MASTER OF COMPUTER APPLICATION

(DRAFT SYLLABUS)

Syllabus w.e.f. the Academic Session 2020-2021

MAULANA ABUL KALAM AZAD
UNIVERSITY OF TECHNOLOGY,
WEST BENGAL

Utech

In Pursuit Of Knowledge And Excellence

MAULANA ABUL K.   TECHNOLOGY

WEST BENGAL

Objective:

To conduct software industry, corporate sector, academia, research-oriented MCA program following the AICTE model for MCA

Eligibility:

Candidates with the following eligibility can take admission in the 2-year MCA program approved by AICTE:

A. Students who have passed Bachelor of Computer Application or Bachelor's degree in Computer Science Engineering or equivalent degree
B. Students who have passed Bachelor of Science, Bachelor of Commerce or Bachelor of Arts with mathematics at 10+2 or at the graduation level with additional bridge courses as per the norms of the concerned university
C. Candidates must have obtained at least 50 percent marks, or 45 percent marks in the case of candidates belonging to reserved categories, in the qualifying examination

Duration:

2 Years (4 Semesters)

Program Educational Objectives (PEOs)

PEO 01: **Technical Expertise:** Develop the ability to plan, analyze, design, code, implement, test and maintain the software product for real time systems that are technically sound, economically feasible and socially acceptable

PEO 02: **Successful Career:** Exhibit professionalism, ethical attitude with updated technologies in Computer Application based career and capability to set up their own enterprise in various sectors of Computer Applications

PEO 03: **Soft Skills:** Develop communication skills, team work and leadership quality in their professional multidisciplinary projects and adapt to current trends by engaging in lifelong learning

PEO 04: **Life Long Learning:** Prepare the students to pursue higher studies by acquiring knowledge in mathematical, computing and engineering principles in the field of computing and related fields and to work in the fields of teaching and research

Program Specific Outcomes (PSOs)

The post-graduates of Master of Computer Application Program will demonstrate:

PSO 01: **Software System Design and Development:** The ability to apply software development life cycle principles to design and develop the application software that meets the automation needs of society and industry.

PSO 02: **Computing and Research ability:** The ability to employ modern computer languages, environments and platforms in creating innovative career paths in SMAC (Social, Mobile, Analytics and Cloud) technologies.

PSO 03: **Professionalism and Ethics:** Efficient team leaders, effective communicators and capable of working in multi-disciplinary environment following ethical values.

Program Outcomes (POs)

On Completion of MCA program, the post-graduates are expected to

PO 01: **Engineering Knowledge:** Ability to apply knowledge of computing, science, mathematics and engineering fundamentals appropriate to the discipline

PO 02: **Problem Analysis:** Ability to identify, critically analyze, formulate the computing requirements appropriate to its solution and develop computer applications

PO 03: **Design/Development of Solutions:** Ability to design, implement and evaluate a computer-based complex system, process, component, or program to meet desired needs with appropriate consideration for public health and safety, cultural, societal and environmental considerations

PO 04: **Conduct Investigations of Complex Problems:** Use of research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions and develop Software with complete satisfaction to the Customer.

PO 05: **Modern Tool Usage:** Ability to apply current technologies, skills, and modern IT tools necessary for computing practice with an understanding of the limitations.

PO 06: **The Engineer and Society:** Ability to understand the impact of system solutions in a contemporary, global, economical, environmental and societal context for sustainable development.

PO 07: **Environment and Sustainability:** Ability to understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO 08: **Ethics:** Ability to discharge their duties with professional and ethical responsibilities as an individual as well as in multidisciplinary teams with positive attitude.

PO 09: **Individual and Team Work:** Ability to function individually in effective manner and on teams, including diverse and multidisciplinary, to accomplish a common goal.

PO 10: **Communication:** Ability to communicate effectively with a range of audiences and be customer friendly.

PO 11: **Project Management and Finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team to manage projects and in multidisciplinary environments and should be economically feasible.

PO 12: **Life-Long Learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological changes.

Program Structure:

SEMESTER	THEORY		PRACTICAL		SESSIONAL		Semester Credits [A+B+C]
	Courses	Credits [A]	Courses	Credits [B]	Courses	Credits [C]	
I	4(C) + 1(E)	17	2	6	1	2	25
II	4(C) + 1(E)	19	3	9	1	2	30
III	3(C) + 2(E)	18	1	3	1	8	29
IV	1(OE)	4	-	-	1	22	26
TOTAL CREDIT →							110

* C → Compulsory Courses
* E → Elective Courses
* OE → Open Elective Courses

Project: Dissertation + Presentation + Project viva

Session:

- Odd Semester/ 1st and 3rd: July - December
- Even Semester/2nd and 4th):   January - June
- Lecture Hour: 1 Hour
- Subject wise Lecture per Week: 4

Examination System:

Subject wise Total Marks: 100
Semester Grade Point Average: SGPA
Yearly Grade Point Average: YGPA
Degree Grade Point Average: DGPA

Teaching Methodology:

Lecture, Discussion, Presentation, Case Studies, Group Task, Assignment, Projects, Special Lecture by Industry Professionals

General Guidelines:

The 2-year MCA curriculum will be applicable w.e.f. the academic year 2020 – 2021.
All rules and regulation regarding admission, examination, registration, migration and others shall exist according to MAKAUT norms.

PART – I
COURSE STRUCTURE

Semester - I							
THEORY							
Sl. No	Paper Code	Paper Name	Contact Hours / Week				Credit
			L	T	P	Total	
1	MCAN-101	Programming Concept through Python	3	1	-	4	4
2	MCAN-102	Relational Database Management System	3	1	-	4	4
3	MCAN-103	Computer Organization and Architecture	3	1	-	4	4
4	MCAN-104	Discrete Mathematics and Combinatorics	3	1	-	4	3
5	**Audit Elective**		2	1	-	3	2
	MCAN-E105A	Environment and Ecology					
	MCAN-E105B	Management Accounting					
	MCAN-E105C	Constitution of India					
	MCAN-E105D	Stress Management through Yoga					
PRACTICAL							
1	MCAN-191	Python Programming Lab	-	-	4	4	3
2	MCAN-192	Relational Database Management System Lab	-	-	4	4	3
SESSIONAL							
1	MCAN-181	Soft Skill and Interpersonal Communication	-	-	4	4	2
Total Weekly Contact Hours and Credit						**31**	**25**
BRIDGE COURSE **[Only for Students of Category "B" stated in the "Eligibility" Section]**							
A minimum 8-week Online Course on Fundamentals of 'Computer Science' or 'Computer Application' or 'Information Technology' or so							

Semester - II							
THEORY							
Sl. No.	Paper Code	Paper Name	Contact Hours / Week				Credit
			L	T	P	Total	
1	MCAN-201	Data Structure through Python	3	1	-	4	4
2	MCAN-202	Modern Operating System	3	1	-	4	4
3	MCAN-203	Object Oriented Programming with JAVA	3	1	-	4	4
4	MCAN-204	Networking and TCP Suite	3	1	-	4	4
5	**Mathematical Elective**		3	1	-	4	3
	MCAN-E205A	Numerical and Statistical Analysis					
	MCAN-E205B	Operation Research and Optimization Techniques					
PRACTICAL							
1	MCAN-291	Data Structure Lab using Python	-	-	4	4	3
2	MCAN-292	Operating System Lab (Unix)	-	-	4	4	3
3	MCAN-293	Object Oriented Programming Lab using JAVA	-	-	4	4	3
SESSIONAL							
1	MCAN-281	Web Technology	-	-	4	4	2
Total Weekly Contact Hours and Credit						36	30
BRIDGE COURSE **[Only for Students of Category "B" stated in the "Eligibility" Section]**							
A minimum 8-week Online Course on Fundamentals of 'Software Engineering' or 'Systems Analysis and Design' or 'Business Systems Applications' or so							

Semester - III

THEORY

Sl. No.	Paper Code	Paper Name	L	T	P	Total	Credit
1	MCAN-301	Software Engineering using UML	3	1	-	4	4
2	MCAN-302	Artificial Intelligence and Expert System	3	1	-	4	4
3	MCAN-303	Formal Language and Automata Theory	3	1	-	4	4
4	**Professional Elective - I**		3	1	-	4	3
	MCAN-E304A	ASP.Net using C#					
	MCAN-E304B	Web Enabled JAVA Programming					
	MCAN-E304C	Web Technology through PHP					
	MCAN-E304D	Android Application Development					
5	**Professional Elective - II**		3	1	-	4	3
	MCAN-E305A	Design and Analysis of Algorithm					
	MCAN-E305B	Data Warehousing and Data Mining					
	MCAN-E305C	Image Processing					

(Contact Hours / Week header spans L, T, P, Total columns)

PRACTICAL

Sl. No.	Paper Code	Paper Name	L	T	P	Total	Credit
1	MCAN-E394 (A/B/C/D)	Professional Elective – I Lab	-	-	4	4	3

SESSIONAL

Sl. No.	Paper Code	Paper Name	L	T	P	Total	Credit
1	MCAN-381	Minor Project and Viva-voce	-	-	10	10	8
	Total Weekly Contact Hours and Credit					**34**	**29**

Semester IV

THEORY

Sl. No.	Paper Code	Paper Name	L	T	P	Total	Credit
1	**Open Elective**						4
	MCAN-OE401	Open Elective					

SESSIONAL

Sl. No.	Paper Code	Paper Name	L	T	P	Total	Credit
1	MCAN-481	Major Project and Viva-voce	-	-	26	26	22
	Total Class / Credit					**30**	**26**

PART – II: DETAILED SYLLABUS

Code: MCAN-101	Paper: Programming Concept through Python	
Contacts Hours / Week: 4	Total Contact Hours: 40	Credit: 4

Course Outcome:

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

- ✓ Learn, understand and comprehend the concept of programming.
- ✓ Design algorithm to solve simple programming problem.
- ✓ Understand and remember syntax and semantics of Python.
- ✓ Create application using secondary storage.
- ✓ Understand and apply library for data analysis.
- ✓ Apply Python to implement different solutions for the same problem and analyze why one solution is better than the other.
- ✓ To write program for real life problem.

UNIT	COURSE CONTENT
1	**Fundamentals of Computer** (6L) History of Computers, Basic Anatomy of Computer System, Primary & Secondary Memory, Processing Unit, Input & Output devices. Basic Concepts of Assembly language, High level language, Compiler and Assembler. Number systems (decimal, octal and hexadecimal) with signed and unsigned numbers (using 1's and 2's complement) - their representation, conversion and arithmetic operations. Packed and unpacked BCD system, ASCII. IEEE-754 floating point representation (half- 16 bit, full- 32 bit, double- 64 bit).
2	**Programming Basics** (2L) Problem analysis, Flowchart, algorithms, Pseudo codes, structured programming, Example of Flowchart and Algorithm representation
3	**Variable and Expression** (4L) Variables as names for values; expressions (arithmetic and logical) and their evaluation (operators, associativity, precedence). Assignment operation; difference between left hand side and right hand side of assignment, Console input/output: taking input from user and printing user information.
4	**Control Statement and Iteration** (5L) If statement, else-if statement, multiple statements within if, multiple if statement. While Loop, For Loop, Nesting Loops, Controlling Loops using Break and Continue, Else Statement, Range Statement and Pass Statement in Loop.
5	**Collections** (2L) Strings, List, Tuples, Dictionary, Set, Selection sort, Bubble sort
6	**Function** (2L) Built in function, user defined function, function passing values, function returning values, default parameter values, Recursive function
7	**File Management** (4L) Operations on files (opening, modes, attributes, encoding, closing), read() & write() methods, tell() & seek() methods, renaming & deleting files and directories
8	**Errors and Exception Handling** (2L) Dealing with syntax errors, Exceptions, Handling exceptions with try/except, Cleaning up with finally
9	**Classes and Objects** (5L) Create a Class, Create Object, __Init__() Function, Methods, Self Parameter, Modification and Deletion of Object Parameter, Deletion of Object, Pass Statement, Inheritance and Polymorphism, Scope, Module, Built-In Math Function, Math Module, Module datetime and Date Objects, RegEx Module andRegEx Functions, Exception Handling.
10	**Modules& Packages** (2L) Importing a module, Creating module, Function aliases, packages
11	**Numpy** (6L) ndArray, Pandas: reading files, exploratory data analysis, data preparation and processing, ,

Matplolib: Scatterplot, Line plot, Bar plot, Histogram, Box plot, Pair plot

Reference Books:
- N.S. Gill, Handbook of Computer Fundamentals, Khanna Publishing House
- Dr.Jeeva Jose-Taming Python by Programming, Khanna Publishing
- Martin C. Brown – The Complete Reference Python, Mc Graw Hill
- A. Martelli, A. Ravenscroft, S. Holden, Python in a Nutshell,OREILLY.
- Jason Rees-Python Programming:Practical introduction to Python Programming for total beginners,
- Anthony Brun - Python Programming: A Step By Step Guide From Beginner To Expert (Beginner, Intermediate & Advanced)
- Mark Pilgrim-Diva into Python, Springer-Verlag Berlin and Heidelberg GmbH & Co. KG
- Summerfield Mark- Programming in Python 3,Pearson Education India

Code: MCAN-102	Paper: Relational Database Management System	
Contacts Hours / Week: 4	Total Contact Hours: 40	Credit: 4

Course Outcome:

After successful completion of this course, students will be able to:
- ✓ Identify the need for a database over the file system.
- ✓ Understand and implement the process of data insertion, retrieval, and manipulation.
- ✓ Implement SQL concept for a database transaction.
- ✓ Understand and analyze the functional dependencies among attributes of the entity set and normalization between the relations.
- ✓ Evaluate the relational tables, PL/SQL programs, triggers, database files, indexing of RDBMS.
- ✓ Understand and Implement the Transaction control and concurrency control management.
- ✓ Understanding the concept of distributed & object oriented database.

UNITS	COURSE CONTENT
1	**Basic Concept** (5L) Database Management System , File based system, Advantages of DBMS over file based system, Database Approach, Logical DBMS Architecture, Three level architecture of DBMS or logical DBMS architecture, Need for three level architecture, Physical DBMS Architecture, Database Administrator (DBA) Functions & Role, Data files indices and Data Dictionary Types of Database, Relational and ER Models: Data Models , Relational Model, Domains, Tuple and Relation, Super keys, Candidate keys , Primary keys and foreign key for the Relations, Relational Constraints, Domain Constraint, Key Constraint , Integrity Constraint,- Update Operations and Dealing with Constraint Violations, Relational Operations **Entity Relationship (ER) Model:** Entities, Attributes, Relationships, More about Entities and Relationships, Defining Relationship for College Database, Conversion of E-R Diagram to Relational Database.
2	**Database Integrity And Normalization** (7L) Relational Database Integrity, The Keys, Referential Integrity, Entity Integrity, Redundancy and Associated Problems, Single Valued Dependencies, Normalization, Rules of Data Normalization, The First Normal Form, The Second Normal Form, The Third Normal Form, Boyce CODD Normal Form, The Fourth Normal Form, The Fifth Normal Form, Multi-valued Functional Dependency, Attribute Preservation, Lossless join Decomposition, Dependency Preservation.
3	**File Organization** (4L) Physical Database Design Issues, Storage of Database on Hard Disks, File Organization and Its Types, Heap files (Unordered files), Sequential File Organization, Indexed (Indexed Sequential) File Organization, Hashed File Organization, Types of Indexes, Index and Tree Structure, Multi-key File Organization, Need for Multiple Access Paths, Multi-list File Organization, Inverted File Organization.
4	**Structure Query Language (SQL)** (6L) Meaning, SQL commands, Data Definition Language, Data Manipulation Language, Data Control Language, Transaction Control Language, Queries using Order by, Where, Group by, Nested Queries. Joins, Views, Sequences, Indexes and Synonyms, Table Handling.
5	**Transaction and Concurrency Management** (8L) Transactions, Concurrent Transactions, Locking Protocol, Serializable Schedules, Locks Two Phase Locking (2PL), Deadlock and its Prevention, Optimistic& Pessimistic Concurrency Control. Database Recovery and Security: Database Recovery meaning, Kinds of failures, Failure controlling methods, Database errors, Backup & Recovery Techniques, Security & Integrity, Database Security Authorization.
6	**PL/SQL** (6L) Introduction to PL/SQL, Variables & Data types, Basic blocks, Conditional & branching statement, Handling of Cursor, Trigger, Function, Procedure, Package and Exception.
7	**Distributed & Object Oriented Databases** (4L) Centralized Versus Non-Centralized Databases, Heterogeneous and Homogeneous Distributed Databases

| | Reference Architecture of DDBMS, Distributed Database Design Query Processing, Distributed Concurrency Control: Serializability, Locking Protocols, Timestamp Protocols, Distributed Deadlock Management, Distributed Commit Protocols: Two-Phase Commit (2PC) & Three-Phase Commit (3PC). |
| | Basic Concept, Limitation of Relational Databases and Need for Object Oriented Databases. |

Reference Books:

- Silverchatz, Korth& Sudarshan-Data Base System Concepts, MH.
- Elmasri, Navathe- Fundamentals of Database Systems, Pearson
- C J date-An Introduction to Database, Addison-Wesley Publishing Company
- Majumder & Bhattacharyya-Data Base Management Systems, TMH
- Feuerstein-Oracle PL/SQL Programming,SPD/O'REILLY
- Leon-Data Base Management Systems, VIKAS
- Kroenke-Data Base Processing:Fundamentals, Design &Implementation,PHI
- P.S Deshpande-SQL PL/SQL for Oracle 8 & 8i, Wiley Dreamtech
- P. Bhatia, S. Bhatia, G. Singh- Concepts of Database Management System, Kalyani Publishers

Code: MCAN-103   Paper: Computer Organization and Architecture

Contacts Hours / Week: 4	Total Contact Hours: 40	Credit: 4

Course Outcome:

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

- ✓ Describe the merits and pitfalls in computer performance measurements and analyze the impact of instruction set architecture on cost-performance of computer design
- ✓ Explain Digital Logic Circuits, Data Representation, Register and Processor level Design and Instruction Set architecture
- ✓ Solve problems related to computer arithmetic and Determine which hardware blocks and control lines are used for specific instructions
- ✓ Design a pipeline for consistent execution of instructions with minimum hazards
- ✓ Explain memory organization, I/O organization and its impact on computer cost/performance.

UNITS	COURSE CONTENT
1	**INTRODUCTION** **(8L)** **Digital Logic Design:** Axioms and laws of Boolean algebra, Reduction of Boolean expressions, conversion between canonical forms, Karnaugh map (4 variable), Half Adder, full adder, 4-bitparallel parity bit generator, checker circuit, Decoder, Encoder, Multiplexer, IC RAM, ROM, Memory Organization, Sequential Circuits, State transistors, Flip-flop, RS, JK, D-Latch, Master-slave.
2	**INSTRUCTION SET ARCHITECTURE:** **(8L)** **Memory Locations and Addresses:** Byte Addressability, Big-Endian and Little-Endian Assignments, Word Alignment, Instructions and Instruction Sequencing, Addressing Modes, Assembly Language, Subroutines, Additional Instructions, dealing with 32-Bit Immediate Values.
3	**BASIC PROCESSING UNIT & PIPELINING** **(8L)** **Basic Processing Unit:** Some Fundamental Concepts, Instruction Execution, Hardware Components, Instruction Fetch and Execution Steps, Control Signals, Hardwired Control, CISC-Style Processors. **Pipelining:** Basic Concept, Pipeline Organization, Pipelining Issues, Data Dependencies, Memory Delays, Branch Delays, Pipeline Performance Evaluation.
4	**MEMORY ORGANIZATION** **(8L)** Basic Concepts, Semiconductor RAM Memories, Read-only Memories, Direct Memory Access, Memory Hierarchy, Cache Memories, Performance Considerations, Virtual Memory, Memory Management Requirements, Secondary Storage.
5	**INPUT OUTPUT & PARALLEL PROCESSING** **(8L)** **Basic Input Output:** Accessing I/O Devices, Interrupts, Input Output Organization: Bus Structure, Bus Operation, Arbitration, Interface, Interconnection Standards. Parallel Processing: Hardware Multithreading, Vector (SIMD) Processing, Shared-Memory Multiprocessors, Cache Coherence, Message-Passing Multicomputers, Parallel Programming for Multiprocessors, Performance Modeling.

Reference Books:

- Computer Organization and Embedded Systems, 6th Edition, Hamacher Carl, et. al, Tata McGraw Hill, New Delhi, 2011.
- Computer Organization and Design: The Hardware Software / Interface, 5th Edition, 1994, Patterson David A.
- Computer System Architecture, Revised 3rd Edition, Mano M. Morris, Pearson Education,

Code: MCAN-104	Paper: Discrete Mathematics and Combinatorics	
Contacts Hours / Week: 4	Total Contact Hours: 40	Credit: 3

Course Outcome:

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

- ✓ Interpret the problems that can be formulated in terms of graphs and trees.
- ✓ Explain network phenomena by using the concepts of connectivity, independent sets, cliques, matching, graph coloring etc.
- ✓ Achieve the ability to think and reason abstract mathematical definitions and ideas relating to integers through concepts of well-ordering principle, division algorithm, greatest common divisors and congruence.
- ✓ Apply counting techniques and the crucial concept of recurrence to comprehend the combinatorial aspects of algorithms.
- ✓ Analyze the logical fundamentals of basic computational concepts.
- ✓ Compare the notions of converse, contrapositive, inverse etc. in order to consolidate the comprehension of the logical subtleties involved in computational mathematics.

UNITS	COURSE CONTENT
1	**Logic and Proofs** (3L) Propositional logic, Propositional equivalences, Predicates and quantifiers, Nested quantifiers, Rules of inference.
2	**Principles of Mathematical Induction** (5L) The Well-Ordering Principle, Recursive definition, The Division algorithm: Prime Numbers, The Greatest Common Divisor: Euclidean Algorithm, The Fundamental Theorem of Arithmetic.
3	**Sets and Sequence** (8L) Sets, Relation and Function: Operations and Laws of Sets, Cartesian Products, Binary Relation, Partial Ordering Relation, Equivalence Relation, Image of a Set, Sum and Product of Functions, Bijective functions, Inverse and Composite Function, Size of a Set, Finite and infinite Sets, Countable and uncountable Sets, Cantor's diagonal argument and The Power Set theorem, Schroeder-Bernstein theorem. Fuzzy set, Basic properties of fuzzy set.
4	**Counting and Combinatorics** (8L) Counting, Sum and product rule, Principle of Inclusion Exclusion. Pigeon Hole Principle, Counting by Bijections. Double Counting. Linear Recurrence relations - methods of solutions. Generating Functions. Permutations and Combination.
5	**Algebraic Structure** (9L) Algebraic Structures with one Binary Operation, Semi Groups, Monoids, Groups, Congruence Relation and Quotient Structures, Free and Cyclic Monoids and Groups, Permutation Groups, Substructures, Normal Subgroups, Algebraic Structures with two Binary Operation, Rings, Integral Domain and Fields. Boolean Algebra and Boolean Ring, Identities of Boolean Algebra, Duality, Representation of Boolean Function, Disjunctive and Conjunctive Normal Form
6	**Graph and Tree** (7L) Graphs and their properties, Degree, Connectivity, Path, Cycle, Sub Graph, Isomorphism, Eulerian and Hamiltonian Walks, Graph Colouring, Colouring maps and Planar Graphs, Colouring Vertices, Colouring Edges, List Colouring, Perfect Graph, definition properties and Example, rooted trees, trees and sorting, weighted trees and prefix codes, Bi-connected component and Articulation Points, Shortest distances.

Reference Books:

- Kandel & Baker- Discrete Mathematics for Comp. Scientists & Mathematicians, Mott, PHI
- C.L.Liu- Discrete Mathematical Structure, C.L.Liu,TMH
- G.S.RAO- Discrete Mathematical Structure, New Age International
- Deo Narsingh - Graph Theory With Applications To Engineering And Computer Science, PHI Learning
- Arumugam, Ramachandran- Invitation to Graph Theory, Scitech Publications (India)

Code: MCAN-E105A Paper: Environment and Ecology
Contacts Hours / Week: 3 **Total Contact Hours: 30** **Credit: 2**

Course Outcome:

After successful completion of this course, students will be able to:
- ✓ Be able to understand the natural environment and its relationships with human activities.
- ✓ Be able to apply the fundamental knowledge of science and engineering to assess environmental and health risk.
- ✓ Be able to understand environmental laws and regulations to develop guidelines and procedures for health and safety issues
- ✓ Be able to solve scientific problem-solving to air, water, noise and land pollutions.

UNITS	COURSE CONTENT
1	**Introduction** (4L Basic ideas of environment and interrelationship among man society and environment. Environmental problems and issues, Segments of environments, Natural Cycles of environments Mathematics of population growth and its associated problems, Logistic population growth
2	**Elements of Ecology** (3L Open and closed system ecology, species, population, community, definition of ecosystem-components types and functions, Environmental perspectives, Montreal protocol
3	**Pollutants and Contaminants** (3L Definition of primary and secondary pollutants and contaminants. Source and effects of different air pollutants suspended particulate matter, oxides of carbon, nitrogen, sulphur particulate
4	**Air Pollution** (5L Structures of the atmosphere, global temperature models, Greenhouse effect, global warming; acid rain: causes, effects and control. Lapse rate and atmospheric stability; pollutants and contaminants; smog; depletion of ozone layer; standards and control measures of air pollution.
5	**Water Pollution** (5L Hydrosphere; pollutants of water: origin and effects; oxygen demanding waste; thermal pollution; pesticides; salts. Biochemical effects of heavy metals; eutrophication: source, effect and control. Water quality parameters: DO, BOD, COD. Water treatment: surface water and wastewater.
6	**Land Pollution** (5L Land pollution: sources and control; solid waste: classification, recovery, recycling, treatment and disposal.
7	**Noise Pollution** (5L Noise: definition and classification; noise frequency, noise pressure, noise intensity, loudness of noise, noise threshold limit value; noise pollution effects and control.

Reference Books:
- Basic Environmental Engineering and Elementary Biology, GourKrishna Das Mahapatra, Vikas Publishing House P. Ltd.
- Environmental Chemistry, A. K. De, New Age International.
- Environmental Engineering, G.M.Masters, Tata Mc Graw Hills
- Environmental Chemistry with Green Chemistry, A. K. Das, Books and Allied P. Ltd.
- Fundamentals of Environment & Ecology, D. De, D. De, S. Chand & Company Ltd.

Code: MCAN-E105B	**Paper: Management Accounting**	
Contacts Hours / Week: 3	**Total Contact Hours: 30**	**Credit: 2**

Course Outcome:

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

- ✓ Understand the basic concepts related to Business.
- ✓ Demonstrate the roles, skills and functions of different discipline of business management.
- ✓ To disseminate knowledge among the students inculcate with theoretical structures about banking system
- ✓ Record basic accounting transactions and prepare annual financial statements; and analyse, interpret and communicate the information contained in basic financial statements
- ✓ Analyse and provide recommendations to improve the operations of Organisations through the application of Cost and Management accounting techniques
- ✓ Equip students with in-depth and expert knowledge of Tally ERP with GST.

UNITS	COURSE CONTENT	
1	**Introduction** Basics of management; Planning, scheduling, organizing, staffing, directing, controlling	**(3L)**
2	**Management** Marketing Management, Financial management, Operation management, Human resource management, Management information System	**(3L)**
3	**Strategy** Firm and its environment, strategies and resources, industry structure and analysis, corporate strategies and its evaluation, strategies for growth and diversification, strategic planning	**(3L)**
4	**Business Trade and Banking** Business: Types of business, Sole Proprietorship, Partnership, Limited company and cooperative society – their characteristics. Banking: role of commercial banks; credit creation and its importance in industrial functioning. Role of central bank: Reserve Bank of India. International Business or Trade Environment.	**(3L)**
5	**Financial Accounting** Journals, Ledgers, Trial Balance, Profit & Loss Account, Balance Sheet, Financial Reporting Financial Statement Analysis and Interpretation (Financial Ratio and Cash Flow analysis)	**(7L)**
6	**Cost Accounting** Concepts and Classification of costs, Cost Sheet Break Even Analysis, Variance Analysis, Cost-volume profit (CVP) relationship, Cash Budgeting	**(7L)**
7	**Packages** Financial accounting computer package (Tally ERP with GST)	**(4L)**

Reference Books:

- Financial Accounting- A Managerial Perspective, R. Narayanswami, Prentice-Hall of India Private Limited. New Delhi
- Fundamentals of Financial Management, Horne, James C Van, Prentice-Hall of India Private Limited, New Delhi
- Modern Economic Theory, H. L. Ahuja., S. Chand. New Delhi.
- Management Accounting, Khan & Jain, TMH
- Management Accounting,M.E.Thukaram Rao,New Age International

Code: MCAN-E105C	Paper: Constitution of India	
Contacts Hours / Week: 3	Total Contact Hours: 30	Credit: 2

Course Outcome:

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

- ✓ Understand the premises informing the twin themes of liberty and freedom from a civil rights perspective.
- ✓ To address the growth of Indian opinion regarding modern Indian intellectuals' constitutional role and entitlement to civil and economic rights as well as the emergence of nationhood in the early years of Indian nationalism.
- ✓ To address the role of socialism in India after the commencement of the Bolshevik Revolution in 1917 and its impact on the initial drafting of the Indian Constitution.

UNITS	COURSE CONTENT
1	**History of Making of the Indian Constitution** (5L) History Drafting Committee, (Composition & Working)
2	**Philosophy of the Indian Constitution** (5L) Preamble Salient Features
3	**Contours of Constitutional Rights & Duties** (5L) Fundamental Rights, Right to Equality, Right to Freedom ,Right against Exploitation, Right to Freedom of Religion, Cultural and Educational Rights, Right to Constitutional Remedies, Directive Principles of State Policy, Fundamental Duties.
4	**Organs of Governance** (5L) Parliament , Composition, Qualifications and Disqualifications, Powers and Functions, Executive, President, Governor, Council of Ministers, Judiciary, Appointment and Transfer of Judges, Qualifications, Powers and Functions
5	**Local Administration** (5L) District's Administration head: Role and Importance, Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal Corporation. Pachayati raj: Introduction, PRI: Zila Pachayat. Elected officials and their roles, CEO Zila Pachayat: Position and role. Block level: Organizational Hierarchy (Different departments), Village level: Role of Elected and Appointed officials, Importance of grass root democracy
6	**Election Commission** (5L) Role and Functioning. Chief Election Commissioner and Election Commissioners. State Election Commission: Role and Functioning. Institute and Bodies for the welfare of SC/ST/OBC and women.

Reference Books:

- The Constitution of India, 1950 (Bare Act), Government Publication.
- Dr. S. N. Busi, Dr. B. R. Ambedkar framing of Indian Constitution, 1st Edition, 2015.
- M. P. Jain, Indian Constitution Law, 7th Edn., Lexis Nexis, 2014.
- D.D. Basu, Introduction to the Constitution of India, Lexis Nexis, 2015.

Code: MCAN-E105D	Paper: Stress Management through Yoga	
Contacts Hours / Week: 3	Total Contact Hours: 30	Credit: 2

Course Outcome:

After successful completion of this course, students will be able to:
- ✓ To achieve overall health of body and mind
- ✓ To overcome stress

UNITS	COURSE CONTENT	
1	**Astanga** Definitions of Eight parts of Yoga (Ashtanga)	**(8L)**
2	**Yam and Niyam** Do`s and Don't's in life. i) Ahinsa, satya, astheya, bramhacharya and aparigraha ii) Shaucha, santosh, tapa, swadhyay, ishwarpranidhan	**(8L)**
3	**Asan and Pranayam** i) Various yog poses and their benefits for mind & body ii)Regularization of breathing techniques and its effects-Typesof pranayama	**(8L)**
4	**Meditation Techniques**	**(6L)**

Reference Books:
- Janardan Swami Yogabhyasi Mandal- Yogic Asanas for Group Tarining-Part-I, Nagpur
- Swami Vivekananda- Rajayoga or conquering the Internal Nature, AdvaitaAshrama (Publication Department), Kolkata

Code: MCAN-191	Paper: Python Programming Lab	
Contacts Hours / Week: 4	Total Contact Hours: 40	Credit: 3

Course Outcome:

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

- ✓ To write simple programs relating to different logical problems.
- ✓ To be able to interpret, understand and debug syntax errors reported by the compiler.
- ✓ Understand and implement the native data types (Python in this course)
- ✓ To implement conditional branching, iteration.
- ✓ To decompose a problem intofunctions.
- ✓ To be able to create, read from and write into simple text files.
- ✓ To understand the basic concept of OOPs
- ✓ To understand and implement Python Numpy Arrray operations

UNITS	COURSE CONTENT
1	**Python Basics:** Installing Python, Setting up Path and Environment Variables, Running Python, First Python Program
2	**Python Data Types & Input/output:** Keywords, Identifiers, Python Statement, Indentation, Documentation, Variables, Multiple Assignment, Understanding Data Type, Data Type Conversion, Python Input and Output Functions, Import command.
3	**Operators and Expressions:** Operators in Python, Expressions, Precedence, Associativity of Operators, Non Associative Operators.
4	**Control Structures:** Decision making statements, Python loops, Python control statements.
5	**Python Native Data Types:** Numbers, Lists, Tuples, Sets, Dictionary, Functions & Methods of Dictionary, Strings(in detail with their methods and operations).
6	**Python Functions:** Built-in Functions, User defined functions, Anonymous functions, Pass by value, Pass by Reference, Recursion
7	**Exception Handling:** Exceptions, Built-in exceptions, Exception handling, User defined exceptions in Python.
8	**File Management in Python:** Operations on files (opening, modes, attributes, encoding, closing), read() & write() methods, tell() & seek() methods, renaming & deleting files in Python, directories in Python.
9	**Python OOPs** Python OOPs Concepts, Object Class, Constructors, Inheritance
10	**Python Numpy** Numpy data types, Operations on Numpy Array (indexing,slicing, shape/reshape, iteration, join, split, search, sort, filter)

Code: MCAN-192	Paper: Relational Database Management System Lab	
Contacts Hours / Week: 4	Total Contact Hours: 40	Credit: 3

Course Outcome:

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

- ✓ Learn to use Entity Relationship Diagram (ERD) model as a blueprint to develop the corresponding relational model in a RDBMS system like Oracle DBMS.
- ✓ Apply DDL component of Structured query language (SQL) to create a relational database from scratch through implementation of various constraints in Oracle RDBMS system.
- ✓ Apply DML component of Structured query language (SQL) for storing and modification of data in Oracle RDBMS system.
- ✓ Apply DQL component of Structured query language (SQL) to construct complex queries for efficient retrieval of data from existing database as per the user requirement specifications.
- ✓ Conceptualize and apply various P/L SQL concepts like cursor, trigger in creating database programs.
- ✓ Develop a fully-fledged database backend system using SQL and P/L SQL programming to establish overall integrity of the database system.
- ✓ Implement PL/SQL function, Procedure and Package and Apply Exception.

UNITS	COURSE CONTENT
1	**Creation of a database based on given ERD Model:** SQL Data Definition Language (DDL) Create (and Alter) table structure, Apply (and Alter) constraints on columns/tables viz., primary key, foreign key, unique, not null, check. Verify/ Review the table structure (along with applied constraints) using appropriate data dictionary tables like user_constraints, user_cons_columns, etc. Create view, materialized view using one or more table. SQL Data Manipulation Language (DML) Insert into rows (once at a time/ and in bulk) from a table, Update existing rows of a table, Delete rows (a few or all rows) from a table.
2	**Data Query Language (DQL)** Basic select-from-where structure - Usage of Top, Distinct, Null keywords in query, Using String and Arithmetic Expressions, Exploring Where Clause with various Operators and logical combination of various conditions, Sorting data using Order By clause. Usage of IN, LIKE, ALL keywords. Introduction to Joins, Natural Joins, equi-join, non-equi-join, Self-Join, Inner Join, Outer (left, right) Join. Set operations: Unions, Intersect, minus set operations on table data using SQL. Using single row functions in Queries NVL function (to handle ambiguity of null data), upper, lower, to_date, to_char functions, etc. Using group/multiple row functions in Queries like Count, Sum, Min, Max, Avg, etc, using Group By and Having Clause, Using Group By with Rollup and Cube. Sub-query - Working with various nested structure of Sub Queries - use in from or where clause with more than one level of nesting, correlated sub-query- Ranking table data using correlated sub-query.
3	**P/L SQL** Stored Procedures and Functions- Basic programming constructs of PL / SQL like if, else, else-if, loop, while, for structure Populate stored procedure variables with the data fetched from table using SQL command. Working with Cursors - Creating Cursors, parameterized cursor, Locks on cursors, Exploring advantages of cursors. Introduction to triggers - Constraints Vs Triggers, Creating, Altering, Dropping triggers, use of for/ after/ instead of triggers, Using trigger to validate/ rollback a Transaction, Automatically populate integer data based primary key columns (e.g., Id.) using trigger.

Handling Function, Procedure & Package – Create Function, Create Procedure and Create Package.
Exception Handling.

Code: MCAN-181	Paper: Soft Skill and Interpersonal Communication	
Contacts Hours / Week: 4	Total Contact Hours: 40	Credit: 2

Course Outcome:

After successful completion of this course, students will be able to:
- ✓ Effectively communicate through verbal/oral communication and improve the listening skills
- ✓ Able to be self-confident with positive vibes
- ✓ Actively participate in group discussion / meetings / interviews and prepare & deliver presentations
- ✓ Become more effective individual through goal/target setting, self-motivation and practicing creative thinking.
- ✓ Function effectively in multi-disciplinary and heterogeneous teams through the knowledge of team work, Inter-personal relationships, conflict management and leadership quality.

UNITS	COURSE CONTENT
1	**Soft Skills& Interpersonal Communication** An Introduction – Definition and Significance of Soft Skills; Process, Importance and Measurement of Soft Skill Development. Inter personal relations; communication models, process and barriers; team communication; developing interpersonal relationships through effective communication; listening skills; essential formal writing skills; corporate communication styles –assertion, persuasion, negotiation.
2	**SWOT & Creative Thinking** Discovering the Self; Setting Goals; Beliefs, Values, Attitude, Virtue. Developing Positive Thinking and Attitude; Driving out Negativity; Meaning and Theories of Motivation; Enhancing Motivation Levels.
3	**Corporate Communication** **Public Speaking:** Skills, Methods, Strategies and Essential tips for effective public speaking. **Group Discussion:** Importance, Planning, Elements, Skills assessed; Effectively disagreeing, Initiating, Summarizing and Attaining the Objective. **Interview& Presentation Skills:** Interviewer and Interviewee– in-depth perspectives. Before, During and After the Interview. Tips for Success: Types, Content, Audience Analysis, Essential Tips – Before, During and After, Overcoming Nervousness.
4	**Non-Verbal Communication & Personality Development** Importance and Elements; Body Language. Concept, Essentials, Tips Meaning, Nature, Features, Stages, Models; Learning Skills; Adaptability Skills.
5	**Business Etiquette & Team Work** Concept of Teams; Building effective teams; Concept of Leadership and honing Leadership skills. Meaning, Nature, Features, Stages, Models; Learning Skills; Adaptability Skills.

Reference Books:
- Managing Soft Skills for Personality Development – edited by B.N.Ghosh,McGraw Hill India, 2012.
- Effective Communication and Soft Skills, Nitin Bhatnagar, Pearson Education India, 2011
- English and Soft Skills – S.P.Dhanavel, Orient Blackswan India, 2010.

Code: MCAN-201	**Paper: Data Structure through Python**	
Contacts Hours / Week: 4	**Total Contact Hours 40**	**Credit: 4**

Course Outcome:

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

- ✓ Understand the concept of abstract data type such as stack, queue, linked list, and trees
- ✓ Chose appropriate data structure to design algorithm to solve the problem.
- ✓ Analyze the algorithms in the context of efficiency.
- ✓ Apply the knowledge of stack and queue to design algorithm
- ✓ Design application using sorting, searching and the concept of tree.

UNITS	COURSE CONTENT
1	**Introduction** (6L) Basic Terminologies: Elementary Data Organizations, Data Structure Operations: insertion, deletion, traversal etc.; Analysis of an Algorithm, Asymptotic Notations, Time-Space trade off. Searching: Linear Search and Binary Search Techniques and their complexity
2	**Stacks and Queues** (8L) ADT Stack and its operations: Algorithms and their complexity analysis, Applications of Stacks: Expression Conversion and evaluation – corresponding algorithms and complexity analysis. ADT, queue, Types of Queue: Simple Queue, Circular Queue, Priority Queue; Operations on each type of Queue: Algorithms and their analysis.
3	**Linked Lists** (6L) Singly linked lists: Representation in memory, Algorithms of several operations: Traversing, Searching, Insertion into, Deletion from linked list; Linked representation of Stack and Queue, Header nodes, Doubly linked list: operations on it and algorithmic analysis; Circular Linked Lists: all operations their algorithms and the complexity analysis.
4	**Trees** (6L) Basic Tree Terminologies, Different types of Trees: Binary Tree, Threaded Binary Tree, Binary Search Tree, AVL Tree; Tree operations on each of the trees and their algorithms with complexity analysis. Applications of Binary Trees. B Tree, B+ Tree: definitions, algorithms and analysis.
5	**Graph** (6L) Graph Terminology, Representation of graphs, Path Matrix, Graph Traversal, BFS, DFS, Minimum Spanning Tree, Kruskal's Algorithm and Prim's Algorithm.
6	**Sorting** (8L) Objective and properties of different sorting algorithms: Selection Sort, Bubble Sort, Insertion Sort, Quick Sort, Merge Sort, Heap Sort; Performance and Comparison among all the methods Hashing: Review of Hashing, Hash Function, Collision Resolution Techniques in Hashing, Separate Chaining, Open Addressing, Linear Probing, Quadratic Probing, Double Hashing, Rehashing, Extendible Hashing.

Reference Books:

- Fundamentals of Data Structures of C, Ellis Horowitz, Sartaj Sahni, Susan Anderson-freed.
- Data Structures in C, Aaron M. Tenenbaum.
- Data Structures, S. Lipschutz.
- Introduction to Algorithms, Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, lifford Stein.

Code: MCAN-202	Paper: Modern Operating System	
Contacts Hours / Week: 4	Total Contact Hours: 40	Credit: 4

Course Outcome:

After successful completion of this course, students will be able to:
- ✓ Describe the main components of OS and their working
- ✓ Explain the concepts of process and thread and their scheduling policies
- ✓ Explain the various memory management techniques
- ✓ Compare the different techniques for managing memory, I/O, disk and files
- ✓ Explains the security and protection features of an Operating System

UNITS	COURSE CONTENT
1	**Introduction** (8L) Generations Concept of Operating systems, Systems, Types of Operating Systems, OS Services, System Calls, Structure of an OS - Layered, Monolithic, Microkernel Operating Systems, Concept of Virtual Machine. Real Time Operating Systems, Distributed Operating Systems, Multiprocessor Operating System.
2	**Process and Scheduling** (12L) **Processes and Threads**: 7 state process model, Process scheduling, Operations on processes, Inter-process communication, Threads overview, Benefits of threads, User and kernel threads. **CPU Scheduling:** Scheduling criteria, Preemptive & non-preemptive scheduling, Scheduling algorithms (FCFS, SJF, RR, Priority, Multi-level queue, Multi-level feedback queue), Comparative study of the algorithms, Multi-processor scheduling. **Process Synchronization**: Background, Critical section problem, Software solution – Peterson and Bakery algorithm, Synchronization hardware, Semaphores, Classical problems of synchronization. **Deadlocks:** System model, Deadlock characterization, Methods for handling Deadlocks, Deadlock prevention, Deadlock avoidance, Deadlock detection, Recovery from deadlock. **Case Study:** Scheduling on Unix and Windows Operating Systems
3	**Memory Management** (10L) Basic concept, Logical and Physical address map, Memory allocation: Contiguous Memory allocation– Fixed and variable partition– Internal and External fragmentation and Compaction; Paging: Principle of operation –Page allocation Hardware support for paging, Protection and sharing, Disadvantages of paging. Virtual Memory: Basics of Virtual Memory – Hardware and control structures – Locality of reference, Page fault, Working Set , Dirty page/Dirty bit – Demand paging, Page Replacement algorithms(Optimal, FIFO, SC, NRU and LRU), Thrashing **Case Study:** Unix Virtual Memory, Windows Virtual Memory
4	**File Systems and I/O Management** (7L) File concept, Fundamental File System Organization and Access Methods, Directory structure, File system structure, Allocation methods (Contiguous, Linked, Indexed), Free-space management (Bit vector, Linked list, Grouping), Directory Implementation (Linear list, Hash table), Efficiency and Performance. PC Bus Structure, I/O connections, Data transfer techniques (Programmed, Interrupt driven, DMA), Bus arbitration (Daisy chain, Polling, Independent request), Blocking and non-blocking I/O, Kernel I/O subsystem (Scheduling, Buffering, Caching, Spooling and device reservation, Error handling). **Case Study:** Unix File System, Windows File System
5	**Security and Protection:** (3L) Overview of Security and Protection, Goals of Security and Protection, Security Attacks, Formal and Practical aspects of Security, Encryption, Authentication and Password Security, Access Descriptors and the Access Control Matrix, Protection Structures, Capabilities, **Case Study:** Unix Security, Windows Security.

Reference Books:
- Operating System Concepts Essentials, 10th Edition by AviSilberschatz, Peter Galvin, Greg Gagne, Wiley Asia Student Edition.
- Operating Systems: Internals and Design Principles, 5th Edition, William Stallings, Prentice Hall of India.
- Operating System Concepts, EktaWalia, Khanna Publishing House (AICTE Recommended Textbook – 2018)
- Operating System: A Design-oriented Approach, 1st Edition by Charles Crowley, Irwin Publishing
- Operating Systems: A Modern Perspective, 2nd Edition by Gary J. Nutt, Addison- Wesley
- Design of the Unix Operating Systems, 8th Edition by Maurice Bach, Prentice-Hall of India
- Understanding the Linux Kernel, 3rd Edition, Daniel P. Bovet, Marco Cesati, O'Reilly and Associates

Code: MCAN-203	Paper: Object Oriented Programming with Java	
Contacts Hours / Week: 4	Total Contact Hours: 40	Credit: 4

Course Outcome:

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

- ✓ Use the characteristics of Java language in a program. Use variables and data types in program development.
- ✓ Identify and implement arrays, String and Selection Statements.
- ✓ Write Java programs using object-oriented programming techniques including classes, objects, methods, instance variables, interface.
- ✓ Design and implementation programs of Exception handling, Packages, Multithreading Programming, Window based programs.

UNITS	COURSE CONTENT
1	**Object-Oriented Languages** (10L) Java's History, Creation of Java, Internet & Java, Byte-code, Its Features, Java Program Structure and Java's Class Library, Data Types, Variables, and Operators, Operator Precedence; Selection Statements, Scope of Variable, Iterative Statement; Defining Classes & Methods, Creating Objects of a Class, Defining and Using a Class, Automatic Garbage Collection. **Arrays and Strings:** Arrays, Arrays of Characters, String Handling Using String Class, Operations on String Handling Using, String Buffer Class.
2	**Classes and Inheritance** (10L Using Existing Classes, Class Inheritance, Choosing Base Class, Multiple Levels of Inheritance, Abstraction through Abstract Classes, Using Final Modifier, Packages: Understanding Packages, Defining a Package, Packaging up Your Classes, Adding Classes from a Package to Your Program, Understanding CLASSPATH, Standard Packages, Access Protection in Packages, Concept of Interface. **Exception Handling:** The concept of Exceptions, Types of Exceptions, Dealing with Exceptions, Exception Objects, Defining Your Own Exceptions.
3	**Multithreading Programming** (10L The Java Thread Model, Understanding Threads, The Main Thread, creating a Thread, Creating Multiple Threads, Thread Priorities, Synchronization. **Input / Output in Java:** I/O Basic, Byte and Character Structures, I/O Classes, Reading Console Input, Writing Console Output, Reading and Writing on Files, Random Access Files, Storing and Retrieving Objects from File, Stream Benefits. **Creating Applets in Java:** Applet Basics, Applet Architecture, Applet Life Cycle, Simple Applet Display Methods, The HTML Applet Tag Passing Parameters to Applets.
4	**Working with Windows** (10L AWT Classes, Window Fundamentals, Working with Frame, Creating a Frame Window in an Applet; Displaying Information within a Window. **Working with Graphics and Texts**: Working with Graphics, Working with Color, Setting the Paint Mode, Working with Fonts, Managing Text Output; Using Font Metrics, Exploring Text and Graphics, Working with AWT Controls, Layout Managers and Menus.

Reference Books:

- The Complete Reference JAVA, Herbert Schildt, TMH Publication.
- JAVA and Object-Oriented Programming Paradigm, Debasish Jana, Prentice Hall of India
- Beginning JAVA, Ivor Horton, WROX Publication.
- JAVA 2 UNLEASHED, Tech Media Publications.
- JAVA 2(1.3) API Documentations.

Code: MCAN-204	Paper: Computer : Networking and TCP Suite	
Contacts Hours / Week: 4	Total Contact Hours: 40	Credit: 4

Course Outcome:

After successful completion of this course, students will be able to:
- ✓ Understand the purpose of network layered models, network communication using the layered concept and able to compare and contrast OSI and TCP/IP model.
- ✓ Differentiate among and discuss the four level of address (physical, logical, port and url) used by the internet TCP/IP protocols.
- ✓ Understand the routing principals and algorithm such as distance vector routing and link state.
- ✓ Judge the efficiency of the connection oriented and connectionless protocol.
- ✓ Familiar with the routing techniques, protocols and quality of service.
- ✓ Explain the concept of network security and cryptography.

UNITS	COURSE CONTENT
1	**Introduction** (4L) Direction of data flow (simplex, half duplex, full duplex), Network topology, categories of network (LAN, MAN, WAN).
2	**Protocol and Standard** (4L) Layered Task, The OSI model, TCP/IP protocol suite, Addressing
3	**Internetworking** (10L) Internetworking concept, IPv4 and IPv6 Addressing, IPv4 protocol, IPv6 protocol, transition from IPV4 to IPV6, transition from IPv4 to IPv6, Address Mapping, Error Reporting, Multicasting, Unicast Routing Protocols, Distance Vector routing, Link state routing, Path vector routing, Multicasting Routing Protocols, Transmission Control Protocol(TCP), User Datagram Protocol(UDP)
4	**Quality of Service** (6L) Data traffic, Congestion, congestion control, Quality of service, Techniques to improve QoS, Integrated services, Differentiated service, QoS in Frame Relay, QoS in ATM
5	**DNS and Web** (8L) Name Space, Domain Name System, Distribution of Name Space, Remote Logging, Electronic Mail and File Transfer, WWW, Web document and HTTP, Network Management, Simple Network Management Protocol (SNMP)
6	**Network Security** (8L) Symmetric Key Cryptography, DES, AES, Asymmetric Key Cryptography, RSA, Diffie-Hellman, Security Services, Digital Signature, Key Management, IP Security, SSL/TLS, PGP, Firewalls

Reference Books:
- Computer Networks, Andrew S. Tanenbaum, Pearson Education, Fourth edition.
- Data and Computer Communication, William Stallings, Prentice hall, Seventh edition.
- High speed Networks and Internets, William Stallings, Pearson education, Second edition.
- Behrouz A Forouzan, - Data communication & Networking , TMH
- Behrouz A Forouzan, - TCP/IP Protocol Suite , TMH
- Kelvin R Fall, W. Richard Stevens- TCP/IP Illustrated Volume 1, Addison Wesley

Code: MCAN-E205A	Paper: Numerical and Statistical Analysis	
Contacts Hours / Week: 4	Total Contact Hours: 40	Credit: 3

Course Outcome:

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

- ✓ To understand approximation and propagation error.
- ✓ To understand and implement different interpolation techniques.
- ✓ To understand and implement integration techniques.
- ✓ To understand and implement solutions for linear and algebraic and differential equations.

UNITS	COURSE CONTENT
1	**Approximation in numerical computation** (3L) Truncation and rounding errors, Fixed and floating point arithmetic, Propagation of errors.
2	**Interpolation** (5L) Newton forward/backward interpolation, Lagrange's and Newton's divided difference Interpolation
3	**Numerical integration** (4L) Trapezoidal rule, Simpson's1/3 rule, Romberg's Integration, Expression for corresponding error terms.
4	**Numerical solution of Linear equations** (6L) Gauss elimination method, Matrix inversion, LU Factorization method, Gauss-Seidel iterative method.
5	**Numerical solution of Algebraic equation** (5L) Bisection method, Regula-Falsi method, Newton-Raphson method, Iteration Method, Secant Method.
6	**Numerical solution of ordinary differential equation** (5L) Euler's method, Runge-Kutta methods, Taylor's series, method, Predictor Corrector methods and Finite Difference method.
7	**Least Square Curve fitting** (3L) Linear & non-linear curve fitting
8	**Introduction to Statistics& Probability** (9L) Basic Statistics-measure of central tendency, dispersion. Probability, distribution introduction to mass function, density function, distribution function (Binomial, Poisson, Normal).

Reference Books:

- R.S. Salaria: Computer Oriented Numerical Methods, Khanna Publishing House
- C.Xavier: C Language and Numerical Methods.
- Dutta & Jana: Introductory Numerical Analysis.
- J.B.Scarborough: Numerical Mathematical Analysis.
- Jain, Iyengar, & Jain: Numerical Methods (Problems and Solution).
- Balagurusamy: Numerical Methods, Scitech.
- Baburam: Numerical Methods, Pearson Education.
- N. Dutta: Computer Programming & Numerical Analysis, Universities Press

Code: MCAN-E205B	Paper: Operation Research and Optimization Techniques	
Contacts Hours / Week: 4	**Total Contact Hours: 40**	**Credit: 3**

Course Outcome:

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

- ✓ 1. Describe the way of writing mathematical model for real-world optimization problems.
- ✓ 2. Identify Linear Programming Problems and their solution techniques
- ✓ 3. Categorize Transportation and Assignment problems
- ✓ 4. Apply the way in which Game Theoretic Models can be useful to a variety of real-world scenarios in economics and in other areas.
- ✓ 5. Convert practical situations into non-linear programming problems.
- ✓ 6. Solve unconstrained and constrained programming problems using analytical techniques.

UNITS	COURSE CONTENT
1	**Linear Programming Problem (LPP)-I** (10L) Formulation of an LPP; Graphical Method of solution of an LPP; Convex Combination and Convex Set; Convex Hull and Convex Polyhedron; Canonical and Standard form of an LPP; Basic Solution of a system of linear equations; Simplex Method; Big-M Method; Concept of Duality; Mathematical formulation of duals.
2	**Linear Programming Problem (LPP)-II** (10L) Transportation Problems (TP) ; Representation of Transportation Problems as LPP; Methods of finding initial basic feasible solution of TP: North-West Corner Rule, Matrix Minima Method, Vogel's Approximation Method; Optimality test of the basic feasible solution; Assignment Problems; Hungarian Method.
3	**Game Theory** (10L) Introduction; Strategies; The Minimax and Maximin Criterion; Existence of Saddle Point; Two person zero some Games; Games with saddle Point – Pure Strategies; Games without a Saddle Point – Mixed Strategies; Symmetric Games; Dominance Principle; Graphical Method of Solution; Algebraic Method of Solution.
4	**Non-Linear Programming Problem (NLPP)** (10L) Single-variable Optimization; Multivariate Optimization with no constraints: Semidefinite Case, Saddle Point; Multivariate Optimization with Equality Constraints: Method of Lagrange Multipliers; Multivariable Optimization with inequality constraints: Kuhn-Tucker Conditions.

Reference Books:

- Linear Programming and Game Theory by J. G. Chakraborty and P. R. Ghosh, Moulik Library.
- Operations Research by Kanti Swarup, P. K. Gupta and Man Mohan, S. Chand and Sons.
- Engineering Optimization by S. S. Rao, New Age Techno Press.
- Operations Research by J K Sharma, Macmillan India Ltd

Code: MCAN-291	Paper: Data Structure Lab using Python	
Contacts Hours / Week: 4	**Total Contact Hours: 40**	**Credit: 3**

Course Outcome:

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

- ✓ To understand linear and non-linear data structures.
- ✓ To understand different types of sorting and searching techniques.
- ✓ To know how to create an application specific data structure.
- ✓ To solve the faults / errors that may appear due to wrong choice of data structure.
- ✓ To analyze reliability of different data structures in solving different problems.

UNITS	COURSE CONTENT
1	Implementation of data structure operations (Insertion, deletion, traversing, searching) on array. Linear search, Binary search.
2	Implementation of stack, queue operation using array. Pop, Push, Insertion, deletion, Implementation of circular queue. Infix to postfix conversion, postfix expression evaluation
3	Implementation of linked lists: Single linked list, circular linked list, double linked list, doubly circular linked list. Implementation of stack and queue using linked list. Merging two linked list, Linked list representation of a polynomial, polynomial addition, polynomial multiplication.
4	Tree: creating Binary Search tree, recursive and non-recursive traversal of BST, deletion in BST, calculating height of a BST, building AVL tree.
5	Implementation of sorting techniques: selection, bubble, quick sort, insertion sort, merge sort, heap sot, implementation of priority queue. Hash table implementation.
6	Implementation of Graph: representation, searching, BFS, DFS

Code: MCAN-292	Paper: Operating System Lab (Unix)	
Contacts Hours / Week: 4	Total Contact Hours: 40	Credit: 3

Course Outcome:

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

- ✓ Do the use of basic UNIX Commands from the command line, and create Shell Scripts to customize their UNIX Working Environment.
- ✓ Organize and manage their processes within UNIX through system calls.
- ✓ Organize and manage their files within the UNIX through system calls.
- ✓ Provide a mechanism for handling asynchronous events through signals (Software Interrupt).
- ✓ Implement the Inter-process communication using FIFOs, Message Queues, Semaphores, and Shared Memory.
- ✓ Explain Socket programming to design Client-Server Environment.
- ✓ Understand and implement Multithreaded Programming Environment.

UNITS	COURSE CONTENT
1	**Shell programming** Creating a script, making a script executable, shell syntax (variables, Conditions, control structures, functions and commands).
2	**Process** Starting new process, replacing a process image, duplicating a process image, waiting for a process, Zombie Process, Orphan Process
3	**File Handling** Programming on files (use create(), open(), read(), write(), close(), lseek(), dup()).
4	**Signal** Signal Handling, Blocking, Suspending, Delivering Signals, Various Signal Related Functions.
5	**Inter-process communication** Pipes (use functions pipe(), popen(), pclose()), Named Pipes (FIFOs, accessing FIFO), Message Queues (use functions msgget(), msgsnd(), msgrcv(), msgctl()), Semaphores (use functions semctl(), semget(), semop()) Shared Memory (use functions shmget(), shmat(), shmdt(), shmctl())
6	**Sockets:** TCP Sockets, UDP Sockets, Socket Options, Cliient /Server Example, Name and Address Conversions
7	**POSIX Threads** Programming with pthread functions (viz. pthread_create(), pthread_join(), pthread_exit(), pthread_attr_init(), pthread_cancel())

Code: MCAN-293 **Paper: Object Oriented Programming Lab using JAVA**
Contacts Hours / Week: 4 **Total Contact Hours: 40** **Credit: 3**

Course Outcome:
After successful completion of this course, students will be able to:
- ✓ Apply object-oriented principles or features in software design process to develop Java programs for real life applications.
- ✓ Reduce the complexity of procedural language by employing different OOP technologiesfor developing robust and reusable software.
- ✓ Develop programs using stream classes for various I/O operations and design concurrent.
- ✓ Design graphical user interface to develop user interactive applications.

UNITS	COURSE CONTENT
1	Assignments on class, constructor, overloading, inheritance, overriding.
2	Assignments on wrapper class, arrays.
3	Assignments on developing interfaces- multiple inheritance, extending interfaces.
4	Assignments on creating and accessing packages.
5	Assignments on multithreaded programming
6	Assignments on applet programming

Code: MCAN-281	Paper: Web Technology	
Contacts Hours / Week: 4	Total Contact Hours: 40	Credit: 2

Course Outcome:

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

- ✓ Understand the basic working methodology of HTML, CSS, java script
- ✓ Apply In-Built and Create User defined functions of java script for form validation..
- ✓ Students are able to develop a dynamic webpage by the use of java script and DHTML..
- ✓ Debug the Programs by applying concepts and error handling techniques.

UNITS	COURSE CONTENT
1	**Understanding of Internet** www, client-server, DNS, IP Protocol, HTTP, URL, Browser working principal, Web Hosting, W3C standard, Cloud Development**.**
2	**Fundamental of Web Design** **HTML:** Introduction, Editor(VS Code/ Sublime), Element, Attribute, Head, Heading, Paragraph, Style, Formatting, Quotation, Comment, Color, CSS, Link, Image, Table, List, Block & Inline, Class, ID, Iframe, Script, File path, Layout, Code, Entity, Symbol, Emoji, Charset, Forms, Form Attributes, Elements, Input types, Input Attributes. **CSS:** Introduction, Selector, External-Internal-Inline CSS, Comments, Color, Background, Border, Margin, Padding, Height, Width, Box model, Outline, Text, Font, Icon, Link, List, Table, Display, Max width, Position, Overflow, Float, Inline-bock, Align, Pseudo-class, Pseudo-element, Opacity, Navigation Bar, Dropdowns, Image gallery, Image sprites, Attr Selector, Form, Counter, Units, Rounded corner, Border image, Gradient, Shadow, Text Effect, Web Fonts, Transition, Animation, Tooltip, Style Image, Button, Pagination, Multiple column, Media Query, Flexbox**.**
3	**Advance Web Design** **CSS Responsive Design:** Introduction, Viewport, Grid view, Media queries, Responsive image, Responsive video. **Bootstrap:** Introduction, Container, Grid, Typography, Color, tables, Images, jumbotron, Alerts, Button, Button group, Badges, Progress bar, Spinner, Pagination, List group, Card, Dropdown, Collapse, Navs, Navbar, Forms, Input, Input group, Carousel, Modal, Tooltip, Popover, Toast, Scrollspy, Flex, Media object**.** **Java Script:** Introduction, output, variables, operator, Datatype, Function, Object, Event, String, String method, Number method, Array, Array method, Array iteration, Date & Date format, Date method, Math, Random, Comparison, Condition, For, While, break, This keyword, Function, Arrow function, Form validation, HTML DOM – Documents, Elements, HTML, CSS, Animation, Event, Even listener, Navigation, Nodes, Collection, Node list.

Code: MCAN-301	Paper: Software Engineering using UML	
Contacts Hours / Week: 4	Total Contact Hours: 40	Credit: 4

Course Outcome:

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

- ✓ Analyze the problem scenario and identify classes/ objects and their properties, relationship in class model.
- ✓ Demonstrate the conceptual modeling techniques of UML for solving Real-World problem.
- ✓ To learn software development life cycle for Object-Oriented solutions for Real-World Problems.
- ✓ Ability to apply the concepts of object oriented methodologies to analyze requirements and design to the point where it is ready for implementation.
- ✓ Demonstrate the concept of Testing to measure quality of software.

UNITS	COURSE CONTENT
1	**Introduction to Software Engineering:** (2L) What is Software Engineering? Software Engineering Concepts, Software Engineering Development Activities, Managing Software Development.
2	**Object Oriented Concept and Modelling:** (5L) **Object-Oriented Principals and Concepts:** Classes and Object, Modularity, Abstraction and Encapsulation; Object Relationship like Association, Aggregation and Composition; Inheritance, Polymorphism and Dynamic Binding Interfaces **Model:** Importance of Modeling, Object Oriented Modeling **Identifying the Elements of an Object Model:** Identifying classes and objects, Specifying the attributes Defining operations, Finalizing the object definition.
3	**Introduction to UML:** (3L) Overview of UML, Conceptual Model of UML, Architecture, S/W Development Life Cycle.
4	**Basic and Advanced Structural Modeling:** (7L) Classes Relationship, Common mechanism, Diagrams, Class Diagram, Advanced classes, Advanced Relationship, Interface, Types and Roles, Packages, Object Diagram.
5	**Basic and Advanced Behavioral Modeling:** (7L) Interactions, Use cases, Use Case Diagram, Sequence Diagram, Collaboration Diagram, Interaction Diagram, Activity Diagram, State Chart Diagram.
6	**Architectural Modeling:** (3L) Artifacts, Artifact Diagram, Implementation Diagram, Deployment Diagram.
7	**Object-Oriented Design:** (5L) Generic components of Object-Oriented Design model, System Design process, Partitioning the Analysis Model, Concurrency and subsystem Allocation, Task Management component, Data Management Component, Resource Management Component, Inter Sub-system Communication.
8	**Object Oriented Analysis:** (4L) Iterative Development, Unified process & its Phases: Inception, Elaboration, Construction, Transition, Understanding requirements.
9	**Object Oriented Testing:** (4L) Overview of Testing and object oriented Testing, Types of Testing, Object oriented Testing strategies, Test case design for Object-Oriented software, Inter class test case design.

Reference Books:

- The Unified Modeling Language User Guide, Grady Booch, James Raumbaugh, Ivar Jacobson.
- Object Oriented Software Engineering, Ivar Jacobson, ACM Press
- Applying UML and Patterns, Craig LarmanMotilalUk Books Of India
- Object-Oriented Software Engineering: Using UML, Patterns, and Java, Bernd Bruegge, Allen Dutoit, Pearson.
- Software Engineering – A Practitioner's Approach, Roger. S. Pressman and Bruce R. Maxim, McGraw Hill

Code: MCAN–302   **Paper: Artificial Intelligence and Expert System**
Contacts Hours / Week: 4   **Total Contact Hours: 40**   **Credit: 4**

Course Outcome:
- ✓ After successful completion of this course, students will be able to understand the underlying assumption of philosophy of the logical sequences of real life problem by applying State Space Search behind the limitation of non-solving method of conventional computational approach.
- ✓ Incorporating heuristic search technique on Game Playing.
- ✓ Various strategies of representing knowledge with decision making algorithms. Creation of substantial domain knowledge base with meta data. Application of knowledge representation issues using Prolog/LISP.
- ✓ To recognize the adoption of new system through learning by an Intelligent System and processing of Natural Language.
- ✓ Ability to apply machine learning techniques to solve real world problems and how Expert Systems can be carried out by the help of learning, analyzing by applying various search techniques and resolute to provide solutions.

UNITS	COURSE CONTENT
1	**Introduction to Intelligent Systems:** (8L Overview of Artificial intelligence- Problems of AI, AI technique, Tic – Tac – Toeproblem.
2	**Search Techniques:** (10L Problems, Problem Space & search. Heuristic Search Techniques, Game planning –Minimax search procedure, adding alpha beta cut-off's, Iterative Deepening.
3	**Knowledge Representation Issues:** (7L Representing knowledge using rules. Weak slot & filler structures. Strong slot & filler structures. Implementation of Knowledge with Prolog Programs. Basic knowledge of programming language like Prolog & Lisp.
4	**Adoption of New Knowledge:** (10L Deep Learning: Introduction to Neural Networks, Convolution of New Knowledge Natural language processing, Understanding. Learning – induction & explanation based learning.
5	**Expert systems:** (5L Expert system shells, knowledge acquisition.

Reference Books:
- Artificial Intelligence: A Modern Approach, Stuart Russell & Peter Norvig, Pearson Education.
- Artificial Intelligence, Rich & Knight, TMH.
- Reference Books
- Artificial Intelligence & Intelligent Systems, N.P Padhy, Oxford University Press.
- Introduction to Artificial Intelligence & Expert Systems, Dan W. Patterson, PHI.
- Artificial Intelligence: A new Synthesis, Nils J. Nilsson, Morgan Kaufmann Publishers, Inc.
- M.C. Trivedi, Artificial Intelligence, Khanna Publishing House, New Delhi

Code: MCAN-303	Paper: Formal Language and Automata Theory	
Contacts Hours / Week: 4	Total Contact Hours: 40	Credit: 4

Course Outcome:

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

✓ Understand the formal notation for strings, languages and machines.

✓ Design and Implement Finite automata to accept a string of a language.

✓ For a given language determine whether the given language is regular or not.

✓ Design context free grammars to generate strings of context free language.

✓ Determine equivalence of languages accepted by Push Down Automata and languages generated by context free grammars

✓ Understand and analyze the hierarchy of formal languages, grammars and machines.

✓ Distinguish between computability and non-computability and Decidability and un-decidability.

UNITS	COURSE CONTENT
1	**Introduction** (3L) Introduction:Alphabet, languages and grammars, productions and derivation, Chomsky hierarchy of languages.
2	**Regular languages and finite automata:** (12L) Regular expressions and languages, deterministic finite automata (DFA) and equivalence with regular expressions, nondeterministic finite automata (NFA) and equivalence with DFA, regular grammars and equivalence with finite automata, properties of regular languages, pumping lemma for regular languages, minimization of finite automata)
3	**Context-free languages and pushdown automata:** (9L) Context-free grammars (CFG) and languages (CFL), Chomsky and Greibach normal forms, nondeterministic pushdown automata (PDA) and equivalence with CFG, parse trees, ambiguity in CFG, pumping lemma for context-free languages, deterministic push down automata, closure properties of CFLs.
4	**Context-sensitive languages:** (6L) Context-sensitive grammars (CSG) and languages, linear bounded automata and equivalence with CSG.
5	**Turing machines:** (6L) The basic model for Turing machines (TM), Turing recognizable(recursively enumerable) and Turing-decidable (recursive) languages and their closure properties, variants of Turing machines, nondeterministic TMs and equivalence with deterministic TMs, unrestricted grammars and equivalence with Turing machines, TMsas enumerators.
6	**Undecidability:** (4L) Church-Turing thesis, universal Turing machine, the universal and diagonalization languages, reduction between languages and Rice s theorem, undecidable problems about languages.

Reference Books:

- Introduction to Automata Theory, Languages, and Computation,John E. Hopcroft, Rajeev Motwani and Jeffrey D. Ullman, Pearson Education Asia.
- Elements of the Theory of Computation,Harry R. Lewis and Christos H. Papadimitriou, Pearson Education Asia.
- Theory of Computer Science, Automata Languages and computation, Mishra and Chandra shekaran, 2nd edition, PHI.
- Automata and Computability, Dexter C. Kozen, Undergraduate Texts in Computer Science, Springer.
- Introduction to the Theory of Computation, Michael Sipser, PWS Publishing.
- Introduction to Languages and The Theory of Computation,John Martin, TataMcGraw Hill., PEARSON.
- Theory of Computation, Dr. R.B.Patel, Khanna Publishing House.

Code: MCAN-E304A	Paper: ASP .Net using C#	
Contacts Hours / Week: 4	Total Contact Hours: 40	Credit: 3

Course Outcome:

After successful completion of this course, students will be able to:
- ✓ Understand the basic working methodology of .NET architecture.
- ✓ After completion of the course the student will be able to use the features of Dot Net Framework along with the features of C#
- ✓ Apply In-Built and Create User defined functions.
- ✓ Debug the Programs by applying concepts and error handling techniques.
- ✓ Create dynamic Website/ Web based Applications, using ASP.NET , SQL SERVER database

UNITS	COURSE CONTENT
1	**Basics of C# and ASP .Net** (8L) C# basics (oops concepts, syntaxes, loops, typecasting etc.), C# Basics –II (Sealed class, Abstract class, Partial class, Sealed Method Generics, Delegates, file/stream, collection), Net Framework, Creating an ASP.NET Web Application Project, ASP .Net Architecture, Processing of an application in .Net, Namespace Fundamentals, Maintaining State Information.
2	**Creating a User Interface (Controls and Master Page)** (4L) Using Controls, Validation Controls, Navigation between Pages, Master Pages & Themes, Simple Master Page Nested Master Page Configuring Master Page Creating Themes, Applying Themes, Applying Style sheet.
3	**Storing and Retrieving Data with ADO.NET** (6L) Accessing Data with ADO.NET, Using Data Sets on Web Forms, Processing Transactions.
4	**Catching and Correcting Errors** (4L) Using Exception Handling, Using Error Pages, Logging Exceptions.
5	**Web Services** (3L) Creating Web Services, Discovering Web Services, Instantiating and Invoking Web Services.
6	**Building and Deploying Web Applications** (6L) Building a Web Application, Deploying a Web Application, Creating an Installation Program.
7	**Maintaining Security** (3L) Authenticating and Authorizing Users, Using Windows Authentication, Using Forms Authentication.
8	**Use of Ajax on the web forms** (3L) Introduction to Ajax Controls, Using Ajax controls on web forms.
9	**Introduction to MVC** (3L) Introduction to MVC Architecture, MVC- Model, Views, Controllers, Creating Simple MVC Application.

Reference Books:
- ASP.net – The Complete Reference- Tata McGraw Hill
- Mastering ASP.Net - BPB Publication
- ASP.NET Programming – Murach

Code: MCAN-E304B   **Paper: Web Enabled JAVA Programming**
Contacts Hours / Week: 4   **Total Contact Hours: 40**   **Credit: 3**

Course Outcome:

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

- ✓ Understand the basic working methodology of JSP, servlet and JSF Frameworks
- ✓ Create dynamic web application using JSP and servlet and database.
- ✓ Design and develop a Web site using AJAX.
- ✓ Debug the Programs by applying concepts and error handling techniques.

UNITS	COURSE CONTENT
1	**Core Java Overview:** (6L) Object oriented concepts, Exception Handling, Multi Threading Introduction to JDBC: Overview of JDBC API, The Java.sql package, JDBC Drivers, Executing SQL commands using JDBC Drivers, static and dynamic Execution of SQL statements, Execution of Stored Procedures using JDBC. Introduction to Transactions and Transaction Methods. Introduction to JNDI, Introduction to Data Source and Connection pooling, Introduction to Web Applications, Web Servers Overview of J2EE Technologies. (6L)
2	**Introduction to Java Servlets:** (8L) Static and Dynamic contents, Servlet life Cycle and Life cycle methods, Servlet Request and Response Model, Deploying a Servlet, Servlet State Transitions, Servlet Config and Servlet Context, Servlet Redirection and Request Dispatch, Servlet Synchronization and Thread Model. Maintaining Client State: Cookies, URL rewriting, Hidden form fields, Session Tracking. (8L)
3	**Introduction to JSP :** (8L) JSP & Servlet as Web Components, Servlets vs. JSP, JSP Lifecycle, JSP Page Lifecycle Phases, General Rules of Syntax, JSP syntactic elements, JSP element syntax, Template content. JSP elements-directives, declarations, expressions, scriptlets, actions. JSP Standard Actions: jsp:useBean, jsp:getPreoperty, jsp:setProperty, jsp:include, jsp:forward, jsp:plugin, jsp:param,java Server Pages Standard Tag Library(JSTL).
4	**Introduction to JSF Frameworks:** (10L) Getting started: A Simple Example, Sample Application Analysis, Development Environments for JSF. Managed Beans: A Sample Application, Bean Scopes Configuring Beans, Navigation, Static Navigation, Dynamic Navigation, Standard JSF tags, Data tables, conversion and validation Overview of the Conversion and Validation Process, Using Standard Converters. Event Handling: Life Cycle Events, Value Change Events, Action Events, Event Listener Tags, Immediate Components, Passing Data from the UI to the Server, Custom Components, Converters and Validators: Classes for Implementing Custom components, Tags and Components, The Custom Component Developer's Toolbox, Encoding: Generating Markup, Decoding: Processing Request Values, Using Converters, Implementing Custom Component Tags, The TLD File, The Tag Handler Class, Defining Tag Handlers in JSF 1.1.
5	AJAX: (8L) Ajax Fundamentals, JavaScript Libraries, The Prototype Library, The Fade Anything Technique Library, Form Completion. Realtime Validation, Propagating Client-Side View State Direct Web Remoting, Ajax Components, Hybrid Components, Keeping JavaScript Out of Renderers, Transmitting JSP Tag Attributes to JavaScript Code,Ajax4jsf,Implementing Form Completion with Ajax4jsf,Implementing Realtime Validation with Ajax4jsf.Introduction to Java Web Services.

Reference Books

- Professional Java Server Programming- J2EE 1.3 Edition- Subrahmanyam Allamaraju and Cedric Buest- Apress publication, 2007.
- Core JavaServer Faces-Second Edition-David Geary,CayHorstmann-Prentice Hall-2007

Code: MCAN-E304C **Paper: Web Technology through PHP**
Contacts Hours / Week: 4 **Total Contact Hours: 40** **Credit: 3**

Course Outcome:
- ✓ After successful completion of this course, students will be able to understand the underlying assumption of defining variables, constants, operators, expressions, HTML Form creation and submissions. POST & GET Method.
- ✓ Incorporating HTML form with PHP
- ✓ Implementation of Decision, Loops, Functions, Array and Exception Handling concepts using PHP server concept.
- ✓ Strategy to connect with MYSQL Server.
- ✓ Ability to check validation using JavaScript & JQuery.
- ✓ Connecting Forms using AJAX Concept.

UNITS	COURSE CONTENT
1	**Introduction to Web Technology & implementation of PHP Programs:** (7L Evaluation of PHP. Basic Syntax. Defining variables and constants. PHP Data type Operator and Expression. Basics of HTML: Form Creation, Handling of Forms, Submission of Forms. POST& GET method.
2	**Handling Html Form With PHP:** (5L Capturing Form. Data Dealing with Multi-value files. Generating File uploaded form. Redirecting a form after submission.
3	**Decisions, Functions, String, Array & Exception Handling:** (12L Making Decisions. Doing Repetitive task with looping. Mixing Decisions and looping with Html What is a function? Cookies, Session and in-built functions. Creating and accessing String. Searching & Replacing String. Formatting String. String Related Library function. PHP Array. Creating index based and Associative array. Accessing array Element. Looping with Index based array. Looping with associative array using each() and foreach(). Some useful Library function. Understanding Exception and error. Try, catch, throw.
4	**Database Connectivity with MySql:** (6L Introduction to RDBMS. Connection with MySql Database. Performing basic database operation(DML) (Insert, Delete, Update, Select). Setting query parameter. Executing query Join (Cross joins, Inner joins, Outer Joins, Self joins.).
5	**Java Script & JQuery:** (5L Introduction to Javascript. Three ways to use Javascript. Working with events Client-side Validation. Introduction to JQuery. Validation using JQuery. JQuery Forms. JQuery Examples.
6	**Connecting Forms using AJAX Concept:** (5L Introduction to AJAX. PHP with AJAX. Working with database.

Reference Books:
- The Joy of PHP Programming: A Beginner's Guide to Programming Interactive Web Applications with PHP and MySQL**.** Alan Forbes, Fifth Edition, Plum Island
- Beginning Web Programming, Jon Duckett, WROX
- Open Source for the Enterprise: Managing Risks, Reaping Rewards,DanWoods and GautamGuliani, O'Reilly, Shroff Publishers and Distributors, 2005.

Code:MCAN-E304D **Paper: Android Application Development**
Contacts Hours / Week: 4 **Total Contact Hours: 40** **Credit: 3**

Course Outcome:
After successful completion of this course, students will be able to:
- ✓ Understand mobile application development trends and Android platform
- ✓ Analyze the need of simple applications, game development, Location map based services
- ✓ Be familiar with SMS, email, service, binding and deploying APks
- ✓ To develop, deploy and maintain the Android Applications.

UNITS	COURSE CONTENT
1	**Android Fundamentals** (8L Mobile Application development and trends – Android overview and Versions – Android open stack, features – Setting up Android environment (Eclipse, SDK, AVD)- Simple Android application development – Anatomy of Android applications – Activity and Life cycle – Intents, services and Content Providers
2	**Android User Interface** (8L Layouts: Linear, Absolute, Table, Relative, Frame, Scroll view, Resize and reposition - Screen orientation – Views: Text view, Edit Text, Button, Image Button, Checkbox, Toggle Button, Radio Button, Radio Group, Progress Bar, Auto complete Text, Picker, List views and Web view– Displaying pictures with views: Gallery and Image View, Image Switcher, Grid view – Displaying Menus: Helper methods, Option and Context
3	**Data Persistence** (8L Shared User preferences – File Handling: File system, System partition, SD card partition, user partition, security, Internal and External Storage – Managing data using SQLite –User defined content providers
4	**Messaging, Networking And Services** (8L SMS Messaging: Sending and Receiving – Sending email and networking – Downloading binary and text data files – Access Web services – Developing android services: create your own services, performing long running task in a service-performing repeated task in a service
5	**Location Access And Publish Android Application** (8L Location based services: Display map, zoom control, view and change, Marking, Geocoding, Get location - Publish Android applications and Deployment

Reference Books:
- Beginning Android Application Development, WeiMeng Lee,(2012) Wrox Publications (John Wiley, New York)
- Hello Android: Introducing Google's Mobile Development Platform, Ed Burnette (2010), The Pragmatic Publishers, 3rd edition, North Carolina USA
- Professional Android 4 Application Development, Reto Meier (2012),Wrox Publications (John Wiley, New York).
- Programming Android: Java Programming for the New Generation of Mobile Devices,ZigurdMednieks, Laird Dornin, Blake Meike G, Masumi Nakamura (2011), OReilly Media, USA

Code: MCAN-E305A   **Paper: Design and Analysis of Algorithm**
Contacts Hours / Week: 4   **Total Contact Hours: 40**   **Credit: 3**

Course Outcome:
After successful completion of this course, students will be able to:

✓ Understand and analyze the running times of algorithms based on asymptotic analysis and justify the correctness of algorithms.
✓ Describe the divide-and-conquer paradigm and explain when an algorithmic design situation calls for it.
✓ Understand and implement the greedy paradigm for a given problem.
✓ Design the dynamic-programming paradigm and implement it.
✓ Understand and implement the Back Tracking and Branch-&-Bound problem.
✓ For a given model engineering problem model it using graph and write the corresponding algorithm to solve the problems.
✓ Explain the ways to analyze randomized algorithms (expected running time, probability of error).

UNITS	COURSE CONTENT
1	**Introduction:** (8L) Characteristics of algorithm. Analysis of algorithm: Asymptotic analysis of complexity bounds – best, average and worst-case behavior; Performance measurements of Algorithm, Time and space trade-offs, Analysis of recursive algorithms through recurrence relations: Substitution method, Recursion tree method and Masters' theorem.
2	**Divide-&-Conquer and Greedy Method:** (8L) *Divide & Conquer*: General Method - Finding maximum and minimum – Merge sort, Quick sort, Selection, Strassen's matrix multiplication. *Greedy Method*: General Method –knapsack problem - Tree vertex splitting - Job sequencing with deadlines – optimal storage on tapes.
3	**Dynamic Programming:** (8L) General Method - multistage graphs – all pairs shortest paths– single source shortest paths - String Editing – 0/1 knapsack. Search techniques for graphs –DFS-BFS-connected components – biconnected components.
4	**Back Tracking and Branch-&-Bound:** (8L) *Back Tracking*: General Method – 8-queens - Sum of subsets - Graph Coloring –Hamiltonian cycles. *Branch and Bound*: General Method - Traveling Salesperson problem.
5	**Lower Bound Theory:** (8L) Comparison trees - Oracles and advisory arguments – Lower bounds through reduction - Basic Concepts of NP-Hard and NP-Complete problems.

Reference Books:

- E. Horowitz, S. Sahni and S. Rajasekaran, 2008, Computer Algorithms, 2ndEdition, Universities Press, India.
- Thomas H Cormen, Charles E Lieserson, Ronald L Rivest and Clifford Stein, Introduction to Algorithms, 4TH Edition, MIT Press/McGraw-Hill.
- A.V. Aho, J.E. Hopcroft, J.D. Ullmann, 1974, The Design and Analysis of Computer Algorithms, Addison Wesley, Boston.

Code: MCAN-E305B	Paper: Data Warehousing and Data Mining	
Contacts Hours / Week: 4	Total Contact Hours: 40	Credit: 3

Course Outcome:

After successful completion of this course, students will be able to:
- ✓ Study of different sequential pattern algorithms
- ✓ Study the technique to extract patterns from time series data and it application in real world.
- ✓ Can extend the Graph mining algorithms to Web mining
- ✓ Help in identifying the computing framework for Big Data

UNITS	COURSE CONTENT
1	**Introduction to Data Warehousing:** (8L) The need for data warehousing, Operational and informational Data stores, Data warehouse definition and characteristics, Data warehouse architecture, Data warehouse Database, Sourcing, Acquisition, Cleanup and transformation tools, Metadata, Access tools, Data marts, Data warehousing administration and management.
2	**Online analytical processing (OLAP):** (6L) Need for OLAP, Multidimensional data model, OLAP guidelines, Multidimensional vs. Muilti-relational (OLAP), Categorization of OLAP tools, OLAP tools internet.
3	**Introduction to data mining:** (8L) The motivation, Learning from past mistake, Data mining, Measuring data mining effectiveness, Embedded data mining into business process, What is decision tree, Business score card, Where to use decision tree, The general idea, How the decision tree works.
4	**Classification and prediction:** (6L) Cluster Analysis – Types of Data in Cluster Analysis, Partitioning methods, Hierarchical Methods; Transactional Patterns and other temporal based frequent patterns
5	**Time Series Analysis:** (5L) Time series Data, Periodicity Analysis for time related sequence data, Trend analysis, Similarity search in Time-series analysis.
6	**Web Mining:** (7L) Web Mining, Mining the web page layout structure, mining web link structure, mining multimedia data on the web, Automatic classification of web documents and web usage mining; Distributed Data Mining.

Reference Books:
- Data warehousing, Data mining and OLAP by Alex Berson& Stephon J. Smith, Tata McGraw Hill.2003.
- Data Warehousing Fundamentals for IT Professionals, Second Edition by Paulraj Ponniah, Wiley India.
- Principles and Implementation of Data Ware housing, Rajeev Parida Fire Wall Media, Lakshmi Publications.2006.

Code: MCAN-E305C   **Paper: Image Processing**
Contacts Hours / Week: 4   **Total Contact Hours: 40**   **Credit: 3**

Course Outcome:
After successful completion of this course, students will be able to:
- ✓ Describe the fundamental concept of the digital image processing system.
- ✓ Experiment the images in the frequency domain and spatial domain using various transforms.
- ✓ Evaluate the techniques for image enhancement and restoration.
- ✓ Explain different feature extraction techniques for image analysis and recognition.
- ✓ Categorize various compression techniques.
- ✓ Develop any image processing application.

UNITS	COURSE CONTENT
1	**Introduction** **(5L)** Background, Digital Image Representation, Fundamental steps in Image Processing, Elements of Digital Image Processing - Image Acquisition, Storage, Processing, Communication, Display.
2	**Digital Image Formation** **(6L)** A Simple Image Model, Geometric Model- Basic Transformation (Translation, Scaling, Rotation), Perspective Projection, Sampling & Quantization - Uniform & Non uniform.
3	**Mathematical Preliminaries** **(7L)** Neighbour of pixels, Connectivity, Relations, Equivalence & Transitive Closure; Distance Measures, Arithmetic/Logic Operations, Fourier Transformation, Properties of The Two Dimensional Fourier Transform, Discrete Fourier Transform, Discrete Cosine & Sine Transform
4	**Image Enhancement** **(8L)** Spatial Domain Method, Frequency Domain Method, Contrast Enhancement -Linear & Nonlinear Stretching, Histogram Processing; Smoothing - Image Averaging, Mean Filter, Low-pass Filtering; Image Sharpening. High-pass Filtering, High-boost Filtering, Derivative Filtering, Homomorphic Filtering; Enhancement in the frequency domain - Low pass filtering, High pass filtering.
5	**Image Restoration** **(7L)** Degradation Model, Discrete Formulation, Algebraic Approach to Restoration - Unconstrained & Constrained; Constrained Least Square Restoration, Restoration by Homomorphic Filtering, Geometric Transformation – Spatial Transformation, Gray Level Interpolation.
6	**Image Segmentation** **(7L)** Point Detection, Line Detection, Edge detection, Combined detection, Edge Linking & Boundary Detection – Local Processing, Global Processing via The Hough Transform; Thresholding - Foundation, Simple Global Thresholding, Optimal Thresholding; Region Oriented Segmentation - Basic Formulation, Region Growing by Pixel Aggregation, Region Splitting & Merging.

Reference Books:
- Digital Image Processing, Rafael C.Gonzalez & Richard E.Woods, Pearson
- Fundamentals of Digital Image Processing, Anil K. Jain, Pearson Education-2003.
- Digital Image Processing, Jahne, Springer India
- Digital Image Processing & Analysis, Chanda & Majumder, PHI
- Fundamentals of Digital Image Processing, Jain, PHI

Code: MCAN-E394A	Paper: ASP.Net using C# Lab	
Contacts Hours / Week: 4	Total Contact Hours: 40	Credit: 3

Course Outcome:

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

✓ Create dynamic Website/ Web based Applications

UNIT	COURSE CONTENT
1	1.Designing user interfaces for online applications with ASP.NET technologies 2.Application of master pages in Web based Applications 3.Application of ADO.NET 4.Apllication of Ajax in Web based Applications 5.Web Applications based on Web Services.

Code: MCAN-E394B	**Paper: Web Enabled JAVA Programming LAB**
Contacts Hours / Week: 4	**Total Contact Hours: 40** **Credit: 3**

Course Outcome:

After successful completion of this course, students will be able to:
- ✓ Create dynamic Website/ Web based Applications

UNIT	COURSE CONTENT
1	1. HTML to Servlet Applications 2. Applet to Servlet Communication 3. Designing online applications with JSP 4. Creating JSP program using JavaBeans 5. Working with Enterprise JavaBeans 6. Performing Java Database Connectivity. 7. Creating and Sending Email with Java 8. Building web applications

Code: MCAN-E394C	Paper: Web Technology through PHP Lab	
Contacts Hours / Week: 4	Total Contact Hours: 40	Credit: 3

Course Outcome:
- ✓ After successful completion of this course, students will be able to understand the underlying assumption of defining variables, constants, operators, expressions, HTML Form creation and submissions. POST & GET Method & Implementation of Decision, Loops, Functions, Array and Exception Handling concepts.
- ✓ How HTML forms are submitted with PHP Server.
- ✓ Strategy to connect with MYSQL Server.
- ✓ Ability to check validation using JavaScript & JQuery.
- ✓ Connecting Forms using AJAX Concept.

UNITS	COURSE CONTENT
1	**Introduction to Web Technology & implementation of PHP Programs &Knowing about Connection Strings and Functions.** Implementing basic PHP programs with Form, Loop, Functions Array and Strings.
2	**Handling Html Form With PHP:** Capturing Form. Data Dealing with Multi-value files. Generating File uploaded form. Redirecting a form after submission.
3	**Database Connectivity with MySql:** Programs implementing displaying data from MYSQL to HTML forms using PHP. Programs implementing updating data from MYSQL to HTML forms using PHP. Programs implementing deleting data from MYSQL to HTML forms using PHP.
5	**Java Script & JQuery:** Validating forms using JAVASCRIPT.
6	**Connecting Forms using AJAX Concept:** Fetching data from one form to another form using AZAX.

Code: MCAN-E394D	Paper: Android Application Development Lab	
Contacts Hours / Week: 4	Total Contact Hours: 40	Credit: 3

Course Outcome:

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

- ✓ Learn to use Android Application development platform.
- ✓ To create simple android application
- ✓ To understand and implement various designing components of Android user interfaces
- ✓ To design application's main navigation screen
- ✓ To understand and designing Android Notification (including push notification)
- ✓ To connect android application to database for data insertion and retrieval

UNITS	COURSE CONTENT
1	**Writing First Application** Creating Android Project, Android Virtual Device Creation, Set up debugging environment, Workspace set up for development, Launching emulator, debugging on mobile devices.
2	**Basic UI design** Basics about Views, Layouts, Resources, Input controls, Input Events, Toasts.
3	**More UI Design** Layouts design GridView and ListView, Action bar, Adapters, Menus: Option menu, context menu, sub menu, Pickers - Date and Time, Spinners.
4	**Activity and Fragment** Activity, Fragment, Activity Lifecycle and Fragment Lifecycle.
5	**Intents** Implicit Intents, Explicit intents, communicating data among Activities.
6	**Navigation Drawer** Panel that displays the app's main navigation screens on the left edge of the screen
7	**Android Notifications** Toast, Dialogs (TimePicker, DatePicker, Progress, Alert), Notification Manager and Push Notification
8	**Introducing SQLite** SQLiteOpenHelper and creating a database - Opening and closing a database, Working with cursors Inserts, updates, and deletes

Code: MCAN-381	Paper: Minor Project and Viva-voce	
Contacts Hours / Week: 10	Total Contact Hours: 80	Credit: 8

A student needs to pursue a research/application based project in his/her institution under the direct supervision/mentorship of assigned teacher(s) and on completion of the same an evaluation will be made on the basis of Project Report, Project Presentation and Viva-voce.

Code: MCAN-OE401	Paper: Open Elective	Credit: 4

A minimum 12-week online course from Massive Open Online Courses (MOOCs) in one or any of the domains including, but not limited to, Machine Learning, Big Data Computing, Internet of Things (IoT), Cyber Security, Information Theory and Coding, Natural Language Processor, Cloud Computing. While opting for a domain for pursuing the online course, a student needs to ensure that the domain was not covered in previous semesters of the program. A student needs to submit a self-attested copy of the mark-sheet of this online course to college well before the end of Semester IV. Directly on the basis of the result obtained by a student, final marks will be allocated to him/her.

Code: MCAN-481	Paper: Major Project & Viva-Voce	
Contacts Hours / Week: 26	Total Contact Hours: 12-15 Weeks	Credit: 22

A student needs to pursue a research/application based project in any of the following modes:

[A] In his/her institution under the supervision/mentorship of assigned teacher(s) belonging to that institution

[B] In his/her institution under the joint supervision/mentorship of assigned teacher(s) belonging to that institution and invited external expert(s)

[C] In a research/software/hardware organization under the joint supervision/mentorship of assigned teacher(s) belonging to that institution and external expert(s) belonging to that research/software/hardware organization

On completion of the same, an evaluation will be made by the institution on the basis of Project Report, Project Presentation, Viva-voce and sufficient measures will be taken by the institution to understand that the project is an outcome based work as a product of student's sole effort.