Tulsiramji Gaikwad-Patil College of Engineering and Technology
Wardha Road, Nagpur-441 108
NAAC A+Accredited
Approved by AICTE ,New Delhi, Govt .of Maharashtra
(An Autonomous Institute Affiliated to RTM Nagpur University, Nagpur)

Department of Master in Computer Application

Structure & Curriculum From AcademicYear 2024-25 (NEP Compliant)

Vision of Institute

To emerge as a learning Center of Excellence in theNational Ethos in domains of Science, Technologyand Management.

Mission of Institute

M1- To strive for rearing standard and stature of the students by practicing high standards of professional ethics, transparency and accountability.

M2- To provide facilities and services to meet the challenges of Industry and Society

M3- To facilitate socially responsive research, innovation and entrepreneurship

M4- To ascertain holistic development of the students and staff members by inculcating knowledge and profession as work practices.

Vision of the Department

The department of Master in Computer Applications aims to generate groomed, technically competent and skilled intellectual professionals specifically from the rural area to meet the current challenges of the modern computing industry.

Mission of the Department

- To stimulate students to learn effectively and apply the knowledge in the field of Engineering and Technology.
- To undertake industry academic collaboration to enhance competency in graduates.
- To foster innovative ideas amongst students for becoming leaders.
- To create an environment of research culture.
- To impart social and ethical values for inculcating the culture of lifelong learning.

Program Educational Objectives (PEO)

- Providing a strong theoretical and practical background across the computer science discipline with an emphasis on software development.
- To provide technical solutions in the field of information technology to the local society.
- To provide need-based quality training in the field of information technology.
- Empowering the youth in rural communities with computer education.
- To provide students with the tools to become productive, participating global citizens and life-long learners.

Program Outcomes (PO)

PO – 1 Computational Knowledge: Apply knowledge of computing fundamentals, computing specialisation, mathematics, and domain knowledge appropriate for the computing specialisation to the abstraction and conceptualisation of computing models from defined problems and requirements.

PO – 2 Problem Analysis: Identify, formulate, research literature, and solve *complex* computing problems reaching substantiated conclusions using fundamental principles of mathematics, computing sciences, and relevant domain disciplines.

PO – 3 Design /Development of Solutions: Design and evaluate solutions for *complex* computing problems, and design and evaluate systems, components, or processes that meet specified needs with appropriate consideration for public health and safety, cultural, societal, and environmental considerations.

PO – 4 Conduct investigations of complex Computing problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO – 5 Modern Tool Usage: Create, select, adapt and apply appropriate techniques, resources, and modern computing tools to *complex* computing activities, with an understanding of the limitations.

PO – 6 Professional Ethics: Understand and commit to professional ethics and cyber regulations, responsibilities, and norms of professional computing practices.

PO – 7 Life-long Learning: Recognise the need, and have the ability, to engage in independent learning for continual development as a computing professional.

PO – 8 Project management and finance: Demonstrate knowledge and understanding of the computing and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO – 9 Communication Efficacy: Communicate effectively with the computing community, and with society at large, about *complex* computing activities by being able to comprehend and write effective reports, design documentation, make effective presentations, and give and understand clear instructions.

PO – 10 Societal and Environmental Concern: Understand and assess societal, environmental, health, safety, legal, and cultural issues within local and global contexts, and the consequential responsibilities relevant to professional computing practices.

PO – 11 Individual and Team Work: Function effectively as an individual and as a member or leader in diverse teams and in multidisciplinary environments.

PO – 12 Innovation and Entrepreneurship: Identify a timely opportunity and using innovation to pursue that opportunity to create value and wealth for the betterment of the individual and society at large.

CURRICULUM FRAMEWORK

The MCA Program is the based on the following type of course:

Sr.No.	Type of Course	Abbreviation's
1	Professional Core Course	PCC
2	Professional Elective Course	PEC
3	Open Elective Course	OEC
4	Project	PRJ
5	Co-curricular Courses (CC)	CCC
6	Vocational and SkillEnhancement Course (VSEC)	VSE
7	Internship/ On Job Training	INT/OJT

The Course and Credit Distribution is as under

Sr. No.	*Type of Course*	*Number of Courses*	*Total Credit*	
			No.	*(%)*
1	Professional Core Course	**20**	**50**	***56.82%***
2	Professional Elective Course	**04**	**12**	***13.64%***
3	Open Elective Course	**00**	**00**	***00.00%***
4	Project	**01**	**2**	***2.27%***
5	Co-curricular Courses (CC)	**01**	**2**	***2.27%***
6	Vocational and Skill Enhancement Course (VSEC)	**03**	**6**	***6.82%***
7	Internship/ On Job Training	**01**	**16**	***18.18%***
	Total	**30**	**88**	**100%**

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SCHEME OF INSTRUCTION & SYLLABI

Programme: Master in Computer Application

Scheme of Instructions: First Year Master in Computer Application (As Per NEP 2020)

Semester - II

Sr.	Course Category	CourseCode	Course Title	L	T	P	Contact Hrs / week	Credits	Exam Scheme				
									CT - 1	CT - 2	TA / CA	ESE	TOTAL
1.	PCC	MCA31201	Artificial Intelligence	3	-	-	3	3	15	15	10	60	100
2.	PCC	MCA31202	Internet Programming	3	-	-	3	3	15	15	10	60	100
3.	PCC	MCA31203	Machine Learning	3	-	-	3	3	15	15	10	60	100
4.	PEC	MCA31204-07*	Professional Elective – II	3	-	-	3	3	15	15	10	60	100
5.	PCC	MCA31208	Salesforce Lab	-	-	4	4	2	-	-	25	25	50
6.	PCC	MCA31209	Artificial Intelligence & Machine Learning Lab using Python	-	-	4	4	2	-	-	25	25	50
7	PRJ	MCA31210	Mini Project	-	-	4	4	2	-	-	25	25	50
8	PCC	MCA31211	Internet Programming Lab using Advance Java	-	-	4	4	2	-	-	25	25	50
9	VSE	MCA31212-15*	Vocational Skill Enhancement – II (Lab)	-	-	4	4	2	-	-	25	25	50
			Total	**12**	**-**	**20**	**32**	**22**	**60**	**60**	**165**	**365**	**650**

L- Lecture T-Tutorial P-Practical CT1- Class Test 1 CT2- Class Test 2 TA/CA- Teacher Assessment / Continuous Assessment

ESE- End Semester Examination (For Laboratory: End Semester Performance)

***Indicates out of the four course codes each student has to select any one PEC from the list provided at the end of structure.**

Chairperson	Dean-Academics	Principal	Dec,2024	1.00	Applicable for AY2024-25 Onwards
			Date of Release	Version	

MCA DEPARTMENT
TULSIRAMJI GAIKWAD-PATIL COLLEGE
OF ENGINEERING AND TECHNOLOGY, NAGPUR

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SCHEME OF INSTRUCTION & SYLLABI

Programme: Master in Computer Application

Scheme of Instructions: Master in Computer Application (As Per NEP 2020)

List of Professional Elective Courses

Semester – I		Semester – II		Semester - IV	
Course Code	**Professional Elective-I**	**Course Code**	**Professional Elective-II**	**Course Code**	**Professional Elective-III**
MCA31105	Internet of Things (IoT)	MCA31204	Enterprise Resource Planning	MCA32402	Business Process Domain
MCA31106	Big Data Analytics	MCA31205	Computer Ethics	MCA32403	Soft Computing
MCA31107	Network Security	MCA31206	Social Network Analysis & Digital Marketing	MCA32404	Cyber Forensic
MCA31108	Parallel Programming	MCA31207	Data warehousing & Mining	MCA32405	Block Chain Technology

Chairperson	Dean-Academics	Principal	Dec,2024	1.00	Applicable for AY2024-25 Onwards
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HOD
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Programme: Master in Computer Application

Scheme of Instructions: Master in Computer Application (As Per NEP 2020)

Vocational Skill Enhancement (Lab) Courses

Semester – I		Semester – II		Semester – III	
Course Code	**Vocational Skill Enhancement – I (Lab)**	**Course Code**	**Vocational Skill Enhancement – II (Lab)**	**Course Code**	**Vocational Skill Enhancement – II (Lab)**
MCA31112	PHP	MCA31212	React-JS	MCA32310	Gen AI
MCA31113	Angular	MCA31213	DJango	MCA32311	Power BI
MCA31114	Computer Assembly & Troubleshooting	MCA31214	Node.js	MCA32312	Google Cloud for NLP
MCA31115	Java Script	MCA31215	DevOps	MCA32313	AWS

Chairperson	Dean-Academics	Principal	Dec,2024	1.00	Applicable for AY2024-25 Onwards
			Date of Release	Version	

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Program: Master in Computer Application

Semester	Course Code	Name of Course	L	T	P	Credits
II	MCA31201	Artificial Intelligence	3	-	-	3

Pre-Requisites: Computer science, Natural language processing, Python Prog., Basic Math

Course Objectives:

1.	The goal is to acquire knowledge on intelligent systems and agents, formalization of knowledge, reasoning with and without uncertainty, machine learning and applications at a basic level.
2.	The purpose of machine learning is to discover patterns in your data and then make predictions based on often complex patterns to answer business questions, detect and analyze trends and help solve problems.
3.	A strong foundation of fundamental concepts in Artificial Intelligence
4.	To investigate probabilistic reasoning under uncertain and incomplete information
5.	To explore the current scope, potential, limitations, and implications of intelligent systems

Course Contents

Unit I	**Introduction:** History and Definition of AI, Foundations Intelligent Agents - Agents and Environments- Good behavior- the nature of environments, Structure of agents-Problem Solving agents, Example problems-Searching for solutions.
Unit II	**Searching Techniques:** Informed search and exploration- Informed search strategies, greedy best-first, A* Algorithm, Memory-bounded heuristic search, heuristic functions, Local search algorithms, and optimization problems, searching in continuous space, CSP – backtracking search for CSPs, Backtracking search for CSPs, Local search for CSP-structure of problems.
Unit III	**Knowledge:** Representation Introduction to Logic, Syntax and semantics of first order logic, Using first order logic, assertions and queries in first-order logic, kinship domain, Wumpus world problem, Knowledge engineering in first order logic, Inference in first order logic- Propositional vs. first-order inference, Unification and lifting, Storage and retrieval, Forward chaining, Backward chaining, Resolution
Unit IV	**Reasoning Under Uncertainty:** Handling Uncertain Knowledge, Random Variables, Prior and Posterior Probability, Inference using Full Joint Distribution, Bayes' Rule and its use, Bayesian Belief Networks, Reasoning in Belief Networks.
Unit V	**Planning and Learning:** The planning problem, Partial order planning, total order planning, Learning in AI, Learning Agent, Concepts of Supervised, Unsupervised, Semi - Supervised Learning, Reinforcement Learning, Ensemble Learning, Expert Systems, Components of Expert System: Knowledge base, Inference engine, user interface, working memory, Development of Expert Systems.

Text Books

T.1	Stewart Russell and Peter Norvig. " Artificial Intelligence-A Modern Approach ", 2nd Edition, Pearson Education/ Prentice Hall of India, 2004

Reference Books	
R.1	Elaine Rich and Kevin Knight, “Artificial Intelligence”, 2nd Edition, Tata McGraw-Hill, 2003
R.2	George F Luger ―Artificial Intelligence‖ Low Price Edition, Pearson Education., Fourth edition.
Useful Links	
1	https://onlinecourses.nptel.ac.in/noc21
2	https://nptel.ac.in/courses/106/106/106106126/

	Course Outcomes	CL	Class Sessions
MCA31201.1	Apply Agents and problems-Searching techniques in applications which involve perception, reasoning and learning.	3	9
MCA31201.2	Analyze the role of agents and how it is related to the environment and the way of evaluating it and how agents can act by establishing goals.	4	9
MCA31201.3	Analyze and design a real-world problem for implementation and understand the dynamic behavior of a system.	4	9
MCA31201.4	Comprehend various learning techniques.	3	9
MCA31201.5	Describe the various building blocks of an expert system for a given real word problem.	5	9

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Semester	Course Code	Name of Course	L	T	P	Credits
II	MCA31202	Internet Programming	3	-	-	3

Pre-Requisites: Programming logics & techniques and C language syntaxes

Course Objectives:

1.	Learn the concepts of java network programming. Develop front end, back end applications using Java Database Connectivity techniques.
2.	To develop web based applications by using Servlets.
3.	Develop applications by using Cookies, Session.
4.	To analyze tag library and implicit objects to develop applications by using Java Server Pages.
5.	To analyze functionalities of java Frameworks. Develop applications by using struts, hibernate frameworks.

Course Contents

Unit I	Networking : Socket, Reserve socket, Internet Addressing, InetAddress, TCP/IP client socket, TCP/IP server socket, URL, URL Connection, Datagram, JDBC - Introduction, SQL Syntax, Environment, Sample Code, Driver Types, Connections, Statement, Result Set, Transactions, Exceptions, Batch Processing, Stored Procedure.
Unit II	Servlet: Basics of Web, Servlet Life Cycle, Servlet API, Servlet Interface GenericServlet, HttpServlet, ServletRequest and its methods, ServletResponse and its methods, RequestDispatcher.
Unit III	sendRedirect, ServletConfig, ServletConfig methods, ServletContext, ServletContext methods. Session Tracking, Hidden Form Field, URL Rewriting, Cookies, HttpSession.
Unit IV	Java Server Pages: Introduction to JSP, Comparison with Servlet, JSP Architecture,JSP Life Cycle, JSP Scripting Elements, JSP Directives, JSP Action, JSP Implicit Objects, JSP Expression Language, JSP Standard Tag Libraries, JSP Custom Tag, JSP Session Management, JSP Exception Handling, JSP CRUD Application.
Unit V	Java Web Frameworks: Hibernate Introduction to Hibernate, Exploring Architecture of Hibernate, O/R Mapping with Hibernate, Hibernate Annotation, Hibernate Query Language, CRUD Operation using Hibernate API. Spring MVC Spring Introduction, Spring Architecture, Spring MVC Module, Life Cycle of Bean Factory, Explore: Constructor Injection, Dependency

Text Books	
1	J2EE: The complete Reference by Jim Keogh McGraw Hill 3rd Edition
2	Java Server Programming Java EE 7 (J2EE 1.7), Black Book by Kogent Learning So. Dream Tech publication 3rd Edition
Reference Books	
1	J2EE Made Easy By Das, Rashmi Kant. Vikas publication 2nd Edition
2	Core J2EE Patterns by Martin Fowler, Chief Scientist. Published by Prentice Hall. 2nd Edition
Useful Links	
1	https://nptel.ac.in/courses/106/105/106105153/
2	https://nptel.ac.in/courses/106/105/106105191/

	Course Outcomes	CL	Class Sessions
MCA31202.1	Apply concepts of ServerSocket, Socket, DatagramSocket, DatagramPacket. Also apply Java Database Connectivity techniques.	3	9
MCA31202.2	Analyze Servlet concept and Create Servlet based web applications by using GenericServlet, HttpServlet.	3	9
MCA31202.3	Apply cookies, session tracking mechanism to maintain information of client.	4	9
MCA31202.4	Evaluate the process of Web Serversand Web based applications by using Java Server Pages.	5	9
MCA31202.5	Create framework-based applications by using spring, Hibernate.	6	9

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Semester	Course Code	Name of Course	L	T	P	Credits
II	MCA31203	Machine Learning	3	-	-	3

Pre-Requisites: **Programming Skills, Probability and Statistics**

Course Objectives:

1.	To understand and apply different search methods and decision tree
2.	To understand and apply neural networks and genetic algorithms
3.	To understand and apply Bayesian and Computational Learning method
4.	To understand and apply instant-based learning methods
5.	To learn and apply advanced learning methods

Course Contents

Unit I	**BASICS:** Learning Problems Perspectives and Issues, Concept Learning Version Spaces and Candidate eliminations – Inductive bias – Decision Tree learning – Representation Algorithm Heuristic Space Search,
Unit II	**NEURAL NETWORKS AND GENETIC ALGORITHMS:** Neural Network, Representation Problems, Neuron, Perceptron, Multilayer Networks and Back Propagation Algorithms, Optimization Techniques. Advanced Topics: Genetic Algorithms, Hypothesis Space Search– Genetic Programming – Models of Evolutions and Learning.
Unit III	**BAYESIAN AND COMPUTATIONAL LEARNING:** Bayes Theorem Concept Learning Maximum Likelihood, Minimum Description Length Principle, Bayes Optimal Classifier Gibbs Algorithm, Naïve Bayes Classifier, Bayesian Belief Network, EM Algorithm, Probability Learning, Sample Complexity, Finite and Infinite Hypothesis Spaces – Mistake Bound Model.
Unit IV	**INSTANT BASED LEARNING:** K-Nearest Neighbor Learning, Locally weighted Regression, Regression models: Linear, and Logistic Regression, Comparison with Support Vector Model, Radial Bases Functions – Case Based Learning.
Unit V	**ADVANCED LEARNING:** Learning Sets of Rules, Sequential Covering, Algorithm Learning Rule Set, First Order Rules, Induction and Inverted Deduction, Inverting Resolution Analytical Learning, Perfect Domain Theories, Explanation Based Learning – First Order Combined Learner (FOCL) Algorithm - Reinforcement Learning, Task Learning, Temporal Difference Learning

Text Books

1	Tom M. Mitchell, “Machine Learning”, McGraw-Hill, 2010
2	Bishop, Christopher. Neural Networks for Pattern Recognition. New York, NY: Oxford University Press, 1995

Reference Books

1	Ethem Alpaydin, (2004) “Introduction to Machine Learning (Adaptive Computation and Machine Learning)”, The MIT Press
2	T. astie, R. Tibshirani, J. H. Friedman, “The Elements of Statistical Learning”, Springer(2nd ed.), 2009
Useful Links	
1	https://archive.nptel.ac.in/courses/106/105/106105152/
2	https://archive.nptel.ac.in/courses/106/106/106106139/

	Course Outcomes	**CL**	**Class Sessions**
MCA31203**.1**	Apply Learning Problems Perspectives and issues Concept Learning Version Spaces.	3	9
MCA31203**.2**	Develop and apply pattern classification algorithms to classify multivariate data.	3	9
MCA31203**.3**	Develop and apply regression algorithms for finding relationships between data variables.	3	9
MCA31203**.4**	Develop and apply reinforcement learning algorithms for learning to control complex systems.	3	9
MCA31203**.5**	Write scientific reports on computational machine learning methods, results and conclusions.	6	9

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Program: Master in Computer Application

Semester	Course Code	Name of Course	L	T	P	Credits
II	**MCA31204**	**ENTERPRISE RESOURCE PLANNING**	3	0	-	3

Pre-Requisites: HR Management and E-Business

Course Objectives:

CO1	To get a working knowledge of how data and transactions are integrated in an ERP system to manage the sales order process, production process, and procurement process.
CO2	To understand and analyze the technical aspect of telecommunication systems, internet and their roles in business environment.
CO3	To understand and analyze the strategic options for ERP identification and adoption.
CO4	To learn the strategic importance of Enterprise Resource Planning.
CO5	To Understand and implement ERP in various Sectors.

Course Contents

Unit I	**INTRODUCTION**: Overview and Benefits of ERP, **ERP Related Technologies**- Business Process Reengineering (BPR), Online Analytical Processing (OLAP), Supply chain Management (SCM). Applications of ERP.
Unit II	**ERP IMPLEMENTATION**: Implementation and Product Lifecycle, Implementation Methodology, Planning Evaluation and selection of ERP systems, Organizing the Project Management and Monitoring. Case Study on Manufacturing.
Unit III	**ERP MODULES**: Business modules in an ERP Package- Manufacturing, Human Resources, Plant Maintenance, Materials Management, Data Warehousing, Data Mining, Quality Management, Sales and Distribution. Case Study in Banking Sector.
Unit IV	**POST IMPLEMENTATION**: Overview of ERP software solution. Maintenance of ERPOrganizational and Industrial impact; Success and Failure factors of ERP Implementation. Case Study of Success Story and Failure of Processing Sector.
Unit V	**EMERGING TRENDS IN ERP**: Extended ERP system, ERP add–ons –Customer Relations

	Management (CRM), Customer satisfaction (CS). Business analytics etc- Future trends in ERP systems-web enabled, Wireless technologies. Case Study in Service Sector.

Text Books

T.1	Alexis Leon, "ERP Demystified", Tata McGraw Hill, New Delhi, 2000
T.2	Jagan Nathan Vaman, ERP in Practice, Tata McGraw-Hill, 2008
T.3	Mahadeo Jaiswal and Ganesh Vanapalli, ERP Macmillan India, 2009.

Reference Books

R.1	Alexis Leon, Enterprise Resource Planning, second edition, Tata McGraw-Hill, 2008.
R 2	Vinod Kumar Grag and N.K. Venkitakrishnan, ERP- Concepts and Practice, Prentice Hall of India,2 nd edition, 2006.
R 3	Joseph A Brady, Ellen F Monk, Bret Wagner, "Concepts in Enterprise Resource Planning", Thompson Course Technology, USA, 2001.

Useful Links

1	http://www.digimat.in/nptel/courses/video/110105083/L10.html
2	http://www.digimat.in/nptel/courses/video/110105057/L01.html

	Course Outcomes	CL	Class Sessions
MCA31204.1	Apply a working knowledge of how data and transactions are integrated in an ERP system to manage the sales order process, production process, and procurement process.	3	9
MCA31204.2	Analyze the technical aspect of telecommunication systems, internet and their roles in business environment.	4	9
MCA31204.3	Analyze the strategic options for ERP identification and adoption.	4	9
MCA31204.4	To know the strategic importance of Enterprise Resource Planning	5	9
MCA31204.5	To Understand and implement ERP in various Sectors.	6	9

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Program: Master in Computer Application

Semester	Course Code	Name of Course	L	T	P	Credits
II	MCA31205	Computer Ethics	3	-	-	3

Pre-Requisites: **Programming Skills, Probability and Statistics**

Course Objectives:

1.	Understand the key ethical issues in computing and technology
2.	Evaluate the impact of computing on society, business, and individuals.
3.	Develop the ability to reason ethically and apply these concepts to real-world computing scenarios.
4.	Recognize the legal and regulatory aspects of computing.
5.	Discuss the moral responsibilities of computer professionals.

Course Contents

Unit I	**Computer Ethics**:- Fundamental of Ethics in Computing, Importance of Ethics for Computer Professionals, Key Ethical Frameworks (Utilitarianism, Deontology, Virtue Ethics), Understanding Privacy: What is private and what is public?, Data Protection Laws (GDPR, CCPA, etc.), Ethical Challenges in Data Collection, Storage and Usage, Overview of Intellectual Property (Copyright, Patent, Trademark), Fair Use and Software Piracy, Ethical Issues in Open-Source vs. Proprietary Software
Unit II	**Intellectual Property and Piracy:-** Overview of Intellectual Property (Copyright, Patent, Trademark), Fair Use and Software Piracy, Ethical Issues in Open-Source vs. Proprietary Software, Understanding Cyber Security Threats (Hacking, Phishing, Malware), Ethical Implications of Cyber attacks, Legal Aspects of Cybercrime, Ethical Challenges of AI and Automation, Bias in AI Algorithms, Implications for Employment and Society
Unit III	**Social Media Ethics:-** Freedom of Speech vs. Hate Speech, Ethical Responsibilities of Social Media Platforms, Fake News and Misinformation, The Role of the Software Engineer in Ethical Decision Making, Software Failures and Their Consequences, Government and Corporate Surveillance, Ethical Boundaries of Data Collection and Monitoring, Location Tracking and User Consent, Case Study: Edward Snowden and the NSA Surveillance Leak
Unit IV	**Professional Ethics for Computing Professionals:-** Code of Ethics in Computing (ACM, IEEE), Professional Responsibility and Accountability, Ethical Issues in Consulting and Client-Server Relationships, Ethical Considerations in Developing Countries, Technology's Role in Global Problems (e.g., climate change, health crises), Ethics of Global Software Development Outsourcing, Key Legislation Affecting Technology (Copyright, Cybercrime Laws, Data Privacy)
Unit V	**The Future of Technology and Ethics:-** Emerging Technologies and Ethical Implications, The Impact of Quantum Computing, Block chain, and Biotech on Ethics, Sustainability and Ethics in Tech Development Case Study: The Ethics of Space Exploration and Colonization

Text Books

1	Ethics for the Information Age by Michael J. Quinn

Reference Books	
1	Scott Smallwood. “Arts Professor at New School U. Resigns after Admitting Plagiarism.” Chronicle of Higher Education, September 20, 2004
2	Katie Hafner. “Lessons in Internet Plagiarism.” New York Times, June 28, 2001
Useful Links	
1	
2	

	Course Outcomes	CL	Class Sessions
MCA31205**.1**	Construct the disciplinary activity for computer functionality	3	9
MCA31205**.2**	Classify and explore things of computer technology implementation for data communication	4	9
MCA31205**.3**	Differentiate Communication network model data flow and its protocol	5	9
MCA31205**.4**	Analyze the global data security management and various methodology	4	9
MCA31205**.5**	Evaluate the application management of communication channels and hacking technology and security	4	9

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Semester	Course Code	Name of Course	L	T	P	Credits
II	**MCA31206**	Social Network Analysis & Digital Marketing	3	0	-	3

Pre-Requisites: E-Commerce, Computer Graphics, Digital Communication Network

Course Objectives:

1.	Understand and Analyze types of alternatives for digitalmarketing
2.	To learn how to preparation of various tools and services fordigital marketing.
3.	To Learn and Apply About Google search engine and itsanalysis
4.	To learn how to Implementation analysis tools and marketing material at various platform of social media.
5.	To learn digital marketing approach at facebook platform.

Course Contents

Unit I	Introduction to Digital Marketing and its Significance, Traditional Marketing Vs Digital Marketing, Digital Marketing Process, Website Planning and Development: Types of websites, Website Planning and Development, Keywords Understanding Domain and Webhosting, Building Website/Blog using CMS WordPress, Using WordPress Plug-ins
Unit II	Introduction to Search Engine Optimization, Keyword P lanner Tools, On Page SEO Techniques-Indexing and Key Word Placement SEO Techniques-Indexing and Key Word Placement On Page SEO Techniques- Content Optimization, On Page SEO : Yoast SEO Plug-in, Off –Page SEO Techniques, Email Marketing- Introduction and Significance, Designing e-mail marketing campaigns using Mail Chimp Building E-mail List and Signup Forms, Email Marketing Strategy and Monitoring, Email –Atomization
Unit III	Pay Per Click Advertising, Google Adword, Types of Bidding strategies, Designing and Monitoring search campaigns, Designing and Monitoring Display campaigns, Designing and Monitoring Video campaigns, Designing and Monitoring Universal App Campaigns, Developing digital marketing strategy in Integration form, Advertising Account.
Unit IV	Marketing: Introduction and Significance, Understanding Audience and its Types, Analytics Interface and Setup, Understanding Goals and Conversions, Monitoring Traffic Behavior and preparing Reports, Social Media Marketing: Introduction and Significance, Social Network Analysis & Marketing: Basics, Designing SocialNetwork AdvertisingCampaigns, Types of Various Ad Formats

Unit V	Case Study: Facebook Linkdin, Twitter (Marketing, Designing Advertising, Campaigns, Analysis Audience behavior).
Text Books	
T.1	V.K. Jain, "Cryptography and Network Security",2ndEdition, Khanna Publishing House.
T.2	Atul Kahate, "Cryptography and Network Security",2ndEdition, McGraw Hill.
T.3	Bothra Harsh, "Hacking", Khanna Publishing House, 3rd Edition, Delhi
Reference Books	
R.1	William Stallings, "Cryptography and Network Security", 2nd Edition, Pearson Education/PHI, 2006.
Useful Links	
1	https://nptel.ac.in/courses/106/105/106105162/
2	https://nptel.ac.in/courses/106/105/106105031/
3	https://nptel.ac.in/courses/106/106/106106178/

	Course Outcomes	CL	Class Sessions
MCA31206.1	Examine various types of alternatives for digital marketing	3	9
MCA31206.2	preparation of various tools and services for digital marketing	4	9
MCA31206.3	preparation About Google search engine and its analysis	4	9
MCA31206.4	Implementation of analysis tools and marketing material at various platform of social media	5	9
MCA31206.5	Demonstrate digital marketing approach at face book platform	5	9

Tulsiramji Gaikwad-Patil College of Engineering and Technology

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Program: Master in Computer Application (MCA)

Semester	Course Code	Name of Course	L	T	P	Credits
II	MCA31207	Data Warehouse and Data Mining	3	-	-	3

Pre-Requisites: Knowledge of DBMS, Advanced SQL Programming

Course Objectives:

1.	To understand the characteristics of Data warehouse and Data mart.
2.	To understand star schema and OLAP concepts
3.	To understand Data Mining concepts and tools
4.	To apply data warehouse concepts to design and build a data warehouse
5.	To study case studies of Data warehousing and Data mining

Course Contents

Unit I	Characteristics of A Data Warehouse, Data Mart, Type of Data Mart, Loading a Data Mart, Metadata for a Data Mart, Data Model for a Data Mart, Maintenance of a Data Mart, Nature of Data in a Data Mart, Software Components for a Data Mart, Tables in Data Mart, External Data, Reference Data, Performance Issues, Monitoring Requirements for a Data Mart, Security in Data Mart.
Unit II	OLTP and OLAP Systems, Data Modeling, Star Schema for Multidimensional view, Multi-fact Star Schema, Categories of OLAP Tools, Managed Query Environment (MQE), Cognos Powerplay, IBI Focus Fusion, Pilot Software, Arbor Web, Information Advantage Web OLAP, Micro strategy DSS Web, Brio Technology, OLAP Tools and the Internet
Unit III	Data Mining: Introduction, From Data Warehouse to Data Mining, Steps of Data Mining, Data Mining Algorithm, Database segmentation, Predictive modeling, Link Analysis, Tools for Data Mining
Unit IV	Developing a Data Warehouse, Building a Data Warehouse, Data Warehouse Architectural Strategies, Design Considerations, Data Content, Metadata, Data Distribution, Tools for Data Warehousing, Performance Considerations, Crucial Decisions in Designing a Data Warehouse, Various Technological Considerations.
Unit V	Application of Data Warehousing & Data Mining, National Data Warehouses, Census Data, Areas for Data Warehousing and Data Mining with Case Studies. Case Study - 1: Data Warehousing in State Government. 2: Data Warehousing for the Ministry of Commerce. 3: Data Warehousing in Hewlett-Packard. 4: Data Warehousing in World Bank,

Text Books

T.1	Data Warehousing - C.S.R. Prabhu, PHI Publication.
T.2	Web Warehousing & Knowledge Management - Mattison, fata McGraw Hill.

Reference Books

R.1	Data Warehousing - Amitesh Sinha, Thomson Publication.
R.2	Data Mining - Claude Seidman, PHI Publication.

Useful Links

1	
2	

	Course Outcomes	CL	Class Sessions
MCA31207.1	To understand the characteristics of Data warehouse and Data mart.	3	9
MCA31207.2	To understand star schema and OLAP concepts	4	9
MCA31207.3	To understand Data Mining concepts and tools	5	9
MCA31207.4	To apply data warehouse concepts to design and build a data warehouse	4	9
MCA31207.5	To study case studies of Data warehousing and Data mining	4	9

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Program: Master in Computer Application

Semester	Course Code	Name of Course	L	T	P	Credits
II	MCA31208	Sales Force Lab	-	-	4	2

Pre-Requisites: Knowledge of cloud-computing, an user account in SalesForce (temporary)

Course Objectives:

1.	To apply triggers for transactions using customer sales data
2.	To apply lead generation tool in salesforce.com
3.	To apply converting lead/opportunity to a deal
4.	To learn how to update employee data in Salesforce
5.	To apply customer notification module through email.

Sr. No.	List of Experiment	CO Mapping
1	Write a program to update customer salary by using transaction.	CO1
2	Write a program to create and fire up date trigger.	CO1
3	Write a program for whenever lead a discrete with lead source as Web the given rating a cold otherwise hot.	CO2
4	Write a program for whenever the Account is created with Industry as Banking then create a contact for account, Contact Last name as Account name and contact phone as account phone.	CO2
5	Write a program whenever Opportunity Stage is modified to Closed Won then set Close Date as Today Date and Type as New Customer.	CO3
6	Write program that will fire when we try to create the account with same name i.e., preventing the users to create Duplicate Accounts.	CO3
7	Write a program in which if an account that has related contacts and the user tries to delete that account it throws you an error Account cannot be deleted.	CO4
8	Write a program to update employees' salary by 5%.	CO4
9	Write a program whenever a case is created with origin as email then set status as new and Priority as Medium.	CO5
10	Write a program on Account, when an account is inserted, automatically account billing address should populate into the account shipping address.	CO5

Text Books	
1	'Salesforce for Beginners' by Sharif Shaalan, Packt Publishing, 2020 Edition, ISBN: 978-1800562276
2	Salesforce CRM' The Definitive Admin Handbook, by Paul Goodey, Packt Publishing, 6th Edition 2022, ISBN: 978-1803246869
Reference Books	
1	Mastering Salesforce DevOps by Andrew Davis, Packt Publishing, 1st Edition, 2021, ISBN**: 978-1800568476
2	Salesforce Platform Developer I Certification Guide by Jan Vandevelde, Gaurav Kheterpal, Packt Publishing, 1st Edition, 2020, ISBN**: 978-1789956711
Useful Links	
1	
2	

	Course Outcomes	CL	Class Sessions
MCA31208.1	To apply triggers for transactions using customer sales data	3	9
MCA31208.2	To apply lead generation tool in salesforce.com	3	9
MCA31208.3	To apply converting lead/opportunity to a deal	4	9
MCA31208.4	To learn updating employee data in salesforce	5	9
MCA31208.5	To apply customer notification module through email.	6	9

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Program: Master in Computer Application

Semester	Course Code	Name of Course	L	T	P	Credits
II	MCA31209	Artificial Intelligence and Machine Learning Lab Using Python	-	-	4	2

Pre-Requisites: Python Programming, Subject Knowledge of AI and Machine Learning

Course Objectives:

1.	To learn and apply the basic programming concepts and Data Structures in Python.
2.	To implement AI search methods like Depth First and Breadth First Search using Python. Implement the A* algorithm of heuristic search.
3.	Learn and apply Min-Max Algorithm for two agents and the Backtracking method on CSP networks to find the optimal solution.
4.	To learn and apply ML tools and methods for data sampling, visualization, and comparison of different ML-supervised models with sample data.
5.	To apply different un-supervised learning models using sample data for different applications

Sr. No.	List of Experiment	CO Mapping
1	Basic Python Programming: A) Demonstration of Branching and Looping statements in Python B) Demonstration of functions to manipulate Strings C) Demonstration of functions to manipulate Array	CO1
2	Python Data Structures, and Standard I/O: A) Demonstration of using List, Set, and Dictionary data structures B) Demonstrate standard modules in Python (collections, OS, etc.)	CO1
3	Implement Depth First and Breadth First Search for the given data.	CO2
4	Implement A* Algorithm to find the shortest path between the source and the destination for the given network of cities.	CO2
5	Implement Mini-Max Algorithm for two agents	CO3
6	Build a network with given constraints and apply the backtracking algorithm to find the optimum solution.	CO3
7	A) Use the Numpy library (random module) to create sample data with different distributions. B) Normal (Gaussian), Binomial, Multinomial, Poisson, Uniform, Logistic, Exponential, Chi-Square C) Use the Data Frames to do multi-dimensional data manipulation D) Use the following libraries in Python for data visualization • Matplotlib	CO4

	• Seaborn	
8	A. Model comparison (Supervised models): Use the K-NN, SVM, Naïve Bayes, and Decision Tree model for regression on sample data and compare their performance (build performance matrix)	CO4
9	**Application:** Customer segmentation, Grouping experiment outcomes Use the K-Means and Hierarchical model for clustering on the above sample data	CO5
10	**Application of Neural Networks**: A) Use a perceptron for Binary classification. B) Use the ANN model for multi-classification.	CO5

Text Books	
1	Hands-On Machine Learning with Scikit-Learn and TensorFlow, Aurélien Géron, O-Reilly-Publication
2	Machine Learning - Step-by-Step Guide to Implement Machine Learning Algorithms with Python, Rudolph Russell
Reference Books	
1	Python Programming, O'Reilly Publication
2	Elaine Rich and Kevin Knight, "Artificial Intelligence", 2nd Edition, Tata McGraw-Hill, 2003
Useful Links	
1	Official web site of Scikit Learn library - https://scikit-learn.org/stable/index.html
2	Official Website of Pandas library - https://pandas.pydata.org/

	Course Outcomes	CL	Class Sessions
MCA31209.1	To apply the basic programming concepts and Data Structures in Python.	3	9
MCA31209.2	To implement AI search methods like Depth First and Breadth First Search, and the A* algorithm of heuristic search.	3	9
MCA31209.3	To apply multi-agent optimization algorithms like Min-Max and CSP problems with a backtracking algorithm.	4	9
MCA31209.4	To apply ML tools and methods for data sampling, visualization, and comparison of different ML-supervised models with sample data.	5	9
MCA31209.5	To apply different un-supervised learning models using sample data for different applications	6	9

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Program: Master in Computer Application

Semester	Course Code	Name of Course	L	T	P	Credits
II	MCA31211	Internet Programming Lab using Advance Java	-	-	4	2

Pre-Requisites: Core Java Programming

Course Objectives:

1.	Learn the concepts of java network programming. Develop front end, back end applications using Java Database Connectivity techniques.
2.	To develop web based applications by using Servlets.
3.	Develop applications by using Cookies, Session.
4.	To analyze tag library and implicit objects to develop applications by using Java Server Pages.
5.	To analyze functionalities of java Frameworks. Develop applications by using struts, hibernate frameworks.

Sr. No.	List of Experiment	CO Mapping
1	Develop application by using Socket.	CO1
2	Develop application by using JDBC.	CO1
3	Develop color based application by using HTML & Servlet.	CO2
4	Develop application by using Input form & Servlet.	CO2
5	Develop application by using cookie.	CO3
6	Develop application by using session.	CO3
7	Develop application by using Java Server Pages.	CO4
8	Develop application by using Java Jserver Pages, JDBC.	CO4
9	Develop application by using Hibernate.	CO5
10	Develop application by using Spring.	CO5

Text Books

1	J2EE: The complete Reference by Jim Keogh McGraw Hill 3rd Edition
2	Java Server Programming Java EE 7 (J2EE 1.7), Black Book by Kogent Learning So. Dream Tech publication 3rd Edition

Reference Books

1	J2EE Made Easy By Das, Rashmi Kant. Vikas publication 2nd Edition
2	Core J2EE Patterns by Martin Fowler, Chief Scientist. Published by Prentice Hall. 2nd Edition

Useful Links	
1	https://nptel.ac.in/courses/106/105/106105191
2	https://nptel.ac.in/courses/106/105/106105191/

	Course Outcomes	CL	Class Sessions
MCA31211.1	Apply concepts of ServerSocket, Socket, DatagramSocket, DatagramPacket. Also apply Java Database Connectivity techniques.	3	9
MCA31211.2	Analyze Servlet concept and Create Servlet based web applications by using GenericServlet, HttpServlet.	3	9
MCA31211.3	Apply cookies, session tracking mechanism to maintain information of client.	4	9
MCA31211.4	Evaluate the process of Web Serversand Web based applications by using Java Server Pages.	5	9
MCA31211.5	Create framework-based applications by using spring, Hibernate.	6	9

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Program: Master in Computer Application

Semester	Course Code	Name of Course	L	T	P	Credits
II	MCA31212	React.JS - Web UI Library Lab	-	-	4	2

Pre-Requisites: JavaScript Basics, OOPs Programming Concepts

Course Objectives:

1.	To understand React.DOM object and use this object to update the contents of home page.
2.	To understand React.JS events and event handling. Demonstrate handling 'Click' event.
3.	To learn how to build reusable components using React.JS
4.	To understand React.JS constructs and build a form component
5.	To understand React.JS routing and memo and demonstrate the application

Sr. No.	List of Experiment	CO
1	**Using React.DOM Object: Update home page header:** Create any home page. Update the header of home page using a react function.	CO1
2	**Creating and rendering a new component:** 1. Create a new component to display a banner on the home page. 2. Create a new component to create a list of students (use Student Data in memory as an array of JSON Objects)	CO1
3	**Using component properties, proptypes, and default value:** Create a component to render the list of issues, by selecting the issue type displayed in a list box. A list of issues is given as an array of JSON objects.	CO2
4	**Using component state:** Implement the text area counter. When the number of characters in the text area changes, it is displayed in the message area.	CO2
5	**Use ReactJS Event Handling:** Create a textbox and a button. Allow only numeric values to be entered in the text box. Onclick of the button, display if the entered value is even or odd.	CO3
6	**Use ReactJS Event Handling:** Create a menu component for the menu items: ['Home', 'About', 'Services', 'Portfolio', 'Contact us']. Implement 'Click' Event on these menu items.	CO3
7	**Crafting Reusable Components:** Create a Timer-Component. Given the time (ex. 10 seconds), the timer component should start from 10 and counts down to 0-secs (Time up).	CO4

8	**Using React Form:** Create a form for student registration with student id, student name, branch, semester, email_id, and contact number.	CO4
9	**Routing with React Router** Create a router component to navigate to about page and contact us page from home page.	CO5
10	**Using React Memo:** Create a component using React-Memo.	CO5

Text Books	
1	React: Up & Running Building Web Applications - Stoyan Stefanov, O'Reilly Publication
2	React and React Native by Adam Boduch, Packt publication
Reference Books	
1	
Useful Links	
1	www.w3schools.com
2	React.JS official web site

	Course Outcomes	CL	Lab Sessions
MCA31212.1	To understand React.DOM object and use this object to update the contents of home page.		4
MCA31212.2	To understand React.JS events and event handling. Demonstrate handling 'Click' event.		4
MCA31212.3	To learn how to build reusable components using React.JS		4
MCA31212.4	To understand React.JS constructs and build a form component		4
MCA31213.5	To understand React.JS routing and memo and demonstrate the application		6

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Program: Master in Computer Application

Semester	Course Code	Name of Course	L	T	P	Credits
II	MCA31213	Django - Python Web Framework Lab	-	-	4	2

Pre-Requisites: Python Programming, OOPs Programming Concepts, Web Programming

Course Objectives:

1.	To understand the MVT architecture of Django web framework (Installation and Configuration of the Django framework with MySQL as backend DB). To learn to build a template for static content.
2.	To learn to build content for dynamic content like form entry and display the entered data.
3.	To learn how to do CRUD operations in Django. To understand how user session is managed in Django.
4.	To learn using error pages and error logging in Django
5.	To learn using Django test module and creating a new reusable module.

Sr. No.	List of Experiment	CO
1	**Installation and Configuration of Django:** Enable Django's user management module and demonstrate the Login functionality. Demonstrate the MVT architecture of Django.	CO1
2	**Create a static content page with navigation from main menu:** Create an "About" page with static content. Create the link on the main menu.	CO1
3	**Creating a static view template with user interaction:** Create an image gallery with any 10 images. Users can slide through the images in the gallery.	CO2
4	**Creating a form template and applying routing**: Create a user registration form with the following fields and a submit button. On submit, display the data entered on a different page.	CO2
5	**Demonstrate the use of user session:** Use the login module of the Django. On successful login, store the userid/username in the session. Display the userid/user name in the home page.	CO3
6	**Demonstrate CRUD operations:** Create a form to store user requests (Userid, RequestID, RequestDetails, RequestDate - default is the current date). Implement updating the request before it is attended. Implement updating the request status (Created, Attended, Resolved, Under observation/Closed).	CO3
7	**Demonstrate using error pages:** Use error pages for different HTTP Errors (like 404, 282, etc.)	CO4
8	**Demonstrate using error logging:** Use the logging module to log system logs into a file. The log should be created for each date.	CO4
9	**Demonstrate using the Django test module:** Use the Django test module for testing the login module (default module).	CO5

10	**Demonstrate Creating a reusable module:** Create a new reusable module for the “Contact Us” option as part of the main menu.	CO5
Text Books		
1	Django - The Easy Way (2nd Edition), Samuli Natri	
2	Learning Django Web Development, Sanjeev Jaiswal and Ratan Kumar, Packt Publication	
Reference Books		
1		
Useful Links		
1	www.w3schools.com	
2	Django official web site.	

	Course Outcomes	CL	Lab Sessions
MCA31213.1	To understand the MVT architecture of Django web framework (Installation and Configuration of the Django framework with MySQL as backend DB). To learn to build a template for static content.	3	2
MCA31213.2	To learn to build content for dynamic content like form entry and display the entered data.	4	3
MCA31213.3	To learn how to do CRUD operations in Django. To understand how user session is managed in Django.	5	4
MCA31213.4	To learn using error pages and error logging in Django	4	4
MCA31213.5	To learn using Django test module and creating a new reusable module.	6	6

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Program: Master in Computer Application

Semester	Course Code	Name of Course	L	T	P	Credits
II	MCA31214	Node.JS Lab	-	-	3	2

Pre-Requisites: OOPs Programming Concepts, JavaScript Programming, Web Server Concepts

Course Objectives:

1.	To understand the NodeJS framework (Installation and Configuration with MongoDB as backend DB). Learn to create an HTTP Server and read data from a query string.
2.	To learn how to use NodeJS as a file server. Learn how to split a URL.
3.	To learn how to do CRUD operations in NodeJS and handle NodeJS events
4.	To learn how to generate error pages and error logging NodeJS
5.	To learn how to use ExpressJS for routing in NodeJS. Use Formidable module to handle uploaded files.

Sr. No.	List of Experiment	CO
1	**Installation and Configuration of NodeJS:** Install NodeJS and use the NodeJS HTTP module to create a web server.	CO1
2	**Reading data from Query String:** Write a function to read the data from the query string.	CO1
3	**Use NodeJS as a file server:** Create a file server using NodeJS. Write programs to Read, Create, Update, Delete, and Rename files	CO2
4	**Splitting URL into readable parts:** Split a web address into readable parts using NodeJS URL Module	CO2
5	**Use NodeJS Events Module:** Use NodeJS events module to capture events generated during file handling. Create a log of different events captured	CO3
6	**Demonstrate CRUD operations:** Create a form to store user requests (Userid, RequestID, RequestDetails, RequestDate - default is the current date). Implement updating the request before it is attended. Implement updating the request status (Created, Attended, Resolved, Under observation/Closed).	CO3
7	**Demonstrate generating server error pages:**	CO4

	Use error pages for different HTTP Errors (like 404, 500, etc.)	
8	**Demonstrate using error logging:** Use the logging module to log system logs into a file. The log should be created for each date.	CO4
9	**Demonstrate using the ExpressJS along with any UI frontend module to demonstrate routing:** Use the ExpressJS to implement routing on NodeJS server.	CO5
10	**Demonstrate Using Formidable Module to handle uploaded files:** Create a webpage to upload a file. Use the Formidable module to be able to parse the uploaded file once it reaches the server. When the file is uploaded and parsed, it gets placed in a temporary folder on your computer.	CO5

Text Books	
1	Node.JS Up and Running, O'Reilly Publication
2	Using NodeJS to build up web applications – Packt Publication
Reference Books	
1	
Useful Links	
1	www.w3schools.com
2	

	Course Outcomes	CL	Lab Sessions
MCA31214.1	To understand the NodeJS framework (Installation and Configuration with MongoDB as backend DB). Learn to create an HTTP Server and read data from a query string.		4
MCA31214.2	To learn how to use NodeJS as a file server. Learn how to split a URL.		4
MCA31214.3	To learn how to do CRUD operations in NodeJS and handle NodeJS events		4
MCA31214.4	To learn how to generate error pages and error logging NodeJS		4
MCA31214.5	To learn how to use ExpressJS for routing in NodeJS. Use Formidable module to handle uploaded files.		4

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Program: Master in Computer Application

Semester	Course Code	Name of Course	L	T	P	Credits
II	MCA31215	DevOps Lab	-	-	4	2

Pre-Requisites: Knowledge of Release Management and Basic Programming skills

Course Objectives:

1.	Set up a Jenkins pipeline, run automated tests
2.	Create a GitHub Action
3.	Able to build and run a multi-container application.
4.	Able to implement auto-scaling for a Kubernetes deployment.
5.	Able to write a Terraform script, deploy an entire VPC

Sr. No.	List of Experiment	CO Mapping
1	Set up a Jenkins pipeline that pulls code from GitHub, builds a Docker image, and deploys it to a Kubernetes cluster.	CO1
2	Write a GitLab CI pipeline to run automated tests and deploy to AWS EC2 on successful builds.	CO1
3	Create a GitHub Action workflow to automatically trigger on a pull request, run unit tests, and notify on Slack if tests fail.	CO2
4	Write a Docker file to containerize a Python Flask application.	CO2
5	Build and run a multi-container application using Docker Compose.	CO3
6	Reduce the size of an existing Docker image by modifying the Docker file.	CO3
7	Implement auto-scaling for a Kubernetes deployment using Horizontal Pod Autoscaler (HPA).	CO4
8	Write a Kubernetes YAML file to create a ConfigMap and inject it into a running pod.	CO4
9	Write a Terraform script to provision an EC2 instance with security group rules and attach an S3 bucket.	CO5
10	Deploy an entire VPC (Virtual Private Cloud) with public and private subnets using Terraform.	CO5

Text Books

1	The DevOps Handbook: How to Create World-Class Agility, Reliability, & Security in Technology Organizations by Gene Kim, Jez Humble, Patrick Debois, John Willis, IT Revolution Press; Illustrated edition (October 6, 2016), ISBN-13: 978-1942788003
2	Accelerate: The Science of Lean Software and DevOps: Building and Scaling High Performing Technology Organizations by Nicole Forsgren, Jez Humble, Gene Kim, IT Revolution Press; 1st edition (March 27, 2018), ISBN-13: 978-1942788331

3	Practical DevOps - Second Edition by Joakim Verona, Packt Publishing; 2nd edition (May 2018), ISBN-13: 978-1788392570
Reference Books	
1	The Phoenix Project: A Novel About IT, DevOps, and Helping Your Business Win by Gene Kim, Kevin Behr, George Spafford, IT Revolution Press; 5th Anniversary edition (February 27, 2018), ISBN-13: 978-1942788294
2	Continuous Delivery: Reliable Software Releases through Build, Test, and Deployment Automation by Jez Humble, David Farley, Addison-Wesley Professional; 1st edition (July 27, 2010) ISBN-13: 978-0321601919
Useful Links	
1	
2	

	Course Outcomes	CL	Class Sessions
MCA31215.1	Set up a Jenkins pipeline, run automated tests	3	9
MCA31215.2	Create a GitHub Action	3	9
MCA31215.3	Able to build and run a multi-container application.	4	9
MCA31215.4	Able to implement auto-scaling for a Kubernetes deployment.	5	9
MCA31215.5	Able to write a Terraform script, deploy an entire VPC	6	9