Faculty of Computer Applications

SYLLABUS FOR

Master of Computer Applications

(Semester I & III)

(Under Credit Based Continuous Evaluation Grading System)

Session: 2026-27

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-I

Course Code	Course Title	Course Type	Credits		Marks				Examination time (in hours)
					Total	Ext.		CA	
			L-T-P	Total		L	P		
MCAL-1121	Design and Analysis of Algorithm	C	4-0-0	4	100	70	-	30	3
MCAL-1122	Web Technologies	C	4-0-0	4	100	70	-	30	3
MCAL-1123	Data Science Foundation	C	4-0-0	4	100	70	-	30	3
MCAL-1174	Probability and Statistical Techniques	C	4-0-0	4	100	70	-	30	3
MCAL-1125 (Opt-II)	Elective-I (Information security)	E	4-0-0	4	100	70	-	30	3
MCAP-1126	Programming Lab based on Web Technologies	C	0-0-2	2	50	-	35	15	3
MCAP-1127	Programming Lab based on Data Science	C	0-0-2	2	50	-	35	15	3
MCAL-1128	*Software Engineering (Bridge Course)	B	2-0-0	2	50	35	-	15	3
MCAL-1129	*Programming in C (Bridge Course)	B	2-0-0	2	50	35	-	15	3
MCAL-1331	* Fundamental Mathematics for computing (Bridge Course)	B	2-0-0	2	50	35	-	15	3
**Students can opt any one of the following interdisciplinary courses	IDE								

Total				**24**					
IDEC-1101	Effective Communication Skills								
IDEM-1362	Basics of Music (Vocal)								
IDEI -1313	Human Rights and Constitutional Duties								
IDEW-1275	Indian Heritage: Contribution to the world								
(Credits of these courses will not be added to SGPA/CGPA)**									

*** For students having no mathematics background at 10 +2 or graduation level, compulsory bridge courses have to be qualified. Credits and grade points of these courses will not be included to the SGPA/CGPA of the semester/programme.**

Options for Elective-I										
Opt - I	MCAL-1125	Advanced Computer Graphics	E	4-0-0	4	100	70	-	30	3
Opt -II	MCAL-1125	Information Security	E	4-0-0	4	100	70	-	30	3
Opt -III	MCAL-1125	Soft Computing	E	4-0-0	4	100	70	-	30	3
Opt -IV	MCAL-1125	***Skill oriented MOOCS (related to IT/AI/ Computer)	E	4-0-0	4					

*****Skill Oriented MOOCS courses can be explored on Swayam Portal, NPTEL 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 Elective Courses

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-III

Course Code	Course Title	Course Type	Credits		Marks				Examination time (in hours)
					Total	Ext.		CA	
			L-T-P	Total		L	P		
MCAL-3121	Image Processing	C	4-0-0	4	100	70	-	30	3
MCAL-3122	Deep Learning	C	4-0-0	4	100	70	-	30	3
MCAL-3323	Optimization Techniques	C	4-0-0	4	100	70	-	30	3
MCAL-3124 (Opt-II)	Elective-III (Devops engineering)	E	4-0-0	4	100	70	-	30	3
MCAM-3125	Advanced Programming Concepts	C	2-0-2	4	100	35	35	30	3+3
MCAD-3126	Capstone Project	C	0-0-2	2	50	-	35	15	3
MCAL-3377	Universal Human Values-II Understanding Harmony	VAC	3-0-0	3	100	70	-	30	3
VACE-3221	Environmental studies	VAC	2-0-0	2	50	35	-	15	3
Total				**27**					

IDEC-3101	Effective Communication Skills
IDEM-3362	Basics of Music (Vocal)
IDEI -3313	Human Rights and Constitutional Duties
IDEW-3275	Indian Heritage: Contribution to the world

*** For students having no mathematics background at 10 +2 or graduation level, compulsory bridge courses have to be qualified. Credits and grade points of these courses will not be included to the SGPA/CGPA of the semester/programme.**

Options of Elective-III										
Opt -I	MCAL -3124	Advance Computer Architecture	E	4-0-0	4	100	70	-	30	3
Opt -II	MCAL-3124	DevOps Engineering	E	4-0-0	4	100	70	-	30	3
Opt-III	MCAL-3124	Research Methodology	E	4-0-0	4	100	70	-	30	3
Opt -IV	MCAL-3124	*Skill Oriented MOOCS (Related to IT/AI/ Computer)	E	4-0-0	4					

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

NOTE: As Per the common ordinances of Credit-Based Evaluation & Grading System (2023-24) of the University, the following shall be applicable: In Case, students admitted to Post Graduate Programmes have not studied compulsory value-added courses such as Drug Abuse, Environmental Sciences, Human Rights and Constitutional Duties and Universal Human Values course/s in under graduate Programmes, they will have to take compulsory value added course/s at PG level

MASTER OF COMPUTER APPLICATIONS (SEMESTER – I)
(Two Year Degree Programme) (CBCEGS)
(Session 2026-27)
COURSE TITLE: DESIGN AND ANALYSIS OF ALGORITHM
COURSE CODE: MCAL-1121

L-T-P: 4-0-0 **Theory:70**

Credits:4

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 sub-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: (Latest Editions/Reprints)

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.

Signature of Head of Department

MASTER OF COMPUTER APPLICATIONS (SEMESTER – I)
(Two Year Degree Programme) (CBCEGS)
(Session 2026-27)
COURSE TITLE: WEB TECHNOLOGIES
COURSE CODE: MCAL-1122

L-T-P:4-0-0 **Theory:70**

Credits:4

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 sub-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: (Latest Editions/Reprints)

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.

Signature of Head of Department

MASTER OF COMPUTER APPLICATIONS (SEMESTER – I)
(Two Year Degree Programme) (CBCEGS)
(Session 2026-27)
COURSE TITLE: DATA SCIENCE FOUNDATION
COURSE CODE: MCAL-1123

L-T-P:4-0-0 **Theory:70**

Credits:4

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 sub-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 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 Books: (Latest Editions/Reprints)

1. Charles Dierbach, Introduction to Computer Science Using Python: A Computational Problem-Solving Focus, 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

Signature of Head of Department

MASTER OF COMPUTER APPLICATIONS (SEMESTER – I)
(Two Year Degree Programme) (CBCEGS)
(Session 2026-27)
COURSE TITLE: PROBABILITY AND STATISTICAL TECHNIQUES
COURSE CODE: MCAL-1174

L-T-P:4-0-0 **Theory:70**
Credits:4
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 sub-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: (Latest Editions/Reprints)

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.

Signature of Head of Department

MASTER OF COMPUTER APPLICATIONS (SEMESTER – I)
(Two Year Degree Programme) (CBCEGS)
(Session 2026-27)
COURSE TITLE: INFORMATION SECURITY (OPT-II)
COURSE CODE: MCAL-1125

L-T-P:4-0-0 **Theory:70**

Credits:4

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 sub-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: (Latest Editions/Reprints)

I. William Stallings, Cryptography and Network Security – Principles and Practice(7thed.), Pearson Education of India,2017.

II. Adam J.Elbirt, Understanding and Applying Cryptography and Data Security CRC Press, Taylor Francis Group, New York,2015.

III. Charles P.Pfleeger and SLPfleeger, Jonathan Margulies, Security in Computing (6thedition 2023), Addison-Wesley Professional.
IV. PeterW. Singer and Allan Friedman, Cybersecurity and Cyberwar: What Everyone Needs to Know, Oxford University Press, 2014.
V. NIIT, Introduction To Information Security Risk Management -Paperback – January 2003,Prentice Hall of India.
VI. Hossein Bidgoli, Hand book of information Security, Threats, Vulnerabilities, Prevention, Detection and Management, John Wiley & Sons, 2006.
VII. Steve G Watkins, An Introduction to Information Security and ISO27001, IT Governance Publishing, 2013.

Signature of Head of Department

MASTER OF COMPUTER APPLICATIONS (SEMESTER – I)
(Two Year Degree Programme) (CBCEGS)
(Session 2026-27)
COURSE TITLE: SOFTWARE ENGINEERING (BRIDGE COURSE)
COURSE CODE: MCAL-1128

L-T-P: 2-0-0
Credits: 2 **Theory: 35**
Examination Time: 3 Hours.

Instructions for Paper Setter -

Eight questions of equal marks (7 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 sub-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 Software: Definition, Software characteristics, Software Components, Software Applications.

Introduction to Software Engineering: Definition, Software Engineering Paradigms, Waterfall Model, Prototyping Model, Incremental Model, Spiral Model.

UNIT – II

Requirement, Analysis and Specifications – Problem Analysis, Requirement Gathering Tools (Questionnaire, Interview, Group Discussion, and Observation), SRS Document and its Characteristics, Structured Analysis: Data Flow Diagram, Data Dictionaries.

Software Design – Characteristics, Structure Chart, Coupling, Cohesion, Functional Independence.

UNIT – III

Project Management – SPMP Document, Size Estimation (LOC, Function Point), COCOMO (Basic, Intermediate and Complete COCOMO), Effort Estimation, Development Time Estimation, Project Scheduling (Work Breakdown Structure, Activity Network, Critical Path Method, Gantt Chart, PERT Chart), Staffing.

Risk management and Control, software Maintenance and its types, Software Reuse, Software Reliability.

UNIT – IV

Coding– Coding Standards and Guidelines, Code Walkthrough, Code Inspection.

Testing - Test Case Design, Unit Testing, Black Box Testing (Equivalence Class Partitioning, Boundary Value Analysis), White Box Testing (Statement, Branch, Condition, Path Coverage), Cyclomatic Complexity, Integration Testing, System Testing (Alpha, Beta, Acceptance), Validation And Verification, Performance Testing.

References / Textbooks:

1. Roger S. Pressman, Software Engineering, McGraw-Hill series (2014) , 8th Edition.
2. Pankaj Jalote, A concise introduction to Software Engineering, Wiley (2008).
3. Rajib Mall, Fundamentals of Software Engineering, PHI Learning (2018), 5th Revised Edition
4. Kogent Learning Solutions Inc., Software Engineering, Dreamtech Press (2012)
5. Bruce R.Maxim, Roger S. Pressman, Software Engineering: A Practioner's Approach, McGraw Hill Education (2019), Eighth edition
6. David A. Gustafson, Schaum's Outline of Software Engineering, McGraw Hill (2020), 1st Edition

Signature of Head of Department

MASTER OF COMPUTER APPLICATIONS (SEMESTER – I)
(Two Year Degree Programme) (CBCEGS)
(Session 2026-27)
COURSE TITLE: PROGRAMMING IN C (BRIDGE COURSE)
COURSE CODE: MCAL-1129

L-T-P:2-0-0 **Theory: 35**

Credits:2

Examination Time: 3 Hours

Instructions for Paper Setter -
Eight questions of equal marks (7 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 sub-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: (Latest Editions/Reprints)

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.

Signature of Head of Department

MASTER OF COMPUTER APPLICATIONS (SEMESTER – III)
(Two Year Degree Programme) (CBCEGS)
(Session 2026-27)
COURSE CODE: MCAL- 3121
COURSE TITLE: IMAGE PROCESSING

L-T-P: 4-0-0 **Theory : 70**
Credits: 4
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 sub-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: (Latest Editions/Reprints)

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

Signature of Head of Department

MASTER OF COMPUTER APPLICATIONS (SEMESTER – III)
(Two Year Degree Programme) (CBCEGS)
(Session 2026-27)
COURSE CODE: MCAL-3122
COURSE TITLE: DEEP LEARNING

L-T-P:4-0-0 **Theory:70**

Credits:4

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 sub-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: (Latest Editions/Reprints)

1. Ian Goodfellow, Yoshua Bengio, and Aaron Courville, *Deep Learning*, MIT Press, Latest Reprint (2016).
2. Francois Chollet, *Deep Learning with Python*, 2nd Edition, Manning Publications, 2021.
3. Michael Nielsen, *Neural Networks and Deep Learning*, Determination Press, Online Book (Latest Edition). Available at: http://neuralnetworksanddeeplearning.com/
4. Aston Zhang, Zachary C. Lipton, Mu Li, and Alexander J. Smola, *Dive into Deep Learning*, Cambridge University Press, Latest Edition/Reprint (also available online).

Signature of Head of Department

MASTER OF COMPUTER APPLICATIONS (SEMESTER – III)
(Two Year Degree Programme) (CBCEGS)
(Session 2026-27)
COURSE CODE: MCAL-3323
COURSE TITLE: OPTIMIZATION TECHNIQUES

L-T-P:4-0-0 **Theory:70**

Credits:4

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 sub-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: (Latest Editions/Reprints)

1. Pant J. C., Introduction to optimization: Operations Research, Jain Brothers (2004)
2. Bazaarra Mokhtar 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).

Signature of Head of Department

MASTER OF COMPUTER APPLICATIONS (SEMESTER – III)
(Two Year Degree Programme) (CBCEGS)
(Session 2026-27)
COURSE CODE: MCAL-3124
COURSE TITLE: ADVANCED COMPUTER ARCHITECTURE

L-T-P: 4-0-0
Credits: 4
Examination Time: 3 Hours **Theory: 70**

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 sub-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: (Latest Editions/Reprints)

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

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MASTER OF COMPUTER APPLICATIONS (SEMESTER – III)
(Two Year Degree Programme) (CBCEGS)
(Session 2026-27)
COURSE CODE: MCAL-3124
COURSE TITLE: DEVOPS ENGINEERING

L-T-P:4-0-0 **Theory: 70**
Credits:4
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 sub-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

Software Configuration Management (SCM), Version Control System (VCS), Need, types of Version Control System, **GIT:** GIT Features, 3-Tree Architecture, GIT – Clone /Commit/ Push,Projects, GIT Hub Management, Rebase & Merge, GIT Stash, Reset, Checkout, GIT Clone, Fetc

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: (Latest Editions/Reprints)

1. Gene Kim, Jez Humble, Patrick Debois, and John Willis, *The DevOps Handbook: How to Create World-Class Agility, Reliability, and Security in Technology Organizations*, 2nd Edition, IT Revolution Press, 2021.
2. Nikhil Pathania, *Learning Continuous Integration with Jenkins*, Packt Publishing, Latest Edition/Reprint.
3. Scott Chacon and Ben Straub, *Pro Git*, 2nd Edition, Apress, Latest Reprint. Available online at: https://git-scm.com/book
4. Nigel Poulton, *Docker Deep Dive*, Updated Edition, Nigel Poulton Publications, Latest Reprint.
5. Joel Bastos and Pedro Araújo, *Infrastructure Monitoring with Prometheus*, Packt Publishing, Latest Edition/Reprint.
6. Jeff Geerling, *Ansible for DevOps: Server and Configuration Management for Humans*, 4th Edition, Leanpub, 2023.

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MASTER OF COMPUTER APPLICATIONS (SEMESTER – III)
(Two Year Degree Programme) (CBCEGS)
(Session 2026-27)
COURSE TITLE: RESEARCH METHODOLOGY
COURSE CODE: MCAL-3124

L-T-P:4-0-0 **Theory: 70**
Credits:4
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 sub-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: Meaning, objectives, and significance of research.
Types of Research: Basic, Applied, Qualitative, Quantitative, Mixed-method. Research process and research lifecycle. Identification and formulation of research problems.

Unit II

Research Objectives: Meaning Research questions and Hypotheses.
Research Design: Exploratory, Descriptive and Experimental.
Literature Review: Sources of scientific literature, Literature review techniques and gap identification.

Unit III

Data collection methods: Surveys, Questionnaires, Interviews, Observations, Case Studies.
Sampling: Concepts and its types. Types of data and measurement scales, Data preparation and organization.

Unit IV

Research Writing: Structure of research proposal, Technical paper and thesis writing. Referencing styles (APA, IEEE) and reference management tools. Citation, bibliography, and acknowledgements.
Plagiarism: Causes, prevention, and plagiarism checking tools, Research ethics and academic integrity.

References/ Text Books: (Latest Editions/Reprints)

1. Kothari, C. R., & Garg, G. (2019). Research Methodology: Methods and Techniques (4th ed.). New Age International Publishers.
2. Kumar, R. (2019). Research Methodology: A Step-by-Step Guide for Beginners (5th ed.). SAGE Publications.
3. Thomas, C. G. (2021). Research Methodology and Scientific Writing (3rd ed.). Springer.
4. Day, R. A., & Gastel, B. (2022). How to Write and Publish a Scientific Paper (9th ed.). Cambridge University Press.
5. Creswell, J. W., & Creswell, J. D. (2018). *Research Design: Qualitative, Quantitative, and Mixed Methods Approaches* (5th ed.). SAGE Publications.
6. Trochim, W. M. K., Donnelly, J. P., & Arora, K. (2016). Research Methods: The Essential Knowledge Base (2nd ed.). Cengage Learning.
7. Fink, A. (2020). Conducting Research Literature Reviews: From the Internet to Paper (5th ed.). SAGE Publications.

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MASTER OF COMPUTER APPLICATIONS (SEMESTER – III)
(Two Year Degree Programme) (CBCEGS)
(Session 2026-27)
COURSE CODE: MCAM-3125
COURSE TITLE: ADVANCED PROGRAMMING CONCEPTS

L-T-P: 2-0-2
Credits: 4 **Theory: 35**
Examination Time: 3 Hours

Instructions for Paper Setter -
Eight questions of equal marks (7 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 sub-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: (Latest Editions/Reprints)

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

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MASTER OF COMPUTER APPLICATIONS (SEMESTER –III)
(Two Year Degree Programme) (CBCEGS)
(Session 2026-27)
COURSE CODE: MCAD-3126
COURSE TITLE: CAPSTONE PROJECT

L-T-P:0-0-2 **Total:50**

Credits:2

Examination Time: 3 Hours

Project Guidelines

- Projects may be undertaken individually or in groups of up to two students.
- The project should address a real-world problem and demonstrate originality, innovation, and practical relevance.
- The project topic must be approved by the Project Guide and the Department.
- Students should follow the Software Development Life Cycle (SDLC), including problem identification, requirement analysis, system design, implementation, testing, deployment, and documentation.
- Modern tools and technologies such as Git/GitHub, cloud platforms, databases, frameworks, APIs, and testing tools should be used wherever appropriate.
- Each student must contribute significantly to the project and maintain regular progress as per the project schedule.

Deliverables

Students are required to submit:

- Project Proposal
- Software Requirement Specification (SRS)
- Design Documents (UML/Architecture/Database Design)
- Source Code with Version Control
- Test Cases and Results
- User Manual
- Final Project Report
- Presentation Slides
- Project Demonstration (with deployment link, if applicable)

Suggested Application Areas

Artificial Intelligence, Machine Learning, Data Science, Full Stack Web Development, Mobile Applications, Cloud Computing, Cyber Security, IoT, Blockchain, Enterprise Applications, and other emerging computing technologies.

Learning Outcomes

Upon successful completion of the Capstone Project, students will be able to:

- Analyze and solve real-world computing problems.
- Design and develop software applications using modern technologies.
- Apply software engineering principles and testing methodologies.
- Demonstrate teamwork, project management, communication, and professional ethics.

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MASTER OF COMPUTER APPLICATIONS (SEMESTER – III)
(Two Year Degree Programme) (CBCEGS)
(Session 2026-27)
COURSE CODE: MCAL-3377
COURSE TITLE: UNIVERSAL HUMAN VALUES-II UNDERSTANDING HARMONY
(Value Added Course)

L-T-P: 3-0-0 **Theory:70**
Credits: 3
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 sub-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

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 fulfilment 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 & Co-existence).

Unit- III

Harmony in Nature and Existence
a) Understanding harmony in the Nature, Holistic perception of harmony at all levels of existence. Film on home to be 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 being.
- Case Studies on typical holistic technologies, management models and production systems.

Reference Books: (Latest Editions/Reprints)

1. Andrews, C. (2006). Slow is Beautiful: New Vision of Community-y, 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). Jeevan Vidya: EkParichaya, Jeevan Vidya Prakashan, 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.

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