of preprocessing techniques commonly used in machine learning. [CO3]
9. Discuss the Q-Learning algorithm and how it is used to learn optimal Policies. [CO2]
10. Describe the process of training a deep learning model using backpropagation. [CO2]

PART B

Answer any ONE questions from each module. Each question carries 10 marks.

Module 1

11. Discuss the ethical considerations surrounding the use of machine learning technologies in decision-making processes. [CO1]
12. Explain the concept of bias and fairness in machine learning algorithms and provide strategies to mitigate them. [CO1]

Module 2

13. Compare and contrast linear regression and logistic regression algorithms. Provide examples of scenarios where each algorithm is suitable. [CO6]
14. Design a supervised learning model to predict customer churn in a telecommunications company using the Random Forest algorithm. Discuss the steps involved in model training and evaluation. [CO4]

Module 3

15. Implement the 1R algorithm to classify a given dataset and evaluate its performance using appropriate metrics. [CO6]
16. Discuss the advantages and limitations of using decision trees for classification tasks. [CO6]

Module 4

17. Apply principal component analysis (PCA) to reduce the dimensionality of a dataset and visualize the results. Discuss the implications of dimensionality reduction on model performance. [CO4]
18. Implement the k-Means clustering algorithm to segment customers based on their purchasing behaviour. [CO3]

Module 5

19. Design a reinforcement learning agent to play the game of Tic-Tac-Toe. Discuss the choice of state representation, action selection, and reward structure. [CO4]
20. Explain the concept of exploration-exploitation tradeoff in reinforcement learning and its impact on agent performance. Provide examples of exploration strategies used in practice. [CO2]

Module 6

21. Implement a convolutional neural network (CNN) to classify images from the CIFAR-10 dataset. Evaluate the model's performance and discuss strategies for improving classification accuracy [CO5]
22. Discuss the challenges associated with training deep learning models, such as vanishing gradients and overfitting. Propose techniques to address these challenges and improve model generalization. [CO1]

MCA MODEL QUESTION PAPER
MCA-CC-524: PYTHON PROGRAMMING
 (2024 Scheme)

Time : 3 Hours

Max. Marks : 100

PART A*(Answer all questions. Each question carries 4 marks.)*

1. Explain type conversion in Python. [CO1]
2. Discuss the concept of mutable and immutable objects in Python, and provide examples for each. [CO1]
3. Discuss the use of two-dimensional lists in Python. Provide examples of iterating through two-dimensional lists. [CO2]
4. Explain character encoding and how strings are handled in Python [CO1]
5. Define a class in Python and explain the concept of constructors. Provide an example demonstrating the use of constructors [CO2]
6. Explain the concept of operator overloading in Python [CO1]
7. Explain the significance of Toplevel Widgets and Frames in Tkinter. Provide examples of event-based Tkinter widgets [CO4]
8. Provide an introduction to Python modules [CO5]
9. Explain the concept of pattern matching using regular expressions in Python [CO7]
10. Explain the basics of plotting in Matplotlib, including ticks, labels, and legends [CO6]

PART B*(Answer any ONE questions from each module. Each question carries 10 marks.)***Module 1**

11. Explain the features of Python, highlighting its advantages over other programming languages. [CO1]
12. Explain Python Data Types with examples. [CO1]

Module 2

13. Discuss the different ways of passing parameters in Python functions [CO2]
14. Explain the different types of exception handling in Python. Provide examples of using Try & Except blocks and user-defined exceptions [CO3]

Module 3

15. Explain the concepts of packages and how they contribute to organizing and managing large Python projects effectively. [CO5]
16. Discuss inheritance in Python with suitable examples [CO2]

Module 4

17. Discuss how menus are implemented using the menu widget in Tkinter [CO2]
18. Provide examples to demonstrate the creation of basic GUI applications using Tkinter and how to handle user events effectively. [CO4]

Module 5

19. Discuss database programming in Python [CO7]
20. Explain different file operations in Python. [CO3]

Module 6

21. Discuss NumPy in Python, including the creation of arrays, reshaping, and various array operations [CO6]
22. Provide examples to illustrate how Matplotlib can be used to create informative and visually appealing plots in Python [CO1]

MCA MODEL QUESTION PAPER
MCA-DE-525(i): SOFTWARE TESTING
(2024 Scheme)

Time : 3 Hours

Max. Marks : 100

PART A

Answer all questions. Each question carries 4 marks.

1. What is the primary role of testers in a software development organization? [CO1]
2. Explain the differences between Fault, Error, and Bug? [CO1]
3. What is the purpose of acceptance testing in the software testing process? [CO2]
4. Briefly describe the role of testing tools in software development and testing methodologies. [CO2]
5. List out the basic principles of Black Box testing. [CO3]
6. What distinguishes White Box testing from Black Box testing? [CO3]
7. Define mutation testing and explain the concepts of mutation and mutants. [CO4]
8. What is mutation score in mutation testing? [CO4]
9. Write notes on the skills required for software test automation? [CO5]
10. List out the challenges commonly encountered in test automation? [CO5]

(10x4=40 Marks)

Part B

(Answer any one question from each module. Each question carries 10 Marks)

MODULE I

11. Discuss the significance of software testing principles in ensuring the quality of software products. [CO1]
12. Explain the differences between verification and validation in software testing. Discuss why both are essential components of the testing process. [CO1]

MODULE II

13. Discuss the significance of test planning and test strategy in ensuring the effectiveness of software testing. Provide examples of how a well-defined test plan and strategy contribute to successful software projects. [CO2]
14. Explain the process of building test data and test cases in software testing. [CO2]

MODULE III

15. Elaborate on the techniques of Boundary Value Analysis and Equivalence Class Partitioning. Provide examples to illustrate their application in test case design. [CO3]
16. Discuss the significance of Control Flow Graphs and Path coverage testing in ensuring code functional testing. [CO3]

MODULE IV

17. Discuss the significance of mutation operators in mutation testing. [CO4]
18. Explain each product/project test metrics in assessing the quality and effectiveness of testing efforts. [CO4]

MODULE V

19. Discuss the scope of test automation, including its benefits and limitations. [CO5]
20. Discuss key principles for implementing test automation, and explain how they contribute to the success of an automation framework. [CO5]

MODULE VI

21. Discuss various black-box testing approaches that can be implemented using JUnit [CO6]
22. Explain the concept of parameterized unit testing (PEX) and how it is implemented in JUnit. [CO6]

(10x6=60 Marks)

MCA MODEL QUESTION PAPER
MCA-DE-525(ii): BLOCKCHAIN TECHNOLOGY
(2024 Scheme)

Time : 3 Hours

Max. Marks : 100

PART A

Answer all questions. Each question carries 4 marks.

1. Write on the evolution of blockchain technology, highlighting key milestones in its development. [CO1]
2. Identify the technological components of the block chain. [CO1]
3. Define the consensus problem in the context of decentralised networks. [CO2]
4. Write on the significance of Nakamoto Consensus in the context of blockchain technology. [CO2]
5. What are the fundamental principles of cryptography and their significance in securing digital assets within blockchain systems. [CO3]
6. Identify the role of hashing in cryptographic protocols, particularly in the context of cryptocurrencies. [CO3]
7. Define and discuss the concept of forks in the context of blockchain, specifically in Bitcoin. [CO4]
8. Write the concept of smart contracts and their role in the Ethereum ecosystem. [CO4]
9. What is the role of the Ethereum Virtual Machine? [CO5]
10. What are the key features of Solidity and how it facilitates the creation of decentralised application? [CO5]

(10 x 4=40 Marks)

Part B

(Answer any ONE question from each module. Each question carries 10 marks).

MODULE I

11. Elaborate the applications of blockchain technology. [CO1]
12. Give a comparative analysis of private and public blockchain networks. [CO1]

MODULE II

13. Elaborate on Proof of Work as a random oracle in the context of blockchain. [CO2]
14. Discuss the advantages and potential challenges associated with hybrid models. [CO2]

MODULE III

15. Define signature schemes in the realm of cryptography and elaborate on their applications within cryptocurrency systems. Discuss how signature schemes contribute to transaction verification and authentication in blockchain networks. [CO3]
16. Explain the principles of Elliptic Curve Cryptography and its significance in the realm of cryptocurrency. [CO3]

MODULE IV

17. Discuss the concept of mining in the Bitcoin network, emphasising the hardness of mining. [CO4]
18. Explain the role of the Ethereum Virtual Machine (EVM) in the execution of smart contracts. [CO4]

MODULE V

19. Provide an overview of Zero Knowledge Proofs (ZKPs) and their applications in blockchain. Discuss how ZKPs contribute to enhancing privacy and security in decentralised systems. [CO5]
20. Explain the concept of Succinct Non-Interactive Argument for Knowledge (SNARK) and its role in blockchain technology. Discuss a practical application scenario where SNARK can be employed to enhance privacy and efficiency in blockchain systems. [CO5]

MODULE VI

21. Write a comprehensive overview of Zero Knowledge Proofs and their applications in Blockchain. [CO6]
22. Discuss the cryptographic techniques employed by Zcash to achieve transaction privacy and anonymity. Compare the privacy features of Zcash with other privacy-focused cryptocurrencies. [CO6]

(10x6=60 Marks)

MCA MODEL QUESTION PAPER
MCA-DE-525(iii): BIOINFORMATICS
(2024 Scheme)

Time : 3 Hours

Max. Marks : 100

PART A

Answer all questions. Each question carries 4 marks.

1. Discuss the characteristics of life and explain the levels of biological organization. How is the cell considered the basic unit of life? [CO1]
2. Write the primary and secondary structures of DNA. [CO1]
3. Write the history of bioinformatics and differentiate between bioinformatics and computational biology. [CO1]
4. Briefly write the characteristics of biological data and discuss the file formats commonly used in bioinformatics. Explain the importance of genome browsers in bioinformatics research. [CO2]
5. Write the significance of open reading frames (ORFs) and palindromes in DNA sequences. [CO3]
6. Compare and contrast the sequence analysis of DNA and RNA using the FASTA format. Discuss the relevance of sequence alignment in bioinformatics research. [CO3]
7. Classify the different types of protein sequence alignments. [CO4]
8. Compare and contrast the pairwise alignment method with multiple analyses of protein structures. Provide examples to illustrate their applications in bioinformatics. [CO6]
9. Differentiate between primary nucleotide sequence databases and secondary nucleotide sequence databases. Discuss their respective roles in bioinformatics research. [CO5]
10. Write short notes on Computer Aided Drug Design. [CO7]

(10 x 4=40 Marks)

Part B

(Answer any one question from each module. Each question carries 10 marks).

Module I

11. Explore the impact of the cell theory on our understanding of life. Discuss the structural differences between prokaryotic and eukaryotic cells, highlighting their respective functions in living organisms. [CO1]
12. Investigate the role of genetic information and genes in shaping the diversity of life. Elaborate on the structural organization of DNA, emphasizing how variations in different forms of DNA contribute to the complexity of genetic codes. [CO1]

Module II

13. Examine the evolution of bioinformatics and computational biology, emphasizing their unique contributions to the field of life science. Evaluate the goals and significance of bioinformatics analysis in advancing our understanding of biological systems. [CO1]
14. Provide an in-depth exploration of the technical toolbox used in bioinformatics research. Discuss the characteristics of biological data and the challenges associated with file formats, emphasizing the importance of data retrieval systems and genome browsers. [CO1]

Module III

15. Delve into the significance of IUPAC codes in analyzing DNA sequences. Explore the complexities of open reading frames (ORFs) and palindromes, discussing how these elements contribute to our understanding of genetic information. [CO2]
16. Write an essay on the role of sequence analysis in understanding DNA and RNA structures. Evaluate the applications of the FASTA format, emphasizing the importance of sequence alignment in deciphering the genetic code. [CO2]

Module IV

17. Critically analyze the role of scoring matrices such as PAM and BLOSUM in protein sequence alignments. Discuss how these matrices contribute to our understanding of evolutionary relationships and functional similarities among proteins. [CO4]
18. Explain pair wise alignment methods and multiple analyses of protein structures in bioinformatics. [CO4]

Module V

19. Assess the impact of primary nucleotide sequence databases on bioinformatics research. Discuss the challenges and opportunities associated with managing vast amounts of biological data in these databases. [CO5]
20. Explain about Protein Structure databases. [CO5]

Module VI

21. Write the significance of the Human Genome Project in advancing bioinformatics [CO7]
22. Explain the importance of Perl language in Bioinformatics. [CO7]

MCA MODEL QUESTION PAPER
MCA-DE-525(iv): SOCIAL NETWORK ANALYSIS
 (2024 Scheme)

Time : 3 Hours

Max. Marks : 100

PART A**Answer all questions. Each question carries 4 marks.***(Answer all questions. All questions carry 4 marks)*

23. State the characters and features of Social Network analysis. [CO1]
24. List some applications of Social Network Analysis. [CO1]
25. What is Semantic Web, and how does it differ from traditional World Wide Web? [CO2]
26. List the components of ontologies. [CO2]
27. What is transitivity and reciprocity in social media analytics? [CO3]
28. What is network metrics? How do you calculate network metrics? [CO3]
29. Define clustering coefficient and how is it used in social network analysis? [CO4]
30. Write the difference between k-clans and k-plexes. [CO4]
31. Illustrate community structure in the context of SNA. [CO5]
32. Define the term betweenness. How will you calculate the betweenness of an edge? [CO5]

(4marks x 10 = 40 marks)**Part B***(Answer any ONE question from each module. Each question carries 10 marks).***MODULE I**

33. Explain in detail about the Electronic sources for network analysis. [CO1]
34. Explain the social network analysis process in Blogs and online communities and Personal networks. [CO1]

MODULE II

35. Discuss in detail about the limitations of the current web and the semantic solutions for each case with diagrams and examples? [CO2]
36. Explain in detail about the ontological representation of social individuals and relationship? [CO2]

MODULE III

37. Discuss the network structure in Social Network Analysis. [CO3]
38. Describe any four measures of centrality used in Social Network Analysis. [CO3]

MODULE IV

17. Explain the following metrics - Cliques, k-cores, k-clans and F-groups. [CO4]
18. Write short note on frequent patterns and network motifs. [CO4]

MODULE V

19. Define Graph partitioning. Explain any two methods of graph partitioning. [CO5]
20. What are affiliation networks? Explain how clustering is performed in networks. [CO5]

MODULE VI

21. What are various techniques used in DATA mining for SNA. [CO6]
22. Briefly explain the role played by SNA in web mining. [CO6]

(10marks x 6= 60 Marks)

MCA MODEL QUESTION PAPER
MCA-DE-525(iii): THEORY OF COMPUTATION
 (2024 Scheme)

Time : 3 Hours

Max. Marks : 100

PART A**Answer all questions. Each question carries 4 marks.**

1. What is a finite automaton? Differentiate between NFA and DFA. (CO 1)
 2. Describe in English the set denoted by the regular expression $(0+1)^*(00+11)(0+1)^*$. (CO 2)
 3. Define a regular expression? (CO 2)
 4. Construct a DFA which accepts the regular expression $L = (11 + 0)1^*0$ (CO 1)
 5. What is ambiguous grammar? Write an example. (CO 3)
 6. Let $n_y(s)$ represent the number of y's in the string s. Construct a CFG, that recognize the CFL: $L(G) = \{z \mid z \in (a + b)^*, |z| \geq 1 \text{ and } n_a(z) = n_b(z)\}$. (CO 3)
 7. Give an example of a production, which is left recursive? (CO 3)
 8. Write about the programming techniques in the Turing machine. (CO 5)
 9. Definition of Linear bound Automata. (CO 4)
 10. Differentiate recursive and recursively enumerable languages. (CO 6)
- (4 * 10 = 40 marks)

Part B*(Answer any ONE question from each module. Each question carries 10 marks)***Module I**

11. Explain the conversion of NFA to DFA with an example. (CO 1)
12. Explain minimization of DFA. (CO 1)

Module II

13. Discuss the algebraic laws of regular expression. (CO 2)
14. Find the regular expression for the following subsets of $\{0, 1\}^*$
 - (a) The language of all strings containing the substring 000.
 - (b) The language of all strings that do not contain the substring 110.
 - (c) The language of all strings containing both 101 and 010 as substrings. (CO 2)

Module III

15. (a) Design PDA that accepts an $\{w \# w^R \mid w \in (0,1)^*\}$
- (b) Design PDA for the language $\{a^n b^{3n} \mid n \geq 1\}$ (CO 3)
16. Prove that, CFL's are in general not closed under complementation. (CO 3)

Module IV

17. How powerful are LBA? What do they capture? (CO 4)
18. Discuss on the design of a Linear bound automata with architecture. (CO 4)

Module V

19. Explain about the general definition and architectural components of Turing machines. (CO 5)
20. Design a Turing Machine which computes the 2's complement of binary numbers. (CO 5)

Module VI

21. Describe complexity theory. Discuss briefly about NP Hard and NP complete problems. (CO 6)
22. Discuss about the halting problems about Turing Machines? Why it is undecidable. (CO 6)

(10 * 6 = 60marks)

MCA MODEL QUESTION PAPER
MCA-CC-527: MACHINE LEARNING LABORATORY

Time : 3 hrs

Max Marks: 100

1. Write a python program that ask the user to enter a string and return a dictionary whose keys are the characters in the string entered and values are number of occurrences of each character in the string.
2. Apply Knn classifier on diabetes dataset
 - a) calculate test and train accuracy of the model
 - b) Plot the accuracies on a chart

Semester 3

Course Code:MCA-CC- 531

Credits: 3

ADVANCED COMPUTER NETWORKS

Preamble: In today's interconnected world, understanding the fundamentals of computer networks is essential for anyone seeking to navigate the complexities of modern communication systems. This comprehensive course aims to provide students with a solid foundation in network concepts, protocols, and technologies. From the basics of network hardware and software to advanced topics like Software Defined Networking (SDN) and Internet Security, this syllabus covers a wide range of essential knowledge and skills. Through a combination of theoretical learning and practical exercises, students will gain the expertise needed to design, implement, and troubleshoot robust network infrastructures.

Prerequisite: Basic computer networks, Web Technology

COURSE OUTCOMES & TAGGING

Course Outcomes	PO	PSO	CL	KC
CO1 Explain the uses and applications of computer networks in mobile networks, RFID, Sensor networks and SDN	PO1	PSO1,PSO9	U, Ap	C, P
CO2 Analyse the properties of internet and the role of protocol and standards in its functioning.	PO2	PSO1	U An	C
CO3 Analyse the various formats of IP and error reporting and error correction methods.	PO3	PSO4	U An	C,P
CO4 Explain the reliability mechanisms of TCP including connection, acknowledgements, and retransmission and sliding window paradigm.	PO4	PSO6	U	C,P
CO5 Describe routing protocols and analyse VPN, NAT and DNS.	PO5	PSO1PSO4	U	C,P
CO6 Analyse various security mechanisms in layers.	PO3	PSO2PSO4	U, An	C, P
CO7 Identify the applications of Intent-Based Networking in real-world scenarios.	PO12	PSO4PSO7	U, Ap	C, P

(CL- Cognitive Level: R-remember, U-understand, Ap- Apply, An-Analyse, E- Evaluate, Cr- Create, KC - Knowledge Category: F- Factual, C- Conceptual, P-Procedural, M- Metacognitive)

COURSE CONTENT

MODULE I

Introduction: Uses of computer networks, Network hardware, Network Software. Reference model: The OSI Reference Model, Software Defined Network (SDN): Architecture, Advantages, and Disadvantages. The Internet, Third, Fourth and Fifth Generation Mobile Phone Networks, Wireless LANs, RFID and Sensor Networks.

MODULE II

Internetworking Concepts: Application-Level Interconnection, Network-Level Interconnection, Properties of the Internet, Protocols and standards, Internet Architecture, Interconnection through IP routers. Internet addressing: IPv4 Classful Addressing and Classless Addressing Scheme, The IPv6 Addressing Scheme, ARP and RARP.

MODULE III

Internet Protocol: Purpose And Importance, Header format IPv4 and IPv6, Transmission across a single Network, The IP Forwarding Algorithm. The Internet Control Message Protocol, Error Reporting Vs. Error Correction, Testing destination reachability and status (Ping), Checksum computation.

MODULE IV

User Datagram Protocol (UDP), UDP Encapsulation and protocol layering. Reliable Stream Transport Service (TCP): Reliability, Acknowledgements and retransmission, The Sliding Window Paradigm, The Transmission Control Protocol, TCP Segment Format, Establishing and closing a TCP Connection, TCP State Machine, Silly Window Syndrome.

MODULE V

Routing: Automatic Route Propagation, Distance-Vector (Bellman-Ford) Routing, Routing Protocols (BGP, RIP, and OSPF). Network Virtualization: VPNs, NATs. Domain Name System (DNS), Mapping Domain Names to Addresses.

MODULE VI

Internet Security and Firewall Design IPsec: AH header, ESP header and trailer only. SSL: Services, Record Protocol, ChangeCipherSpec Protocol, Alert Protocol, Record Protocol. Intent-Based networking (IBN): Working, Advantages, Disadvantages, Applications.

LEARNING RESOURCES

References

- Computer Networks – Andrew S.Tanenbaum, David J.Pearson
- Internetworking with TCP/IP – Douglas E Comer,Pearson
- Computer Networks – A Systems Approach – Larry L.Peterson and Bruce S.Davie,Morgan Kaufmann
- Mobile Communications – Jochen Schiiler, Pearson
- TCP/IP Protocol Suite –Behrouz A.Forouzan,McGraw Hill
- www.geeksforgeeks.org

Semester 3

Course Code: MCA-CC-532

Credits: 3

SMART APPLICATION DEVELOPMENT

Preamble: Smart Application Development is a comprehensive exploration of Android application development. This course provides students with the theoretical foundations and practical skills needed to navigate the Android platform efficiently. Through a structured module approach, students will progress from understanding the basics to designing and creating their own Android applications.

Prerequisite: Basic programming concepts and a fundamental understanding of software development principles.

COURSE OUTCOMES & TAGGING

Course	Outcomes	PO	PSO	CL	KC
CO1	Understand the Android development environment.	PO1	PSO7,PSO9	U	C, P
CO2	Identify the basic concepts in App development.	PO1	PSO7	U	C
CO3	Critically evaluate mobile applications on their design aspects	PO3	PSO11	U	C
CO4	Develop a simple mobile application.	PO4	PSO7,PSO5	U	C,P
CO5	Design a user interface using the Android framework.	PO3	PSO7	U	C,P
CO6	Implement advanced features in Android applications.	PO5	PSO5	U, An	C, P
CO7	Understand the principles of testing and deploying Android applications.	PO2	PSO7	U	C, P
CO8	Familiarize with advanced features and various applications in Android development.	PO5	PSO9	U	C, P

(CL- Cognitive Level: R-remember, U-understand, Ap- Apply, An-Analyse, E- Evaluate, Cr- Create, KC - Knowledge Category: F- Factual, C- Conceptual, P-Procedural, M- Metacognitive)

COURSE CONTENT

MODULE I

Introduction to Android Basics: Overview of smart applications and their role in modern computing, Evolution of mobile computing, Introduction to mobile application frameworks (e.g., Android, iOS). User interface design for mobile applications, Mobile application development lifecycle, Overview of the Android platform and SDK, Eclipse installation and Android setup, Building the first Android application.

MODULE II

App Development Essentials: Anatomy of Android applications, Overview of the Android Manifest file Android terminologies and application context, Components: activities, services, and intents, Android Manifest file settings and permissions, utilizing intent filters and managing permissions.

MODULE III

UI Design Fundamentals: Introduction to user interface screen elements, designing user interfaces with layouts, drawing techniques and working with animation.

MODULE IV

Testing and Deployment: Principles of testing Android applications, Strategies for publishing Android applications, Utilizing Android preferences, managing application resources in a hierarchy, Working with different types of resources.

MODULE V

Common Android APIs: Using Android data and storage APIs, managing data using SQLite, sharing data between applications with content providers, Using Android networking APIs, Using Android web APIs, Using Android telephony APIs, Deploying Android applications to the world.

MODULE VI

Advanced Features and Case Studies: Exploring advanced features in Android applications, Introduction to cloud computing and services (e.g., AWS, Azure), Security and Privacy in Smart Applications, Principles of UX design for smart applications, Analysing case studies in Android application development.

LEARNING RESOURCES

References

- Lauren Darcey and Shane Conder, "Android Wireless Application Development," Pearson Education, 2nd ed. (2011).
- Reto Meier, "Professional Android 2 Application Development," Wiley India Pvt Ltd.
- Mark L Murphy, "Beginning Android," Wiley India Pvt Ltd.
- Barry Burd, "Android Application Development All in One for Dummies."
- Grant Allen and S. Ann McFadden, "Beginning Android 4 Application Development," Wiley.

Online Resources

- http://index-of.es/Android/Android_Application_Development_For_Dummies.pdf
- <https://developer.android.com/docs>

Semester 3

Course Code: MCA-CC-533

Credits:3

BIG DATA ANALYTICS

Preamble: The Big Data Analytics course, an exploration into the dynamic and transformative field of managing and analysing large-scale data sets. This course is designed to provide students with a comprehensive understanding of Big Data concepts, technologies, and applications. The syllabus is structured into six modules, each delving into specific aspects of Big Data Analytics.

Prerequisite: Basic Understanding of Information Technology, Proficiency in Data Concepts, Statistical and Mathematical Foundations, Programming Skills, Database Management, Understanding of Business Intelligence

COURSE OUTCOMES & TAGGING

Course Outcomes	PO	PSO	CL	KC
CO1 Define Big Data and comprehend its characteristics.	PO1	PSO1, PSO2 PSO5	U	C
CO2 Identify the goals, retrieve, prepare, explore, model data, and present findings in the Data Science process.	PO2	PSO1, PSO4 PSO6	Ap	P
CO3 Classify analytics, understand the analytics life cycle, and identify the benefits of Big Data Analytics.	PO1	PSO1, PSO2	Ap	C
CO4 Introduce data visualization concepts and tools. Create an interactive dashboard with dc.js.	PO3	PSO4	Ap	P
CO5 Explore features, advantages, and components of Hadoop. Compare Hadoop with SQL and RDBMS.	PO4	PSO2, PSO5	U	C
CO6 Understand the CAP Theorem and the BASE Concept. Introduce NoSQL databases and compare SQL, NoSQL, and NewSQL.	PO7	PSO5, PSO8	U	C

(CL- Cognitive Level: R-remember, U-understand, Ap- Apply, An-Analyse, E- Evaluate, Cr- Create, KC - Knowledge Category: F- Factual, C- Conceptual, P-Procedural, M- Metacognitive)

COURSE CONTENT

MODULE I

Introduction to Big Data: Definition – Characteristics. Architecture of Big Data - Challenges with Big Data - 3Vs of Big Data - Non-Definitional traits of Big Data - Business Intelligence vs. Big Data, Data Warehouse: Definition, Types, Characteristics.

MODULE II

Data Science Process: Overview- Defining goals- Retrieving data – Data preparation – Data exploration – Data modeling – Presentation. Data Science Ethics. Data Ownership, Doing good Data Science. Future Trends. Data Scientist-Qualities of Data Scientist

MODULE III

Big Data Analytics: Classification of analytics, Life cycle, Benefits. Five C's, Data Science Vs Data Analytics. Valuing different aspects of privacy - Getting informed consent.

MODULE IV

Introduction to data visualization – Data visualization options – Filters –MapReduce – Dashboard development tools – Creating an interactive dashboard with dc.js summary.



MODULE V

Introduction to Hadoop: Features - Advantages - Versions - Hadoop Components - Architecture - HDFS - Hadoop vs. SQL - RDBMS vs. Hadoop - Hive- Pig

MODULE VI

Terminologies in Big Data - CAP Theorem - BASE Concept. NoSQL: Types of Databases - Advantages - NewSQL - SQL vs. NOSQL vs NewSQL.

LEARNING RESOURCES

References

- "Big Data: A Revolution That Will Transform How We Live, Work, and Think" by Viktor Mayer-Schönberger and Kenneth Cukier.
- "Hadoop: The Definitive Guide" by Tom White.
- "Data Science for Business" by Foster Provost and Tom Fawcett.
- "Big Data Analytics: Turning Big Data into Big Money" by Frank Ohlhorst.
- "Data Analytics Made Accessible" by Anil Maheshwari.
- "Hadoop Operations" by Eric Sammer.
- "NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence" by Martin Fowler and Pramod J. Sadalage.

Online Resources

- Understanding Big Data: What Is It And Why It Matters
- Challenges in Big Data Analytics
- The Data Science Process
- Ethics in Data Science
- Benefits of Big Data Analytics
- Introduction to Data Visualization
- Understanding the CAP Theorem
- Overview of NoSQL Databases

Semester 3

Course Code: MCA-CC-536

Credits: 2

MINI PROJECT

Preamble: This course aims to equip students with advanced technical skills and methodologies essential for conducting Mini project work. Students will learn to identify pertinent research problems, critically evaluate existing literature, implement established methodologies, analyze system limitations, propose innovative method improvements, evaluate experimental results, and help this work for their final dissertation work.

Prerequisite: Research Methodology, Critical Thinking Skills, Literature Review Skills, Academic Writing Skills, Proficiency in Information Retrieval, Time management skill.

COURSE OUTCOMES & TAGGING

Course Outcomes	PO	PSO	CL	KC
CO1 Identify a problem statement for the project work.	PO2	PSO1	U	C, P
CO2 Perform literature review by analyzing the related works.	PO2	PSO1, PSO3	U An	C
CO3 Implement the existing work from the literature.	PO3	PSO4	U Ap	C, P
CO4 Analyze the existing system capture the limitations	PO2, PO4	PSO1, PSO6	U	C, P
CO5 Propose a method improvement to overcome the limitations.	PO7	PSO3, PSO4	U, Ap	C, P
CO6 Evaluate and interpret the design and experimental results.	PO8	PSO2, PSO9	Ap	C, P
CO7 Develop the skill set to write project report.	PO12	PSO4, PSO9	Ap	C, P

(CL- Cognitive Level: R-remember, U-understand, Ap- Apply, An-Analyse, E- Evaluate, Cr- Create, KC - Knowledge Category: F- Factual, C- Conceptual, P-Procedural, M- Metacognitive)

COURSE CONTENT

The students can do individually or a group of maximum 4 students under the guidance of a faculty member and prepares a comprehensive mini project report after completing the work to the satisfaction. The progress of the project is evaluated based on a minimum of two reviews. The review committee may be constituted by the Head of the Department. A mini project report is required at the end of the semester.

The mini project work is evaluated based on oral presentation and implementation and the mini project report jointly by external and internal examiners.

1. The work shall give enough opportunity for the students to apply some of the skills and knowledge earned through the theory courses.

2. The student shall get an exposure in developing industry type applications/utility software for computer systems or mobile devices/in studying and analyzing theoretical concepts and presenting a comparative analysis of state-of-the-art techniques/in developing new or improved algorithms/in the use of soft computing techniques in selected area/discipline. On Completion of the mini project work students will be in a position to take up their final year project work and find solution by formulating proper methodology.

The students need to do the following activities:

1. The candidate shall submit a proposal for different topics before the assessment team.

The team shall select and finalize one of the proposals. The candidate shall prepare and

submit a synopsis of the accepted proposal. A record of the accepted synopsis of each candidate shall be maintained in the department.

2. A detailed study of the requirements and feasibility of the proposed work shall be conducted by the candidate with the help of the project guide. A study phase report shall be presented before the assessment team. The design of proposed work shall be completed and presented before the assessment team. The design shall be finalized with suggested corrections/updates.

3. The developed software/algorithm shall be implemented and demonstrated before the internal assessment team. A short presentation explaining the proposed work and experimental results shall also be made. The Project Report shall be finalized only after the internal presentation after correcting/updating the document based on the comments from internal assessment team.

4. All students need to attend a viva at the end of project work. All students will be evaluated by an expert on their knowledge on the basis of the project work. There will be evaluation of their professional development acquired by the project.

Semester 3

Course Code: MCA-CC-537

Credits: 2

APPLICATION DEVELOPMENT LABORATORY

Preamble: The Smart Application Development Laboratory is designed to equip students with practical skills in Android application development. The course spans from fundamental concepts to the creation of advanced mobile applications, leveraging the Android framework.

Prerequisite: Foundation in Java Programming, Basics of Mobile Application Development.

COURSE OUTCOMES & TAGGING

Course Outcomes	PO	PSO	CL	KC
CO1 Create a fundamental mobile application with a user-friendly interface.	PO2	PSO9, PSO4	Ap	C, P
CO2 Utilize the Android framework proficiently for developing diverse applications.	PO1	PSO4	Ap	C, P
CO3 Demonstrate expertise in UI design principles for mobile applications.	PO3	PSO7, PSO9	Ap	C, P
CO4 Identify, integrate, and manipulate various components within the Android application development environment.	PO4	PSO9, PSO12	Ap	C, P
CO5 Implement socket programming techniques to establish connections from mobile devices.	PO5	PSO4, PSO7	Ap	C, P
CO6 Design and develop advanced mobile applications tailored to specific requirements.	PO2	PSO9	Ap	C, P
CO7 Apply analytical and problem-solving skills in mobile app development.	PO4	PSO9, PSO12	Ap	C, P
CO8 Incorporate security measures and best practices in mobile app development.	PO3	PSO9, PSO12	Ap	C, P

(CL- Cognitive Level: R-remember, U-understand, Ap- Apply, An-Analyse, E- Evaluate, Cr- Create, KC - Knowledge Category: F-Factual, C- Conceptual, P-Procedural, M- Metacognitive)

COURSE CONTENT

It is advised to complete the problems to be given under the following cycle. There may be a set of experiments in each cycle, and all cycles are mandatory. The faculty in charge will give the list of exercises as and when you have completed the minimum experiments in each cycle. The students can suggest new and innovative exercises in the second cycle, provided it can be implemented with the available lab infrastructure.

Mobile App Development Cycle:

First application: Creating Android Project, Android Virtual Device Creation, Set up debugging environment, Workspace set up for development, Launching emulator, debugging on mobile devices.

Android Java Basics: Getting started with Android development, project folder structure, simple programming, running project, generating build/APK of the app from Android Studio.

Basic UI design: Basics about Views, Layouts, Drawable Resources, Input controls, Input Events, Toasts.

More UI Components: Layouts - GridView and ListView, Action bar, Adapters, Menus: Option menu, context menu, sub-menu, Pickers - Date and Time, Spinners.

Activity and Fragment: Activity, Fragment, Activity Lifecycle, and Fragment Lifecycle.



Intents: Implicit Intents, Explicit intents, communicating data among Activities.

Navigation Drawer: Panel that displays the app's main navigation screens on the left edge of the screen.

Android Notifications - Toast, Dialogs (TimePicker, DatePicker, Progress, Alert), Notification Manager, and Push Notification.

Write a sample program to show how to make a SOCKET Connection from a Mobile phone.

LEARNING RESOURCES

References

- Lauren Darcey and Shane Conder, "Android Wireless Application Development," Pearson Education, 2nd ed. (2011).
- Reto Meier, "Professional Android 2 Application Development," Wiley India Pvt Ltd.
- Mark L Murphy, "Beginning Android," Wiley India Pvt Ltd.
- Barry Burd, "Android Application Development All in One for Dummies."
- Grant Allen and S. Ann McFadden, "Beginning Android 4 Application Development," Wiley.

Online Resources

- http://index-of.es/Android/Android_Application_Development_For_Dummies.pdf
- <https://developer.android.com/docs>

Semester: 3

Course Code: MCA-CC-538

Credits: 2

CASE STUDY

Preamble: The objective of doing Case Study allows students with real expertise and understanding, how and why an innovation has worked in a specific case.

Prerequisite: Nil.

COURSE OUTCOMES & TAGGING

Course Outcomes	PO	PSO	CL	KC
CO1 Identify a research problem which is significant in the area of computer science	PO1	PSO1	U	F
CO2 Analyze the literature survey in the selected topic as an individual	PO2	PSO2, PSO12	An	C,F
CO3 Design the experiment with proper hypothesis	PO4	PSO9	Ap	C,F
CO4 Evaluate and interpret the experimental results	PO5	PSO6, PSO12	An	F
CO5 Analyze effectiveness of the method implemented	PO3	PSO1	Ap	C
CO6 Suggest modifications and improvement of the system	PO4	PSO2	Ap	M,C

(CL- Cognitive Level: R-remember, U-understand, Ap- Apply, An-Analyse, E- Evaluate, Cr- Create, KC - Knowledge Category: F- Factual, C- Conceptual, P-Procedural, M- Metacognitive)

COURSE CONTENT

A case study is a detailed investigation done by a student on a specific topic in the courses studied till Semester III. It is a milestone and precursor to the final presentation of the Project. The students must implement a published article from the Research and Development area. The presentation will be oral. A faculty member is assigned by the Department council for each student to select the case. The case study report should contain the case's background, analysis, alternatives, recommendations, and implementation plan. Students can use the presentation aids to deliver the theoretical aspects of the work. The interaction with the audience, students, and faculty is beneficial for the student to strengthen the different aspects of the presentation, such as presentation skill, depth of knowledge, language and rendering, and defending the questions.

ASSESSMENT

Continuous interaction and Discussion with guide: 20 marks

Continuous interaction and work progress will lead to a valuable contribution to the final project work.

Case study Report: 30 marks

A technical report on studies and experiments will improve your technical writing skill.

Presentation and Viva: 50 marks

The presentation skills of the students are evaluated systematically.

Semester: 3

Course Code: CCS-CC-539

Credits: 2

MASSIVE ONLINE OPEN COURSE (MOOC)

Preamble: MOOCs enable access to quality education for as many students as possible and contribute to the continuous education of various social groups. MOOCs can be addressed to the unemployed, helping them develop skills needed for employability.

Prerequisite: Nil.

COURSE CONTENT

Massive Open Online Courses (MOOCs) are free online courses for anyone to enroll. MOOCs provide an affordable and flexible way to learn new skills, advance your career and deliver quality educational experiences at scale. Millions of people worldwide use MOOCs to learn for various reasons, including career development, changing careers, college preparations, supplemental learning, lifelong learning, corporate eLearning and training, and more. For instance, SWAYAM or Coursera provides an integrated platform for online courses, using information and communication technology (ICT) and covering courses for post-graduate subjects, including skill sector courses, to ensure that every student benefits from learning material through ICT.

The Department Council will announce the sources of MOOC at the time of the semester beginning. Students can choose their course from MOOC as per their choice and inform the course coordinator before they join. Each student must submit a report on what MOOC has completed during their MCA programme to complete their Semester III.

LEARNING RESOURCES

Online Resources

- https://www.ugc.gov.in/pdfnews/8449573_Intruction-Manual.pdf

Semester 3

Course Code: MCA-DE-534 (i)

Credits: 3

CLOUD COMPUTING

Preamble: Through a concise and engaging curriculum, students gain a comprehensive understanding of cloud computing's core principles, evolution, and its impact on various industries. Through this course student will be able to understand service and deployment models, empowering you to make informed decisions for your specific needs. Security is paramount, and this course explore robust practices to secure the data and applications in the cloud. Cloud service providers - AWS, Azure, and Google Cloud - providing valuable insights to select the platform that best aligns with student's professional goals. Furthermore, course gives the emerging realm of mobile cloud computing and the possibilities it presents for the future.

Prerequisite: Basic computer science, Operating system experience, Familiarity with programming

COURSE OUTCOME AND TAGGING

Course Outcome	PO	PSO	CL	KC
CO1 Understanding the Foundations of Cloud Computing	PO1	PSO2	R,U	F
CO2 Identify Factors Influencing Cloud Service Adoption	PO2	PSO3	U	F
CO3 Evaluate Cloud Deployment and Service Models	PO3	PSO2	E	C
CO4 Analysing and Evaluating Popular Cloud Service Providers	PO2	PSO2	A	C
CO5 Identifying Virtualization Techniques	PO3	PSO4	U,A	F
CO6 Evaluating Security Concerns in Cloud Computing	PO3	PSO2	E	C
CO7 Understanding Practical Cloud-based Solutions	PO5	PSO4	U	F

(CL- Cognitive Level: R-remember, U-understand, Ap- Apply, An-Analyse, E- Evaluate, Cr- Create, KC - Knowledge Category: F- Factual, C- Conceptual, P-Procedural, M- Metacognitive)

COURSE CONTENT

MODULE I

Introduction to Cloud Computing: Limitations of the Traditional Computing Approaches - Three Layers of Computing - Three Layers in Traditional Computing- The Evolution of Cloud Computing -Influences behind Cloud Service adoption - Comparison between Cluster, Grid and Cloud Computing- Benefits of cloud computing

MODULE II

Cloud Computing: Network as Computer - Role of Web Service - Role of API - Standard Cloud Model - Deployment and Service Models- Essential Characteristics-Choosing the Appropriate Deployment Model-The Actors and Their Roles-Cloud Deployment Models.

MODULE III

Service Delivery Models: Infrastructure Service -Platform Service - Software Application Service-PaaS-IaaS Integration -A Traditional System Vs Cloud System Model-ASP Model - SaaS Model- Other Cloud Services.

MODULE IV

Resource Virtualization: Virtualizing Physical Computing Resources - Understanding Abstraction - Business Benefits of Virtualization - Machine or Server Level Virtualization - Hypervisor-Based Virtualization Approaches- Operating System Level Virtualization- Introduction to MapReduce, GFS, HDFS, Hadoop Framework.

MODULE V

The Security Concern in Cloud: Elements Of Cloud Security Model- Cloud Security Reference Model-The Cloud Cube Model- Collaborating Using Cloud Services: Email Communication over the Cloud - CRM Management - Project Management-Event Management - Task Management - Calendar - Schedules - Word Processing - Presentation - Spreadsheet - Databases.

MODULE VI

Popular Cloud Services: Amazon Web Services - Microsoft Azure - Google Cloud - A Comparison among AWS, Azure and Google Cloud- Mobile Cloud Computing - Introduction to The Internet of Things.

LEARNING RESOURCES

Reference

- Sandeep Bhowmik, Cloud Computing, Cambridge University Press
- Dan C. Marinescu , Cloud Computing Theory and Practice, Elsevier Inc
- Anthony T. Velte, Toby J. Velte, Robert Elsenpeter, Cloud Computing "A Practical Approach" McGraw-Hill.
- John W.Rittinghouse and James F.Ransome, "Cloud Computing: Implementation, Management, and Security", CRC Press, 2010.
- Toby Velte, Anthony Velte, Robert Elsenpeter, "Cloud Computing, A Practical Approach", TMH, 2009.
- Kumar Saurabh, " Cloud Computing - insights into New -Era Infrastructure", Wiley India,2011.
- Anthony T. Velte, Toby J. Velte, Robert Elsenpeter, Cloud Computing "A Practical Approach" McGraw-Hill.
- Lovely Professional University, Cloud Computing, Excel Book Private Ltd.
- Ronald L. Krutz, Russell Dean Vines, "Cloud Security - A comprehensive Guide to Secure Cloud Computing", Wiley - India, 2010.
- Kai Hwang, Geoffrey C Fox, Jack G Dongarra, "Distributed and Cloud Computing, From Parallel Processing to the Internet of Things", Morgan Kaufmann Publishers, 2012.
- John W.Rittinghouse and James F.Ransome, "Cloud Computing: Implementation, Management, and Security", CRC Press, 2010.
- Toby Velte, Anthony Velte, Robert Elsenpeter, "Cloud Computing, A Practical Approach", TMH, 2009.
- Kumar Saurabh, " Cloud Computing - insights into New -Era Infrastructure", Wiley India,2011.

Online Resources

- <https://cloud.google.com/learn/training>
- <https://cloudacademy.com/>
- <https://www.youtube.com/watch?v=-8O32k26RWA>

Semester 3

Course Code: MCA-DE-534(ii)

Credits: 3

MANAGEMENT INFORMATION SYSTEM

Preamble: In this course syllabus, explore Information Systems and Business Management. Students learn about new digital companies and how information systems help them achieve goals. Throughout the modules, course cover topics like business processes, computer programs for businesses, and how companies work. Syllabus also discuss about teamwork, keeping information safe, and new tech trends. By the end of the course, students understand how information systems shape modern businesses and how to use them effectively.

Prerequisites: Basic Understanding of Business Concepts, Proficiency in Computer Skills, Critical Thinking and Analytical Skills

COURSE OUTCOMES AND TAGGING

Course Outcome	PO	PSO	CL	KC
CO1 Understand the Business Objectives of Information Systems	PO1	PSO2	R,U	F
CO2 Analyze Dimensions and Levels in Information Systems	PO2	PSO3	U,A	C
CO3 Evaluate Enterprise Application Architecture and Collaboration Tools	PO3	PSO4	E	C
CO4 Apply Systems for Business Intelligence and Social Business Technologies	PO6	PSO3	U,A	C
CO5 Analyze the Impact of Information Systems on Organizational Structure	PO6	PSO4	A	F
CO6 Evaluate Ethical and Social Implications in Information Systems	PO6	PSO3	E,U	C
CO7 Understand security issues in MIS	PO1	PSO2	U	C

(CL- Cognitive Level: R-remember, U-understand, Ap- Apply, An-Analyse, E- Evaluate, Cr- Create, KC - Knowledge Category: F-Factual, C- Conceptual, P-Procedural, M- Metacognitive)

COURSE CONTENT

MODULE I

Information Systems and Business: Management Information Systems- The Emerging Digital Firm- Business Objectives Of Information Systems- Functions Of An Information System- Dimensions of Information Systems- Levels In A Firm- The Business Information Value Chain- Information Systems: Technical Approach Vs Behavioral Approach

MODULE II

Business Processes: Transaction Processing Systems- Systems for Business Intelligence- ENTERPRISE Application Architecture- E-business, E-commerce, and E-government- Collaboration- Social Business- Tools and Technologies for Collaboration and Social Business

MODULE III

Organizations, and Strategy: The Behavioral View of Organizations- Features of Organizations- Organizational Structure- impact of information systems on organizations- Porter's Competitive Forces Model- The Internet's Impact on Competitive Advantage- The Value Web.

MODULE IV

Ethical and Social Issues in Information Systems: The Dark Side of Big Data- Ethical, Social, and Political Issues- NORA Alerts- Ethical Analysis- Candidate Ethical Principles- Property Rights: Intellectual Property.



MODULE V

IT Infrastructure and Emerging Technologies: Defining IT Infrastructure- Evolution of IT Infrastructure - The IT Infrastructure Ecosystem- The Mobile Digital Platform- Software Outsourcing and Cloud Services - Green Computing

MODULE VI

Securing Information Systems: Security Challenges and Vulnerabilities- Malicious Software- Hackers and Computer Crime- Software Vulnerability- Legal and Regulatory Requirements for Electronic Records Management- Disaster Recovery Planning.

LEARNING RESOURCES

Reference

- Kenneth C. Laudon , Jane P. Laudon, Management Information Systems Managing the Digital Firm Fifteenth Edition, Pearson Education Limited
- Management Information Systems, C Laudon and Jane P. Laudon, et al, 9/e, PHI and Pearson
- 2. Stair, R. M. & Reynolds, G. W. (2001).
- Principles of Information Systems, 5e, Singapore: Thomson Learning.
- Management Information Systems, Gordon B. Davis & Margrethe H. Olson, Tata McGraw-Hill, 2006.
- Management Information Systems Text & Cases, W S Jawadekar, Tata McGraw-Hill , 2009
- Introduction to Information Systems, Rainer, Turban, Potter, WILEY-India, 2006.
- Management Information Systems, James A. O brein, Tata McGraw-Hill , 10/e, 2009.
- Management Information Systems, Dharminder and Sangeetha, 1/e, Excel books, 2006
- Cases in MIS, Mahapartra, PHI, 2009
- Management Information Systems, Text & Applications C.S.V. Murthy, Himalaya Publishing House.
- Management Information Systems, Cengage Learning India Pvt. Ltd, Delhi Oz,2008.
- Management Information Systems, Pearson Education, Noida McLeod, 2008
- Information Systems Project Management, Pearson Education, Noida- John McManus and Trevor Wood-Harper,2010.

Online resources

- <https://www.edx.org/learn/information-systems/universidad-carlos-iii-de-madrid-introduction-to-management-information-systems-mis-a-survival-guide>
- https://onlinecourses.nptel.ac.in/noc20_mg60/preview
- <https://archive.nptel.ac.in/courses/110/105/110105148/>

Semester 3

Course Code: MCA-DE-534 (iii)

Credits: 3

INTERNET OF THINGS

Preamble: This course serves as an introductory exploration into the fundamental concepts of IoT and its practical application. With a focus on understanding key IoT technologies and their real-world implications, course delve into topics such as smart devices, communication protocols, data analytics, and more. By examining case studies and hands-on examples, students will gain insights into the diverse applications of IoT, from sensor networks to smart manufacturing. Through this course, learners will develop a solid understanding of IoT principles, enabling them to navigate the dynamic landscape of connected devices and contribute to innovative IoT solutions.

Prerequisites: Data Communication, Computer Networks

COURSE OUTCOMES AND TAGGING

Course Outcome	PO	PSO	CL	KC
CO1 Understand the Conceptual Framework of IoT and Its Architectural View	PO1	PSO1	U	F
CO2 Explain the Technology Behind IoT, APIs, and Device Interfacing Components	PO2	PSO2	R,U	C
CO3 Understand the Role of Sensors and Actuators in IoT	PO1	PSO1	U,E	F
CO4 Explore Software-Defined Networks and IoT Communication Models	PO2	PSO2	U,E	C
CO5 Analyze IoT-Friendly Internet Protocols, Wireless Radio Technologies	PO2	PSO2	A	C
CO6 Understand Data Ingestion Technologies, Processing Models in IoT	PO3	PSO1	U,E	F
CO7 Explore Applications of AI, Cognitive IoT, Security Frameworks	PO6	PSO1	U	C

(CL- Cognitive Level: R-remember, U-understand, Ap- Apply, An-Analyse, E- Evaluate, Cr- Create, KC - Knowledge Category: F- Factual, C- Conceptual, P-Procedural, M- Metacognitive)

COURSE CONTENT

MODULE I

Internet of Things - Smart and Hyperconnected Devices- IoT Conceptual Framework- IOT Architectural View- Technology Behind IoT- APIs and Device Interfacing Components- Sources of IoT- Examples of IoT

MODULE II

IOT & Machine to Machine, Difference between IoT and M2M, Software defined Network; Technologies – Sensors Roles of sensors in IOT. Actuators- Role of actuators, Gateways, Local & Global Connectivity, Communication models & APIs

MODULE III

Communication Channels - IoT Friendly Internet Protocols- MQTT- CoAP - Connectivity Solutions- Wireless Radio Technology- IoT Wireless Radio Solutions- Long Range IoT Radio Solutions : LPWA - Medium Range IoT Radio Solutions: ZigBee - 802.15.4 Standard- Short Range IoT Radio Solutions: Bluetooth.

MODULE IV

Software- Data Ingestion Technology -Publish/Subscribe Model (MQTT) - Request/Report Model (CoAP) - Data Processing - Data Processing Technologies - Interfacing with other



Systems - Data Storage - Application - User Interface - Data Analytics - Real-time Communications - Data Visualization

MODULE V

Artificial Intelligence and Cognitive IoT- IoT of Robotic Things- Wearables- Smart Clothing- Industrial IoT and Smart Manufacturing- IoT Standardisation- IoT Security- IoT Security Framework

MODULE VI

Basic data analytics in IoT- Top-level cloud pipeline- Rules engines- Ingestion – streaming, processing- Complex event processing- Machine learning in IoT Comparison

LEARNING RESOURCES

References

- Raj Kamal, “Internet of Things Architecture and Design Principles”, Mcgraw Hill Education (India) Private Limited
- Kayla Little and Ron Pascuzzi, “A Reference Guide to the Internet of Things”, Bridgera LLC, First Edition
- Perry Lea, “Internet of Things for Architects”, Packt Publishing Ltd.
- Arshdeep Bahga and Vijay Madisetti , “Internet of Things: A Hands-on Approach “
- Jan Holler, Vlasios Tsiatsis, Catherine Mulligan, Stefan Avesand, Stamatis, Karnourkos, David Boyle ,”From Machine-to-Machine to the Internet of Things:
- Introduction to a New Age of Intelligence
- Rajkumar Buyya, Amir Vahid Dastjerdi, Internet of Things Principles and Paradigms
- Pethuru Raj and Anupama C. Raman, “The Internet of Things: Enabling Technologies, Platforms, and Use Cases”
- David Hanes, “ IoT Fundamentals: Networking Technologies, Protocols and Use Cases for the Internet of Things”, Cisco Press, Pearson

Online resources

- https://onlinecourses.nptel.ac.in/noc22_cs53/preview
- <https://archive.nptel.ac.in/courses/106/105/106105166/>
- <https://www.edx.org/learn/iot-internet-of-things>
- <https://innovationatwork.ieee.org/internet-of-things/>

Semester 3

Course code : MCA-DE-534 (iv)

Credits: 3

CYBER SECURITY AND CYBER LAW

Preamble: Objective of this course is to inculcate in students an awareness of cyber world. The student should realize the potential of technology in bringing in cyberlaws and cyber security. The course has been designed to give students an extensive overview of cyber security issues, tools and techniques critical in solving problems in cyber security domains. The course provides students with concepts of computer security, cryptography, digital money, secure protocols, detection and other security techniques. The course will help students understand essential techniques in protecting information systems, IT Infrastructure, analyzing and monitoring potential threats and attacks, devising security architecture and implementing security solutions.

Prerequisite: Knowledge in Internet and Computer Networking.

COURSE OUTCOMES & TAGGING

Course Outcome	PO	PSO	CL	KC
CO1 Understanding the security aspects in computing Profession and its vulnerabilities	PO1	PSO1	U	C
CO2 Understand the fundamentals of cyberspace,cyber security and threat landscape	PO1	PSO1	U	C
CO3 CO3 Analyze and evaluate the importance of personal data its privacy and security	PO2	PSO2	An	C
CO4 Identify the role of human in security systems with an emphasison ethics,social engineering vulnerabilities and training	PO6	PSO5	An	C
CO5 Evaluate the digital payment system security and remedial measures against digital payment frauds using modern cryptographic techniques	PO5	PSO4	E	P
CO6 Develop a deeper understanding and familiarity with various types of cyber-attacks,cybercrimes,vulnerabilities and remedies	PO6	PSO4	Ap	P
CO7 Apply different computer forensic tools to a given cybercrime scene and examine current practices to data recovery and acquisition	PO5	PSO6	U	C
CO8 Generalize the impact based on the Risk assessment, plan suitable security controls, audit and compliance in network security	PO10	PSO6	U	C

(CL- Cognitive Level: R-remember, U-understand, Ap- Apply, An-Analyse, E- Evaluate, Cr- Create,KC - Knowledge Category: F-Factual, C- Conceptual, P-Procedural, M- Metacognitive)

COURSE CONTENT**MODULE I**

Introduction to Computer Forensics: History of computer forensics, Developing computer forensics resources, Preparing for computer investigations, Understanding law enforcement agency investigations, corporate investigations, maintaining professional conduct, understanding computer investigations- preparing, taking a systematic approach, procedures for corporate high tech investigations, Understanding data recovery workstations and software, Conducting an investigation, completing the case, requirements for forensic lab certification, determining the physical requirements for a computer forensics lab, Selecting a basic forensic workstation, building a business case for developing a forensic lab

MODULE II

Data Acquisition: Storage formats for digital evidence, Determining the best acquisition method, contingency planning for image acquisitions, using acquisition tools, validating data



acquisitions, performing RAID data acquisitions, using remote network acquisition tools, using other forensic acquisition tools, processing crime and incident scene- identifying digital evidence, collecting evidence in private sector incident scenes, processing law enforcement crime scenes, preparing for a search, securing a computer incident or crime scene- seizing digital evidence at the scene, storing digital evidence

MODULE III

Working with windows and DOS systems-file systems: exploring Microsoft file structures, examining NTFS disks, whole disk encryption, the windows registry, Microsoft and Ms-DOS start up tasks, virtual machines

MODULE IV

Analysis and Validation: Determining what data to collect and analyze, validating forensic data, addressing data- hiding techniques, performing remote acquisitions. Recovering Graphics Files-Recognizing, locating and recovering graphic files, understanding data compression, copy rights issues with graphics, identifying unknown file formats, copy right issues with graphics. Network Forensics- overview, performing live acquisitions, developing standard procedures for network forensics, using network tools.

MODULE V

E-Mail investigations: Role of E-mail in investigations, exploring the roles of the client and server, investigating e-mail crimes and violations, understanding E-mail servers, specialized e-mail forensic tools. Report writing for high tech investigations- importance of reports, guidelines for writing, generating report findings with forensic software tools.

MODULE VI

Applications: The Concept of Cyberspace E-Commerce, The Contract Aspects in Cyber Law, The Security Aspect of Cyber Law, The Intellectual Property Aspect in Cyber Law, The Evidence Aspect in Cyber Law, The Criminal Aspect in Cyber Law, Global Trends in Cyber Law, Legal Framework for Electronic Data Interchange Law Relating to Electronic Banking, The Need for an Indian Cyber Law.

LEARNING RESOURCES

References

- Bill Nelson, Amelia Philips, Frank Enfinger, ChristoferSteuart' Guide to Computer Forensics and Investigations ', Second Indian Reprint 2009, Cengage Learning India Private Limited
- Eoghan Casey, 'Digital Evidence and Computer Crime' Edition 3, Academic Press,2011
- MarjieBritz,' Computer Forensics and Cyber Crime: An Introduction' Edition 2, Prentice Hall, 2008
- Talat Fatima, "Cyber Law in India", Wolters Kluwer, 2017
- Practical guide to Computer Forensics-David Benton and Frank Grindstaff, 2006, Book of Surge Publishing, 2006
- Christopher L.T Brown Charles,' Computer Evidence: Collection & Preservation '-, River Media publishing, Edition1, 2005
- Keith Jejune, Richard Bejtlich and Curtis W. Rose,' Real Digital Forensics 'Addison- Wesley publishers, 2005

Semester 3

Course Code: MCA-DE-534 (v)

Credits: 3

CRYPTOGRAPHY AND NETWORK SECURITY

Preamble: The course aims at providing students with concept of computer security, cryptography, digital money, secure protocols, detection and other security techniques.

Prerequisite: Computer Networks, Data Communication.

COURSE OUTCOMES & TAGGING

Course Outcome	PO	PSO	CL	KC
CO1 Create awareness for the various cryptographic primitives and to understand the security concerns and vulnerabilities	PO1	PSO1	U	C
CO2 Familiarize with different types of cryptosystems there by generating the ability to analyse different types of attacks on various cryptosystems	PO2	PSO2	An	C
CO3 To be able to secure a message over insecure channel by various means of conventional cryptographic encryption techniques	PO5	PSO4	E	P
CO4 Identify and mitigate software security vulnerabilities in existing systems and should be able to inculcate ciphers and key based principles	PO4	PSO2	An	P
CO5 To understand various protocols for network security to protect against the threats in the networks	PO6	PSO6	U	C
CO6 Apply methods for authentication, access control, intrusion detection and prevention	PO5	PSO6	Ap	P
CO7 Understanding various protocols for network security to protect against the threats in the networks	PO5	PSO6	U	F
CO8 Generate and distribute a PGP keypair and use the PGP package to send an encrypted email message	PO4	PSO9	Ap	P

(CL- Cognitive Level: R-remember, U-understand, Ap- Apply, An-Analyse, E- Evaluate, Cr- Create, KC - Knowledge Category: F-Factual, C- Conceptual, P-Procedural, M- Metacognitive)

COURSE CONTENT**MODULE I**

Introduction: Goals of Security, Security Trends: Security attacks- Security services- Security Mechanisms, Classical Encryption Techniques -Symmetric Cipher Model - Substitution Techniques - Transposition Techniques - Rotor Machines- Steganography. Block Cipher Principles, DES, Differential and Linear Cryptanalysis, Block Cipher Design Principles

MODULE II

Multiple encryption and Triple DES, Block Cipher Modes of Operation, Advanced Encryption Standard, Blowfish Algorithms, Rabin crypto system, ELGAMAL crypto system, Elliptic curve cryptosystem

MODULE III

Principles of Public Key Cryptosystems: RSA Algorithm, Key Management, Message Authentication and Hash Functions, Authentication Requirements, Authentication

Functions, Message Authentication, Hash Functions, Security of Hash Functions and MACs, Digital Signatures, Authentication Protocols, Digital Signature Standard.

MODULE IV

Network Security Applications: Kerberos, X.509 Authentication Service, Public Key Infrastructure, Pretty Good Privacy, S/MIME, IP Security Overview, IP Security architecture, Authentication Header, Encapsulating Security Payload, Combining Security associations, Key Management.

MODULE V

System Security: Secure Socket Layer and Transport Layer Security, Secure Electronic Transaction, Intruders, Intrusion Detection, Password Management, Malicious Software, Firewalls, Trusted Systems.

MODULE VI

Mathematical Concepts of Cryptography: Divisibility and Division Algorithm - Euclidean Algorithm, Modular Arithmetic- Groups - Rings - Fields, Finite Fields of the Form $GF(p)$ - Polynomial Arithmetic-Finite Fields of the Form Introduction to Number Theory - Prime Numbers - Fermat's and Euler's Theorems, Testing for Primality

LEARNING RESOURCES

References

- William Stallings, "Cryptography and Network Security-Principles and Practices", Fifth Edition, Pearson Education
- AtulKahate , "Cryptography and Network Security, 3rd Edition
- Behrouz A Forouzan, "Cryptography and Network Security", Tata McGraw Hill, 2008
- Matt Bishop, "Computer Security: Art and Science", Addison-Wesley Professional, 2003
- Wade Trappe, Lawrence C Washington, "Introduction to Cryptography with Coding Theory", Second Edition, Pearson Education

Semester 3

Course Code: MCA-DE-535(i)

Credits: 3

DIGITAL MARKETING

Preamble: This Digital Marketing syllabus is designed to introduce students to the fundamental concepts, tools, and strategies used in the field. Through a series of modules, participants will learn how digital marketing differs from traditional marketing, explore various digital marketing channels, and gain hands-on experience with search engine optimization (SEO), search engine marketing (SEM), web analytics, and social media marketing. The program aims to prepare students for effective digital marketing planning and execution, with a focus on real-world application.

Prerequisite: Basic understanding of marketing principles, Familiarity with the internet and online platforms, Basic computer skills and access to a computer with internet.

COURSE OUTCOMES & TAGGING

Course Outcomes	PO	PSO	CL	KC
CO1 Understand the basic principles of digital marketing and differentiate between digital and traditional marketing strategies.	PO1	PSO1,PSO9	U	C
CO2 Develop a foundational digital marketing plan incorporating the 5 D's of digital marketing and content strategy.	PO3	PSO2,PSO4	U,Cr	P
CO3 Perform keyword research and apply on-page and off-page SEO strategies to optimize web content.	PO5	PSO1,PSO4	U,Ap	P
CO4 Design and manage SEM campaigns, including PPC on Google Ads, focusing on conversion optimization.	PO4	PSO2,PSO5, PSO7	U,An	P
CO5 Analyse web analytics to inform marketing strategies and optimize social media profiles for business engagement.	PO4	PSO2,PSO5, PSO7	U,An	P
CO6 Integrate CRM strategies into digital marketing plans, considering the impact of AI and machine learning.	PO6	PSO3, PSO4,PSO5	U,E	P

(CL- Cognitive Level: R-remember, U-understand, Ap- Apply, An-Analyse, E- Evaluate, Cr- Create, KC - Knowledge Category: F- Factual, C- Conceptual, P-Procedural, M- Metacognitive)

COURSE CONTENT

MODULE I

Introduction to Digital marketing: Digital vs. Real Marketing- Understanding Digital Marketing Process, Increasing Visibility, Types of visibility, Examples of visibility-Visitors Engagement, Examples of engagement

MODULE II

The 5D's and Planning: 5 D's in digital marketing- Digital Marketing Channels- Creating initial digital marketing plan - Content Strategy and brand story telling- SWOT analysis and Target group analysis in the digital era

MODULE III

Search engine optimization –fundamentals of SEO- search engines –working of search engines- Major functions of a search engine- keyword research- Different types of keywords- SEO Optimization – On-page and Off-page SEO strategies-Writing the SEO content.

MODULE IV



Search engine marketing (SEM): definition of SEM-Introduction to PPC- campaign creation and management on Google Ads and other PPC platforms- conversion optimization and A/B testing

MODULE V

Introduction to Web analytics: Web analytics - levels - Introduction of Social Media Marketing- Social media trends and platform-specific strategies, Creating a Facebook page -Optimization of Instagram profiles -Integrating Instagram with a Web Site and other social networks.

MODULE VI

Customer Relationship Management (CRM) in the digital age- Current trends in digital marketing- The role of AI and machine learning in digital marketing.

LEARNING RESOURCES

References

- Ryan, D. (2014). Understanding Digital Marketing: Marketing Strategies for Engaging the Digital Generation, Kogan Page Limited.
- The Beginner's Guide to Digital Marketing (2015). Digital Marketer. Pulizzi,J.(2014)
- Epic Content Marketing, Mcgraw Hill Education.
- Digital Marketing Excellence: Planning, Optimizing and Integrating Online Marketing* by Dave Chaffey & PR Smith.
- The Art of SEO: Mastering Search Engine Optimization by Eric Enge, Stephan Spencer, and Jessie Stricchiola
- Social Media Marketing: A Strategic Approach by Melissa Barker, Donald I. Barker, Nicholas F. Bormann, and Debra Zahay.

Online Resources

- HubSpot's Guide on Digital Marketing: HubSpot
- BCcampus Open Publishing on Paid, Owned, and Earned Media: BCcampus
- Google's Fundamentals of Digital Marketing: Google Digital Garage
- DMI Essentials - Foundation Certificate in Digital Marketing: Digital Marketing Institute
- FutureLearn's Introduction to Digital Marketing: FutureLearn

Semester 3

Course Code:MCA-DE-535(ii)

Credits 3

DEEP ARCHITECTURE

Preamble: This course provides an in-depth exploration of deep architecture in machine learning. Students will delve into the theoretical foundations and practical applications of deep neural networks, convolutional neural networks, recurrent neural networks, and various optimization techniques. The course includes hands-on training, case studies, and real-world applications, enabling students to develop a comprehensive understanding of advanced topics in deep learning.

Prerequisite: Basic understanding of machine learning concepts, Familiarity with linear models and logistic regression, Prior exposure to neural networks, Proficiency in programming languages such as Python, Knowledge of mathematics, including calculus and linear algebra

COURSE OUTCOMES & TAGGING

Course Outcomes	PO	PSO	CL	KC
CO1 Understand the basics of machine learning.	PO1	PSO1,PSO2, PSO5	U	C
CO2 Introduction to Neural Networks	PO1	PSO1,PSO3,PSO6	U	C
CO3 Apply training and regularization techniques in deep models.	PO3	PSO2,PSO4,PSO6	U,Ap	P
CO4 Understand the convolution operation, pooling, and variants of convolution functions	PO4	PSO2,PSO5, PSO7	U	C
CO5 Apply CNNs for structured outputs and efficient convolution algorithms	PO5	PSO1,PSO4, PSO9	U,Ap	P
CO6 Apply non-convex optimization for deep networks	PO6	PSO3, PSO4,PSO5	U,Ap	P
CO7 Understand spatial transformer networks and recurrent networks.	PO7	PSO3,PSO4,PSO6	U	C
CO8 Design and comprehend RNNs, encoder-decoder architectures, and deep recurrent networks	PO8	PSO3,PSO9	U,Cr	C,P
CO9 Apply deep learning techniques to various real-world applications.	PO9	PSO1,PSO5,PSO8	U,Ap	P,M

(CL- Cognitive Level: R-remember, U-understand, Ap- Apply, An-Analyse, E- Evaluate, Cr- Create, KC - Knowledge Category: F- Factual, C- Conceptual, P-Procedural, M- Metacognitive)

COURSE CONTENT

MODULE I

Introduction to ANN: Linear models (SVMs and Perceptrons, logistic regression)- Intro to Neural Nets: Single layer perceptrons, Multi Layer Perceptrons (MLPs), Representation Power of MLPs, What a shallow network computes- Training a network: loss functions, back propagation and stochastic gradient descent- Neural networks as universal.

MODULE II

History of Deep Learning: A Probabilistic Theory of Deep Learning, Training deep models - Back propagation and regularization, batch normalization- VC Dimension and Neural Nets-Deep Vs Shallow Networks Convolutional Networks- Generative Adversarial Networks (GAN), Semi-supervised Learning.

MODULE III



Convolutional Neural Networks: Convolutional Neural Networks – convolution operation, motivation, pooling, Convolution and Pooling as an infinitely strong prior, variants of convolution functions, structured outputs, data types, efficient convolution algorithms.

MODULE IV

Optimization and Generalization: Optimization in deep learning– Non-convex optimization for deep networks- Stochastic Optimization Generalization in neural networks- Spatial Transformer Networks- Recurrent networks, LSTM –Recurrent Neural Network Language Models- Word-Level RNNs & Deep Reinforcement Learning.

MODULE V

Recurrent neural networks: Computational graphs, RNN design, encoder – decoder sequence to sequence architectures, deep recurrent networks, recursive neural networks.

MODULE VI

Case Study and Applications: Imagenet- Detection-Audio WaveNet-Natural Language Processing Word2Vec-Joint Detection, BioInformatics- Face Recognition- Scene Understanding- Gathering Image Captions.

LEARNING RESOURCES

References

- Cosma Rohilla Shalizi, *Advanced Data Analysis from an Elementary Point of View*, 2015.
- Deng & Yu, *Deep Learning: Methods and Applications*, Now Publishers, 2013.
- Ian Goodfellow, Yoshua Bengio, Aaron Courville, *Deep Learning*, MIT Press, 2016.
- *Neural Networks and Deep Learning*, Aggarwal, Charu C.
- **Online Resources**
- <https://www.deeplearningbook.org/BCcampus> Open Publishing on Paid, Owned, and Earned Media: BCcampus
- <http://neuralnetworksanddeeplearning.com/>DMI Essentials - Foundation Certificate in Digital Marketing: Digital Marketing Institute
- *A Comprehensive Hands-on Guide to Transfer Learning with Real-World Applications*
- *Deep Residual Learning for Image Recognition - ResNet Paper*

Semester 3

Course Code: MCAEC535(iii)

Credits: 3

SOFTWARE PROJECT MANAGEMENT

Preamble: Software Project Management bridges the gap between client expectations- resource constraints- and technological advancements. By mastering these principles- professionals can navigate the complexities of software development and deliver high-quality products.

Prerequisite: Basic programming skills- Familiarity with Software Development Tools- Software Engineering fundamentals- communication skills- critical thinking and problem solving skills

COURSE OUTCOMES & TAGGING

Course Outcomes	PO	PSO	CL	KC
CO1 Understanding the concepts of software project management with its life cycle	PO1	PSO1, PSO2	U, An	C, P
CO2 Apply project estimation and evaluation techniques to real world problems	PO2, PO4	PSO2, PSO3, PSO6	U, An, Ap	F,P
CO3 Produce an activity plan for a project, and produce a work plan and a resource scheduling	PO3,PO12	PSO7, PSO9	U, An, Cr	C,P
CO4 Apply Key project management system techniques.	PO5, PO8	PSO4, PSO5	U, Ap	F,P
CO5 Identify project risks and apply different techniques in monitoring.	PO7	PSO3, PSO8	An	C,P
CO6 Management of contract and people in software environment.	PO6, PO9,PO11	PSO3, PSO8	U, An	P
CO7 Understanding Software Quality Measures	PO10	PSO7	U,Ap	C, P

(CL- Cognitive Level: R-remember- U-understand- Ap- Apply- An-Analyse- E- Evaluate- Cr- Create- KC - Knowledge Category: F- Factual- C- Conceptual- P-Procedural- M- Metacognitive)

COURSE CONTENT

MODULE I

Project Definition – Importance – Activities – Categorizing- Project Charter – Stakeholders - Setting Objectives-Management - Management Control – Project Management Life Cycle. Overview Of The Project Planning.

MODULE II

Software scope and Feasibility-Project Portfolio Management-Cost Benefit Evaluation Techniques – Risk Evaluation-Programme Management- Aids to Programme Management- Software Processes and Process Models. Basis of Software estimation – Software Effort Estimation Techniques- Bottom- up Estimating- The Top-down Approach and Parametric Models – COCOMO – Staffing Pattern.

MODULE III

ACTIVITY PLANNING AND RESOURCE ALLOCATION: Objectives of Activity Planning- Project Schedules- Projects and Activities- Sequencing and Scheduling Activities- Network Planning Models- The Forward Pass- Backward Pass- Identifying the Critical Path - Identifying Critical Activities- Activity-on-Arrow Networks.



RESOURCE ALLOCATION: Nature of Resources- Identifying Resource Requirements- Scheduling Resources- Creating Critical Paths- Counting the Cost- Being Specific- Publishing the Resource Schedule- Cost Schedules- Scheduling Sequence.

MODULE IV

RISK MANAGEMENT AND MONITORING: Risk- Categories of Risk- Risk Management Approaches- Risk Identification- Risk Assessment- Risk Planning- Risk Management- Evaluating Risks to the Schedule-Applying the PERT Technique- Monte Carlo Simulation- Critical Chain Concepts.

MONITORING: Creating Framework - Decision making - Cost Monitoring - Software Configuration Management

MODULE V

MANAGING CONTRACTS: Types of Contract - Stages in Contract Placement - Terms of a Contract-Contract Management.

MANAGING PEOPLE IN SOFTWARE ENVIRONMENTS: Understanding Behaviour - Organizational Behaviour - Selecting the Right Person for the Job - Motivation -The Oldham -Hackman Job Characteristics Model - Stress- Stress Management - Health and Safety - Ethical and Professional Concerns.

MODULE VI

SOFTWARE QUALITY: Software Quality in Project Planning- Importance of Software Quality- Defining Software Quality- Software Quality Models- ISO 9126- Product and Process Metrics- Product versus Process Quality Management- Quality Management Systems- Process Capability Models- Techniques to Enhance Software Quality- Testing- Software Reliability- Quality Plans.

LEARNING RESOURCES

References

- Bob Hughes- Mike Gotterell & Rajib Mall " Software Project Management"- McGraw-Hill publications- 6th Edition
- Software Testing Techniques- Boris Beizer
- Software Project Management- Subramaniam Chandra Mouli- Saikatt Dutt
- Roger S Pressman "Software Engineering- A Practitioner's Approach" McGraw-Hill publications- 9th Edition

Semester 3

Course Code: MCA-DE-535 (iv)

Credits: 3

FUNCTIONAL PROGRAMMING

Preamble: This course introduces the principles and applications of functional programming. It covers key concepts such as immutability, higher-order functions, recursion, and monads. The course also explores the use of functional programming languages and their application in real-world scenarios.

Prerequisite: Programming Fundamentals, Data Structures

COURSE OUTCOMES & TAGGING

Course Outcomes	PO	PSO	CL	KC
CO1 Understand the principles of functional programming	PO1	PSO7,PSO9	U, Ap	C, P
CO2 Familiarize with higher-order functions and immutability	PO1	PSO7	U	C
CO3 Develop proficiency in recursion and pattern matching	PO3	PSO11	U	C,P
CO4 Apply monadic principles in programming	PO4	PSO7, PSO5	U	C,P
CO5 Design and implement programs using functional programming languages	PO3	PSO7	U	C,P
CO6 Analyse and compare the performance of functional and imperative solutions	PO5	PSO5	U, An	C, P
CO7 Understand the use of functional programming in distributed systems	PO2	PSO7	U	C, P
CO8 Explore real-world applications of functional programming	PO5	PSO9	U	C, P

(CL- Cognitive Level: R-remember, U-understand, Ap- Apply, An-Analyse, E- Evaluate, Cr- Create, KC - Knowledge Category: F-Factual, C- Conceptual, P-Procedural, M- Metacognitive)

COURSE CONTENT

MODULE I

Introduction to Functional Programming: Basics of functional programming, Pure functions, Immutability, First-class and higher-order functions, Lambda calculus.

MODULE II

Functional Programming Languages: Overview of functional programming languages (e.g., Haskell, Scala, Clojure), Syntax and semantics, Type systems, Type inference.

MODULE III

Recursion and Pattern Matching: Recursive functions, Tail recursion, Pattern matching, List comprehensions, Structural recursion.

MODULE IV

Monads and Functors: Introduction to monads, Functor concept, Monad laws, Monadic composition, Option, Either, State monad.

MODULE V

Functional Programming in Distributed Systems: MapReduce, Spark and Flink, Functional programming for parallelism, Reactive programming.



MODULE VI

Real-world Applications: Functional programming in web development, Microservices architecture, Functional programming in artificial intelligence, Functional data processing.

LEARNING RESOURCES

References

- Simon Thompson, "Haskell: The Craft of Functional Programming", Addison-Wesley, 2011.
- Paul Chiusano and Rúnar Bjarnason, "Functional Programming in Scala", Manning Publications, 2014.
- Michael Fogus, "Functional JavaScript: Introducing Functional Programming with Underscore.js", O'Reilly Media, 2013.

Online Resources

- <https://www.haskell.org/documentation/>
- <https://www.scala-lang.org/documentation/>
- https://clojure.org/guides/getting_started
- <https://www.youtube.com/watch?v=QyJZzq0v7Z4>
- <https://www.coursera.org/learn/scala-functional-programming>

Semester 3

Course Code: MCAEC535(v)

Credits: 3

WIRELESS SENSOR NETWORKS

Preamble: Wireless Sensor Networks (WSNs) have emerged as a vital area of study and application within the realm of modern computing and telecommunications. This course provides a comprehensive exploration into the theoretical foundations, practical implementations, and cutting-edge advancements in the field of WSNs. With a focus on understanding the architecture, design principles, and deployment considerations, students will get knowledge about enabling technologies that underpin the functionality of WSNs.

Prerequisite: prerequisites provide a foundation for students to comprehend the theoretical concepts, design principles, and practical implementations covered in the syllabus on Wireless Sensor Networks.

COURSE OUTCOMES & TAGGING

Course Outcomes	PO	PSO	CL	KC
CO1 Comprehensive understanding of the architecture of wireless sensor networks, including the hardware components and network characteristics, enabling them to analyze and design efficient sensor nodes	PO1	PSO7,PSO9	U	C, P
CO2 Enabling to identify, evaluate and utilize appropriate technologies for different types of wireless sensor networks	PO2	PSO7	U	C
CO3 Proficiency in designing sensor networks including physical layer, transceiver design considerations and optimization goals, allowing them to develop efficient and reliable wireless sensor networks	PO3	PSO4	U	C,P
CO4 Analyse and implement protocols for wireless sensor networks, enabling seamless communication and data transmission	PO2	PSO1,PSO8	U	C,P
CO5 Acquire expertise in routing protocols specific to wireless sensor networks, enabling them to optimize network performance and resource utilization	PO4	PSO4,PSO6	U	C,P
CO6 Develop skills in establishing the infrastructure of wireless sensor networks	PO3	PSO4	U, An	C, P
CO7 Expertise in utilizing sensor network platforms, tools such as programming challenges, node-level software platforms, simulators and develop and deploy sensor network solutions	PO4	PSO2,PSO5	U, Ap	C, P
CO8 Develop critical analysis skills enabling them to identify strengths, weakness and areas for improvement in wireless sensor networks compared to alternative architectures	PO3	PSO2,PSO4	U, An	C, P

(CL- Cognitive Level: R-remember, U-understand, Ap- Apply, An-Analyse, E- Evaluate, Cr- Create, KC - Knowledge Category: F- Factual, C- Conceptual, P-Procedural, M- Metacognitive)

COURSE CONTENT

MODULE I

Overview of wireless sensor networks: Single Node Architecture Hardware Components Network Characteristics unique constraints and challenges, Enabling Technologies for Wireless Sensor Networks Types of wireless sensor networks.

MODULE II

Architectures: Network Architecture Sensor Networks Scenarios Design Principle, Physical Layer and Transceiver Design Considerations, Optimization Goals and Figures of



Merit, Gateway Concepts, Operating Systems and Execution Environments introduction to Tiny OS and nesC Internet to WSN Communication

MODULE III

Wireless Sensor Network: Applications, design Challenges, Protocol stack, comparisons with MANET node architecture, network architecture, MAC protocols-requirements, IEEE 802.15.4 MAC protocol.

MODULE IV

Routing Protocol –energy aware routing, Location based routing, clustering, aggregation, QoS, security protocol, Zigbee standard.

MODULE V

Infrastructure Establishmant: Topology Control, Clustering, Time Synchronization, Localization and Positioning, Sensor Tasking and Control.

MODULE VI

Sensor network platforms and tools: Sensor Node Hardware – Berkeley Motes, Programming Challenges, Node level software platforms, Node level Simulators, State centric programming.

LEARNING RESOURCES

References

- Holger Karl & Andreas Willig, "Protocols and Architectures for Wireless Sensor Networks", John Wiley, 2005.
- Feng Zhao & Leonidas J.Guibas, "Wireless Sensor Networks An Information Processing Approach", Elsevier, 2007.
- Walteneagus Dargie, Christian Poellabauer, "Fundamentals of Wireless Sensor Networks Theory and Practice", John Wiley & Sons Publications, 2011
- Kazem Sohraby, Daniel Minoli, & Taieb Znati, "Wireless Sensor Networks Technology, Protocols, and Applications", John Wiley, 2007.
- Anna Hac, "Wireless Sensor Network Designs", John Wiley, 2003

MCA MODEL QUESTION PAPER
MCA-CC-531: ADVANCED COMPUTER NETWORKS
(2024 Scheme)

Time:3hrs

Total Marks: 100

Part A

Answer **all** questions. Each carries 4 marks

1. Describe Software Defined Network.
2. Write a short note on wireless LAN.
3. What is RFID network?
4. Write a short note about properties of internet.
5. Explain IPV4 classless addressing scheme.
6. How to detect error using checksum computation?
7. What is silly window syndrome?
8. Explain is OSPF.
9. Discuss about NAT.
10. What is Alert protocol in SSL?

Part B

Answer any **one** question from each module. Each carries 10 marks.

Module I

11. Explain OSI reference model with the help of a figure.
12. What is SDN? Explain.

Module II

13. What is internet? What are the properties of internet?
14. Explain classfull and class less addressing scheme with the help of an example.

Module III

15. Discuss about different types of error detection and error correction methods.
16. What is ICMP? What are different types of ICMP messages?

Module IV

17. Discuss the connection establishment and connection release in TCP with the help of figure.
18. What is silly window syndrome? Explain the different causes and its solution.

Module V

19. Explain the concept of Automatic Route propagation in routing protocols. Provide an example of how this feature operates in a practical scenario.
20. Discuss the difference between Distance -Vector Routing and Link-State Routing protocols such as OSPF. Include their respective advantages and disadvantages.

Module VI

21. Explain the components and functionality of IPsec, focusing on the Authentication Header (AH) and Encapsulating Security Payload (ESP) header and trailer. How do these components contribute to secure communication over IP networks?
22. Discuss the architecture and key components of Intent-Based Networking (IBN). Evaluate its advantages, disadvantages, and potential applications in modern network management

(10×6 =60 Marks)

MCA MODEL QUESTION PAPER
MCA-CC-532: SMART APPLICATION DEVELOPMENT
(2024 Scheme)

Time : 3 Hours

Max. Marks : 100

PART - A

Answer **all** questions. Each question carries **4** marks.

1. Discuss the significance of mobile application frameworks in the development of smart applications.
2. Explain the role of Android Manifest file in Android application development.
3. Describe the importance of user interface design in mobile applications, with a focus on layout design.
4. Briefly discuss the principles of testing Android applications.
5. Explain the usage of Android data and storage APIs, emphasizing the management of data using SQLite.
6. Discuss the principles of security and privacy in smart applications, particularly in the context of cloud computing services
7. Explain the evolution of mobile computing and its impact on smart application development.
8. Describe the components of Android applications
9. Discuss the fundamental principles of UI design for mobile applications, including animation techniques.
10. Explain the strategies for publishing Android applications and managing application resources effectively.

(10 × 4 = 40 Marks)

PART - B

Answer any **One** question from each module. Each question carries 10 marks.

Module - I

11. Discuss the role of mobile application frameworks like Android and iOS in modern app development, highlighting their differences and similarities.
12. Explain the Android development lifecycle in detail, including the steps involved in building the first Android application.

Module - II

13. Describe the various components of Android applications such as activities, services, and intents, and explain their roles in app development.
14. Discuss the significance of Android Manifest file settings and permissions management in ensuring the security and functionality of Android applications.

Module - III

15. Elaborate on the process of designing user interfaces for mobile applications, focusing on the best practices for layout design and usability.
16. Explain different drawing techniques and how they can be utilized to enhance the visual appeal of mobile app interfaces.

Module - IV

17. Discuss the importance of utilizing Android preferences in app development and how they contribute to enhancing user experience.
18. Explain the strategies for managing application resources effectively in Android, including resource hierarchy and resource optimization techniques.

Module - V

19. Describe the usage of Android networking APIs and Android web APIs in developing network-enabled Android applications.
20. Explain the process of deploying Android applications to the world, including the necessary steps and considerations for successful deployment.

Module - VI

21. Explore advanced features in Android applications, providing examples and discussing their practical applications in real-world scenarios.
22. Discuss the principles of UX design for smart applications, focusing on user-centered design approaches and usability testing methodologies.

(6 × 10 = 60 Marks)

MCA MODEL QUESTION PAPER
MCA-CC-533: BIG DATA ANALYTICS
(2024 Scheme)

Time: 3 Hours

Max Marks :100

SECTION- A

Answer all question. Each question carries 4 marks

1. Define Big Data and elaborate on its characteristics.
2. Compare Business Intelligence with Big Data.
3. Outline the steps involved in the Data Science process.
4. Explore the qualities expected of a Data Scientist.
5. Discuss the five C's in Big Data
6. Compare Data Science and Data Analytics.
7. Explain the CAP Theorem
8. Discuss the importance of Data Science ethics?
9. Explain about Data Visualization?
10. What are the different steps involved in data preparation?

(10 × 4 =40 Marks)

SECTION B

Answer any one question from each module. Each question carries 10 marks

Module - I

11. Discuss the architecture of Big Data, highlighting the challenges and the 3Vs.
12. Provide a detailed overview of Data Warehouses.

Module - II

13. Highlight the future trends in Data Science and the principles of doing good Data Science.
14. Discuss the importance of Data Science ethics and the concept of Data Ownership.

Module - III

15. Classify Big Data analytics and describe its life cycle and benefits.
16. Discuss the importance of valuing different aspects of privacy. Explain the process of obtaining informed consent.

Module - IV

17. Explain the concept of MapReduce in detail?
18. Explain about Dashboard development tools? How to Create an interactive dashboard with dc.js?

Module - V

19. Elaborate on the components of Hadoop and its architecture
20. Compare Hadoop with SQL and discuss the distinctions between RDBMS and Hadoop.

Module - VI

21. Provide an overview of NoSQL databases, highlighting their types, advantages,
22. Discuss the emergence of NewSQL and compare SQL, NoSQL.

(10×6 =60 Marks)

MCA MODEL QUESTION PAPER
MCA-DE-534 (i): CLOUD COMPUTING
(2024 Scheme)

Time : 3 Hours

Max. Marks : 100

PART A

Answer all questions. Each question carries 4 marks.

2. Briefly describe two key limitations of traditional computing approaches addressed by cloud computing. [CO1]
3. List and explain the three layers of the traditional computing model. [CO3]
4. Describe the role of an API in interacting with cloud services. [CO6]
5. Briefly differentiate between public, private, and hybrid cloud deployment models. [CO3]
6. Briefly explain the concept of Platform as a Service (PaaS) and its benefits. [CO2]
7. Differentiate between Software as a Service (SaaS) and traditional software applications. [CO2]
8. Explain the concept of virtualization and its importance in cloud resource management. [CO5]
9. Describe two security concerns associated with using cloud services. [CO6]
10. Briefly explain one strategy for mitigating data security risks in the cloud. [CO6]
11. Briefly explain the concept of mobile cloud computing and give an example of its application. [CO1]

PART B

(Answer any ONE questions from each module. Each question carries 10 marks.)

Module 1

12. Discuss the evolution of cloud computing from its early stages to its current state. [CO2]
13. Analyse the impact of cloud computing on different industries and business models. [CO3]

Module 2

14. Explain the role of virtualization in cloud computing and its benefits for resource management. [CO5]
15. Compare and contrast cluster, grid, and cloud computing technologies. [CO3]

Module 3

16. Describe the different service delivery models in cloud computing (IaaS, PaaS, SaaS) and provide examples of each. [CO1]
17. Discuss the security concerns associated with using cloud services and strategies for mitigating them. [CO6]

Module 4

18. Explain the concept of resource virtualization and its key benefits for cloud computing. [CO5]
19. Compare and contrast hypervisor-based and operating system-level virtualization approaches. [CO5]

Module 5

20. Discuss the different ways cloud services can be used for collaboration in various business functions. [CO2]

21. Analyze the security challenges and best practices for data security in the cloud. [CO6]

Module 6

22. Compare and contrast the offerings of leading cloud service providers (AWS, Azure, Google Cloud) based on specific criteria (e.g., pricing, features, security). [CO4]
23. Explain the potential of mobile cloud computing and its impact on various industries. [CO7]

(10×6 =60 Marks)

MCA MODEL QUESTION PAPER
MCA-DE-534 (ii): MANAGEMENT INFORMATION SYSTEM
(2024 Scheme)

Time : 3 Hours

Max. Marks : 100

PART A

(Answer all questions. Each question carries 4 marks.)

1. Briefly explain the key differences between Management Information Systems (MIS) and Decision Support Systems (DSS). [CO1]
2. How can information systems support the emerging digital firm in achieving its business objectives? [CO1]
3. Describe the role of Transaction Processing Systems (TPS) in an organization. [CO2]
4. Briefly explain how Business Intelligence (BI) systems can be used to gain insights from organizational data. [CO4]
5. How do organizational structures influence the implementation and effectiveness of information systems? [CO4]
6. Explain Porter's Competitive Forces Model and its relevance to understanding information systems in a competitive environment. [CO2]
7. Discuss two ethical challenges associated with the use of big data in organizations. [CO6]
8. Describe the key components of an IT infrastructure ecosystem. [CO2]
9. Briefly explain the benefits and potential challenges of adopting cloud computing services for an organization. [CO7]
10. Briefly explain the importance of disaster recovery planning for organizations. [CO7]

Part B

Answer any ONE questions from each module. Each question carries 10 marks.

Module 1

11. Discuss the role of information systems in different functional areas of a business [CO2]
12. Analyze the impact of information systems on the evolving relationship between businesses and their customers. [CO1]

Module 2

13. Explain the different types of enterprise application architecture and their advantages and disadvantages. [CO3]
14. Discuss the impact of e-business, e-commerce, and e-government on business models and societal trends. [CO4]

Module 3

15. How can information systems be used to facilitate collaboration and knowledge sharing within an organization? [CO2]
16. Analyze the potential impact of social media and other collaborative technologies on organizational cultures and practices. [CO5]

Module 4

17. Discuss the ethical considerations involved in using personal data collected through information systems. [CO6]
18. Explain the challenges of balancing the benefits of information systems with the need to protect individual privacy. [CO7]

Module 5

19. Analyze the potential impact of emerging technologies like blockchain and artificial intelligence on information systems and business practices. [CO5]
20. Discuss the challenges and opportunities associated with green computing initiatives in organizations. [CO4]

Module 6

21. Explain different strategies for securing information systems against cyber threats. [CO7]
Analyze the legal and regulatory requirements for managing electronic records in a globalized environment. [CO7] **(10×6 =60 Marks)**

MCA MODEL QUESTION PAPER
MCA-DE-534 (iii): INTERNET OF THINGS
(2024 Scheme)

Time : 3 Hours

Max. Marks : 100

PART A

(Answer all questions. Each question carries 4 marks)

1. Briefly explain the key difference between "Smart" and "Hyperconnected" devices in the IoT context. [CO1]
2. Describe the main components of the IoT Architectural View. [CO2]
3. Differentiate between IoT and Machine-to-Machine (M2M) communication. [CO1]
4. Explain the role of sensors in the IoT and provide an example of their use. [CO3]
5. Briefly describe the MQTT and CoAP protocols and their suitability for IoT communication. [CO2]
6. Compare and contrast LPWA and ZigBee technologies for long-range and medium-range IoT applications. [CO4]
7. Explain the Publish/Subscribe and Request/Report data models used in IoT. [CO5]
8. Discuss the potential of Wearable technology in the context of the Internet of Things. [CO7]
9. Briefly explain the concept of IoT Security Framework. [CO6]
10. What is the purpose of a rules engine in basic IoT data analytics? [CO7]

PART B

Answer any ONE questions from each module. Each question carries 10 marks.

Module 1

11. Discuss the impact of the Internet of Things on various industries and sectors. [CO1]
12. Analyze the challenges and opportunities associated with the widespread adoption of IoT technology. [CO1]

Module 2

13. Explain the role of actuators in the Internet of Things and provide examples of their use. [CO2]
14. Discuss the different types of gateways used in IoT systems and their functionalities. [CO3]

Module 3

15. Analyze the advantages and disadvantages of different wireless radio technologies used in IoT communication. [CO4]
16. Discuss the future of connectivity solutions for the Internet of Things. [CO5]

Module 4

17. Explain the importance of data processing in IoT systems and describe different processing techniques. [CO6]
18. Discuss the benefits and limitations of real-time data communication in IoT applications. [CO6]

Module 5

19. Analyze the potential applications of Artificial Intelligence and Cognitive Computing in the Internet of Things. [CO6]
20. Discuss the ethical considerations and privacy concerns surrounding the collection and use of data in IoT systems. [CO5]

Module 6

21. Explain how machine learning can be used for data analysis in IoT applications. [CO6]
22. Discuss the importance of cybersecurity and different strategies for securing IoT systems. [CO7]

(10×6 =60 Marks)

MCA MODEL QUESTION PAPER
MCA-DE-534 (iv) CYBER SECURITY AND CYBER LAW
(2024 Scheme)

Time : 3 Hours

Max. Marks : 100

PART A

(Answer all questions. Each question carries 4 marks.)

1. State digital investigation . [CO1]
2. Explain about data acquisition. [CO1]
3. Write short notes on disk partition of Windows OS. [CO3]
4. Explain Macintosh File Structure. [CO3]
5. Illustrate block-wise hashing. [CO5]
6. Explain about network forensics. [CO6]
7. Describe the role of email in investigation. [CO7]
8. Describe about forensic tools. [CO7]
9. Explain cyberspace Ecommerce. [CO8]
10. Explain the need of cyber law. [CO8]

PART B

Answer any ONE questions from each module. Each question carries 10 marks.

Module 1

11. Discuss an overview of a computer crime and company policy violation [CO1]
12. Describe the hardware requirements, software requirements for building a business case for developing forensic lab [CO2]

Module 2

13. Illustrate the storage format for digital evidence [CO3]
14. Describe the commercial acquisition tools for forensics acquisition [CO7]

Module 3

15. Explain about the NTFS disk [CO10]
16. Explain in detail Microsoft and Ms-DOS start up tasks

Module 4

17. Explain about locating and recovering graphic files [CO6]
18. Describe about copy rights issues with graphics [CO6]

Module 5

19. Explain about generating report findings with forensic software tools [CO7]
20. Discuss investigating e-mail crimes and violations [CO7]

Module 6

21. Explain the Security Aspect of Cyber Law [CO8]
22. Describe about Intellectual Property Aspect in Cyber Law [CO8]

(10×6 =60 Marks)

MCA MODEL QUESTION PAPER
MCA-DE-534 (v): CRYPTOGRAPHY AND NETWORK SECURITY
(2024 Scheme)

Time : 3 Hours

Max. Marks : 100

PART A

Answer all questions. Each question carries 4 marks.

1. What is the difference between DES and Triple DES [CO3]
2. State the two key operations in block cipher [CO4]
3. What is digital signature [CO5]
4. Define password management and give the standard password format [CO5]
5. What is message authentication and Hash Function [CO5]
6. Define the types of Intrusion Detection System [CO5]
7. Define the three types of Malicious Software [CO6]
8. What is Number Theory? [CO1]
9. Explain Modular Arithmetic [CO1]
10. What is Security Attack and its types [CO2]

PART B

(Answer any ONE questions from each module. Each question carries 10 marks.)

Module 1

11. Explain the four types of security mechanisms [CO2]
12. Describe in detail about the types of security services [CO2]

Module 2

13. Explain the Blowfish Algorithm and its applications [CO5]
14. Describe Rabin Cryptosystem [CO5]

Module 3

15. Explain about the Message authentication and Hash function [CO5]
16. Explain in detail about the different types of Signatures [CO5]

Module 4

17. Discuss in detail about the IPsec
18. Explain about Security Association in detail [CO9]

Module 5

19. Explain the two main types of Intrusion Detection System [CO6]
20. Discuss about the password management [CO6]

Module 6

21. Explain Fermats and Eulers Theorem [CO1]
22. Describe Divisibility and Division algorithm [CO1]

MCA MODEL QUESTION PAPER
MCA-DE-535 (i): DIGITAL MARKETING
(2024 Scheme)

Time: 3 Hours

Max Marks :100

PART A

(Answer all question. Each question carries 4 marks)

1. Define digital marketing and explain how it differs from traditional marketing.
2. Describe two types of visibility in digital marketing with examples.
3. List the 5 D's of digital marketing.
4. Explain the importance of content strategy in brand storytelling
5. What are the major functions of a search engine?
6. Explain the difference between on-page and off-page SEO strategies.
7. Define Search Engine Marketing (SEM) and its importance.
8. What is PPC and how does it relate to SEM?
9. Describe the role of web analytics in digital marketing.
10. How can businesses optimize their Instagram profiles for better engagement?

(10 × 4 =40 Marks)

PART B

(Answer any one question from each module. Each question carries 10 marks)

Module - I

11. Discuss how digital marketing has evolved over the last decade.
12. Evaluate the impact of visitor engagement on online visibility and brand presence.

Module - II

13. Describe how to create an initial digital marketing strategy.
14. What is SWOT analysis in digital marketing strategy? Conduct a SWOT analysis for a local restaurant looking to expand its digital marketing efforts?

Module - III

15. How does keyword research influence SEO strategy? Provide examples.
16. Describe the process and importance of writing SEO-optimized content

Module - IV

17. Compare and contrast SEO and SEM strategies in digital marketing campaigns.
18. Design a campaign creation and management strategy for Google Ads for a small e-commerce business.

Module - V

19. Discuss the importance of integrating web analytics with social media marketing strategies.
20. Create a social media marketing strategy for a new fitness app focusing on Facebook and Instagram.

Module - VI

21. Analyse the role of AI and machine learning in enhancing CRM systems within digital marketing.
22. Explore current trends in digital marketing and predict how they might evolve in the next five years.

(10×6 =60 Marks)

MCA MODEL QUESTION PAPER
MCA-DE-535(ii): DEEP ARCHITECTURE
(2024 Scheme)

Time: 3 Hours

Max Marks :100

PART A

(Answer all question. Each question carries 4 marks)

1. Discuss the key components of training a neural network.
2. Define and differentiate between linear models.
3. Discuss the significance of Convolutional Networks in deep learning.
4. Explain about convolution operation?
5. What are the different efficient convolution algorithms?
6. What is Pooling?
7. Discuss the role of Spatial Transformer Networks in neural networks.
8. Explore the challenges involved in non-convex optimization for deep networks.
9. Discuss about recursive neural networks.
10. Compare with Deep Vs Shallow Networks Convolutional Networks?

(10 × 4 =40 Marks)

PART B

Answer any one question from each module. Each question carries 10 marks

Module - I

11. Explain the representation power of Multi-Layer Perceptron (MLPs) and how it differs from single-layer perceptron.
12. How are neural networks considered universal function approximators? Provide insights into their capabilities.

Module - II

13. Explain the role of regularization and batch normalization in training deep models.
14. Compare and contrast the concepts of VC Dimension in relation to deep and shallow networks?

Module - III

15. Describe the variants of convolution functions used in deep learning. Provide examples of structured outputs in CNNs?
16. Elaborate on the convolution operation in CNNs, emphasizing its motivation and the role of pooling

Module - IV

17. Explain the concept of Generalization in neural networks. How can it be achieved effectively?
18. Describe the applications of Recurrent Neural Networks (RNNs) in language modelling and deep reinforcement learning.

Module - V

19. Discuss the design principles of RNNs, focusing on encoder-decoder sequence-to-sequence architectures.
20. Explore the applications and advantages of recursive neural networks in deep learning.

Module - VI

21. Discuss the challenges and opportunities in the field of Bioinformatics using deep learning.
22. Explain the concept of Joint Detection in natural language processing with examples.

(10×6 =60 Marks)

MCA MODEL QUESTION PAPER
MCAEC535(iii):SOFTWARE PROJECT MANAGEMENT

Time: 3Hrs

Total Marks: 100

Part A

(Answer all questions. Each carries 4 marks)

1. Write short notes on project charter.
2. What is the importance of software project management?
3. Explain bottom- up estimation.
4. Explain forward pass.
5. Write short notes on cost schedules.
6. What is risk assessment?
7. Write short notes on software configuration management.
8. What is tender process?
9. Write short notes on software quality.
10. Explain product metrics.

Part B

(Answer any one question from each module. Each question carries 10 marks.)

Module I

11. Explain about categories of software project.
12. Explain project management life cycle.

Module II

13. What are the different cost -benefit evaluation techniques?
14. Explain software effort estimation techniques.

Module III

15. What are the different approaches for identifying activities?
16. Explain the categories of resources.

Module IV

17. What are the steps involved in planning risk?
18. Explain about the visualization of project progress.

Module V

19. What are the different stages in contract placement?
20. Explain about the models of motivation.

Module VI

21. What are the different process capability models?
22. What are the levels of testing and the activities involved in testing?

(10×6 =60 Marks)

MCA MODEL QUESTION PAPER
MCA-DE-535 (iv): FUNCTIONAL PROGRAMMING
(2024 Scheme)

Time : 3 Hours

Max. Marks : 100

PART - A

(Answer all questions. Each question carries 4 marks.)

1. Explain the concept of pure functions in functional programming and discuss their significance.
2. Describe the syntax and semantics of functional programming languages, with examples.
3. Define tail recursion and explain its importance in functional programming.
4. Discuss the concept of monads in functional programming and illustrate their use with examples.
5. Compare and contrast first-class and higher-order functions, highlighting their differences.
6. Explain the application of list comprehensions in functional programming, providing examples.
7. Define functors in the context of functional programming and explain their role.
8. Discuss the principles of immutability and its advantages in functional programming.
9. Explain the concept of structural recursion and its application in solving problems.
10. Describe the MapReduce paradigm and discuss its relevance in functional programming for distributed systems.

(10 × 4 = 40 Marks)

PART - B

(Answer any One question from each module. Each question carries 10 marks.)

Module - I

11. Discuss the role of pure functions in ensuring referential transparency in functional programming.
12. Explain lambda calculus and its significance in functional programming languages.

Module - II

13. Describe the type systems used in functional programming languages and explain their importance.
14. Discuss the concept of currying and partial application in functional programming, providing examples.

Module - III

15. Explain the process of pattern matching in functional programming, with examples illustrating its use.
16. Discuss the advantages of tail recursion over traditional recursion in functional programming.

Module - IV

17. Illustrate the concept of monadic composition in functional programming, providing examples.
18. Explain the implementation of the State monad in functional programming, with examples.

Module - V

19. Describe the principles of functional programming for parallelism and how they are applied in distributed systems.
20. Discuss the role of reactive programming in functional programming paradigms, with examples.

Module - VI

21. Explain how functional programming is utilized in web development, providing examples of frameworks and libraries.
22. Discuss the application of functional programming in artificial intelligence, highlighting its advantages and challenges.

(6 × 10 = 60 Marks)

MCA MODEL QUESTION PAPER
MCA-DE-534(v):WIRELESS SENSOR NETWORKS

Time:3hrs

Total Marks: 100

Part A

(Answer all questions each carries 4 marks)

1. Explain the single-node architecture of a wireless sensor network (WSN).
2. Discuss the optimization goals and figures of merit in WSNs.
3. Discuss the significance of physical layer and transceiver design considerations in WSNs.
4. Explain the concept of TinyOS.
5. Compare the protocol stack of WSNs with that of Mobile Ad-Hoc Networks.
6. Discuss the requirements of MAC protocols in WSNs.
7. Discuss the role of location-based routing.
8. Describe the importance of aggregation and Quality of Service in routing protocols of WSNs.
9. Explain the concepts of clustering and time synchronization in WSN deployments.
10. Explain the techniques used for localization and positioning in wireless sensor networks.

(4*10=40 marks)

Part B

Answer any one question from each module. Each carries 10 marks

Module I

11. What are the unique constraints and challenges faced by WSNs in comparison to traditional wired networks? Elaborate on the enabling technologies for WSNs and provide examples of different types of wireless sensor networks.
12. Explain the concept of network architecture in wireless sensor networks, focusing on different sensor network scenarios and design principles.

Module II

13. Discuss the optimization goals and figures of merit associated with WSN design considerations. Additionally, elaborate on the concepts of gateway and its significance in WSN deployments.
14. Discuss the role of operating systems and execution environments in wireless sensor networks, with a specific focus on TinyOS and nesC programming languages.

Module III

15. Discuss the various applications of Wireless Sensor Networks (WSNs) in different domains such as environmental monitoring, healthcare, and industrial automation. Highlight the design challenges encountered in each application domain and how WSNs address these challenges.
16. Explain the IEEE 802.15.4 MAC protocol in detail, focusing on its requirements and features in the context of Wireless Sensor Networks (WSNs). Discuss how the IEEE 802.15.4 MAC protocol addresses the unique challenges of WSNs such as low power consumption and low data rates.

Module IV

17. Discuss the concept of energy-aware routing in Wireless Sensor Networks (WSNs), highlighting its importance in prolonging network lifetime.
18. Explain the significance of Quality of Service (QoS) in routing protocols for Wireless Sensor Networks (WSNs). Discuss the various aspects of QoS, such as reliability, latency, and throughput, and how they are addressed in WSN routing protocols.

Module V

19. Explain the concepts of clustering and aggregation in WSNs and their role in reducing energy consumption and improving scalability.
20. Explain the methods of localization and positioning in WSNs and their applications in various scenarios such as asset tracking and environmental monitoring.

Module VI

21. Describe the hardware components of Berkeley Motes, a widely used sensor node hardware platform. Explain the key features and capabilities of Berkeley Motes that make it suitable for Wireless Sensor Networks (WSNs).
22. Discuss the programming challenges associated with developing applications for Wireless Sensor Networks (WSNs) using node-level software platforms. Explain the concept of state-centric programming and its significance in designing efficient and reliable WSN applications.

(10*6=60 marks)



DISSERTATION AND VIVA VOCE

Preamble: The case study and dissertation are sequentially ordered, where the studies conducted in the initial course can be exploited further in the later. The course aims to equip the students to understand high standard Industrial project and develop self-questions that can be empirically addressed during the study. In addition, the students should understand the purposes, assumptions, and logic inherent in computational methodologies. The experimentally evaluated studies should be documented systematically in the form of a dissertation, and it will help the students to prepare their carried growth in later stages. The objectives are:

1. To analyse the practical knowledge for solving a practical problem.
2. To enable the students to experience the method of solving real-life problems under the guidance of a supervisor.
3. To prepare the students for the demand of national/international organizations.
4. To train the students in scientific approaches in solution formulation and result analysis.
5. Develop technical document writing and presentation skills.
6. Inculcate the spirit of collaborative work and time management.

Prerequisite: Strong background in Programming, Software Engineering, Strong foundation of Computer Application Technique

COURSE OUTCOMES & TAGGING

Course Outcomes		PO	PSO	CL	KC
CO1	Investigate the related and recent works in the area of dissertation	PO1, PO2, PO3	PSO4, PSO2	U, An	C
CO2	Apply critical thinking and design new strategies for the work	PO1, PO4, PO5	PSO5, PSO5	Ap	C, P
CO3	Implement and analyse the performance of the new Method for software development	PO3, PO7, PO8	PSO7, PSO8	An	C
CO4	Propose a new algorithm or design in the area of study	PO4, PO8, PO9	PSO6, PSO8	An, Ap	C
CO5	Prepare a dissertation on the work done in the prescribed format	PO5, PO10	PSO3, PSO9	U, An, Ap	C, P
CO6	Presentation on the entire work done as part of the course	PO4, PO7, PO9	PSO2, PSO5	U, Ap	C

(CL- Cognitive Level: R-remember, U-understand, Ap- Apply, An-Analyse, E- Evaluate, Cr- Create, KC - Knowledge Category: F-Factual, C- Conceptual, P-Procedural, M- Metacognitive)

COURSE CONTENT

This programme will equip the student with skills in Computational techniques to develop software applications for the Industry. The courses up to the last semesters will give a comprehensive perspective of the theories and concepts of computational methods. The case study and dissertation can be pipelined to conduct continuous studies through experiments in a particular application area. An enthusiastic student can critically evaluate methods and design experiments to evaluate them further for possible contributions. The supervisor will assist the student throughout the course in properly studying the problem and designing and evaluating the experiments. The findings of the studies should be documented in the form of a dissertation with all the components of a

typical application document focusing on the literature reviews, understanding concepts, defining industrial problems and methods, collecting and analysing data, experimental evaluation and communicating the findings.

The students need to do the following activities:

1. The candidate shall submit a proposal for different projects before the assessment team. The team shall select and finalize one of the proposals. However, if all proposals are not acceptable, the candidate may be asked to submit new/modified proposals. The candidate shall prepare and submit a synopsis of the accepted proposal. A record of the accepted synopsis of each candidate shall be maintained in the department.
2. A detailed study of the requirements and feasibility of the proposed work shall be conducted by the candidate with the help of the project guide. A study phase report shall be presented before the assessment team within one month from the beginning of project work. The design of the proposed work shall be completed and presented before the assessment team. The design shall be finalized with suggested corrections/updates.
3. The developed software/algorithm shall be implemented and demonstrated before the internal assessment team. A short presentation explaining the proposed work and experimental results shall also be made. The Project Report shall be finalized only after the internal presentation after correcting/updating the document based on the comments from the internal assessment team.

Students are expected to

1. Perform an in-depth study of the topic assigned in light of the detailed study in Semester III.
2. Prepare the problem statement with proper objectives with the help of the supervisor.
3. Prepare a detailed action plan for conducting the investigation, process flow and design.
4. Perform detailed analysis/ modelling/ simulation/ design/ problem solving/ experiment as needed.
5. Evaluate and fine-tune the model with proper enhancements and modifications.
6. Analyse the outcome of the experiments and studies, and validate with the objectives targeted.
7. Prepare the list of achievements and challenges of the studies.
8. Plan for Industrial collaboration by exploiting the findings of the experiments.
9. Prepare a dissertation of the work in the standard format for being evaluated by the External Assessment.
10. Present the work precisely and concisely in front of the panel at the evaluation.

The course assessment will be carried out in two phases: continuous and end-semester examinations. Apart from the continuous monitoring by the respective supervisor, the continuous assessment will consist of two presentations in front of the panel of teachers. The first internal presentation will be carried out amid the semester, which will evaluate the progress and feasibility of the proposal. The second internal presentation will be conducted before preparing for the final presentation. Students have to incorporate the

panel's recommendations while preparing the final dissertation and presentation. A panel chaired by the Head of the Department will conduct the end-semester examination. In addition to the external expert, the supervisor will be a mandatory panel member. The assessment will be based on Content (40), Methodology (30), Presentation (20), and Viva (10); where the figure in bracket represents the maximum % of grades that can be awarded in each category. In the internal evaluation, the criteria content will be awarded by the respective supervisor based on the continuous monitoring of the work and dissertation and others by the panel of teachers.

End Semester Dissertation Evaluation and Course Viva

All students need to attend a course viva of the programme at the end of the dissertation work. All students will be evaluated by a panel of experts on their knowledge of different courses in the program, case studies done and the final dissertation work. An evaluation of their professional development acquired by the programme will be conducted.