FACULTY OF COMPUTER SCIENCE AND APPLICATIONS

SYLLABUSFOR

Master of Computer Applications

2nd Meeting of Board of Studies

(UnderCreditBasedContinuousEvaluationGradingSystem)

Session:2026-27

TheHeritageInstitution

KANYAMAHAVIDYALAYAJALANDHAR

(Autonomous)

KANYA MAHA VIDYALAYA JALANDHAR

SCHEME AND CURRICULUM OF MCA PROGRAMME
PG DEPARTMENT OF COMPUTER SCIENCE AND APPLICATIONS

Programme Outcomes

1. Apply advanced knowledge of computing fundamentals, mathematics, and domain-specific principles to analyze and solve computing problems.
2. Analyze complex computing problems, identify requirements, and formulate appropriate computational models and solutions.
3. Select and apply appropriate modern computing tools, frameworks, programming languages, cloud platforms, and software development practices for solving complex computing problems.
4. Evaluate and integrate emerging computing technologies such as Artificial Intelligence, Data Science, Cloud Computing, Cyber Security, Internet of Things, and Machine Learning to develop innovative computing solutions.
5. Design and develop secure, scalable, sustainable, reliable, and efficient software solutions that satisfy user, organizational, and societal requirements.
6. Engage in independent learning, continuous professional development, and adaptation to emerging technologies and industry practices.
7. Communicate technical concepts, project outcomes, and research findings effectively through oral, written, and digital media with technical and non-technical stakeholders.
8. Demonstrate professional ethics, legal responsibilities, cybersecurity awareness, and integrity while developing computing solutions.
9. Conduct investigations using research methodologies, experimentation, data analysis, and interpretation to solve complex computing problems.
10. Demonstrate leadership, teamwork, project management, and decision-making skills while working effectively in multidisciplinary environments.
11. Apply innovation, entrepreneurship, and research skills to develop technology-driven solutions for real-world problems.
12. Evaluate the societal, ethical, environmental, and sustainability impacts of computing solutions and promote responsible and inclusive technological practices.

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-1124	Probability and Statistical Techniques	C	4-0-0	4	100	70	-	30	3
MCAL-1125 (Opt-II)	Elective-I	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-1130	* 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										
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-II

Course Code	Course Title	Course Type	Credits		Marks				Examination time(in hours)
					Total	Ext.		CA	
			L-T-P	Total		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)	Elective –II	E	4-0-0	4	100	70	-	30	3
MCAP-2126	Programming Labbasedon Advanced Database Management System	C	0-0-2	2	50	-	35	15	3
MCAP-2127	Programming Labbased on Full Stack Development	C	0-0-2	2	50	-	35	15	3
VACH-2401	HumanRights and Constitutional Duties	VAC	2-0-0	2	50	35	-	15	3
Total				**26**					

OptionsforElective-II										
Opt -I	MCAL-2125	Big Data Analyticsand Business Intelligence	E	4-0-0	4	100	70	-	30	3
Opt -II	MCAL-2125	Theoryof Computation	E	4-0-0	4	100	70	-	30	3
Opt-III	MCAL-2125	Microprocessor and Its Applications	E	4-0-0	4	100	70	-	30	3
Opt -IV	MCAL-2125	*SkillOriented MOOCS (Relatedt o 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

MASTEROFCOMPUTERAPPLICATIONS(SEMESTER– III)
(TwoYearDegreeProgramme)(CBCEGS) (Session 2026-27)
COURSE CODE: MCAM-3121
COURSE TITLE: ADVANCED PROGRAMMING CONCEPTS

L-T-P: 2-0-2 **Max. Marks: 100**
Credits: 4
Examination Time: 3 Hours **Theory: 35**
Practical:35
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 Java programming concepts including packages, interfaces, generics, file handling, and multithreading to develop modular applications.
CO2: Implement JDBC-based database connectivity and perform database operations using Java.
CO3: Develop dynamic web applications using JSP and JavaBeans with appropriate server-side programming concepts.
CO4: Apply Hibernate ORM for object-relational mapping, persistence, and CRUD operations in Java-based applications.

CO	BT Level
CO1	L3
CO2	L3
CO3	L3
CO4	L3

CO/PO	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12
CO1	3	2	3	–	3	1	–	–	–	1	–	–
CO2	3	3	3	–	3	–	–	–	1	–	–	–
CO3	3	3	3	1	3	1	1	–	1	1	1	–
CO4	3	3	3	2	3	1	–	–	2	1	1	1

MASTEROFCOMPUTERAPPLICATIONS(SEMESTER– III)
(TwoYearDegreeProgramme)(CBCEGS) (Session 2026-27)
SEMESTER – III
COURSE CODE: MCAM-3121
COURSE TITLE: ADVANCED PROGRAMMING CONCEPTS

L-T-P: 2-0-2 **Max. Marks: 100**
Credits: 4
Examination Time: 3 Hours **Theory: 35**
Practical:35
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: (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. 5.Javascript A Beginners Guide, 3rd Edition – John Pollock - Tata McGraw-Hill Edition

MASTEROFCOMPUTERAPPLICATIONS(SEMESTER– III)
(TwoYearDegreeProgramme)(CBCEGS)
(Session 2026-27)
COURSE CODE: MCAL-3122
COURSE TITLE: IMAGE PROCESSING

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: Explain the basic concepts, components and applications of digital image processing systems
CO2: Analyse image representation, human visual system concepts, image formats and imaging system specifications.
CO3: Apply image enhancement, restoration, compression and pattern recognition techniques to digital images.
CO4: Apply colour models and colour image processing techniques for image analysis and transformation.

Bloom's Taxonomy Mapping

CO1 –L2

CO2 – L4

CO3 – L3

CO4 – L3

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	–	–	2	–	–	–	–	1	–	1
CO2	3	3	2	2	3	–	–	–	–	1	–	2
CO3	3	3	3	2	3	–	–	–	–	1	1	3
CO4	3	2	2	1	3	–	–	–	–	1	–	3

MASTEROFCOMPUTERAPPLICATIONS(SEMESTER– III)
(TwoYearDegreeProgramme)(CBCEGS)
(Session 2026-27)
COURSE CODE: MCAL-3122
COURSE TITLE: 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: (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

MASTEROFCOMPUTERAPPLICATIONS(SEMESTER– III)
(TwoYearDegreeProgramme)(CBCEGS) (Session 2026-27)
COURSE CODE: MCAL-3123
COURSE TITLE: 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: Explain the fundamentals of artificial neural networks, including perceptrons, activation functions, learning algorithms, and backpropagation.
CO2: Analyze convolutional neural network (CNN) architectures and operations such as convolution, pooling, dropout, and batch normalization.
CO3: Evaluate recurrent neural networks (RNNs), GRU, LSTM, attention mechanisms, and transformer architectures for sequential data processing.
CO4: Apply deep learning models and libraries to develop solutions for real-world computing problems.

CO	BT Level
CO1	L2
CO2	L4
CO3	L5
CO4	L3

CO/PO	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12
CO1	3	2	1	2	–	–	–	–	–	–	–	–
CO2	3	3	2	3	2	1	–	–	2	–	1	–
CO3	3	3	2	3	2	1	–	–	3	–	2	1
CO4	3	3	3	3	3	1	1	–	2	1	2	1

MASTEROFCOMPUTERAPPLICATIONS(SEMESTER– III)
(TwoYearDegreeProgramme)(CBCEGS) (Session 2026-27)
COURSE CODE: MCAL-3123
COURSE TITLE: 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: (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).

MASTEROFCOMPUTERAPPLICATIONS(SEMESTER–III)
(TwoYearDegreeProgramme)(CBCEGS) (Session 2026-27)
COURSE CODE: MCAL-3124
COURSE TITLE: CAPSTONE PROJECT

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

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.

MASTEROFCOMPUTERAPPLICATIONS(SEMESTER– III)
(TwoYearDegreeProgramme)(CBCEGS) (Session 2026-27)
COURSE CODE: MCAL-3124
COURSE TITLE: 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: Apply graphical, simplex, Big-M, and dual methods to formulate and solve linear programming problems.
CO2: Apply transportation and assignment models to obtain optimal solutions for decision-making problems.
CO3: Analyze game theory, integer programming, and dynamic programming techniques to solve computational decision-making problems.
CO4: Apply optimization techniques for single-variable, multivariable, and constrained optimization problems to solve real-world computing problems.

CO	BT Level
CO1	L3
CO2	L3
CO3	L4
CO4	L3

CO/PO	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12
CO1	3	3	2	–	2	1	–	–	1	–	–	–
CO2	3	3	2	–	3	1	–	–	2	1	–	–
CO3	3	3	2	1	3	1	–	–	3	1	1	1
CO4	3	3	3	2	3	1	–	–	2	1	2	1

MASTEROFCOMPUTERAPPLICATIONS(SEMESTER– III)
(TwoYearDegreeProgramme)(CBCEGS) (Session 2026-27)
COURSE CODE: MCAL-3124
COURSE TITLE: 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: (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).

MASTEROFCOMPUTERAPPLICATIONS(SEMESTER–III)
(TwoYearDegreeProgramme)(CBCEGS)
(Session 2026-27)
COURSE CODE: MCAL-3125
COURSE TITLE: 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: Explain the computing paradigms and hardware/software taxonomies of parallel computing systems.

CO2: Analyze parallel computing models and the principles of parallelism in uniprocessor systems.

CO3: Compare pipeline, array, and multiprocessor architectures based on instruction and data processing techniques.

CO4: Evaluate the performance of pipelined processors using throughput, speedup, efficiency, and hazard-handling techniques.

CO	BT Level
CO1	L2
CO2	L4
CO3	L4
CO4	L5

CO/PO	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12
CO1	3	2	1	1	–	1	–	–	–	–	–	–
CO2	3	3	2	2	2	1	–	–	1	–	–	–
CO3	3	3	2	2	3	1	–	–	2	1	1	–
CO4	3	3	2	2	3	1	–	–	3	1	1	1

MASTEROFCOMPUTERAPPLICATIONS(SEMESTER– III)
(TwoYearDegreeProgramme)(CBCEGS)
(Session 2026-27)
COURSE CODE: MCAL-3125
COURSE TITLE: 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: (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

MASTEROFCOMPUTERAPPLICATIONS(SEMESTER–III)
(TwoYearDegreeProgramme)(CBCEGS)
(Session 2026-27)
COURSE CODE: MCAL-3126
COURSE TITLE: DEVOPS ENGINEERING

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: Explain DevOps principles, lifecycle, pipeline stages, CI/CD practices, and Jenkins-based automation.
CO2: Apply Git and GitHub for version control, collaboration, and project management.
CO3: Apply Docker concepts to build, run, and manage containers and images for application deployment.
CO4: Apply monitoring, configuration management, and container orchestration tools, including Prometheus, Grafana, Ansible, and Kubernetes, for application deployment and management.

CO	BT Level
CO1	L2
CO2	L3
CO3	L3
CO4	L3

CO/PO	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12
CO1	3	2	2	2	2	1	–	1	–	–	–	–
CO2	3	2	3	–	3	1	1	1	1	2	1	–
CO3	3	3	3	2	3	1	–	1	1	1	1	1
CO4	3	3	3	3	3	1	1	1	2	2	2	1

MASTEROFCOMPUTERAPPLICATIONS(SEMESTER–III)
(TwoYearDegreeProgramme)(CBCEGS)
(Session 2026-27)
COURSE CODE: MCAL-3126
COURSE TITLE: DEVOPS ENGINEERING

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

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.

MASTEROFCOMPUTERAPPLICATIONS(SEMESTER–III)
(TwoYearDegreeProgramme)(CBCEGS) (Session 2026-27)
COURSE CODE: MVAC- 3128
COURSE TITLE: UNIVERSAL HUMAN VALUES: UNDERSTANDING HARMONY-II
(Value Added Course)

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:

By the end of the course, students are expected to become more
CO1: Aware of themselves, and their surroundings (family, society, nature);
CO2: Responsible in life, and in handling problems with sustainable solutions, while keeping human relationships and human nature in mind
.CO3: Sensitive to their commitment towards what they have understood (human values, human relationship and human society)
CO4: Competent to apply what they have learnt to their own self in real life settings

CO	Bloom's Level
CO1	L2
CO2	L3
CO3	L4
CO4	L3

CO \ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	–	–	–	–	–	2	2	3	–	2	–	2
CO2	–	2	2	–	–	3	3	3	2	2	1	2
CO3	–	–	–	–	–	3	2	3	2	2	–	3
CO4	–	2	2	–	–	2	2	3	2	3	2	3

MASTEROFCOMPUTERAPPLICATIONS(SEMESTER– III)
(TwoYearDegreeProgramme)(CBCEGS) (Session 2026-27)
Course Code: MVAC- 3128
COURSE TITLE: UNIVERSAL HUMAN VALUES: UNDERSTANDING HARMONY-II
(Value Added Course)

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

Instructions for the Paper Setters: Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (I-IV. Questions may be subdivided 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.

MASTEROFCOMPUTERAPPLICATIONS(SEMESTER– III)
(TwoYearDegreeProgramme)(CBCEGS) (Session 2026-27)
COURSETITLE: RESEARCH METHODALOGY
COURSE CODE: MCAL-3125

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 Outcome:

CO1: Comprehend the concepts, types, process, and significance of research, and identify research problems in computing and related domains.

CO2: Apply the principles of research design and literature review techniques to formulate research objectives, questions, hypotheses, and identify research gaps.

CO3: Apply appropriate data collection methods, sampling techniques, and data organization practices for conducting research studies.

CO4: Comprehend the principles of research writing, citation practices, plagiarism prevention, and research ethics for preparing scientific documents.

Course Outcome (CO)	Bloom's Level
CO1	**L2**
CO2	**L3**
CO3	**L3**
CO4	**L2**

CO \ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	–	2	–	–	–	–	–	–	–	2
CO2	2	3	2	3	2	–	–	–	–	–	–	2
CO3	2	2	2	3	3	–	–	–	2	–	–	2
CO4	–	–	–	2	2	3	–	3	–	–	–	2

MASTEROFCOMPUTERAPPLICATIONS(SEMESTER–III)
(TwoYearDegreeProgramme)(CBCEGS) (Session 2026-27)
COURSETITLE: RESEARCH METHODALOGY
COURSE CODE: MCAL-3125

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

Instructions for the Paper Setters: Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided 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.

MASTEROFCOMPUTERAPPLICATIONS(SEMESTER–IV)
(TwoYearDegreeProgramme)(CBCEGS) (Session 2026-27)
COURSE CODE: MCAL-4121
COURSE TITLE: 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

Course Outcomes (COs)
CO1: Identify, analyze, and define a real-world problem by applying appropriate engineering and computing principles.
CO2: Design, develop, and implement a software/hardware solution using suitable tools, technologies, and methodologies.
CO3: Evaluate the developed solution through testing, analysis, validation, and performance assessment to meet the specified requirements.
CO4: Demonstrate professional ethics, effective teamwork, project management, and communication skills by preparing technical documentation and presenting the project outcomes.

CO Bloom's Level

CO1 L4

CO2 L6

CO3 L5

CO4 L3

PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	2	2	–	–	–	–	–	–	2
CO2	3	2	3	2	3	–	–	–	2	–	2	2
CO3	2	3	2	3	2	–	–	–	–	–	–	2
CO4	–	–	–	–	1	2	–	3	3	3	2	2

MASTEROFCOMPUTERAPPLICATIONS(SEMESTER–IV)
(TwoYearDegreeProgramme)(CBCEGS) (Session 2026-27)
COURSE CODE: MCAL-4121
COURSE TITLE: 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)