The Heritage Institution
KANYA MAHA VIDYALAYA
JALANDHAR
(Autonomous)

Master of Computer Applications
Programme Outcomes

1. Apply knowledge of core computing fundamentals, skills and domain knowledge to solve problems related to real life applications.
2. Select and apply appropriate techniques, resources, and modern computing tools to complex computing activities.
3. Enhance skills to analyze the problem and define logical modeling of solutions.
4. Effectively integrate and utilize contemporary I.T. tools across all computer applications.
5. Create and manage data through relational and non-relation databases using DBMS.
6. Learn latest web technologies and develop dynamic and responsive websites and web applications.
7. Involve in continuous learning and relearning various technical skills and adapt to up-and coming technologies and industry standards.
8. Apply statistical methods, machine learning algorithms and visualization technique for analysis of datasets.
9. Apply project management standards and guidelines for efficient, timely and quality development of software products.
10. Effective communication and presentation of technical information
11. Identify research literature to solve complex computing problems.
12. Show understanding with computing principles and utilize the same as a member, leader and team member in handling projects and working in multidisciplinary settings.

PROPOSED SCHEME OF MCA FOR THE BATCH 2025-27
PG DEPARTMENT OF COMPUTER SCIENCE AND APPLICATIONS
MASTER OF COMPUTER APPLICATIONS (MCA)
SEMESTER-I

S. No.	Course No.	Title	L	T	P	Cr	Marks
1	MCAL-101	Design and Analysis of Algorithm	4	0	0	4.0	100
2	MCAL-102	Web Technologies	4	0	0	4.0	100
3	MCAL-103	Data Science Foundation	4	0	0	4.0	100
4	MCAL-104	Probability and Statistical Techniques	4	0	0	4.0	100
5		General Elective – I	4	0	0	4.0	100
6	MCAP-108	Programming Lab based on Web Technologies	0	0	2	2.0	50
7	MCAP-109	Programming Lab based on Data Science	0	0	2	2.0	50
8	MCAB-110	Fundamentals of Computers* (Bridge Course)	2	0	0	2.0	50
9	MCAB-111	Programming in C* (Bridge Course)	2	0	0	2.0	50
		Total				**24.0**	**600**

***not mandatory for all students, refer to MCA eligibility for this course.**

Options for Elective – I							
1	MCAL-105	Advanced Computer Graphics					
2	MCAL-106	Information Security					
3	MCAM-107	Skill oriented MOOCS*					

*Skill Oriented MOOCS courses can be explored on Swayam Portal and other websites offering MOOCS with atleast 4 credits, otherwise Dept. will provide a list of available MOOCS Courses.

SEMESTER-II

S. No.	Course No.	Title	L	T	P	Cr	Marks
1.	MCAL-201	Full Stack Development	4	0	0	4.0	100
2.	MCA-L202	Advanced Database Management System	4	0	0	4.0	100
3.	MCAL-203	Machine Learning	4	0	0	4.0	100
4.	MCAL-204	Software Project Management	4	0	0	4.0	100
5.		General Elective – II	4	0	0	.4.0	100
6.	MCAP-208	Programming Lab based on Advance Database Management System	0	0	2	2.0	50
7.	MCAL-209	Programming Lab based on Full Stack Development	0	0	2	2.0	50
8.	MCAL-210	Universal Human Values, Understanding Harmony (Value Added Course)	2	0	0	2.0	50
		Total	**22**		**4**	**26.0**	**650**

Options for Elective - II							
1	MCAL-205	Big Data Analytics and Business Intelligence					
2	MCAL-206	Theory of Computation					
3	MCAM-207	Skill oriented MOOCS					

*Skill Oriented MOOCS courses can be explored on Swayam Portal and other websites offering MOOCS with atleast 4 credits, otherwise Dept. will provide a list of available MOOCS Courses.

SEMESTER-III

S. No.	Course No.	Title	L	T	P	Cr	Marks
1	MCAL-301	Advanced Programming Concepts	4	0	0	4.0	100
2	MCAL-302	Image Processing	4	0	0	4.0	100
3	MCAL-303	Deep Learning	4	0	0	4.0	100
4	MCAL-304	Optimization Techniques	4	0	0	4.0	100
5.		General Elective – III	4	0	0	4.0	100
6	MCAP-308	Capstone Project	0	0	4	4.0	100
7	MCAP-309	Programming Lab based on Advanced Programing Concepts	0	0	2	2.0	50
		Total	**20**	**0**	**6**	**26.0**	**650**

Options for Elective- III							
1	MCAL-305	Advance Computer Architecture					
2	MCAL-306	Devops					
3	MCAM-307	Skill oriented MOOCS					

*Skill Oriented MOOCS Courses can be explored on Swayam Portal and other websites offering MOOCS with atleast 4 credits,, otherwise Dept. will provide a list of available MOOCS Courses.

SEMESTER-IV

S. No.	Course No.	Title	L	T	P	Cr	Marks
1	MCA-401	Industrial Training/ Dissertation. / Project	-	-	-	24	600
		Total	-	-	-	24	600
Grand Total of All Semesters						**100**	**2500**

Master of Computer Applications (CBCEGS) SEMESTER – I
(Session 2025-26)
COURSE CODE: MCAL-101
DESIGN AND ANALYSIS OF ALGORITHM

L-T-P: 4-0-0 **Max.Marks:100**
Credits: 4 **Theory:70**
Examination Time: 3 Hours **CA:30**

Mid Semester Examination: 30% weightage
End Semester Examination: 70% weightage
Course outcomes

CO1: Demonstrate a clear understanding of algorithms and evaluate their performance using appropriate analytical techniques.

CO2: Apply algorithmic strategies to systematically solve computational problems.

CO3: Design and implement solution approaches for problems requiring exploratory or backtracking methods.

CO4: Analyze graph-based problems and recognize computationally complex or intractable challenges.

MCA (Two Year Programme) (CBCEGS) SEMESTER – I
(Session 2025-26)
COURSE CODE: MCAL-101
DESIGN AND ANALYSIS OF ALGORITHM

L-T-P: 4-0-0 **Max.Marks:100**
Credits:4 **Theory:70**
Examination Time: 3 Hours. **CA:30**

Instructions for Paper Setter -
Eight questions of equal marks (16 Marks each) are to set, two in each of the four sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be divided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any section.

UNIT–I

Introduction to Algorithms: Definition and characteristics of algorithms, analyzing algorithms, importance of algorithm design, asymptotic notations.
Basic Sorting and Searching Algorithms: Bubble sort, insertion sort, selection sort, linear search, binary search.

UNIT–II

Greedy Method: General strategy, fractional knapsack problem, minimum spanning tree – Prim's and Kruskal's algorithms.
Dynamic Programming: General strategy, matrix chain multiplication, 0/1 knapsack problem, Floyd-Warshall all-pairs shortest paths.

UNIT–III

Backtracking: General method, N-Queens problem, sum of subsets, graph coloring, Hamiltonian cycle.
Amortized Analysis: Aggregate, accounting, and potential methods – example of stack operations.

UNIT–IV

Graph Algorithms: BFS and DFS traversal, connected components, topological sort, articulation points.
NP-Completeness: P, NP, NP-Complete.

References/Text Books:

1. Cormen, Leiserson, Rivest, and Stein – *Introduction to Algorithms*, PHI.
2. Horowitz, Sahni, Rajasekaran – *Fundamentals of Computer Algorithms*, Galgotia.
3. Aho, Hopcroft, Ullman – *The Design and Analysis of Computer Algorithms*, Pearson Education.
4. Kleinberg and Tardos – *Algorithm Design*, Pearson.
5. Dasgupta, Papadimitriou, Vazirani – *Algorithms*, McGraw-Hill.

Master of Computer Applications (CBCEGS) SEMESTER – I
(Session 2025-26)
COURSE CODE: MCAL-102
WEB TECHNOLOGIES

L-T-P:4-0-0 **Max.Marks:100**
Credits:4 **Theory:70**
Examination Time: 3Hours. **CA:30**

Mid Semester Examination: 30% weightage
End Semester Examination: 70% weightage
Course Outcomes: After completing this course, students will be able to:
CO1: Comprehend the concepts of CSS and JavaScript for developing web pages and describe the Client-Server Architecture.
CO2: Comprehend the concepts of Web Application Frameworks such as Java Servlets, JSP.
CO3: Implement Database connection using JDBC and program the server-side logic using PHP.
CO4: Comprehend middleware and advanced web technologies with case studies.

Master of Computer Applications (CBCEGS) SEMESTER – I
(Session 2025-26)
COURSE CODE: MCAL-102
WEB TECHNOLOGIES

L-T-P:4-0-0 **Max.Marks:100**
Credits:4 **Theory:70**
Examination Time: 3Hours. **CA:30**

Instructions for Paper Setter -
Eight questions of equal marks (16 Marks each) are to set, two in each of the four sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be divided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any section.

UNIT –I

Web Essentials, Markup languages, CSS Basics of Client side programming, Java script language, java script objects, host objects, Browsers and DOM

UNIT –II

Basics of Server side programming, Java servlets- Life cycle, Servlet API, Reading Servlet parameters, Handling HTTP requests and responses, Cookies and Session Tracking ASP/JSP, Basics of ASP/JSP objects, simple ASP and JSP pages

UNIT –III

Representing Web data, Database connectivity, JDBC, Dynamic web pages, XML, DTD, XML schema, DOM, SAX, XQuery, Building web applications, cookies, sessions, open source environment Introduction to PHP, basics, PHP File handling, file upload, cookies, error handling, PHP MySQL introduction

UNIT –IV

Middleware technologies, Ecommerce architecture and technologies, Ajax, Advanced web technologies and tools. Case Studies: PHP and MySQL case studies.

References/Text Books:

1. Jeffery C Jackson, “Web Technology-A Computer Science Perspective”, Pearson Education
2. Chris Bates, “Web Programming- Building Internet Applications”, Wiley India
3. *Web Technologies: HTML, JavaScript, PHP, Java, JSP, ASP.NET, XML and Ajax, Black Book* by Kogent Learning Solutions Inc.,
4. *Web Technologies: A Developer's Perspective* by N.P. Gopalan and J. Akilandeswari,
5. *Java Server Programming: Java EE6 (J2EE 1.6) Black Book* by Kogent Learning Solutions Inc.,
6. *Beginning PHP and MySQL: From Novice to Professional* by W. Jason Gilmore,
7. *XML: How to Program* by Deitel & Deitel.

Master of Computer Applications (CBCEGS)
SEMESTER – I
(Session 2025-26)
COURSE CODE: MCAL-103
DATA SCIENCE FOUNDATION

L-T-P:4-0-0	**Max.Marks:100**
Credits:4	**Theory:70**
Examination Time: 3 Hours.	**CA:30**

Mid Semester Examination: 30% weightage
End Semester Examination: 70% weightage
Course Outcomes: After completing this course, students will be able to:
CO1: Comprehend basics of Python programming like operators, data types, control structures, etc.
CO2: Implement Data Structures for handling and accessing data and implement various functions to solve computing problems.
CO3: Apply concepts of Object Oriented Programming and files and database module in Python to manage, manipulate, clean, and analyze different types of data.
CO4: Apply operations to visualize the dataset using different visualization techniques.

MCA (Two Year Programme) (CBCEGS) SEMESTER – I
(Session 2025-26)
COURSE CODE: MCAL-103
DATA SCIENCE FOUNDATION

L-T-P: 4-0-0 **Max.Marks:100**
Credits: 4 **Theory:70**
Examination Time: 3 Hours **CA:30**

Instructions for Paper Setter -
Eight questions of equal marks (16 Marks each) are to set, two in each of the four sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be divided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any section.

UNIT -1

Introduction to Python: Basic syntax, Literals, Variables and Identifiers, variables, Operators Data types (Numbers, Booleans, Strings), Control Structures (if, if-else, for loop, while loop, break/continue), Nested conditions, String Operations

UNIT -II

Introduction to Data Structures in Python: List, Tuple, Sets, Dictionary, Operations on Data Structures (Declarations, Iterations, Adding/deleting element, min/max/sorting, merge, select).
Functions: Fundamental Concepts, arguments passing, block structure, scope, Program routine, recursion, iteration vs recursion, Lambda function

UNIT -III

Files: Working with Files, File Handling (Read, Write etc.), String Processing, Exception Handling, use of Libraries.
OOPs in Python: Introduction to Object Oriented Programming Classes, Methods, Objects, Functions as objects, multiple inheritance.
Using Databases and SQL: Database Concepts, Using Databases and SQL: Database Concepts, SQLite Manager Firefox Add-on, SQL basic summary, Basic Data modeling, Programming with multiple tables.

UNIT IV

Advance Topics in Python: Working with Numpy, Working with Scipy.
Plotting and Visualization in Python: Plotting using Matplotlib library (Histogram, Box Plot, Scatter Plot, Bar Graphs, Line Graph, etc)
Data Science: Working with Pandas, Working with Scikit-Learn, Basics of Correlation, Regression

Reference/Text:

1. Charles Dierbach, Introduction to Computer Science Using Python: A Computational Problem-SolvingFocus, Wiley Publications,
2. Guttag John V, Introduction To Computation And Programming Using Python, PHI, .

3. Jeeva Jose and Sojan P. Lal, Introduction to Computational & Problem Solving Through Python, Khanna Publishers,
4. Mark J. Guzdial, Introduction to Computing and Programming in Python, arson Education
5. Kenneth Lambert, Fundamentals of Python, Course Technology, Cengage Learning,
6. Mark Lutz, Learning Python, O'Reilly Media

Master of Computer Applications (CBCEGS) SEMESTER – I
(Session 2025-26)
COURSE CODE: MCAL-104
PROBABILITY AND STATISTICAL TECHNIQUES

L-T-P:4-0-0 **Max.Marks:100**
Credits:4 **Theory:70**
Examination Time: 3 Hours **CA:30**

Mid Semester Examination: 30% weightage
End Semester Examination: 70% weightage

Course Outcomes: After passing course the student will be able to:

CO1: Comprehend the core principles of probability.

CO2: Understand various probability distributions along with importance of its underlying assumptions and applications.

CO3: Apply various statistical methods related to regression and correlation techniques for data analysis.

CO4: Apply various tests to check for goodness of fit comparing observed data with theoretical distribution.

Master of Computer Applications (CBCEGS) SEMESTER – I
(Session 2025-26)
COURSE CODE: MCAL-104
PROBABILITY AND STATISTICAL TECHNIQUES

L-T-P:4-0-0 **Max.Marks:100**
Credits:4 **Theory:70**
Examination Time: 3Hours **CA:30**

Instructions for Paper Setter -
Eight questions of equal marks (16 Marks each) are to set, two in each of the four sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be divided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any section.

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Unit-I

Basic Statistics: Measures of central tendency, measures of dispersion, range quartile deviation, mean deviation, standard deviation, coefficient of variation, Skewness and Kurtosis, problems.

Statistical Methods: Correlation and Regression –Karl Pearson's coefficient of correlation and rank correlation problems, regression analysis-lines of regression, problems. Curve fitting: curve fitting by the method of least square.

Unit-II

Probability: Introduction, sample space and events, Axioms of probability, Addition and multiplication theorems, conditional probability, Baye's Theorem.

Discrete, continuous and mixed random variables, probability mass, probability density and cumulative distribution functions.

Unit-III

Probability Distributions: Random variables (discrete and continuous), Binomial, Poisson and normal distributions- problems (no derivations for mean and standard deviation)

Unit-IV

Sampling theory: Introduction to sampling distributions, standard error, type-I and type-II errors. Test of hypothesis of means, Neyman-Pearson Fundamental Lemma, tests for one sample and two sample problems for normal populations, tests for proportions.

References/Text Books:

1. An Introduction to Probability and Statistics by V.K. Rohatgi& A.K. Md.E.Saleh.
2. Introduction to Probability and Statistics by J.S. Milton &J.C.Arnold.
3. Introduction to Probability Theory and Statistical Inference by H.J. Larson.
4. Introduction to Statistical Methods by Guptha ,C.B and Vijay Guptha.
5. An Outline of Statistical Theory, Vols. I & II by Goon, A.M., Gupta, M.K. and Das Gupta.
6. Fundamentals of Mathematical Statistics by Gupta and Kapoor .
7. Mathematical Statistics by Kapur, J.N. and Saxena.

Master of Computer Applications (CBCEGS) SEMESTER – I
(Session 2025-26)
COURSE CODE: MCAL-105
ADVANCED COMPUTER GRAPHICS

L-T-P:4-0-0 **Max.Marks:100**
Credits:4 **Theory:70**
Examination Time: 3 Hours **CA:30**

Mid Semester Examination: 30% weightage
End Semester Examination: 70% weightage

Course Outcomes: After passing course, the student will be able to:

After passing this course, the student will be able to:
CO1: Understand the fundamental concepts and applications of computer graphics.
CO2: Apply geometric transformations and viewing techniques in 2D graphics.
CO3: Develop skills in 3D transformations and projection methods.
CO4: Analyze and implement techniques for 3D viewing and hidden surface removal.

Master of Computer Applications (CBCEGS) SEMESTER – I
(Session 2025-26)
COURSE CODE: MCAL-105
ADVANCED COMPUTER GRAPHICS

L-T-P:4-0-0 **Max.Marks:100**
Credits:4 **Theory:70**
Examination Time: 3 Hours **CA:30**

Instructions for Paper Setter -
Eight questions of equal marks (16 Marks each) are to set, two in each of the four sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be divided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any section.

UNIT–I

Elements of Computer Graphics: Introduction to computer graphics; types of computer graphics; applications; overview of raster and random scans.
Drawing Algorithms: Line drawing algorithms – DDA, Bresenham's; circle and ellipse drawing algorithms, area filling – boundary fill and flood fill algorithms.

UNIT–II

2D Geometric Transformations: Basic transformations – translation, rotation, scaling, reflection, shear; matrix representations; homogeneous coordinates; composition of transformations.
2D Viewing and Clipping: Window and viewport; window-to-viewport transformation; point and line clipping – Cohen-Sutherland, polygon clipping – Sutherland-Hodgman algorithm.

UNIT–III

3D Geometric Transformations: Translation, rotation, scaling, reflection; composite transformations in 3D; transformation matrices.
Projections: Types of Projections: Parallel and Perspective
3D Viewing and Clipping: Viewing transformations in 3D; projection matrices; 3D clipping.

UNIT–IV

Hidden Surface Removal: Z-buffer algorithm; painter's algorithm; scan-line method; Warnock's algorithm.
Ray Tracing and Texturing: Introduction, Antialiasing techniques of ray tracing, Distributed ray tracing, Advantages and disadvantages; Texture – Texture mapping, Bump mapping and Normal mapping.

Reference/Text Books

1. Donald Hearn and M. Pauline Baker – *Computer Graphics with OpenGL*
2. F.S. Hill Jr. and Stephen M. Kelley – *Computer Graphics Using OpenGL*
3. Roy A. Plastock and Gordon Kalley – *Theory and Problems of Computer Graphics*
4. James D. Foley et al. – *Computer Graphics: Principles and Practice*

Master of Computer Applications (CBCEGS) SEMESTER – I
(Session 2025-26)

COURSE CODE: MCAL-106
INFORMATION SECURITY

L-T-P: 4-0-0 **Max. Marks: 100**
Credits: 4
Examination Time: 3 Hours **Theory: 70**
CA:30

Mid Semester Examination: 30% weightage
End Semester Examination: 70% weightage
Course Outcomes:

CO1: Comprehend essential terminology of cyber security and its importance**.**
CO2: Identify various Information security threats and measures.
CO3: Comprehend email and web security services.
CO4: Realize the role of Firewalls and IDS in Information security.

Master of Computer Applications (CBCEGS) SEMESTER – I
(Session 2025-26)

COURSE CODE: MCAL- 106
INFORMATION SECURITY

L-T-P: 4-0-0 **Max. Marks: 100**
Credits: 4
Examination Time: 3 Hours **Theory: 70**
CA:30

Instructions for Paper Setter -
Eight questions of equal marks (16 Marks each) are to set, two in each of the four sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be divided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any section.

Unit-I

Overview of Security: Introduction to Information Security, Principles of Information security, Services and attacks, functional requirements of security. Current trends in security**,** Protection versus security. Aspects of security– confidentiality, authentication, integrity, non-repudiation, availability, Access controls.

Unit-II

Information Security Threats: Virus, Worms, Bots, Adware, Spyware, Ransomware, DoS and DDoS attacks, Trojanhorse, buffer overflow; system threats- intruders; communication threats-tapping and piracy.

Authentication-Types of Authentications - Biometric Authentication and Multi factor authentication.

Information Security Solutions – Encryption -Objectives, types- Symmetric Key Encryption, Asymmetric Key encryption. Data Encryption Algorithms -DES, TDES, RSA, ECC**.**

Unit-III

Integrity-Message Integrity, Message authentication, Hash Functions – MD5, SHA.

Email attacks and Email Security – Threats, Best Practices - PGP, S/MIME, TLS.

Web security Services – Types, Web Application Firewalls, Web filtering, Vulnerability assessment scanners, Fuzzing tools, Black box and white box testing tools.

Unit-IV

Network Security – Firewalls-Introduction, Characteristic, Types: Packet Filter, Stateful and Stateless Packet Filter, Attacks of Packet Filter.

Intrusion detection system - Intruders, Intrusion Detection, Behavior of Authorized user and Intruder, Approaches for Intrusion Detection: Statistical Anomaly Detection and Rule based Detection.

References/Text Books

1. William Stallings, Cryptography and Network Security – Principles and Practice(7^{th}ed.), Pearson Education of India,2017.
2. Adam J.Elbirt, Understanding and Applying Cryptography and Data Security CRC Press, Taylor Francis Group, New York,2015.
3. Charles P.Pfleeger and SLPfleeger, Jonathan Margulies, Security in Computing (6thedition 2023), Addison-Wesley Professional.
4. PeterW. Singer and Allan Friedman, Cybersecurity and Cyberwar: What Everyone Needs to Know, Oxford University Press, 2014.
5. NIIT, Introduction To Information Security Risk Management -Paperback – January 2003,Prentice Hall of India.
6. Hossein Bidgoli, Hand book of information Security, Threats, Vulnerabilities, Prevention, Detection and Management, John Wiley & Sons, 2006.
7. Steve G Watkins, An Introduction to Information Security and ISO27001, IT Governance Publishing, 2013.

Master of Computer Applications (CBCEGS) SEMESTER – I
COURSE CODE: MCAP-108
PROGRAMMIN LAB BASED ON WEB TECHNOLOGEIS

L-T-P: 0-0-2 **Max. Marks: 50**
Credits: 2
Examination Time: 3 Hours **Practical : 35**
CA:15

Mid Semester Examination: 30% weightage
End Semester Examination: 70% weightage
Practical based on:

Web Technologies: HTML: Basic HTML tags, HTML Forms, HTML tables. CSS: Basic CSS styling, Internal CSS, Linking External CSS, CSS box model, JavaScript: Adding dynamic functionality to HTML page, insert, update and delete HTML elements at runtime, JavaScript Objects, Servlets: Creating a Servlet, handling GET and POST requests with Servlets, extracting parameters from GET and POST requests, JDBC: Connecting to a MySQL database, Create, Read, Update and Delete records using JDBC, PHP: Basics of PHP, Exception handling in PHP, handling file uploads in PHP, AJAX and XML: Making asynchronous requests using AJAX, basics of XML

Master of Computer Applications (CBCEGS) SEMESTER – I
(Session 2025-26)

COURSE CODE: MCAP- 109
PROGRAMMING LAB BASED FOUNDATION OF DATA SCIECNE

L-T-P: 0-0-2 **Max. Marks: 50**
Credits: 2
Examination Time: 3 Hours **Practical : 35**
CA:15

Mid Semester Examination: 30% weightage
End Semester Examination: 70% weightage
Practical based on:

Develop mini project based on real-world use-cases and implement general problems in Python and programs based on :

String analyzer (count vowels, reverse etc.)
List filtering using conditions
Contact book using dictionaries
Recursive factorial and Fibonacci
Basic calculator with function
Read from a file and process data
Student grade management using classes
Exception-handling

Master of Computer Applications (CBCEGS) SEMESTER – II
(Session 2025-26)

COURSE CODE: MCAB-110
FUNDAMENTALS OF COMPUTERS

L-T-P: 2-0-0 **Max. Marks: 50**
Credits: 2 **Theory: 35**
Examination Time: 3 Hrs. **CA: 15**

Mid Semester Examination: 30% weightage
End Semester Examination: 70% weightage

Course Outcome: After passing course the student will be able to:

CO1: Comprehend about computer hardware, operating system concepts and various system software.
CO2: Identify various input, output and memory devices.
CO3: Apply word processing software to create professional and academic documents.
CO4: Create effective and well-formatted presentation.

Master of Computer Applications (CBCEGS) SEMESTER – II
(Session 2025-26)

COURSE CODE: MCAB-110
FUNDAMENTALS OF COMPUTERS

L-T-P: 2-0-0 **Max. Marks: 50**
Credits: 2 **Theory: 35**
Examination Time: 3 Hrs. **CA: 15**

Instructions for Paper Setter -
Eight questions of equal marks (16 Marks each) are to set, two in each of the four sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be divided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any section.

Unit-I

Fundamentals of Computer: Introduction to computer, Applications of computer, Components of computers (Input unit, Output Unit, Memory Unit & CPU).
Software: Application Software, Service software, System software, booting a System.
Memories: Primary Memory -RAM (Working and Its types), ROM (Types of ROM). Secondary Memory - Hard Disk (Structure of a hard disk, working, concept of tracks, sectors, clusters, cylinders).

Unit-II

Input Devices: Keyboards, Mouse, Joystick, Light Pen and Data Scanning devices (scanner, OCR, OMR, MICR, Bar Code Reader, Card Reader)
Output Devices: Monitor, Printers (laser printer, dot matrix printer, ink jet printer)
Word Processing: Introduction to Office, word processing & its features, Parts of window of word (Title bar, menu bar, status bar, and ruler), understanding the Ribbon, Use of Office Button and Quick Access Toolbar, Creation of new documents, opening document, insert a document into another document.

Unit-III

Word Processing: Page setup, margins, gutters, font properties, Alignment, page breaks, header & footer, deleting, moving, replace, editing text in document, saving a document, spell checker, printing a document. Creating a table, entering and editing, Text in tables. Changing format of table, height, width of row/column. Editing, deleting Rows, columns in table. Adding picture, page colors and Watermarks, Borders, shading, Templates, wizards, drawing objects.
Presentation: Introduction to PowerPoint, exploring menus, starting a new slide, saving presentation, moving/rearranging slides, printing slides. Applying theme to presentation, Views (slide View, slide sorter, note's view, outline view), Formatting & enhancing text formatting. Displaying slide show, adding multimedia. Slide transitions, applying Animation, Timing slide display, adding movies & sounds.

Unit-IV

Spreadsheet: Introduction to Worksheet/Spreadsheets, creating a simple Worksheet, Computations in a Worksheet, Printing the Worksheet, Graphs, Data Sorting, Filling, Filtering data, Applying

Formulas. Inserting and Editing a Function, Auto Calculate and Manual Calculation, Defining Names, Using and Managing Defined Names, Displaying and Tracing Formulas, Understanding Formula Errors

References/Text Books

1. Joyce Cox, Joan Lambert and Curtis Frye, Microsoft office Professional 2010 Step by Step, Microsoft Press.
2. V. Rajaraman, Neeharika Adabala, Fundamentals of Computers, PHI Learning,
3. P.K. Sinha, Computer Fundamentals, BPB Publications.
4. Anshuman Sharma, A book of Fundamentals of Information Technology, Lakhanpal Publishers, 5th Edition.
5. Peter Norton, Peter Norton's Computing Fundamentals, McGraw-Hill Technology Education,

Master of Computer Applications (CBCEGS) SEMESTER – II
(Session 2025-26)

COURSE CODE: MCAB1-111

INTRODUCTION TO PROGRAMMING - C

L-T-P: 2-0-0	**Max. Marks: 50**
Credits: 2	**Theory: 35**
Examination Time: 3 Hrs.	**CA: 15**

Mid Semester Examination: 30% weightage
End Semester Examination: 70% weightage

Course Outcome: After passing course the student will be able to:

CO1: Comprehend the working of various programming constructs involved in C Programming.
CO2: Design C program and control its sequence using various control statements.
CO3: Apply programming concepts such as arrays, functions and strings to provide solution in different problem domains.
CO4: Work with pointers, structures and union.

Master of Computer Applications (CBCEGS) SEMESTER – II
(Session 2025-26)

COURSE CODE: MCAB1-111

INTRODUCTION TO PROGRAMMING - C

L-T-P: 2-0-0 **Max. Marks: 50**
Credits: 2 **Theory: 35**
Examination Time: 3 Hrs. **CA: 15**

Instructions for Paper Setter -
Eight questions of equal marks (16 Marks each) are to set, two in each of the four sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be divided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any section.

Unit-I

Fundamentals: Character set, Identifiers and Keywords, Data types, Constants, Variables, Expressions, Statements, Symbolic Constants.

Operations and Expressions: Arithmetic operators, Unary operators, Relational Operators, Logical Operators, Assignment and Conditional Operators, Library functions. Data Input and Output statements

Unit-II

Control Statements: Preliminaries, While, do–while and for statements, Nested loops, if–else, Switch, Break – Continue statements.

Program Structure Storage Class: Storage Classes- Auto, extern, register and static.

Unit-III

Functions: Brief overview, defining, accessing functions, passing arguments to function, specifying argument data types, function prototypes, recursion.

Arrays: Defining, processing an array, passing arrays to a function, multi–dimensional arrays.

Strings: String declaration, string functions and string manipulation.

Unit-IV

Structures & Unions: Defining and processing a structure, user defined data types, structures and pointers, passing structures to functions, self-referenced structure, and unions.

Pointers: Fundamentals, pointer declaration, passing pointer to a function, pointer and one-dimensional arrays, operation on pointers, pointers & multi–dimensional arrays of pointers, passing functions

References/Textbooks:

1. E Balagurusamy, Programming in ANSI C, Tata McGraw-Hill, 2002.
2. Byron Gottfried, Schaum's Outline Programming with C, McGraw Hill, 1996.
3. Brian W. Kernighan, Dennis M. Ritchie, The C Programming language, Prentice Hall, 1988.
4. Stephen G. Kochan, Programming in C, Pearson Education, 2015. Note: The latest editions of the books should be followed.

Master of Computer Applications (CBCEGS) SEMESTER – II
(Session 2025-26)
COURSE CODE: MCAL-201
FULL STACK DEVELOPMENT

L-T-P: 4-0-0 **Max. Marks: 100**
Credits: 4
Examination Time: 3 Hours **Theory : 70**
CA: 30

Mid Semester Examination: 30% weightage
End Semester Examination: 70% weightage
Course Outcomes: After passing this course, the student will be able to:

CO1: Comprehend server-side applications using Node.js and Express.js, including RESTful APIs and middleware, to handle HTTP requests, routing, and error handling effectively.
CO2: Analyze the structure and behavior of React-based Single Page Applications (SPAs), leveraging components, state, props, lifecycle methods, and hooks to manage UI rendering and user interactions.
CO3: Evaluate and configure full-stack architectures using MERN/MEAN stacks, addressing cross-origin communication through CORS and proxies to ensure secure and efficient frontend-backend integration.
CO4: Design and deploy full-stack web applications with features such as file uploads, real-time updates, role-based access, and testing, utilizing tools like Multer, Socket.IO, Jest, Postman, and deployment platforms (Render, Vercel).

Master of Computer Applications (CBCEGS) SEMESTER – II (Session 2025-26)

COURSE CODE: MCAL-201
FULL STACK DEVELOPMENT

L-T-P: 4-0-0 **Max. Marks: 100**
Credits: 4
Examination Time: 3 Hours **Theory : 70**
CA:30

Instructions for Paper Setter -
Eight questions of equal marks (16 Marks each) are to set, two in each of the four sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be divided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any section.

Unit-I

Node.js and Express.js: Introduction to Node.js and npm, creating basics Node.js server, Understanding modules and package management in Node.js., Express framework basics, Middleware, REST API development, Handling JSON and URL-encoded data, Error handling Introduction to RESTful APIs and their principles, Using Express.js framework for developing web applications and APIs, Express routing & middleware, Route definition, HTTP request and response handling, Building RESTful API endpoints for CRUD (Create, Read, Update, Delete) operations.

Unit – II

Introduction to React and Single Page Applications (SPA), JSX syntax and transformation using Babel, Functional vs Class components, React Rendering Process and Virtual DOM, Creating reusable components, Component composition and nesting, Props: Passing data parent to child,, Introduction to state in React The useState hook: syntax and usage, Conditional rendering based on state, Handling user input and form data, React Lifecycle (old: componentDidMount etc. / new: useEffect), useEffect hook: dependencies, cleanup, multiple effects, Data fetching from external APIs, Basic error handling and loading indicators

Unit-III

What is Full Stack Development?, Overview of MERN and MEAN stacks, CORS Configuration: What is CORS and why it matters, Handling cross-origin requests in Express, CORS middleware and origin whitelisting, Proxy Setup: Setting up frontend proxies for development, Avoiding CORS issues in React/Angular,

Unit-IV

Testing: Unit testing (Jest for backend, React Testing Library for frontend), Postman for Pagination, Search, Filtering, Real-time updates with Socket.IO, Role-based permissions.
Using Multer for File Uploads: Installing and configuring Multer, Accepting single/multiple files, Validating and filtering file types, Storing images locally vs. using cloud storage, Backend Deployment with Render: Creating a production build, Environment variable setup.

Frontend Deployment with Vercel: Deploy React/Angular project, Setup environment variables and API URLs

Reference/Text Books:

1. *Node.js Design Patterns* by Mario Casciaro and Luciano Mammino,
2. *Learning React: Modern Patterns for Developing React Apps* by Alex Banks and Eve Porcello,
3. *Full-Stack React, TypeScript, and Node* by David Choi,
4. *Web Development with Node and Express: Leveraging the JavaScript Stack* by Ethan Brown,
5. *Testing JavaScript Applications* by Lucas Fernandes da Costa.

Master of Computer Applications (CBCEGS) SEMESTER – II
(Session 2025-26)
COURSE CODE: MCAL-202
ADVANCED DATABASE MANAGEMENT SYSTEM

L-T-P: 4-0-0 **Max. Marks: 100**
Credits: 4
Examination Time: 3 Hours **Theory : 70**
CA:30

Mid Semester Examination: 30% weightage
End Semester Examination: 70% weightage

Course Outcomes: After passing this course, the student will be able to:

CO1: Apply advanced database concepts to design and manage efficient relational database systems.
CO2: Develop procedural database programs to enhance functionality and maintain data integrity.
CO3: Understand and utilize various types of NoSQL databases for managing unstructured data.
CO4: Perform advanced operations in document-oriented databases for scalable data management.

Master of Computer Applications (CBCEGS) SEMESTER – II
(Session 2025-26)

COURSE CODE: MCAL- 202
ADVANCED DATABASE MANAGEMENT SYSTEM

L-T-P: 4-0-0 **Max. Marks: 100**
Credits: 4
Examination Time: 3 Hours **Theory : 70**
CA:30

Instructions for Paper Setter -
Eight questions of equal marks (16 Marks each) are to set, two in each of the four sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be divided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any section.

UNIT –I

Relational SQL Enhancements: Join types and subqueries, Set operations: UNION, INTERSECT, EXCEPT, Working with Indexes and Views.
Transaction Management: ACID properties, concurrency issues, locking protocols

UNIT –II

PL/SQL Enhancements: Structure, variables, data types, control statements, built-in functions, cursors (implicit and explicit), procedures, functions, packages, and exception handling. Triggers and Event Handling: Row-level vs Statement-level triggers. Introduction to Data Engineering: Big Data: Concept, characteristics, benefits, CAP theorem.

UNIT –III

NoSQL Databases: Need, characteristics, and classification (Key-Value, Document, Column-Family,Graph). MongoDB: Installation and setup, collections, CRUD operations, MongoDB shell, schema-less design.

UNIT –IV

Advanced MongoDB Operations: SQL-to-MongoDB query mapping, Projection, sorting, limiting, aggregation, Indexing strategies, Replication, sharding

Reference/ Textbooks :

1. C.J. Date, *An Introduction to Database Systems*, Pearson Education.
2. H. F. Korth & A. Silberschatz, *Database System Concepts*, McGraw-Hill.
3 Elmasri & Navathe, *Fundamentals of Database Systems*, Addison-Wesley.
4. Adam Fowler, *NoSQL for Dummies*, Wiley.
5. Pramod Sadalage & Martin Fowler, *NoSQL Distilled*, Pearson.
6. MongoDB, Inc., *MongoDB: The Definitive Guide*, O'Reilly Media.

Master of Computer Applications (CBCEGS) SEMESTER – II

(Session 2025-26)

COURSE CODE: MCAL-203

MACHINE LEARNING

L-T-P: 4-0-0 **Max. Marks: 100**

Credits: 4

Examination Time: 3 Hours **Theory : 70**

CA:30

Course Outcomes: After completing this course, students will be able to:

CO1: Comprehend the Machine Learning Techniques.

CO2: Compare and explain Linear Regression and Multiple Linear Regressions.

CO3: Understand the concepts of Clustering and Classification Techniques.

CO4: Comprehend the concepts of Artificial Neural Networks.

Master of Computer Applications (CBCEGS) SEMESTER – II
(Session 2025-26)
COURSE CODE: MCAL- 203
MACHINE LEARNING

L-T-P: 4-0-0 **Max. Marks: 100**
Credits: 4
Examination Time: 3 Hours **Theory : 70**
CA:30

Instructions for Paper Setter -
Eight questions of equal marks (16 Marks each) are to set, two in each of the four sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be divided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any section.

UNIT-1

Introduction: Well-Posed learning problems, Basic concepts, Designing a learning system, Types of machine learning: Learning associations, Supervised learning, Unsupervised, Semi-supervised and Reinforcement learning, Data Pre-processing Technique

UNIT - II

Linear Regression, Relationship between attributes using Covariance and Correlation, Relationship between multiple variables: Regression (Linear, Multivariate) in prediction. Multiple Linear Regressions Polynomial Regression, Regularization methods, Categorical Variables in Regression.

Regression: Linear regression, Multiple regression, Polynomial regression. Nearest Neighbours, Evaluation parameters.

UNIT - III

Classification: Bayesian learning, Logistic Regression, Decision Tree Learning: Entropy and Gini Index based decision tree**,** Support vector machines, and Evaluation parameters. Ensemblers, Naïve Bayes Classifier

Clustering: Distance Measures in Algorithmic Methods, Different clustering methods (Distance, Density, Hierarchical), Iterative distance-based clustering. **Classification:** Naïve Bayes Classifier, Model Assumptions, Probability estimation, Required data processing

UNIT - IV

Artificial Neural Networks: Basic Concepts of Artificial Neurons,Perceptron, Training a perceptron, Training a perceptron, Gradient Decent & Momentum Based Optimization, Back propagation Algorithm. Basic concepts of Genetic Algorithms, Basic Concepts of Convolutional Neural Networks.

References / Textbooks:

1 Bishop C., Pattern Recognition and Machine Learning, Springer-Verlag
2 Alpaydin E., Introduction to Machine Learning, MIT Press

3. Mitchell T.M., Machine Learning, McGraw Hill
4. Michie D.,Spiegelhalter D. J.,TaylorC. C., Machine Learning, Neural and Statistical Classification. Overseas Press

Master of Computer Applications (CBCEGS) SEMESTER – II
(Session 2025-26)
COURSE CODE: MCAL-204
SOFTWARE PROJECT MANAGEMENT

L-T-P: 4-0-0 **Max. Marks: 100**
Credits: 4 **Theory: 70**
Examination Time: 3 Hours **CA: 30**
Mid Semester Examination: 30% weightage
End Semester Examination: 70% weightage

Course Outcomes: After passing course, the student will be able to:
CO1: Understand and practice the process of project management
CO2: Develop the scope of work, provide accurate cost estimates and to plan the various activities.
CO3: Understand and use risk management analysis techniques that identify the factors that put a project at risk and to quantify the likely effect of risk on project timescales
CO4: Identify the resources and people required for a project and to produce a work plan and resource schedule.

Master of Computer Applications (CBCEGS) SEMESTER – II
(Session 2025-26)
COURSE CODE: MCAL-204
SOFTWARE PROJECT MANAGEMENT

L-T-P: 4-0-0 **Max. Marks: 100**
Credits: 4
Examination Time: 3 Hours **Theory: 70**
CA:30

Instructions for Paper Setter -
Eight questions of equal marks (16 Marks each) are to set, two in each of the four sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be divided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any section.

UNIT-I

Fundamentals: Basic Definitions, Project Stakeholders, Project Management Processes, Project Initiating Processes.

Project Planning - Identify Requirements, Creating the Work Breakdown structure, developing the Project Schedule, Project Cost Estimate, Planning Quality, Organizing the Project Team, Planning for Potential Risks

UNIT-II

Project Evaluation and Planning: Overview of Project Planning, Software processes and process models. Cost Benefit Analysis, Cash Flow Forecasting, Cost-Benefit Evaluation Techniques, Risk Evaluation.

Project costing, COCOMO 2, Project Sequencing and Scheduling Activities, Scheduling resources, Critical path analysis, Network Planning, Risk Management, Nature and Types of Risks, Managing Risks, Risk Planning and Control, PERT and Monte Carlo Simulation techniques.

UNIT-III

Project Execution and Management: Project Executing Processes, Acquiring and Developing the Project Team, Managing the Project Team, Managing Stakeholder Expectations, Directing and Managing the Project while assuring Quality.

Project Monitoring and Controlling Processes: Verifying and Controlling Scope, Managing Schedule and Cost, Controlling Quality, Monitoring and Controlling Risks. Integrated Change Control, Project Closing Process, Collecting Data, Visualizing Progress, Cost Monitor in greview techniques, Project termination review, earned value analysis, Change Control, Software Configuration Management (SCM), Managing Contracts, Types of Contracts and Stages in Contract Placement, Contract Management and Acceptance.

UNIT-IV

Quality Management and People Management: Introduction, Understanding Behaviour, Organizational Behaviour, Selecting The Right Person for The Job, Motivation, The Oldman – Hackman Job Characteristics Model, working in Groups, Organization and team structures, Decision Making, Leadership, Organizational Structures, Stress ,Health and Safety.

Overview of project management tools for software.

Reference / Text Books:

1.
2. Robert K. Wysocki, “Effective Software Project Management”, Wiley
3. Mathiazhagan P Sakthimuthiah K Richu A Vikkash.M, “Software Project Management”, Alpha International Publication.
4. Ian Sommerville, Software Engineering, Seventh Edition, Pearson Education.
5. Chandramouli / Dutt, “Software Project Management”, Pearson Education.
6. R.S. Pressman, Software Engineering: A Practitioner's Approach, Sixth Edition, Tata McGraw-Hill.
7. Bob Hughes, Mike Cotterell, “Software Project Management”, Tata McGraw Hill.
8. Royce, “Software Project Management: A Unified Framework, Pearson Education.

Master of Computer Applications (CBCEGS) SEMESTER – II
(Session 2025-26)
COURSE CODE: MCAL-205
BIG DATA ANALYTICS AND BUSINESS INTELLIGENCE

L-T-P: 4-0-0 **Max. Marks: 100**
Credits: 4 **Theory: 70**
Examination Time: 3 Hours **CA: 30**

Course Outcomes: After passing course the student will be able to:
CO1**:** Understand the basic concepts of data analytics and big data, including data relationships, visualization techniques, and foundational tools used in modern data analysis.
CO2**:** Describe the key components and processes of Business Intelligence systems, including data processing, reporting tools, and how BI supports business decision-making.
CO3**:** Apply basic tools and techniques of big data analytics using platforms like Hadoop, and understand the role of ETL, HDFS, and predictive analytics in processing large-scale data.
CO4**:** Analyze real-world applications of big data technologies in business, including the use of NoSQL databases, data streams, and cloud platforms while considering security, governance, and best practices.

Master of Computer Applications (CBCEGS) SEMESTER – II
(Session 2025-26)
COURSE CODE: MCAL-205
BIG DATA ANALYTICS AND BUSINESS INTELLIGENCE

L-T-P: 4-0-0 **Max. Marks: 100**
Credits: 4
Examination Time: 3 Hours **Theory : 70**
CA:30

Instructions for Paper Setter -
Eight questions of equal marks (16 Marks each) are to set, two in each of the four sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be divided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any section.

UNIT- I

Foundations of Data Analytics: Understanding Data and Types, Basics of Data Relationships, Introduction to Data Visualization Tools, Simple Correlation and Regression, Basics of Forecasting, Introduction to Classification and Clustering with examples.

Overview of Big Data: Concept and Characteristics of Big Data (3Vs – Volume, Velocity, Variety), Common Big Data Sources, Key Technologies in Big Data, High-Level Big Data Architecture, Basics of Data Warehousing and its role in Big Data.

UNIT- II

Introduction to Business Intelligence (BI): Role of IT in Decision Making, Structured vs. Unstructured Data, OLTP and OLAP Simplified, Core Concepts of BI, Key BI Roles in Organizations, BI Components and Tools, Simple BI Project Life Cycle, Comparison of BI and Business Analytics with examples.

UNIT- III

Applied Big Data Analytics: Purpose and Scope of Big Data Analytics, Practical Frameworks and Tools for Analysis, ETL Basics for Big Data, Introduction to Hadoop Ecosystem and HDFS, Simplified MapReduce Concept, Introduction to Text Analytics, Basics of Predictive Analysis using case studies, Role and Skills of a Data Analyst.

UNIT- IV

Real-world Applications of Big Data: Step-by-step Big Data Implementation Process, Basic Workflow and Tools Used, Introduction to NoSQL and Graph Databases, Understanding Real-Time Data Streams, Simple Business Use Cases, Fundamentals of Big Data Security, Cloud-based Big Data Platforms (AWS, Azure – overview), Do's and Don'ts in Big Data Projects, Current Trends in Big Data Usage, Basic Challenges in Big Data Storage and Processing.

Reference/ Text Books:

1. “Big Data: Principles and Best Practices of Scalable Real-Time Data Systems” *By Nathan Marz and James Warren*
2. “Business Intelligence: A Managerial Perspective on Analytics” *By Ramesh Sharda, DursunDelen, and EfraimTurban* .
3. “Big Data Fundamentals: Concepts, Drivers & Techniques” *By Thomas Erl, WajidKhattak, and Paul Buhler*
4. “Hadoop: The Definitive Guide” *By Tom White*
5. “Data Science for Business” *By Foster Provost and Tom Fawcett*

Master of Computer Applications (CBCEGS) SEMESTER – II
(Session 2025-26)
COURSE CODE: MCAL-206
THEORY OF COMPUTATION

L-T-P: 4-0-0 **Max. Marks: 100**
Credits: 4
Examination Time: 3 Hours **Theory : 70**
CA:30

Mid Semester Examination: 30% weightage
End Semester Examination: 70% weightage
Course Outcomes: After completing this course, students will be able to:
CO1: Comprehend various grammars in the Chomsky hierarchy and their closure properties.
CO2: Define production rules for Context Free Grammar (CFG), Convert CFG into Chomsky and Greibach Normal Form.
CO3: Apply Pumping Lemma to identify membership of a language.
CO4: Construct computing machines like Finite Automata, Pushdown Automata, Turing machine, etc.

Master of Computer Applications (CBCEGS) SEMESTER – II
(Session 2025-26)
COURSE CODE: MCAL-206
THEORY OF COMPUTATION

L-T-P: 4-0-0 **Max. Marks: 100**
Credits: 4
Examination Time: 3 Hours **Theory : 70**
CA:30

Instructions for Paper Setter -
Eight questions of equal marks (16 Marks each) are to set, two in each of the four sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be divided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any section.

UNIT-I

Chomsky Hierarchy, regular expressions, Operations on Regular Sets, Regular grammars, Linear Grammar, equivalence of Regular Grammars, properties of regular languages, pumping lemma, Closure properties.

UNIT-II

Finite Automata – DFA, transition graphs, non-deterministic FA, equivalence of DFA and NDFA, Minimization of NFA, ε-NFA and its conversion into NFA, Mealy and Moore Machines.
Context Free Languages – Leftmost and rightmost derivation, parsing and ambiguity, Chomsky normal form, Greibach Normal form.

UNIT-III

Pushdown Automata – NDPDA, DPDA, context free languages and PDA, comparison of deterministic and non-deterministic versions, closure properties, pumping lemma for CFL
Context Sensitive Languages, Variations, Linear Bounded Automata, Closure Properties, The Kuroda Normal Form, One sided Context Sensitive Grammars.

UNIT-IV

Turing Machines, variations, halting problem, Post Correspondence Problem (PCP)
Properties of LL(k) and LR(k) grammars, Decidability, Recursive and Recursively Enumerable Languages, Closure properties.

References / Textbooks:

1.K.L.P. Mishra and N. Chandrasekaran, “Theory of Computer Science, Third Edition”, PHI Learning Private Limited
2.John E. Hopcroft, Rajeev Motwani, Jeffrey D. Ullman, “Introduction to Automata Theory”,Languages and Computation, Pearson Education.
3.M. Sipser, “Introduction to the Theory of Computation”, Second Edition, Cengage Learning.
4.K. V. N. Sunitha , N. Kalyani, “Formal Languages and Automata Theory”, McGraw-Hill
5.Stephen Wolfram, “Theory and Applications of Cellular Automata”, World Scientifi
6.G.E. Revesz, “Introduction to Formal Languages”, Dover Publications.
7.M. A. Harrison, “Introduction to Formal Language Theory”, Addison-Wesley

8.R.K. Shukla," Theory of Computation", Cengage Learning.
9.Peter Linz, An Introduction to Formal Languages and Automata, Third Edition, Narosa Publishers

Master of Computer Applications (CBCEGS) SEMESTER – II

(Session 2025-26)

COURSE CODE: MCAP-208

PROGRAMMIING LAB BASED ON ADVACNED DATABASE MANAGEMENT SYSTEM

L-T-P: 0-0-2 **Max. Marks: 50**

Credits: 2

Examination Time: 3 Hours **Practical : 35**

CA:15

Mid Semester Examination: 30% weightage

End Semester Examination: 70% weightage

Lab Based on:

Advanced SQL Practices

- Execute complex joins and nested sub queries
- Perform set operations (UNION, INTERSECT, EXCEPT)
- Create and manage views and indexes

PL/SQL Programming

- Develop procedures, functions, and packages
- Implement cursors and exception handling
- Design and test triggers (row-level and statement-level)

NoSQL Database Concepts

- Install and configure MongoDB
- Perform CRUD operations using MongoDB shell
- Understand schema-less design through practical examples

Advanced MongoDB Operations

- Apply projection, sorting, limiting, and aggregation
- Implement indexing, replication, and sharding

Master of Computer Applications (CBCEGS) SEMESTER – II
(Session 2025-26)
COURSE CODE: MCAP-209
PROGRAMMIING LAB BASED ON FULL STACK DEVELOPMENT

L-T-P: 0-0-2 **Max. Marks: 50**
Credits: 2
Examination Time: 3 Hours **Practical : 35**
CA:15

After passing this course, the student will be able to:

Lab Based on Full Stack Development:

1. **Working on Node.js**
   - Install Node.js and npm.
   - Create a basic Node.js HTTP server.
   - Use built-in and custom modules.
   - Set up an Express.js server with basic routing.
2. **REST API:**
   - Create RESTful routes for CRUD operations.
   - Handle JSON and URL-encoded data.
3. **React Setup and Components:**
   - Set up a React project using create-react-app.
   - Create and render functional/class components.
4. **State and Props:**
   - Use useState and props to manage and pass data.
   - Implement conditional rendering.
5. **Forms and Hooks:**
   - Handle user input and form submission.
   - Use useEffect for lifecycle behavior and data fetching.
6. **API Integration:**
   - Fetch data from Express API and display in React UI.
   - Implement loading/error states.
7. **MERN Stack Mini Project (Backend + Frontend):**
   - Build a simple full-stack application (e.g., Task Manager or Blog).

Master of Computer Applications (CBCEGS) SEMESTER – II
(Session 2025-26)
COURSE CODE: MCAL-210
UNIVERSAL HUMAN VALUES: UNDERSTANDING HARMONY

L-T-P: 2-0-0 **Max. Marks: 50**
Credits: 2
Examination Time: 3 Hours **Practical : 35**
CA:15

Instructions: The course involves training in technical/non-technical aspects to students to thrive as a professional in the field. A course coordinator will coordinate and monitor the conduct and evaluation of the Professional Development courses for the class activities and assessment. Evaluation will be continuous as per the assessment criteria. Plan of the activities during the semester should be as per the expected evaluation.

Objectives: The objectives of the course are four fold:

• Development of a holistic perspective based on self- exploration about self, family, society and existence.
• Understanding harmony in relationships among human beings, family, society and nature and existence.
• Development of Ashtang Yoga in daily life.
• Strengthening of self-reflection.
• Development of commitment and courage to act.

Course Outcomes: After passing course the student will be able to:

CO1: Understand the concept, requirements and methodologies used to fulfil human aspirations
CO2: Understand and apply values to live in harmony with other human beings and society as a whole.
CO3: Understand about the balance required to live in harmony with nature.
CO4: Apply what they have learnt to their own self in real life settings to achieve mutual goals.

Master of Computer Applications (CBCEGS) SEMESTER – II
(Session 2025-26)
COURSE CODE: MCAL-210
UNIVERSAL HUMAN VALUES: UNDERSTANDING HARMONY

L-T-P: 2-0-0 **Max. Marks: 50**
Credits: 2
Examination Time: 3 Hours **Theory : 35**
CA:15

Instructions: The course involves training in technical/non-technical aspects to students to thrive as a professional in the field. A course coordinator will coordinate and monitor the conduct and evaluation of the Professional Development courses for the class activities and assessment. Evaluation will be continuous as per the assessment criteria. Plan of the activities during the semester should be as per the expected evaluation.

UNIT–I

Development of Holistic Perspective through Universal Human Values

a) Recapitulation from universal human values and its implications for holistic development. Self-Exploration- Meaning, Content, Process (Natural Acceptance and Experiential validation).

b) Human Aspirations- Concept, Requirements (Right understanding, relationship- and physical facility) and methods for fulfillment of aspirations, Critical appraisal of human aspirations to achieve happiness and prosperity.

UNIT –II

Harmony in Human Beings and Human-Human Relationship

a) Human being as a co-existence of self and body: Characteristics of self, needs of self and body, Body as an instrument of self, Harmony of self with body: Sanyam and Health, Programs to ensure Sanyam& Health.

b) Human-Human Relationship: Universal Values in Human-Human relationship,Programmes for fulfilment of values, Trust & Intention, Respect & Differentiation, Harmony in society: Undivided Society, Universal order, family to world family for Achieving comprehensive human goals (Resolution, Prosperity, fearlessness & Coexistence).

UNIT –III

Harmony in Nature and Existence

a) Understanding harmony in the Nature, Holistic perception of harmony at all levels of existence. Film on hometobe used for balance / imbalance in nature.

b) Importance of Yoga in daily life; Ashtang Yoga (Eight stages of Yoga) and benefits of Asanas, Pranayama and Concentration.

UNIT –IV

Harmony on Professional Ethics

a) Natural acceptance of human values, Humanistic Education, Humanistic Constitution, Humanistic Universal order and Ethical Human Conduct.

b) Competence in professional ethics: Ability to utilize the professional competence for augmenting universal human order, identify the scope and characteristics of people friendly and eco-friendly production systems, identify and develop appropriate technologies and management patterns for above production systems.

Tutorials/ Sessional Work

• Discussion/presentation on living in relationship, harmony and co-existence.

• Reflection on prosperity v/s accumulation.

• Reflections on relationships in family, hostel and institute as extended family, real life examples, teacher student relationship.

• Reflect the importance of Ashtang Yoga in human life.

• Enlist the causes of imbalance in nature caused by human beings.

• Case Studies on typical holistic technologies, management models and production systems.

Reference Books:-

1.Andrews, C. (2006). *Slow is Beautiful: New Vision of Community, Leisure and Joie De Vivre.* New Society Publishers Paperback in English.

2.Azad, M.A.K. (1988*). India Wins Freedom.*Madras: Orient Longman Limited.

3.Dharampal. (2003). *Rediscovering India*. New Delhi: Society for Integrated Development of Himalayas.

4.Gandhi, M.K. (1921). *Hind Swaraj or Indian Home Rule*. Madras: Navajivan Publishing House.

5.Gandhi, & Desai, M. H. (1993). *An autobiography: the story of my experiments with truth.* American ed. Boston, Beacon Press.

6.Kumarappa, J.C. (1984). Economy of Permanence.Sarva-Seva-Sangh-Prakashan: Rajghat, Varanasi.

7.Leonard, A. (2007). *The story of stuff.*Widescreen format.[Berkeley, Calif.], Free Range Studios.

8.Nagraj, A. (1999). JeevanVidya: EkParichaya, JeevanVidyaPrakashan, Amarkantak. Ajab Distributer.

9.Rolland, R. (1930). *Mahatma Gandhi*. London: George Allen &Unwin Ltd. Museum Street.

10.Rolland, R. (1961).*The Life of Vivekananda and the Universal Gospel*. Utter Pradesh: Swami Vireswarananda.

11.Schumacher, E.F. (1999). *Small is beautiful: economics as if people mattered: 25 years later… with commentaries.* Point Roberts, Wash, Hatley& Marks Publishers.

12.Sunderlal. (1929). *Bharat Mein Angreji Raj*. Allahabad: TriveniNathVajpai Press.

Master of Computer Applications (CBCEGS) SEMESTER – III
(Session 2025-26)
COURSE CODE: MCAL-301
ADVANCED PROGRAMMING CONCEPTS

L-T-P: 4-0-0 **Max. Marks: 100**
Credits: 4
Examination Time: 3 Hours **Theory : 70**
CA: 30

Mid Semester Examination: 30% weightage
End Semester Examination: 70% weightage
Course Outcomes: After passing this course, the student will be able to:
CO1: Comprehend the concepts of Packages and Threads.
CO2: Comprehend the concepts of JDBC and handling with Database.
CO3: Apply JSP tags and its services to web applications and Develop applications using JAVA Beans.
CO4: Apply Hibernate framework for performing CRUD operations through Java based frameworks.

Master of Computer Applications (CBCEGS) SEMESTER – III
(Session 2025-26)
COURSE CODE: MCAL-301
ADVANCED PROGRAMMING CONCEPTS

L-T-P: 4-0-0 **Max. Marks: 100**
Credits: 4
Examination Time: 3 Hours **Theory : 70**
CA: 30

Instructions for Paper Setter -
Eight questions of equal marks (16 Marks each) are to set, two in each of the four sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be divided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any section.

UNIT-I

Packages and Interfaces – Input/Output Files, Utility Classes. Generics, Generic Class, Generic methods. Multithreading, threading basics, Life cycle of thread, Creating Threads, Priorities and Synchronization, Inter Thread Communication, Runnable Interface

UNIT-II

JDBC Overview – The design of JDBC, Basic JDBS program Concept, JDBC implementation – Connection class – Statements - Catching Database Results, handling database Queries, MetaData.

UNIT-III

Overview of JSP: JSP Technology, Need of JSP, Benefits of JSP, Advantages of JSP, Basic Syntax, JSP Building Blocks, Invoking Java code with JSP Scripting Elements, Creating Template Text, Invoking Java Code form JSP, Limiting Java Code in JSP, Using JSP Expressions, Comparing Servlets and JSP, Writing Scriptlets.

UNIT-IV

JavaBeans Components, Need of beans, the bean-writing process, Using beans to build an application, jar file

Hibernate Framework: Overview, ORM, architecture, configuration, lifecycle, mapping, annotations, persistence, HQL and CRUD operations, caching.

References / Textbooks:

1. Java The Complete Reference, Herbert Schildt 7th Edition. Tata McGraw Hill Edition
2. Java 6 by Rogers Cadenhead, Laura Lemay, Pearson education
3. Java Programming – A Practical Approach – C Xavier, Tata McGraw-Hill Edition
4. K. Arnold and J. Gosling, “The JAVA programming language”, Third edition, Pearson Education,
5. 5.Javascript A Beginners Guide, 3rd Edition – John Pollock - Tata McGraw-Hill Edition

Master of Computer Applications (CBCEGS) SEMESTER – III
(Session 2025-26)
COURSE CODE: MCAL-302
IMAGE PROCESSING

L-T-P: 4-0-0 **Max. Marks: 100**
Credits: 4
Examination Time: 3 Hours **Theroy : 70**
CA: 30

Mid Semester Examination: 30% weightage
End Semester Examination: 70% weightage
Course Outcomes: After passing this course, the student will be able to:
CO1: Identify current applications in the field of digital image processing along with its basics.
CO2: Comprehend fundamental concepts of Digital Image Processing like human visual system model, image signal representation, imaging system specification
CO3: Identify basic image processing operations.
CO4: Comprehend various colour models and colour image processing techniques.

Master of Computer Applications (CBCEGS) SEMESTER – III
(Session 2025-26)
COURSE CODE: MCAL-302
IMAGE PROCESSING

L-T-P: 4-0-0 **Max. Marks: 100**
Credits: 4
Examination Time: 3 Hours **Theory : 70**
CA: 30

Instructions for Paper Setter -
Eight questions of equal marks (16 Marks each) are to set, two in each of the four sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be divided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any section.

UNIT-I

Background: Introduction to electronic systems for image transmission and storage, computer processing and recognition of pictorial data, overview of practical applications.

UNIT-II

Fundamentals: Mathematical and perceptual preliminaries, human visual system model, image signal representation, imaging system specification building image quality, role of computers, image data formats.

UNIT-III

Image Processing Techniques: Image enhancement, image restoration, image data compression and statistical pattern recognition.

Applications of Image Processing: Picture data archival, machine vision, medical image processing.

UNIT-IV

Techniques of Colour Image Processing: Colour image signal representation, colour system transformations, extension of processing techniques to colour domain.

References / Textbooks:

1. Pratt, W.K. Digital Image Processing, John Wiley, N.Y./1978.
2. Rosenfield, A and Kak, A.C., Picture processing, Academic Press N.Y., 1982.
3. Jain, A.K., Fundamentals of Digital Image Processing, Englewood Cliffs, Prentice Hall, 1989.
4. Chris Soloman, Stuart Gibson, Fundamentals of Digital Image Processing: A Practical Approach using MatLab, John Wiley and Sons, 2007.
5. Gonzalez and Woods, Digital Image Processing, Addison Wesley, 2000.
6. Jayaraman S, Veerakumar T, Esakkirajan S, Digital Image Processing, Tata McGraw Hill Education (2017), 1st Edition

Master of Computer Applications (CBCEGS) SEMESTER – III
(Session 2025-26)
COURSE CODE: MCAL-303
DEEP LEARNING

L-T-P: 4-0-0 **Max. Marks: 100**
Credits: 4
Examination Time: 3 Hours **Theory : 70**
CA: 30

Mid Semester Examination: 30% weightage
End Semester Examination: 70% weightage
Course Outcomes: After passing this course, the student will be able to:
CO1: Comprehend the advancements in learning techniques.
CO2: Compare and explain various deep learning architectures and algorithms.
CO3: Demonstrate the applications of deep learning in various fields.
CO4: Apply deep learning-specific open-source libraries for solving real-life problems.

Master of Computer Applications (CBCEGS) SEMESTER – III
(Session 2025-26)
COURSE CODE: MCAL-303
DEEP LEARNING

L-T-P: 4-0-0 **Max. Marks: 100**
Credits: 4
Examination Time: 3 Hours **Theory : 70**
CA: 30

Instructions for Paper Setter -
Eight questions of equal marks (16 Marks each) are to set, two in each of the four sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be divided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any section.

UNIT-I

Artificial Neural Networks: Basic Concepts of Artificial Neurons, Single and Multi-Layer Perceptron, Learning Algorithm, Gradient Descent & Momentum Based Optimization, Activation Functions, Back propagation.

UNIT - II

Convolutional Neural Networks: Basic Concepts of Convolutional Neural Networks. Convolution and Pooling Operation, Convnet Architectures, Regularization, Dropout, Batch-Norm etc. Convnet Architectures - Alexnet, Zfnet, VGG, Googlenet, Resnet, Mobilenet etc.

UNIT - III

Recurrent Neural Networks: Recurrent Architecture, BPTT, Vanishing and Exploding Gradients, GRU, LSTM, Attention Mechanism and Transformers.

UNIT - IV

Autoencoders: Autoencoder and its Relation to PCA, Stack Autoencoders, Denoising Autoencoders Variational Autoencoders, Sparse Autoencoders and GANs.

References/ Textbooks:

1. Ian Goodfellow and YoshuaBengio and Aaron Courville,"Deep Learning", MIT Press
2. Michael Nielsen, "Neural Network and Deep Learning", Online Book

Master of Computer Applications (CBCEGS) SEMESTER – III
(Session 2025-26)
COURSE CODE: MCAL-304
OPTIMIZATION TECHNIQUES

L-T-P: 4-0-0 **Max. Marks: 100**
Credits: 4
Examination Time: 3 Hours **Theory : 70**
CA: 30

Mid Semester Examination: 30% weightage
End Semester Examination: 70% weightage

Course Outcomes: After passing course the student will be able to:

CO1: Comprehending formulation and solution to linear programming problem.
CO2: Apply different methods to provide optimal solution to transportation and assignment problem.
CO3: Understand game theory along with applications of Integer and Dynamic Programming.
CO4: Apply various single variable, multivariable and constrained optimization techniques.

Master of Computer Applications (CBCEGS) SEMESTER – III
(Session 2025-26)
COURSE CODE: MCAL-304
OPTIMIZATION TECHNIQUES

L-T-P: 4-0-0 **Max. Marks: 100**
Credits: 4
Examination Time: 3 Hours **Theory : 70**
CA: 30

Instructions for Paper Setter -
Eight questions of equal marks (16 Marks each) are to set, two in each of the four sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be divided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any section.

UNIT-I

Scope of Operations Research: Introduction to linear and non-linear programming formulation of different models.

Linear Programming: Geometry of linear programming, Graphical method, Linear programming (LP) in standard form, Solution of LP by simplex method, Exceptional cases in LP, Big-M method, Dual simplex method, duality and Sensitivity analysis.

UNIT -II

Transportation Problem: Introduction, Initial basic feasible solutions of balanced and unbalanced transportation problems (North-West Corner method, Matrix Minima Method and Vogel's Approximation Method), Optimal solutions (Stepping Stone and MODI Method), Alternate and Degenerate Solutions.

Assignment Problem: Introduction, differentiation with transportation problem, Hungarian Method for solution to assignment problem.

UNIT -III

Game Theory: Two person zero-sum game, Game with mixed strategies, Graphical method and solution by linear programming.

Integer Programming: Introduction, Branch and Bound, Cutting Plane method.

Dynamic Programming: Introduction, optimal substructure and principle of optimality, multistage decision problem, optimizing inventory control and resource allocation.

UNIT-IV

Single Variable Optimization Problems: Optimality Criterion, Bracketing Methods, Region Elimination Methods, Fibonacci Search Method, Golden Section Method. Gradient Based Methods: Newton-Raphson Method and Biunit Method.

Multivariable and Constrained Optimization Techniques: Optimality criteria, Direct search Method, Cauchy's Steepest descent method, Newton's method. Kuhn - Tucker conditions, Penalty Function.

Reference / Text Books:

1. Pant J. C., Introduction to optimization: Operations Research, Jain Brothers (2004)
2. BazaarraMokhtar S., Jarvis John J. and ShiraliHanif D., Linear Programming and Network flows, John Wiley and Sons (1990).
3. Swarup, K., Gupta, P. K., Mammohan, Operations Research, Sultan Chand & Sons, (2010).
4. Chandra, S., Jayadeva, Mehra, A., Numerical Optimization and Applications, Narosa Publishing House, (2013).
5. Taha H.A., Operations Research-An Introduction, PHI (2007).
6. S. S. Rao, Engineering Optimisation: Theory and Practice, Wiley (2008).
7. K. Deb, Optimization for Engineering design algorithms and Examples, Prentice Hall, 2nd Edition (2012).
8. C.J. Ray, Optimum Design of Mechanical Elements, Wiley (2007).
9. P. Rama Murthy, Operations Research, New Age International Publishers, 2nd Edition (2007).

Master of Computer Applications (CBCEGS) SEMESTER – III
(Session 2025-26)
COURSE CODE: MCAL-305
ADVANCED COMPUTER ARCHITECTURE

L-T-P: 4-0-0 **Max. Marks: 100**
Credits: 4
Examination Time: 3 Hours **Theory: 70**
CA: 30

Course Outcomes: After completing this course, students will be able to:

CO1: Comprehend paradigms and various kinds of classifications of computing.
CO2: Gain knowledge of parallel computing models.
CO3: comprehend various architectural classifications of computers on the basis of data processing schemes.
CO4: Analyse pipelined architecture against parameters like throughput, speedup, efficiency, etc.

Master of Computer Applications (CBCEGS) SEMESTER – III
(Session 2025-26)
COURSE CODE: MCAL-305
ADVANCED COMPUTER ARCHITECTURE

L-T-P: 4-0-0 **Max. Marks: 100**
Credits: 4
Examination Time: 3 Hours **Theory: 70**
CA: 30

Instructions for Paper Setter -
Eight questions of equal marks (16 Marks each) are to set, two in each of the four sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be divided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any section.

UNIT-I

Paradigms of Computing: Synchronous – Vector/Array, SIMD, Systolic
Asynchronous – MIMD, reduction Paradigm, Hardware taxonomy: Flynn's classification, Software taxonomy: Kung's taxonomy, SPMD.

UNIT-II

Parallel Computing Models, Parallelism in Uniprocessor Systems: Trends in parallel processing, Basic Uniprocessor Architecture, Parallel Processing Mechanism.

UNIT-III

Parallel Computer Structures: Pipeline Computers, Array Computers, Multiprocessor Systems Architectural Classification Schemes: Multiplicity of Instruction-Data Streams, Serial versus Parallel Processing, Parallelism versus Pipelining.

UNIT-IV

Pipelining: An overlapped Parallelism, Principles of Linear Pipelining, Classification of Pipeline Processors, General Pipelines and Reservation Tables.
Principles of Designing Pipelined Processors: Instruction Prefetch and Branch Handling, Data Buffering and Busing Structure, Internal Forwarding and Register tagging, Hazard Detection and Resolution.

References / Textbooks:

1. Kai Hwang, Faye A. Briggs, Computer Architecture and Parallel Processing, McGraw-Hill International Editions
2. John D. Carpinelli, Computer Systems Organization & Architecture, Addison Wesley, 2001.
3. Kai Hwang, Advanced Computer Architecture: Parallelism, Scalability and Programmability, McGraw-Hill, International Edition
4. T. J. Fountain, D Sima , Peter Kacsuk, Advanced Computer Architectures: A Design Space Approach, Addison-Wesley

Master of Computer Applications (CBCEGS) SEMESTER – III
(Session 2025-26)
COURSE CODE: MCAL-306
DEVOPS

L-T-P: 4-0-0 **Max. Marks: 100**
Credits: 4
Examination Time: 3 Hours **Theory: 70**
CA: 30

Mid Semester Examination: 30% weightage
End Semester Examination: 70% weightage
After passing this course, the student will be able to:
CO1: Comprehend the concepts of Devops
CO2: Apply GIT hub to work on live projects.
CO3: Comprehend the core concepts of containerization and Docker.
CO4: Apply metrics tools Prometheus and Grafana for monitoring the websites.

Master of Computer Applications (CBCEGS) SEMESTER – III
(Session 2025-26)
COURSE CODE: MCAL-306
DEVOPS

L-T-P: 4-0-0 **Max. Marks: 100**
Credits: 4
Examination Time: 3 Hours **Theory: 70**
CA: 30

Instructions for Paper Setter -
Eight questions of equal marks (16 Marks each) are to set, two in each of the four sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be divided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any section.

Unit-1

Devops: Understanding Devops, Devops definition, History of Devops, Main Objectives, advantages of adopting practices, DevOps and Software Development Life Cycle, DevOps pipeline and its key stages, Continuous Integration & Deployment: Jenkins

Unit-II

GIT: GIT Features, 3-Tree Architecture,, GIT – Clone /Commit/ Push,Projects, GIT Hub Management, Rebase & Merge, GIT Stash, Reset, Checkout, GIT Clone, Fetch

Unit-III

Docker: Docker Installation, Learning Docker fundamentals, images, Introduction to container, understanding containerization and its benefits, Docker Engine, creating Containers with an Image, working with Images, Docker Command Line Interphase, Docker Compose, Docker Hub, Docker swarm, Docker attach, Docker File & Commands

Unit-IV

Exploring monitoring tools: Prometheus and Grafana, Logging Strategies and practices for troubleshooting, setting up alerts and notifications for proactive monitoring, Understanding Ansible tool for configuration management. Container Orchestration: Kubernetes, Integrating security practices into the DevOps pipeline.

References / Textbooks:

1. "The DevOps Handbook" by Gene Kim, Jez Humble, Patrick Debois, and John Willis
2. "Learning Continuous Integration with Jenkins" by Nikhil Pathania
3. Pro Git" by Scott Chacon and Ben Straub *(online at git-scm.com)*
4. Docker Deep Dive" by igel Poulton
5. "Infrastructure Monitoring with Prometheus" by Joel Bastos and Pedro Araújo
6. "Ansible for DevOps" by Jeff Geerling – Excellent resource for Unit IV on Ansible and configuration management.

Master of Computer Applications (CBCEGS) SEMESTER – III
(Session 2025-26)
COURSE CODE: MCAP-309
PROGRAMMING LAB BASED ON ADVANCED PROGRAMMING CONCEPTS

L-T-P: 0-0-2 **Max. Marks: 50**
Credits: 2
Examination Time: 3 Hours **Practical : 35**
CA: 15

Mid Semester Examination: 30% weightage
End Semester Examination: 70% weightage
Lab Based on:

To provide hands-on experience in Java programming on packages, interfaces, multithreading, generics, JDBC, JSP, and JavaBeans to develop robust, scalable, and modular applications.

- Create a custom package myutils with utility classes.
- Create and implement interfaces for a simple shape calculator (area, perimeter).
- Write a programs to perform read and write into files.
- Create a basic thread using Thread and Runnable.
- Demonstrate thread priorities and synchronization in a bank account scenario.
- Hands-on with Java file handling and utility classes.
- Connect to a sample MySQL/SQLite database and perform CRUD operations.
- Execute and handle database queries with result sets.
- Write JSP to invoke Java code for calculating factorial and Fibonacci series.
- Separate logic using Java classes and import in JSP.
- Create a JavaBean User with properties: username, email, password.

Master of Computer Applications (CBCEGS) SEMESTER – III
(Session 2025-26)
COURSE CODE: MCAL-401
MAJOR PROJECT/INDUSTRIAL TRAINING/DISSERTATION

L-T-P: 0-0-24 **Max. Marks: 600**
Credits: 24
Examination Time: 3 Hours **Viva/Practical: 420**
CA: 180

Mid Semester Examination: 30% weightage
End Semester Examination: 70% weightage

Instructions for the Project/Dissertation Report

1. Title Page
2. Declaration
3. Certificate from the Project Supervisor
4. Acknowledgement
5. Abstract
6. Table of Contents
7. List of Figures
8. List of Tables
9. List of acronyms and abbreviations
10. Introduction to the project topic
11. Problem Statement
12. Project Objectives
13. Software Development Life Cycle and its deliverables as the project progresses

· Requirement Gathering and Analysis
· Feasibility Study
· Design
· Coding- complete code is not required. You can add important code snippets.-
· Implementation and Testing
· Building and Deployment

14. Limitations of the project
15. Conclusions and Future Work
16. References
17. Annexures(optional)