

Faculty of Computer Applications

SYLLABUS FOR

Master of Computer Applications

(Semester II)

(Under Credit Based Continuous Evaluation Grading System)

Session: 2025-26



The Heritage Institution

KANYA MAHA VIDYALAYA JALANDHAR

(Autonomous)

KANYA MAHA VIDYALAYA JALANDHAR

**SCHEME AND CURRICULUM OF EXAMINATION OF TWO-YEAR DEGREE
PROGRAMME**

**PG DEPARTMENT OF COMPUTER SCIENCE AND APPLICATIONS
MASTER OF COMPUTER APPLICATIONS (MCA)**

SEMESTER-II

Course Code	Course Title	Course Type	Credits		Marks			Examination time (in hours)	
			L-T-P	Total	Total	Ext.			CA
						L	P		
MCAL-2121	Full Stack Development	C	4-0-0	4	100	70	-	30	3
MCAL-2122	Advanced Database Management System	C	4-0-0	4	100	70	-	30	3
MCAL-2123	Machine Learning	C	4-0-0	4	100	70	-	30	3
MCAL-2124	Software Project Management	C	4-0-0	4	100	70	-	30	3
MCAL-2125 (Opt-II)	Theory of Computation (General Elective –II)	E	4-0-0	4	100	70	-	30	3
MCAP-2126	Programming Lab based on Advanced Database Management System	C	0-0-2	2	50	-	35	15	3
MCAP-2127	Programming Lab based on Full Stack Development	C	0-0-2	2	50	-	35	15	3
VACH-2401	Human Rights and Constitutional Duties	VAC	2-0-0	2	50	35	-	15	3
Total				26	650				

Options for General Elective-II									
Opt -I	MCAL-2125	Big Data Analytics and Business Intelligence							
Opt -II	MCAL-2125	Theory of Computation							
Opt -III	MCAL-2125	*Skill Oriented MOOCS (related to IT/AI/Computer)							

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

Note: Student can opt any of one General Elective Courses.

MASTER OF COMPUTER APPLICATIONS (SEMESTER – II)
(Two Year Degree Programme) (CBCEGS)
(Session 2025-26)
COURSE CODE: FULL STACK DEVELOPMENT
COURSE CODE: MCAL-2121

L-T-P: 4-0-0

Theory : 70

Examination Time: 3 Hours

Instructions for Paper Setter -

Eight questions of equal marks (14 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.

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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 (SEMESTER – II)
(Two Year Degree Programme) (CBCEGS)
(Session 2025-26)
COURSE TITLE: ADVANCED DATABASE MANAGEMENT SYSTEM
COURSE CODE: MCAL-2122

L-T-P: 4-0-0

Theory : 70

Examination Time: 3 Hours

Instructions for Paper Setter -

Eight questions of equal marks (14 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.

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MASTER OF COMPUTER APPLICATIONS (SEMESTER – II)
(Two Year Degree Programme) (CBCEGS)
(Session 2025-26)
COURSE TITLE: MACHINE LEARNING
COURSE CODE: MCAL-2123

L-T-P: 4-0-0

Theory : 70

Examination Time: 3 Hours

Instructions for Paper Setter -

Eight questions of equal marks (14 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 Descent & Momentum Based Optimization, Back propagation Algorithm. Basic concepts of Genetic Algorithms, Basic Concepts of Convolutional Neural Networks.

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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., Taylor C. C., Machine Learning, Neural and Statistical Classification. Overseas Press

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MASTER OF COMPUTER APPLICATIONS (SEMESTER – II)
(Two Year Degree Programme) (CBCEGS)
(Session 2025-26)

COURSE TITLE: SOFTWARE PROJECT MANAGEMENT

COURSE CODE: MCAL-2124

L-T-P: 4-0-0

Theory : 70

Examination Time: 3 Hours

Instructions for Paper Setter -

Eight questions of equal marks (14 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.

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

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MASTER OF COMPUTER APPLICATIONS (SEMESTER – II)
(Two Year Degree Programme) (CBCEGS)
(Session 2025-26)

COURSE TITLE: BIG DATA ANALYTICS AND BUSINESS INTELLIGENCE
COURSE CODE: MCAL-2125

L-T-P: 4-0-0

Theory : 70

Examination Time: 3 Hours

Instructions for Paper Setter -

Eight questions of equal marks (14 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.

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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 EfrainTurban .*
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*

Signature of Course Teacher

Signature of Head of Department

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MASTER OF COMPUTER APPLICATIONS (SEMESTER – II)
(Two Year Degree Programme) (CBCEGS)
(Session 2025-26)
COURSE TITLE: THEORY OF COMPUTATION
COURSE CODE: MCAL-2125

L-T-P: 4-0-0

Theory : 70

Examination Time: 3 Hours

Instructions for Paper Setter -

Eight questions of equal marks (14 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 NFA, 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. 1.K.L.P. Mishra and N. Chandrasekaran, “Theory of Computer Science, Third Edition”, PHI Learning Private Limited
2. 2.John E. Hopcroft, Rajeev Motwani, Jeffrey D. Ullman, “Introduction to Automata Theory”, Languages and Computation, Pearson Education.
3. 3.M. Sipser, “Introduction to the Theory of Computation”, Second Edition, Cengage Learning.
4. 4.K. V. N. Sunitha , N. Kalyani, “Formal Languages and Automata Theory”, McGraw-Hill
5. 5.Stephen Wolfram, “Theory and Applications of Cellular Automata”, World Scientific
6. 6.G.E. Revesz, “Introduction to Formal Languages”, Dover Publications.
7. 7.M. A. Harrison, “Introduction to Formal Language Theory”, Addison-Wesley
8. 8.R.K. Shukla,” Theory of Computation”, Cengage Learning.
9. 9.Peter Linz, An Introduction to Formal Languages and Automata, Third Edition, Narosa Publishers.

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MASTER OF COMPUTER APPLICATIONS (SEMESTER – II)
(Two Year Degree Programme) (CBCEGS)
(Session 2025-26)

**COURSE TITLE: PROGRAMMING LAB BASED ON ADVANCED DATABASE
MANAGEMENT SYSTEM**
COURSE CODE: MCAP-2126

L-T-P: 0-0-2

Theory: 50

Examination Time: 3 Hours

Continuous Assessment: 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 (SEMESTER – II)
(Two Year Degree Programme) (CBCEGS)
(Session 2025-26)
COURSE TITLE: PROGRAMMING LAB BASED ON FULL STACK
DEVELOPMENT
COURSE CODE: MCAP-2127

L-T-P: 0-0-2

Theory : 35

Examination Time: 3 Hours

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 (SEMESTER – II)
(Two Year Degree Programme) (CBCEGS)
(Session 2025-26)
COURSE TITLE: HUMAN RIGHTS AND CONSTITUTIONAL DUTIES
(Value Added Course)
COURSE CODE: VACH-2401

L-T-P: 2-0-0

Theory : 35

Examination Time: 3 Hours

Instructions for the Paper Setters –

Eight questions of equal marks (7 Marks each) are to be set, two in each of the four sections (A-D). Questions may be subdivided into parts (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.

SECTION -A

Human Rights : Meaning, Nature , Characteristics and Classification
International framework: United Nation Declaration of Human Rights

SECTION -B

Indian Perspective of Human Rights : Fundamental Rights
Protective Mechanism in India: The composition, Powers, Functions of National Human Rights Commission of India (NHRC)

SECTION - C

Human Duties : Meaning, Nature, Characteristics and Classification
Application of Human Duties in a Modern Professional life.

SECTION -D

Fundamental Duties in the Indian Constitution
Fundamental Duties with special reference to Corporate Social Responsibility (CSR) and Ethical Business Practices.

Reading List

1. United Nation. The United Nations and Human Rights 1945-1995. Geneva : United Nation Blue Books Series, Vol. VII, 1996.
2. Shastry, S.N. Introduction to Human Rights and Duties. Pune :University of Pune Press, 2011.
3. Deol , Satnam Singh. Human Rights in India-Theory and practice . New Delhi: Serials Publication,2011.
4. V.P. Srivastav and R.S. Narayan(ed.), United Nation on Human Rights ,Vol II, Indian Pub. Distributor , New Delhi, 2002.

5. Professional Ethics: A contemporary-based approach to understanding and applying business professional Ethics Wesley. E. Donahue, 2021
6. Professional Ethics and Human Values R.S. Naagrazan. New age International Publishers , New Delhi, 2006.
7. Corporate social responsibility in India: Cases and Development after the legal mandate: Nayan Mitra and Rene Schmidpeter, Atlantic Publisher 2017.