Master of Computer Applications (1 Year)
Postgraduate Program

Learning Outcomes-based Curriculum Framework
(as per NEP)

For Batch 2025-2026 and Onward

Department of Computer Science & Engineering
Faculty of Engineering and Technology
Chaudhary Devi Lal University
Sirsa-125055
2025

Learning Outcomes-based Curriculum Framework
(as per NEP)

Committee.

24-05-2025

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24/5/25

Staff Council (16/6/2025)

For

Master of Computer Applications (2 Year)
Postgraduate Program

&

Master of Computer Applications (1 Year)
Postgraduate Program

BoS (03/07/2025)

03/07/2025

Faculty of Engg & Tech. (4/7/25)

Department of Computer Science & Engineering
Faculty of Engineering and Technology
Chaudhary Devi Lal University
Sirsa-125055
2025

Abbreviations:

1. MCA: Master of Computer Application
2. NHEQF: National Higher Education Qualification Framework
3. DSC: Discipline-specific courses
4. SEC: Skill enhancement courses
5. VOC: Vocational courses
6. INT: Internship
7. PRW: Project Work
8. RPR: Research Project

Note 1: MCA one-year program have three different structures. Students have to selectone of the following three optionsforthesecondyearof the MCAprogram.

Option 1: Only coursework (Table 1.1, Table 2.1)

Option 2: Coursework and research work (Table 1.2, Table 2.2)

Option 3: Only research work (Table 1.3, Table 2.3)

Structurefor 1-yearMCAProgram (NHEQF Level 6.5)

Table 1.1: One-yearMCAprogram (Option 1 – Only Coursework)

	Sem	DSC	SEC/VOC/Internship	Research Thesis	TotalCredits
Option-1	I	Discrete Mathematics (4 credit) Machine Learning (4 credit) Network Security (4 credit) OR Wireless Network (4 credit) Theory of Computation (4 credit) OR Compiler Construction (4 credit) Python Programming (4 credit)	Android Development (4 credit) OR Linux and Shell Script (4 credit)	---	24
	II	Deep Learning (4 credit) IoT & Cloud Computing (4 credit) Data Science (4 credit) OR Big Data Analysis (4 credit) Soft Computing (4 credit) OR Bioinspired Computing (4 credit) R Programming (4 credit)	Project Work (4 credit)	---	24

Table 1.2: One-yearMCAprogram (Option 2 – Coursework and Research Thesis/Project)

	Sem	DSC	SEC/VOC/Internship	Research Thesis	TotalCredits
Option –2	I	Discrete Mathematics (4 credit) Machine Learning (4 credit) Network Security (4 credit) OR Wireless Network (4 credit) Theory of Computation (4 credit) OR Compiler Construction (4 credit) Python Programming (4 credit)	Android Development (4 credit) OR Linux and Shell Script (4 credit)	---	24
	II	--	Research Methodology (4 credit)	Research Thesis/Project (20 credit)	24

Table 1.3: One-yearMCAprogram (Option 3 – OnlyResearch)
(onlyforthestudentswhohavecompleted a 4-yearBachelor'sProgram without Research)

	Sem	DSC	SEC/VOC/Internship	Research Thesis	TotalCredits
Option3	I	--	Research Methodology (4 credit)	Research Thesis(Synopsis)[@] (20 credit)	24
	II	--	LLM & Generative AI and Research & Publication Ethics (4 credit)	Research Thesis(Final)[@@] (20 credit)	24

Note 2: Option 3 shall be available onlyforthestudentswhohavecompletedPostgraduate Diploma in Computer Applications or 4-yearBachelor'sprogram without research.

[@]At the end, and as a part of the first semester, students who opted for Option 3 shall submit a Research Synopsis of at least 50 pages comprising a Literature Survey, identification of the Research Problem, Plan of Work, Methodology, and Practical Work (if any), which will be evaluated by internal and external examiners.

[@@]The students going for Option 3 shall continue the research work in the second semester based on the project work/synopsis submitted at the end of the first semester. The final Research Thesis will be evaluated by the internal and external examiners.

Table 2.1: Semester-wise course codes, course titles, workload and credits
(MCA 1-year Program – Option 1 – Only Coursework)

Course Code	Course Title	Workload			Credit
		L	T	P	
Semester: I, Option: 1					
MCA/CSE/3/DSC/501	Discrete Mathematics	3	1	-	4
MCA/CSE/3/DSC/502	Machine Learning×	3	1	-	4
MCA/CSE/3/DSC/503(i) OR MCA/CSE/3/DSC/503(ii)	Network Security OR Wireless Network	3	1	-	4
MCA/CSE/3/DSC/504(i) OR MCA/CSE/3/DSC/504(ii)	Theory of Computation OR Compiler Construction	3	1	-	4
MCA/CSE/3/DSC/505	Python Programming*	2	-	4	4
MCA/CSE/3/SEC/501(i) OR MCA/CSE/3/SEC/501(ii)	Android Development OR Linux and Shell Script	2	-	4	4
Total		16	4	8	24
Semester: II, Option: 1					
MCA/CSE/4/DSC/551 MSc/ CSE/4/DSC/554	Deep Learning×	3	1	-	4
MCA/CSE/4/DSC/552	IoT and Cloud Computing	3	1	-	4
MCA/CSE/4/DSC/553(i) OR MCA/CSE/4/DSC/553(ii)	Data Science× OR Big Data Analysis×	3	1	-	4
MCA/CSE/4/DSC/554(i) OR MCA/CSE/4/DSC/554(ii)	Soft Computing OR Bioinspired Computing	3	1	-	4
MCA/CSE/4/DSC/555	R Programming*	2	-	4	4
MCA/CSE/4/PRW/551	Project Work	-	-	-+	4
Total		14	4	4	24

× Machine Learning and Deep Learning exercises will be implemented using Python language, whereas Data Science and Big Data Analytics exercises will be implemented using R language.

+ Supervision of up to four students' dissertation/research thesis/projects will be counted as a workload of one hour per week (two hours of workload per week for supervision of five or more students).

Table 2.2: Semester-wise Courses' codes, titles, workload and credits
(MCA 1-year program – Option 2 – Coursework and Research)

Course Code	Course Title	Workload			Credit
		L	T	P	
Semester: I, Option: 2					
MCA/CSE/3/DSC/501	Discrete Mathematics	3	1	0	4
MCA/CSE/3/DSC/502	Machine Learning[xx]	3	1	0	4
MCA/CSE/3/DSC/503(i) OR MCA/CSE/3/DSC/503(ii)	Network Security OR Wireless Network	3	1	-	4
MCA/CSE/3/DSC/504(i) OR MCA/CSE/3/DSC/504(ii)	Theory of Computation OR Compiler Construction	3	1	-	4
MCA/CSE/3/DSC/505	Python Programming[xx]	2	-	4	4
MCA/CSE/3/SEC/501(i) OR MCA/CSE/3/SEC/501(ii)	Android Development OR Linux and Shell Script	2	-	4	4
Semester: II, Option: 2					
MCA/CSE/4/SEC/551	Research Methodology	3	-	2	4
MCA/CSE/4/RPR/552	Research Project	-	-	-+	20
Total		3	-	2	24

[xx]Machine Learning exercises will be implemented using Python language.

+ Supervision of up to four students' dissertation/research thesis/projects will be counted as a workload of one hour per week (two hours of workload per week for supervision of five or more students).

Table 2.3: Semester-wise Courses' codes, titles, workload and credits
(MCA 1-year program – Option 3 – Only Research)

Course Code	Course Title	Workload			Credit
		L	T	P	
Semester: I, Option: 3					
MCA/CSE/3/SEC/501	Research Methodology	3	-	2	4
MCA/CSE/3/RPR/502	Research Project 1[#]	-	-	-+	20
Total		3	-	2	24
Semester: II, Option: 3					
MCA/CSE/4/SEC/551	LLM & Generative AI and Research & Publication Ethics	3	-	2	4
MCA/CSE/4/RPR/552	Research Project 2 (Final)[##]	-	-	-+	20
Total		3	-	2	24

Note 3: Option 3 shall be available onlyforthestudentswhohavecompleted 4-yearBachelor'sprogram without research.

+ Supervision of up to four students' dissertation/research thesis/projects will be counted as a workload of one hour per week (two hours of workload per week for supervision of five or more students).

[#]At the end, and as a part of the first semester, students who opted for Option 3 shall submit a Research Synopsis of at least 50 pages comprising a Literature Survey, identification of the Research Problem, Plan of Work, Methodology, and Practical Work (if any), which will be evaluated by internal and external examiners.

[##]The students going for Option 3 shall continue the research work in the second semester based on the project work/synopsis submitted at the end of the first semester. The final Research Thesis will be evaluated by the internal and external examiners.

MCA 1-Year Program

Semester I

Options 1 & 2

MCA/CSE/3/DSC/501: Discrete Mathematics

Course Type	Course Credit	Contact Hours/ Week	Delivery Mode	Maximum Marks			Exam Duration	Assessment Methods
				External	Internal			
DSC Theory	04	04	Lecture/ Tutorial	70	30		3 Hours	TEE/MTE/ Assignment/ Attendance
					20	5 5		

Instructions for Mid-Term examination: The mid-term examination shall cover the first two units of the course content. The question paper will be set by the internal teacher.

Instructions to paper setter for term-end examination: The term-end examination shall cover the whole content of the course. The total number of questions shall be nine. Question number one will be compulsory and will be consisting of short/objective-type questions from the complete syllabus. In addition to the compulsory first question, there shall be four units in the question paper each consisting of two questions. The student will attempt one question from each unit in addition to the compulsory question. All questions will carry equal marks.

Course Objectives: This course is aimed at making the students familiar with various discrete structures, operations performed thereupon and their implementation mechanism.

Course Outcomes	By the end of this course, the student will be able to
CO1	define: sets and elements, introduction and representation of relations, types of functions, graphs and multigraphs, Boolean algebra, group, and subgroups
CO2	describe and discuss:inclusion-exclusion principle, finite and Infinite sets., types & composition of relations, types of graphs, sorting and searching, Boolean algebra and groups.
CO3	solve: various mathematical problems related to sets, graphs, Boolean algebra and groups, directed and undirected graphs, basic logical operations on propositions and truth tables.
CO4	illustrate: sets and elements, representation of relations, types of graphs and multigraph, Boolean algebra operations, group and subgroups lattices.
CO5	determine: complex problem related to sets and elements, graphs and multigraphs, Boolean algebra, groups and subgroups.

CO-PEO Mapping Matrix for Course MCA/CSE/3/DSC/501

COs	PEO1	PEO2	PEO3	PEO4	PEO5
CO1	1	3	1	3	3
CO2	2	3	1	3	3
CO3	3	3	1	3	3
CO4	3	3	1	3	3
CO5	3	3	1	3	3
Average	2.4	3	1	3	3

CO-PO Mapping Matrix for Course MCA/CSE/3/DSC/501

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	3	1	1	1	-	3	-	-	-	-	-

CO2	2	1	1	3	1	-	3	-	-	-	-	-
CO3	3	1	1	3	3	-	3	-	-	-	-	-
CO4	2	1	1	3	1	-	3	-	-	-	-	-
CO5	2	1	3	1	3	-	3	-	-	-	-	-
Average	2	1.4	1.4	2.2	1.8	-	3	-	-	-	-	-

CO-PSO Mapping Matrix for Course MCA/CSE/3/DSC/501

COs	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	1	3	1	-
CO2	3	1	3	2	-
CO3	3	1	3	3	-
CO4	3	1	3	3	-
CO5	3	1	3	3	-
Average	3	1	3	2.6	-

Course Content
MCA/CSE/3/DSC/501: Discrete Mathematics

Unit - I	Sets and elements, inclusion-exclusion principle, finite and Infinite sets, power sets, multisets, introduction and representation of relations, types of relations, composition of relations: introduction to functions, types of functions.
Unit - II	Graphs and multigraphs, sequential and linked representation of graphs, Directed and Undirected graphs: Types of graphs, labelled and weighted graphs, complete, regular and bipartile graphs, planar graphs, tree graphs, paths, connectivity, depth first search, breadth first search, topological sort.
Unit - III	Boolean algebra, basic definitions, duality, truth tables, boolean functions, basic logical operations on propositions, proposition and truth tables, tautologies and contradictions, algebra of propositions, rules of inference.
Unit - IV	Group and subgroups, semigroups groups, normal subgroups, homomorphisms, rings, integral domain, ordered sets, hasse diagram of partially ordered sets, lattices, bounded lattices, distributive lattices, complemented lattices.

Text/Reference Books

Text Books	1. Seymour Lipschutz, Marc Lars Lipson, Discrete Mathematics, McGraw-Hill International Editions, Schaum's Series. 2. Bernard Kolman, Robert C. Busbym, Discrete Mathematical Structures for Computer Science, Prentice-Hall of India Pvt. Ltd.
Reference Books	1. Alan Doerr, Kenneth Levaseur, Applied Discrete Structures for Computer Science, Galgotia Publication Pvt. Ltd. 2. Kennech G. Rosen, Discrete Mathematics and its Applications, McGraw-Hill International Editions, Mathematics Series.

MCA/CSE/3/DSC/502: Machine Learning								
Course Type	Course Credit	Contact Hours/ Week	Delivery Mode	Maximum Marks			Exam Duration	Assessment Methods
				External	Internal			
DSC Theory	04	04	Lecture/ Tutorial	70	30		3 Hours	TEE/MTE/ Assignment/ Attendance
					20	5 5		

Instructions for Mid-Term examination: The mid-term examination shall cover the first two units of the course content. The question paper will be set by the internal teacher.

Instructions to paper setter for term-end examination: The term-end examination shall cover the whole content of the course. The total number of questions shall be nine. Question number one will be compulsory and will be consisting of short/objective-type questions from the complete syllabus. In addition to the compulsory first question, there shall be four units in the question paper each consisting of two questions. The student will attempt one question from each unit in addition to the compulsory question. All questions will carry equal marks.

Course Outcomes	At the end of this course, the student will be able to :
CO1	define: the terms of machine learning: types of machine learning, data preprocessing, classification, regression, and neurons.
CO2	explain: learning types, data preprocessing and architecture of ANN.
CO3	apply: training and testing data using data pre processing and model selection techniques and classification, regression, clustering techniques according to their problem.
CO4	Classify: data preprocessing, model selection, regression, classification, and unsupervised learning techniques.
CO5	compare: Data Preprocessing techniques, Supervised and unsupervised learning.

CO-PEO Mapping Matrix for Course MCA/CSE/3/DSC/502

COs	PEO1	PEO2	PEO3	PEO4	PEO5
CO1	1	3	1	3	3
CO2	2	3	1	3	3
CO3	3	3	1	3	3
CO4	3	3	1	3	3
CO5	3	3	1	3	3
Average	2.4	3	1	3	3

CO-PO Mapping Matrix for Course MCA/CSE/3/DSC/502

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

CO5	2	1	3	1	3	-	3	-	-	-	-	-
Average	2	1.4	1.4	2.2	1.8	-	3	-	-	-	-	-

CO-PSO Mapping Matrix for Course MCA/CSE/3/DSC/502

COs	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	1	3	1	-
CO2	3	1	3	2	-
CO3	3	1	3	3	-
CO4	3	1	3	3	-
CO5	3	1	3	3	-
Average	3	1	3	2.6	-

Course Content
MCA/CSE/3/DSC/502: Machine Learning

Unit – I	Basics of Machine Learning: Introduction to artificial Intelligence and machine learning, types of machine learning and its comparisons, applications of machine learning, issues in machine learning.
Unit – II	Preparing to Model: Introduction, machine learning activities, types of data in machine learning, exploring structure of data, data pre-processing (dimension reduction and feature subset selection), model selection.
Unit – III	Supervised Learning: Introduction, classification (introduction, classification model, learning steps, common classification algorithm: kNN, decision tree, naïve Bayes, SVM, logistic regression. Regression method, linear regression.
Unit – IV	Unsupervised Learning: Introduction and its applications, techniques in unsupervised learning. Clustering algorithms: K-means, hierarchical, DBSCAN. Neural Network: Introduction, architecture of artificial neural network.

Text/Reference Books

Text Books	1. Tom M. Mitchell, Machine Learning, McGraw-Hill Education (India) Private Limited. 2. EthemAlpaydin, Introduction to Machine Learning (Adaptive Computation and Machine Learning), The MIT Press.
Reference Books	1. Stephen Marsland, Machine Learning: An Algorithmic Perspective, CRC Press. 2. Peter Flach, Machine Learning: The Art and Science of Algorithms that Make Sense of Data, Cambridge University Press. 3. Peter Harrington, Machine Learning in Action, Manning 4. ShaiShalevShwartz and Shai Ben David, Understanding Machine Learning From Theory to Algorithms, Cambridge University Press

MCA/CSE/3/DSC/503(i): Network Security								
Course Type	Course Credit	Contact Hours/ Week	Delivery Mode	Maximum Marks			Exam Duration	Assessment Methods
				External	Internal			
DSE Theory	04	04	Lecture/ Tutorial	70	30		3 Hours	TEE/MTE/ Assignment/ Attendance
					20	5 5		

Instructions for Mid-Term examination: The mid-term examination shall cover the first two units of the course content. The question paper will be set by the internal teacher.

Instructions to paper setter for term-end examination: The term-end examination shall cover the whole content of the course. The total number of questions shall be nine. Question number one will be compulsory and will be consisting of short/objective-type questions from the complete syllabus. In addition to the compulsory first question, there shall be four units in the question paper each consisting of two questions. The student will attempt one question from each unit in addition to the compulsory question. All questions will carry equal marks.

Course Outcomes	At the end of this course, the student will be able to :
CO1	define: computer security, security standards, cipher model, encryption techniques, data encryption standards, public-key cryptography, security at transport layer, SSL/TSL attacks, wireless security and IEEE 802.11i.
CO2	explain: computer concepts related withthe security, symmetric techniques, advanced encryption standard, RSA, concept of digital signature, security protocols, wireless security measures and email security.
CO3	illustrate: the different features related with computer security, encryption and symmetric techniques, data encryption standards, security at transport layer and wireless LAN security.
CO4	classify: the information about security, its architecture, types of attacks, security mechanism, encryption standards, protocols at transport layer and wireless LAN security.
CO5	evaluate:the security trends, security mechanisms, cipher model, RSA, Diffie-Hellman key exchange, transport layer security, SSL/TSL attacks, wireless security and IP security.

CO-PEO Mapping Matrix for Course MCA/CSE/3/DSC/503(i)

COs	PEO1	PEO2	PEO3	PEO4	PEO5
CO1	1	3	1	3	3
CO2	2	3	1	3	3
CO3	3	3	1	3	3
CO4	3	3	1	3	3
CO5	3	3	1	3	3
Average	2.4	3	1	3	3

CO-PO Mapping Matrix for Course MCA/CSE/3/DSC/503(i)

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	3	1	1	1	-	3	1	-	2	-	-
CO2	2	1	1	3	1	-	3	2	-	2	-	-
CO3	3	1	1	3	3	-	3	3	-	2	-	-
CO4	2	1	1	3	1	-	3	3	-	2	-	-
CO5	2	1	3	1	3	-	3	3	-	2	-	-
Average	2	1.4	1.4	2.2	1.8	-	3	2.4	-	2	-	-

CO-PSO Mapping Matrix for Course MCA/CSE/3/DSC/503(i)

COs	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	2	3	1	-
CO2	3	2	3	2	-
CO3	3	2	3	3	-
CO4	3	2	3	3	-
CO5	3	2	3	3	-
Average	3	2	3	2.4	-

Course Content
MCA/CSE/3/DSC/503(i): Network Security

Unit – I	Computer Security Concepts – Introduction, security, security trends, components of information system, OSI security architecture, security attacks, goals for security, security mechanisms, security standards. Cipher model, cryptanalysis and brute-force attack, classical encryption techniques – symmetric techniques – substitution techniques, transposition techniques, rotor machines, steganography.
Unit – II	Traditional block cipher; data encryption standard – encryption and decryption, advanced encryption standard – structure and expansion functions. Public-key cryptography – principles, applications and requirements; RSA, Diffie-Hellman key exchange. Concept of digital signature.
Unit – III	Security at Transport Layer, web security considerations, Transport Layer Security, TLS record protocol, change cipher spec protocol, alert protocol, handshake protocol, heart-beat protocol; SSL/TSL attacks; HTTPS; Secure shell; user authentication protocol, connection protocol.
Unit – IV	Wireless Security, wireless security measures, mobile device security - threats and strategy. Wireless LAN security, IEEE 802.11i - services, operation and phases. Email security, S/MIME, PGP, overview of IP security.
Text/Reference Books	
Text Books	1. William Stallings, Cryptography And Network Security Principles And

	Practice, Pearson Education 2. Forouzan, Mukhopadhyay, Cryptography & Network Security, McGraw Hill
Reference Books	1. AtulKahate, Cryptography and Network Security, TMH 2. Godbole, Information Systems Security, Wiley India Mark Stamp, Information Security Principles and Practice, Willy India

MCA/CSE/3/DSC/503(ii): Wireless Network								
Course Type	Course Credit	Contact Hours/ Week	Delivery Mode	Maximum Marks			Exam Duration	Assessment Methods
				External	Internal			
DSE Theory	04	04	Lecture/ Tutorial	70	30		3 Hours	TEE/MTE/ Assignment/ Attendance
					20	5 5		

Instructions for Mid-Term examination: The mid-term examination shall cover the first two units of the course content. The question paper will be set by the internal teacher.

Instructions to paper setter for term-end examination: The term-end examination shall cover the whole content of the course. The total number of questions shall be nine. Question number one will be compulsory and will be consisting of short/objective-type questions from the complete syllabus. In addition to the compulsory first question, there shall be four units in the question paper each consisting of two questions. The student will attempt one question from each unit in addition to the compulsory question. All questions will carry equal marks.

Course Objectives: To study fundamental concepts in wireless network, various LAN standards, IP and IPV6 Layer, Transmission protocols and WAN standards.

Course Outcomes	At the end of this course, the student will be able to :
CO1	define: wireless LAN, architecture, mobile network layer, mobile transport layer and wireless wide area network.
CO2	describe: WLAN technologies, IEEE 802.11 types , IEEE 802.16, Bluetooth, IPV6, mobile ad-hoc network, TCP enhancements for wireless network, UTMS, 3G-MSC, 3G-SGSN, 3G-GGSN, applications of 4G, features and challenges of 5G.
CO3	illustrate: wireless LAN, system architecture, physical layer, Mac layer, Bluetooth architecture, mobile IP, mobile ad-hoc network, mobile transport layer, TCP improvements, wireless wide area network, HSDPA, features and challenges of 4G, 5G.
CO4	analyze: WLAN technologies, 802.11b, 802.11a, IEEE 802.16, IPV6, Routing, TCP enhancements, TCP improvements, UMTS core network architecture, firewall, 3G, 4G and 5G networks.
CO5	compare: different Wireless LAN technologies, mobile network layer, mobile transport layer, Mobile IP, mobile ad-hoc networks, protocols, TCP improvements and wireless WAN types.

CO-PEO Mapping Matrix for Course MCA/CSE/3/DSC/503(ii)

COs	PEO1	PEO2	PEO3	PEO4	PEO5
CO1	1	3	1	3	3
CO2	2	3	1	3	3
CO3	3	3	1	3	3
CO4	3	3	1	3	3
CO5	3	3	1	3	3
Average	2.4	3	1	3	3

CO-PO Mapping Matrix for Course MCA/CSE/3/DSC/503(ii)

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	3	1	1	1	-	3	1	-	2	-	-
CO2	2	1	1	3	1	-	3	2	-	2	-	-
CO3	3	1	1	3	3	-	3	3	-	2	-	-
CO4	2	1	1	3	1	-	3	3	-	2	-	-
CO5	2	1	3	1	3	-	3	3	-	2	-	-
Average	2	1.4	1.4	2.2	1.8	-	3	2.4	-	2	-	-

CO-PSO Mapping Matrix for Course MCA/CSE/3/DSC/503(ii)

COs	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	2	3	1	-
CO2	3	2	3	2	-
CO3	3	2	3	3	-
CO4	3	2	3	3	-
CO5	3	2	3	3	-
Average	3	2	3	2.4	-

Course Content
MCA/CSE/3/DSC/503(ii): Wireless Network

Unit – I	Wireless LAN: Introduction-WLAN technologies: Infrared, UHF narrowband, spread spectrum -IEEE802.11: System architecture, protocol architecture, physical layer, MAC layer, 802.11b, 802.11a – Hiper LAN: WATM, BRAN, HiperLAN2 – Bluetooth: Architecture, Radio Layer, Baseband layer, Link manager Protocol, security - IEEE802.16-WIMAX: Physical layer, MAC, Spectrum allocation for WIMAX.
Unit – II	Mobile Network Layer: Introduction - Mobile IP: IP packet delivery, Agent discovery, tunneling and encapsulation, IPV6- Network layer in the internet- Mobile IP session initiation protocol - mobile ad-hoc network: Routing, Destination Sequence distance vector, Dynamic source routing
Unit – III	Mobile Transport Layer :TCP enhancements for wireless protocols - Traditional TCP: Congestion control, fast retransmit/fast recovery, Implications of mobility - Classical TCP improvements: Indirect TCP, Snooping TCP, Mobile TCP, Time out freezing, Selective retransmission, Transaction oriented TCP - TCP over 3G wireless networks.
Unit – IV	Wireless Wide Area Network: Overview of UTMS Terrestrial Radio access network-UMTS Core network Architecture: 3G-MSC, 3G-SGSN, 3G-GGSN, SMS-GMSC/SMS-IWMSC, Firewall, DNS/DHCP-High speed Downlink packet access (HSDPA)- LTE network architecture and protocol, features and challenges of 4G, Applications of 4G, Introduction to 5G vision,5G features and challenges.
Text/Reference Books	
Text Books	1. Jochen Schiller, ”Mobile Communications”, 2e, Pearson Education

	2012. 2. Vijay Garg, “Wireless Communications and Networking”, 1e, Elsevier, 2007
Reference Books	1. William Stallings, Wireless Communications and Networks, Pearson/Prentice Hall of India. 2. Erik Dahlman, Stefan Parkvall, Johan Skold and Per Beming, "3G Evolution HSPA and LTE for Mobile Broadband”, 2e, Academic Press, 2008. 3. Anurag Kumar, D. Manjunath, Joy Kuri, “Wireless Networking”, 1e, Elsevier 2011. 4. Simon Haykin, Michael Moher, David Koilpillai, “Modern Wireless Communications”, 1e, Pearson Education, 2013.

MCA/CSE/3/DSC/504(i): Theory of Computation								
Course Type	Course Credit	Contact Hours/ Week	Delivery Mode	Maximum Marks			Exam Duration	Assessment Methods
				External	Internal			
DSE Theory	04	04	Lecture/ Tutorial	70	30		3 Hours	TEE/MTE/ Assignment/ Attendance
					20	5 5		

Instructions for Mid-Term examination: The mid-term examination shall cover the first two units of the course content. The question paper will be set by the internal teacher.

Instructions to paper setter for term-end examination: The term-end examination shall cover the whole content of the course. The total number of questions shall be nine. Question number one will be compulsory and will be consisting of short/objective-type questions from the complete syllabus. In addition to the compulsory first question, there shall be four units in the question paper each consisting of two questions. The student will attempt one question from each unit in addition to the compulsory question. All questions will carry equal marks.

Course Objectives: to understand fundamental concepts of finite automata, regular grammar, mealy and Moore machine, context free language and grammar their properties, context free language and grammar.

Course Outcomes	By the end of this course, the student will be able to
CO1	define: fundamental concept of finite automata, pushdown automata, Linear bound automata, Turing machine,context free language &grammar, context sensitive language & grammar.
CO2	discuss: concept of context free language and grammar, pushdown automata, equivalence of deterministic and non-deterministic finite automata, ambiguity in grammars and languages, concept of Turing machine.
CO3	use: Pumping lemma to check language is not regular, pushdown automata to check context free language ,Turing machine to solve basic calculation.
CO4	classify: finite automata, regular grammar, context free grammar, context free language, context sensitive grammar, normal forms, pushdown automata, Turing machine.
CO5	Compare and contrast: NFA & DFA, mealy and Moore machine ,CNF&GNF, languages, grammars, different automata, Turing machine.

CO-PEO Mapping Matrix for Course MCA/CSE/3/DSC/504(i)

COs	PEO1	PEO2	PEO3	PEO4	PEO5
CO1	1	3	1	3	3
CO2	2	3	1	3	3
CO3	3	3	1	3	3
CO4	3	3	1	3	3
CO5	3	3	1	3	3
Average	2.4	3	1	3	3

CO-PO Mapping Matrix for Course MCA/CSE/3/DSC/504(i)

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	3	1	1	1	-	3	-	-	-	-	-
CO2	2	1	1	3	1	-	3	-	-	-	-	-

CO3	3	1	1	3	3	-	3	-	-	-	-	-
CO4	2	1	1	3	1	-	3	-	-	-	-	-
CO5	2	1	3	1	3	-	3	-	-	-	-	-
Average	2	1.4	1.4	2.2	1.8	-	3	-	-	-	-	-

CO-PSO Mapping Matrix for Course MCA/CSE/3/DSC/504(i)

COs	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	1	3	1	-
CO2	3	1	3	2	-
CO3	3	1	3	3	-
CO4	3	1	3	3	-
CO5	3	1	3	3	-
Average	3	1	3	2.6	-

Course Content
MCA/CSE/3/DSC/504(i): Theory of Computation

Unit - I	Finite Automata: Deterministic and non-deterministic finite automata, applications of finite automata, equivalence of deterministic and non-deterministic finite automata, state minimization of DFA, Kleen's characterization theory for sets accepted by finite automata, regular grammar, mealy and Moore machine.
Unit - II	Context Free Language and Grammar: Context free grammar, parse tree, application of context free grammars, ambiguity in grammars and languages. Pushdown Automata: Deterministic pushdown automata and Non-deterministic pushdown automata, language of pushdown automata, equivalence of PDA's and CFG's.
Unit - III	Properties of Context-Free Languages: Normal form of context free grammars, pumping lemma for context-free grammars, closure properties of context-free languages, decision properties of context free languages. Context Sensitive Language and Grammar: Introduction, closure properties of CSL.
Unit - IV	Turing machine: Construction of Turing machine, programming techniques for Turing machine, extensions to the basic Turing machine (multi-tape Turing machine, equivalence of one-tape and multi-tape Turing machine, Non Deterministic Turing machine), restricted Turing machine (multi-stack machines, counter machines).

Text/Reference Books

Text Books	1. John C. Martin, Introduction to Languages and the Theory of Computation, McGraw Hill. 2. Peter Linz, An introduction to formal language & automata, Jones & Bartlett publications.
Reference Books	1. Hopcroft J. E. & Ullman J. D, Formal languages and their relation to Automata, Pearson Education. 2. Lewis, H.R. &Papadimitrious, C. H., Elements of the theory of computation, PHI Learning. 3. Michael Sipser, Introduction to the Theory of Computation, Cengage Learning.

MCA/CSE/3/DSC/504(ii): Compiler Construction								
Course Type	Course Credit	Contact Hours/Week	Delivery Mode	Maximum Marks			Exam Duration	Assessment Methods
				External	Internal			
DSE Theory	04	04	Lecture/ Tutorial	70	30		3 Hours	TEE/MTE/ Assignment/ Attendance
					20	5 5		

Instructions for Mid-Term examination: The mid-term examination shall cover the first two units of the course content. The question paper will be set by the internal teacher.

Instructions to paper setter for term-end examination: The term-end examination shall cover the whole content of the course. The total number of questions shall be nine. Question number one will be compulsory and will be consisting of short/objective-type questions from the complete syllabus. In addition to the compulsory first question, there shall be four units in the question paper each consisting of two questions. The student will attempt one question from each unit in addition to the compulsory question. All questions will carry equal marks.

Course Objectives: To study fundamental concepts of compiler, interpreters, assemblers, lexical analysis, syntax analysis, intermediate code generation and code optimization techniques used in compiler design.

Course Outcomes	At the end of this course, the student will be able to:
CO1	define: syntax analysis, grammar, intermediate code, code optimization, code generation ,syntax directed translation.
CO2	explain: basics of compilers, interpreters, assemblers, compiler construction tools, process of lexical analysis, syntax analysis, types of grammar, code optimization and code generation.
CO3	illustrate: various analysis-synthesis model of translation, lexical analysis, syntax analysis, optimization of basic blocks, loops optimization, peephole optimization and blocks code generation from directed acyclic graphs.
CO4	analyze: phase of compilation, finite state automata recognition of regular expressions, parser generator, optimization technique of code and management of code.
CO5	contrast: compiler, interpreters and assemblers, finite state automata recognition, process of syntax analysis, code improving transformations and syntax directed translation scheme.

CO-PEO Mapping Matrix for Course MCA/CSE/3/DSC/504(ii)

COs	PEO1	PEO2	PEO3	PEO4	PEO5
CO1	1	3	1	3	3
CO2	2	3	1	3	3
CO3	3	3	1	3	3
CO4	3	3	1	3	3
CO5	3	3	1	3	3
Average	2.4	3	1	3	3

CO-PO Mapping Matrix for Course MCA/CSE/3/DSC/504(ii)

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	3	1	1	1	-	3	-	-	-	-	-

CO2	2	1	1	3	1	-	3	-	-	-	-	-
CO3	3	1	1	3	3	-	3	-	-	-	-	-
CO4	2	1	1	3	1	-	3	-	-	-	-	-
CO5	2	1	3	1	3	-	3	-	-	-	-	-
Average	2	1.4	1.4	2.2	1.8	-	3	-	-	-	-	-

CO-PSO Mapping Matrix for Course MCA/CSE/3/DSC/504(ii)

COs	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	1	3	1	-
CO2	3	1	3	2	-
CO3	3	1	3	3	-
CO4	3	1	3	3	-
CO5	3	1	3	3	-
Average	3	1	3	2.6	-

Course Content
MCA/CSE/3/DSC/504(ii): Compiler Construction

Unit - I	Introduction to Compilers: Basics of compilers, interpreters, assemblers, phases of compilation, analysis-synthesis model of translation, compiler construction tools. Lexical Analysis: Process of lexical analysis, finite state automata recognition of regular expressions.
Unit – II	Syntax Analysis: Process of syntax analysis, types of grammars, top-down and bottom-up parsing techniques, Parser generator.
Unit – III	Intermediate Code Generation: Intermediate languages, generating intermediate code for assignment statement, Boolean expression, and case statement. Code Optimization: Introduction to code optimization, potential cases of code optimization, optimization of basic blocks, loops optimization, code improving transformations.
Unit – IV	Code Generation: Basics, dynamic storage management, translating basic blocks, a simple code generator, peephole optimization, directed acyclic graphs and basic blocks code generation from directed acyclic graphs. Syntax Directed Translation: Overview of syntax directed translation scheme.

Text/Reference Books

Text Books	1. Alfred V Aho, Principles of Compiler Design, Narosa Publishing House. 2. Aho, Sethi, & Ullman, Compilers Principles, Techniques and Tools, Pearson Education.
Reference Books	1. Dhamdhere D.M, System programming and operating system, McGraw Hill. 2. Beck L. Leland, System Software, Pearson Education. 3. Fischer, Crafting a Compiler in C, Pearson Education. 4. Jean Paul Tremblay and Sorenson, The Theory and Practice of Compiler Writing, McGraw Hill.

MCA/CSE/3/DSC/505: Python Programming							
Course Type	Course Credit	Contact Hours/ Week	Delivery Mode	Maximum Marks		Exam Duration	Assessment Methods
				External	Internal		
DSC Theory + Practical	04	06 (2T+4P)	Lecture/ Practical	30 Theory	20 (10 / 5 / 5)	3 Hours	TEE/MTE/ Assignment/ Attendance
				50 Practical	-	3 Hours	TEE (Experiment, Practical file, Viva)

Instructions for Mid-Term examination: The mid-term examination shall cover the first two units of the course content. The question paper will be set by the internal teacher.

Instructions to paper setter for term-end theory examination: The term-end examination of theory part the total number of questions shall be NINE. Question number one will be compulsory and will be consisting of SIX short/objective-type questions from the complete syllabus. In addition to the compulsory question, there shall be EIGHT questions (two questions from each unit). The student will attempt one question from each unit in addition to the compulsory question. All questions will be of SIX marks each.

Course Objectives: The objectives of this course is to get the students familiar with basic concepts of Python programming, decision making and functions, file handling and object oriented programming concepts, database programming and to implement machine learning concepts.

Course Outcomes	At the end of this course, the student will possess an understanding of:
CO1	define:installations,working,structures,controlstatements,operators,lists ,object oriented programming concepts,python libraries.
CO2	explain: conditional & control statements ,strings, OOPs ,file handling concepts,librariesand packages of python programming.
CO3	use: various python libraries such as numpy, matplotlib ,pandas . apply: python programming constructs to solve real world problems.
CO4	categorize:datatypes,dictionaries,conditional&controlstatements,functions,python libraries.
CO5	compare:datatypes,dictionaries,conditional&controlstatements,functions,python libraries.
CO6	design:basic and advanced applications in python.

CO-PEO Mapping Matrix for Course MCA/CSE/3/DSC/505

Cos	PEO1	PEO2	PEO3	PEO4	PEO5
CO1	1	3	3	3	3
CO2	2	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
CO6	3	3	3	3	3
Average	2.5	3	3	3	3

CO-PO Mapping Matrix for Course MCA/CSE/3/DSC/505

COs	PO1	PO2	PO3	PO4	PO5	PO	PO7	PO8	PO9	PO1	PO1	PO12
CO1	1	3	1	1	1	-	3	1	-	-	-	-
CO2	2	1	1	3	1	-	3	2	-	-	-	-

CO3	3	1	1	3	3	-	3	3	-	-	-	-
CO4	3	3	1	3	1	-	3	3	-	-	-	-
CO5	3	1	1	3	3	-	3	3	-	-	-	-
CO6	3	3	3	3	3	-	3	3	-	-	-	-
Average	2.5	2	1.3	2.6	2	-	3	2.5	-	-	-	-

CO-PSO Mapping Matrix for Course MCA/CSE/3/DSC/505

COs	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	1	1	1	-
CO2	3	2	2	2	-
CO3	3	3	3	3	-
CO4	3	3	3	3	-
CO5	3	3	3	3	-
CO6	3	3	3	3	-
Average	3	2.5	2.5	2.5	-

Course Content
MCA/CSE/3/DSC/505: Python Programming

Unit – I	Introduction and Features of Python, Tokens, Identifiers, Reserved keywords, Literals, Variables, Python basic Operators, Data Types in Python, Casting in Python, Scope of a Variable. **Decision Control Statements**: Selection Control, Loop Control, Continue, Break ,Pass statement.
Unit – II	**Functions and Modules**: Creating Module and function, Built-in Modules (Math, random, Statistics) and user defined modules. Packages: Package Types, Importing Package, Viewing Package Lambda Function in python.
Unit – III	**Object Oriented Programming**: Concept of Class & Object, Constructor, Class Attributes and Destructors, Inheritance, Method Overloading, Overriding, Data Hiding, Exception Handling. **File Handling**: Creating, Opening, Closing, Writing & Reading File Content, Deleting a File, dump module.
Unit – IV	**Python NumPy**: Array Slicing, Array Indexing, Data Types, Array Shape & Reshape, Array Join, Array Split, Random. **Python Pandas**: Data Frames, Read CSV, Analyzing Data and Cleaning Data. **Python Matplotlib**: Line, Grid, Scatter, Bars, Histograms, Scatter Plot and Pie Charts.
Text/Reference Books	
Text Books	1. Chun, J Wesley, Core Python Programming, 2e, Pearson, 2007. 2. E. Balagurusamy, Introduction to Computing and Problem Solving Using Python, McGraw Hill Education, 2016.
Reference Books	1. Barry and Paul, Head First Python, 2e, O Reilly, 2010. 2. Lutz and Mark, Learning Python, 4e, O Reilly, 2009

MCA/CSE/3/SEC/501(i): Android Development							
Course Type	Course Credit	Contact Hours/ Week	Delivery Mode	Maximum Marks		Exam Duration	Assessment Methods
				External	Internal		
SEC Theory + Practical	04	06 (2T+4P)	Lecture/ Practical	30 Theory	20 (10 / 5 / 5)	3 Hours	TEE/MTE/ Assignment/ Attendance
				50 Practical	-	3 Hours	TEE (Experiment, Practical file, Viva)

Instructions for Mid-Term examination: The mid-term examination shall cover the first two units of the course content. The question paper will be set by the internal teacher.

Instructions to paper setter for term-end theory examination: The term-end examination of theory part the total number of questions shall be NINE. Question number one will be compulsory and will be consisting of SIX short/objective-type questions from the complete syllabus. In addition to the compulsory question, there shall be EIGHT questions (two questions from each unit). The student will attempt one question from each unit in addition to the compulsory question. All questions will be of SIX marks each.

Course Objectives: The objective of this course is to provide in-depth coverage of various concepts of android application development. This course will help the students in learning to develop and publish their own android applications.

Course Outcomes	At the end of this course, the student will able to:
CO1	define: android, features, development environment, architecture, software development platform and the framework related to android applications.
CO2	explain: versions of android, architecture, software development platform, JAVA SE, the Dalvik virtual machine and various android services.
CO3	demonstrate: android SDK, IDE, AVDs, project configuration settings, directory structure of android project, activities and services of android.
CO4	illustrate: android versions, features, system requirements, applications, directory structures, resource folders, android services, screen sizes and android framework.
CO5	compare and contrast: android versions with their functions, types of android applications, development platforms, layout of android applications, activities associated with android and user interfaces.
CO6	create: android applications using different types of resources and development platforms.

CO-PEO Mapping Matrix for Course MCA/CSE/3/SEC/501(i)

Cos	PEO1	PEO2	PEO3	PEO4	PEO5
CO1	1	3	1	3	3
CO2	2	3	1	3	3
CO3	3	3	1	3	3
CO4	3	3	1	3	3
CO5	3	3	1	3	3
CO6	3	3	1	3	3
Average	2.5	3	1	3	3

CO-PO Mapping Matrix for Course MCA/CSE/3/SEC/501(i)

COs	PO1	PO2	PO3	PO4	PO5	PO	PO7	PO8	PO9	PO1	PO1	PO12
CO1	1	1	1	1	1	-	3	1	-	-	-	-
CO2	2	2	1	3	1	-	3	2	-	-	-	-
CO3	3	3	1	3	3	-	3	3	-	-	-	-
CO4	2	3	1	3	3	-	3	3	-	-	-	-
CO5	2	3	3	1	3	-	3	3	-	-	-	-
CO6	2	3	3	1	3	-	3	3	-	-	-	-
Average	2	2.5	1.66	2	2.33	-	3	2.5	-	-	-	-

CO-PSO Mapping Matrix for Course MCA/CSE/3/SEC/501(i)

COs	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	1	-
CO2	3	3	3	2	-
CO3	3	3	3	3	-
CO4	3	3	3	3	-
CO5	3	3	3	3	-
CO6	3	3	3	3	-
Average	3	3	3	2.5	-

Course Content
MCA/CSE/3/SEC/501(i):Android Development

Unit – I	Introduction: Android, Android versions and its feature, The Android market application store. Android Development Environment: system requirements, Android SDK, installing Java, and ADT bundle, eclipse integrated development environment (IDE), creating Android Virtual Devices (AVDs).
Unit – II	Android Architecture Overview, creating a new Android project, defining the project name and SDK settings, project configuration settings, configuring the launcher icon, creating an activity, running the application in the AVD, stopping a running application, modifying the example application, reviewing the layout and resource files.
Unit – III	Android software development platform, understanding Java SE and the Dalvik Virtual Machine, The directory structure of an Android project, common default resources folders, screen sizes, launching your application.
Unit – IV	Android Framework overview, Android application components, Android activities: defining the UI, Android services: processing in the background, Android Manifest XML: declaring your components, understanding Android views, view groups and layouts, Graphical User Interface screen with views, displaying pictures, files, content providers, and databases.

Text/Reference Books	
Text Books	1. Burton Michael, Android App Development for Dummies, Wiley, 2015. 2. Wei-Meng Lee, Beginning Android 4 Application Development, Wiley India (Wrox), 2013. 3. John Horton, Android Programming for Beginners, Packet Publishing, 2015.
Reference Books	1. Ian F. Darwin, Android CookbookProblems and Solutions for Android Developers**,** 2e, O′Reilly,2017.

MCA/CSE/3/SEC/501(ii): Linux and Shell Scripts

Course Type	Course Credit	Contact Hours/ Week	Delivery Mode	Maximum Marks		Exam Duration	Assessment Methods
				External	Internal		
SEC Theory + Practical	04	06 (2T+4P)	Lecture/ Practical	30 Theory	20 (10 + 5 + 5)	3 Hours	TEE/MTE/ Assignment/ Attendance
				50 Practical	-	3 Hours	TEE (Experiment, Practical file, Viva)

Instructions for Mid-Term examination: The mid-term examination shall cover the first two units of the course content. The question paper will be set by the internal teacher.

Instructions to paper setter for term-end theory examination: The term-end examination of theory part the total number of questions shall be NINE. Question number one will be compulsory and will be consisting of SIX short/objective-type questions from the complete syllabus. In addition to the compulsory question, there shall be EIGHT questions (two questions from each unit). The student will attempt one question from each unit in addition to the compulsory question. All questions will be of SIX marks each.

Course Objectives: The objectives of this course are to provide the in-depth coverage of various concepts of Linux. Linux administration is an essential course for the students

Course Outcomes	At the end of this course, the student will be able to:
CO1	define and outline: basic requirements, features, essential commands of Linux, vi editors, processes scheduling, communication commands, simple (grep, sed) and advanced filters (awk, perl).
CO2	explain: the organization, file system, Shells, file permissions, priorities, processes, communication commands in Linux and operations performed by the simple as well as advanced filters.
CO3	perform: operations in Linux, modes of operations in vi, mailing communication, regular expressions along with the simple and advanced filters.
CO4	categorize: the Linux commands, processes, priorities, communication commands, simple and advanced filters using regular expressions.
CO5	compare: shells, file permissions, processes, command with different options, simple filters like grep, sed and advanced filters like awk, perl.
CO6	create: Linux shell scripts showing the use of commands, regular expressions and filters.

CO-PEO Mapping Matrix for Course MCA/CSE/3/SEC/501(ii)

Cos	PEO1	PEO2	PEO3	PEO4	PEO5
CO1	1	3	1	3	3
CO2	2	3	1	3	3
CO3	3	3	1	3	3

CO4	3	3	1	3	3
CO5	3	3	1	3	3
CO6	3	3	1	3	3
Average	3	3	1	3	3

CO-PO Mapping Matrix for Course MCA/CSE/3/SEC/501(ii)

COs	PO1	PO2	PO3	PO4	PO5	PO	PO7	PO8	PO9	PO1	PO1	PO12
CO1	1	1	1	1	1	-	3	1	-	-	-	-
CO2	2	2	1	3	1	-	3	2	-	-	-	-
CO3	3	3	1	3	3	-	3	3	-	-	-	-
CO4	2	3	1	3	3	-	3	3	-	-	-	-
CO5	2	3	3	1	3	-	3	3	-	-	-	-
CO6	2	3	3	1	3	-	3	3	-	-	-	-
Average	2	2.5	1.66	2	2.33	-	3	2.5	-	-	-	-

CO-PSO Mapping Matrix for Course MCA/CSE/3/SEC/501(ii)

COs	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	1	-
CO2	3	3	3	2	-
CO3	3	3	3	3	-
CO4	3	3	3	3	-
CO5	3	3	3	3	-
CO6	3	3	3	3	-
Average	3	3	3	2.5	-

Course Content
MCA/CSE/3/SEC/501(ii)Linux and Shell Scripts

Unit – I	Introduction, hardware requirements for Unix/Linux, salient features of Unix-multiuser capability, multitasking, communication, security, portability. Unix system organization, types of shells, Unix commands, the Unix file system, listing of files and directories, file permissions with chmod, disk related commands. Essential Unix/ Linux commands: cal, touch, file, file related commands, viewing files, taking printouts, file compression, the on-line Unix manual.
Unit – II	I/O redirection and piping, the vi editor, modes of operations in vi. processes in Unix/Linux: background processes, nohup command, killing a process, changing process priorities, scheduling of processes- the at command, the batch command, the crontab command. Communication: the write command, the wall command, motd command, mail-sending, handling incoming mail, customizing mail.
Unit - III	Simple Filters: the sample database, pr- paginating files, head, tail, cut, paste, sort, uniq, tr, displaying a word-count list. Filters using regular expressions: grep – searching for a pattern, basic regular expression, extended regular expression.

	Sed: the stream editor, line addressing, using multiple instruction (-E and –F), context addressing, text editing, substitution(s), basic regular expression revisited.
Unit – IV	Awk: an advanced filter, simple awk filtering, splitting into fields, variables and expressions, the comparison operators, number processing, variables, the –f option, the begin and end sections, built-in-variables, arrays, functions. Perl: the master manipulator- perl preliminaries, chop function, string handling functions, split, join, for each, lists and arrays, file handling, file tests, subroutines.
Text/Reference Books	
Text Books	1. Sumitabha Das, Your Unix – The Ultimate Guide, Tata McGraw Hill, 2008. 2. YaswantKanetkar, "Unix Shell Programming", BPB Publication, (2009).
Reference Books	1. Matthew Neil, Stones Richard, Beginning Linux Programming, Wiley India Pvt. Ltd. 2. Christopher Negus, Linux Bible, Wiley India Pvt. Ltd. 3. Richard Peterson, Linux – The Complete Reference, Tata McGraw Hill

MCA 1-Year Program
Semester II
Option 1

MCA/CSE/4/DSC/551:
MSc/ CSE/4/DSC/554: **Deep Learning**

Course Type	Course Credit	Contact Hours/ Week	Delivery Mode	Maximum Marks				Exam Duration	Assessment Methods
				External	Internal				
DSC Theory	04	04	Lecture/ Tutorial	70	30			3 Hours	TEE/MTE/ Assignment/ Attendance
					20	5	5		

Instructions for Mid-Term examination: The mid-term examination shall cover the first two units of the course content. The question paper will be set by the internal teacher.

Instructions to paper setter for term-end examination: The term-end examination shall cover the whole content of the course. The total number of questions shall be nine. Question number one will be compulsory and will be consisting of short/objective-type questions from the complete syllabus. In addition to the compulsory first question, there shall be four units in the question paper each consisting of two questions. The student will attempt one question from each unit in addition to the compulsory question. All questions will carry equal marks.

Course Outcomes	At the end of this course, the student will be able to :
CO1	Define: the terms of machine learning, deep learning, regression, classification, neurons, CNN and RNN
CO2	explain: architecture of ANN and deep learning, variants of the basic convolution function, Long short –term memory.
CO3	Appy: classification, regression, clustering techniques, Feed forward multilayer neural network, CNN, RNN according to their problems.
CO4	Classify: regression, classification, Convolutional neural network, RNN
CO5	compare: single layer and multi layer perceptron, CNN and RNN

CO-PEO Mapping Matrix for Course MCA/CSE/4/DSC/551 & MSc/ CSE/4/DSC/554

COs	PEO1	PEO2	PEO3	PEO4	PEO5
CO1	1	3	1	3	3
CO2	2	3	1	3	3
CO3	3	3	1	3	3
CO4	3	3	1	3	3
CO5	3	3	1	3	3
Average	2.4	3	1	3	3

CO-PO Mapping Matrix for Course MCA/CSE/4/DSC/551 & MSc/ CSE/4/DSC/554

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	3	1	1	1	-	3	-	-	-	-	-
CO2	2	1	1	3	1	-	3	-	-	-	-	-
CO3	3	1	1	3	3	-	3	-	-	-	-	-
CO4	2	1	1	3	1	-	3	-	-	-	-	-
CO5	2	1	3	1	3	-	3	-	-	-	-	-
Average	2	1.4	1.4	2.2	1.8	-	3	-	-	-	-	-

CO-PSO Mapping Matrix for Course MCA/CSE/4/DSC/551 & MSc/ CSE/4/DSC/554					
COs	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	1	3	1	-
CO2	3	1	3	2	-
CO3	3	1	3	3	-
CO4	3	1	3	3	-
CO5	3	1	3	3	-
Average	3	1	3	2.6	-

Course Content

MCA/CSE/4/DSC/551:
MSc/ CSE/4/DSC/554: **Deep Learning**

Unit – I	**Introduction:** Introduction to machine learning, deep learning and AI, historical trendsin deeplearning, architectureofdeeplearning, significance of deep learning, application of deep learning, challenges of deep learning. **Neuralnetwork**:Introduction,architecture,differencebetweenBiological Neuron Network and Artificial Neuron Network.
Unit – II	**Foundation of deep learning:**Vector, scalars, matrix, statistics, probability.Regression,classification,underfitting, over fitting,gradientdescent, logistic regression, confusion matrix. activation functionsof Neural Network (liner, sigmoid, tanh, softmax).
Unit – III	**Fundamental of deep learning:**Common architectural principles of deep learning,single-layerand multi-layer perceptron, cross-entropylossfunctions for neural networks, matrix representation of neural nets. **Buildingblockofdeepnetwork**:Feedforwardmultilayerneuralnetwork, RBMs, autoencoders.
Unit – IV	**Convolutional neural networks:** Deep learning and neural networks perceptrons,convolutional networks,variantsof the basicconvolutionfunction, efficient convolution algorithms. **Recurrent neural networks:** Bidirectional RNNs, deep recurrent networks,recursiveneuralnetworks,the long short–termmemoryandothergatedRNNs.
Text/Reference Books	
Text Books	1.DavidFoster, GenerativeDeepLearning, O'Reilly, 2019. 2.Goodfellow,Y. Bengio,A.Courville,Deep Learning,MITPress,2016. 3.Patterson,JoshandAdamGibson.Deeplearning:Apractitioner's approach. " O'Reilly Media, Inc.", 2017. 4.Charu,C.Aggarwal.Neuralnetworksanddeeplearning:atextbook. 2018.
Reference Books	1. Buduma,Nithin,NikhilBudumaandJoePapa.Fundamentalsofdeep learning. " O'Reilly Media, Inc.", 2022. 2. Weidman,Seth.Deep learning fromscratch:buildingwithpythonfrom first principles. O'Reilly Media, 2019

	3. IanGoodfellow,YoshuaBengioandAaronCourville.Deeplearning,The MIT Press, 2016.

MCA/CSE/4/DSC/552: IoT and Cloud Computing

Course Type	Course Credit	Contact Hours/Week	Delivery Mode	Maximum Marks				Exam Duration	Assessment Methods
				External	Internal				
DSC Theory	04	04	Lecture/ tutorial	70	30			3 Hours	TEE/MTE/ Assignment/ Attendance
					20	5	5		

Instructions for Mid-Term examination: The mid-term examination shall cover the first two units of the course content. The question paper will be set by the internal teacher.

Instructions to paper setter for term-end examination: The term-end examination shall cover the whole content of the course. The total number of questions shall be nine. Question number one will be compulsory and will be consisting of short/objective-type questions from the complete syllabus. In addition to the compulsory first question, there shall be four units in the question paper each consisting of two questions. The student will attempt one question from each unit in addition to the compulsory question. All questions will carry equal marks.

Course Objectives: To study the fundamental concepts of cloud computing, its enabling technologies, cloud service models and security concerns, to learn core issues of Internet of Things, IOT communication protocols and security concerns.

Course Outcomes	At the end of this course, the student will be able to:
CO1	list/defineIoT: framework, architecture, design, communication challenges, applications, principles of web connectivity. list/define cloud computing: evolution, characteristics, working, service models, virtualization, architecture, security challenges and risks.
CO2	understand and describe IoT: framework, architecture, design, communication challenges, applications, principles of web connectivity. understand and describe cloud computing: evolution, characteristics, working, service models, virtualization, architecture, security challenges and risks.
CO3	use cloud computing services in different fields of applications.
CO4	diagrammatise IOT: framework, architecture, physical and logical design. diagrammatise cloud computing: service models, service-oriented architecture.
CO5	grade/compareIoT: communication challenges, security issues, enabling technologies, application areas, and protocols. grade/compare cloud computing: service models. virtualization, and hypervisors.

CO-PEO Mapping Matrix for Course MCA/CSE/4/DSC/552

COs	PEO1	PEO2	PEO3	PEO4	PEO5
CO1	1	3	1	3	3
CO2	2	3	1	3	3
CO3	3	3	1	3	3
CO4	3	3	1	3	3
CO5	3	3	1	3	3
Average	2.4	3	1	3	3

CO-PO Mapping Matrix for Course MCA/CSE/4/DSC/552

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	3	1	1	1	-	3	1	-	2	-	-
CO2	2	1	1	3	1	-	3	2	-	2	-	-
CO3	3	1	1	3	3	-	3	3	-	2	-	-
CO4	2	1	1	3	1	-	3	3	-	2	-	-
CO5	2	1	3	1	3	-	3	3	-	2	-	-
Average	2	1.4	1.4	2.2	1.8	-	3	2.4	-	2	-	-

CO-PSO Mapping Matrix for Course MCA/CSE/4/DSC/552

COs	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	1	-
CO2	3	3	3	2	-
CO3	3	3	3	3	-
CO4	3	3	3	3	-
CO5	3	3	3	3	-
Average	3	3	3	2.4	-

Course Content
MCA/CSE/4/DSC/552: IoT and Cloud Computing

Unit - I	Internet of Things: what is the IOT and why is it important, IoT conceptual framework, IoT architectural view, technology behind IoT, sources of IoT, examples of IoT, M2M communication, layered architecture (3 & 5 Layered) of IoT, physical design and logical design, domain-specific IoTs, security issues of IoT.
Unit - II	Communication challenges related to IoT, enabling technologies for IoT. Applications of IoT: home automation, smart cities, social life and entertainment, health & fitness, smart environment and agriculture, supply chain and logistics, energy conservation. Design principles for web connectivity: web communication protocols for connected devices, message communication protocols for connected devices.
Unit - III	Introduction to cloud computing: what is a cloud, definition of cloud computing, evolution of cloud computing, characteristics of cloud computing, how cloud computing works, role of networks in cloud computing. Service models: IaaS, PaaS, SaaS, public, private and hybrid cloud.
Unit - IV	Introduction to virtualization, resource virtualization-server, storage, network, load balancing and virtualization. Hypervisors and its types, service oriented architecture (SOA), overview of security issues, challenges and risks of cloud.
Text/Reference Books	
Text Books	1. Anthony T. Velte, Toby J. Velte, Robert Elsenpeter, Cloud Computing a Practical Approach, Tata McGraw Hill, New Delhi, 2010 2. Robert Elsenpeter, Toby J. Velte, Anthony T. Velte, Cloud Computing: A

	Practical Approach, 1e, Tata McGraw Hill Education, 2011. 3. Judith Hurwitz, Robin Bloor, Marcia Kaufman, Fern Halper, Cloud Computing for Dummies, Wiley Publishing, 2010
Reference Books	1. RajkumarBuyya, James Broberg, AndrzejGoscinski, Cloud Computing-Principles and Paradigms, Wiley, 2011. 2. Raj Kamal, Internet of Things-Architectures and Design Principles, McGraw Hill Education, 2017

MCA/CSE/4/DSC/553(i): Data Science

Course Type	Course Credit	Contact Hours/Week	Delivery Mode	Maximum Marks				Exam Duration	Assessment Methods
				External	Internal				
DSE Theory	04	04	Lecture/Tutorial	70	30			3 Hours	TEE/MTE/ Assignment/ Attendance
					20	5	5		

Instructions for Mid-Term examination: The mid-term examination shall cover the first two units of the course content. The question paper will be set by the internal teacher.

Instructions to paper setter for term-end examination: The term-end examination shall cover the whole content of the course. The total number of questions shall be nine. Question number one will be compulsory and will be consisting of short/objective-type questions from the complete syllabus. In addition to the compulsory first question, there shall be four units in the question paper each consisting of two questions. The student will attempt one question from each unit in addition to the compulsory question. All questions will carry equal marks.

Course Objectives: The objective of this course is to get the students familiar with the concepts and processes of Data Science including collection, filtering, processing, analysis and visualization.

Course Outcomes	At the end of this course, the student will be able to :
CO1	define: data science process, classification of data, sampling, data analysis techniques-correlation, regression, mean, mode, kurtosis, Bayesian network, and visualization.
CO2	understand and describe: exploratory data analysis, evolution of analytic scalability, data analysis techniques, Bayesian network, parametric and non-parametric tests, data analysis framework and visualization.
CO3	use: data science process, modern data analytic tools, statistical concepts, data analysis techniques, different statistical tests, and visualization.
CO4	categorize: analytic processes and tools, analysis, reporting, data analysis techniques, linear and non-linear time series.
CO5	choose: data science process, data analytic tools and processes, different tests, data analysis technique, time series, visual data analysis framework and technique suitable in given situation.

CO-PEO Mapping Matrix for Course MCA/CSE/4/DSC/553(i)

COs	PEO1	PEO2	PEO3	PEO4	PEO5
CO1	1	3	1	3	3
CO2	2	3	1	3	3
CO3	3	3	1	3	3
CO4	3	3	1	3	3
CO5	3	3	1	3	3
Average	2.4	3	1	3	3

CO-PO Mapping Matrix for Course MCA/CSE/4/DSC/553(i)

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	3	1	1	1	-	3	-	-	1	-	-

CO2	2	1	1	3	1	-	3	-	-	1	-	-
CO3	3	1	1	3	3	-	3	-	-	1	-	-
CO4	2	1	1	3	1	-	3	-	-	1	-	-
CO5	2	1	3	1	3	-	3	-	-	1	-	-
Average	2	1.4	1.4	2.2	1.8	-	3	-	-	1	-	-

CO-PSO Mapping Matrix for Course MCA/CSE/4/DSC/553(i)

COs	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	1	3	1	-
CO2	3	1	3	2	-
CO3	3	1	3	3	-
CO4	3	1	3	3	-
CO5	3	1	3	3	-
Average	3	1	3	2.4	-

Course Content
MCA/CSE/4/DSC/553(i):Data Science

Unit I	**Introduction unstructured to Data Science**: Introduction, types of data- structured versus steps data, quantitative versus qualitative data, the four levels of data, five data, of graphical data science, data science process, exploratory data analysis, collection of science, presentation of data, classification of data, components of data reporting. evolution of analytic scalability, analytic processes and tools, analysis vs reporting.
Unit – II	**Statistical Concepts:** Correlation, regression, probability, conditional probability, random variables, analysis using mean, median, mode, standard deviation, skewness, kurtosis, regression modeling, multivariate analysis, Bayesian network. Analysis of Time Series: linear systems analysis, nonlinear dynamics.
Unit – III	**Data Analytics**: Analytics for Data Science, Data Analytics examples, Life Cycle of Data Analytics, Data Discovery, Data preparation, Model Planning, Model Building Operationalization. Parametric & Non-Parametric tests: Z-test, t-test, F-test, sign test, Wilcoxon sign rank test, Mann-Whitney U test.
Unit – IV	**Data Visualization**: Introduction, importance of data visualization, types of data visualization, the five Cs of data visualization, seven stages of data visualization, visualizing amounts, visualizing distributions, visualizing propositions, visualizing associations, visualizing time series, visualization trends.

Text/Reference Books

Text Books.	1. Michael Berthold, David J. Hand, "Intelligent Data Analysis", Springer, 2007. 2. AnandRajaraman and Jeffrey David Ullman, "Mining of Massive Datasets", Cambridge University Press, 2012.
Reference Books	1. Bill Franks, "Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics", John Wiley & Sons, 2012. 2. Jiawei Han, MichelineKamber "Data Mining Concepts and Techniques", 2e, Elsevier. 3. Rachel Schutt, Cathy O'Neil, "Doing Data Science", O'Reilly Publishers, 2013. 4. Foster Provost, Tom Fawcet, "Data Science for Business", O'Reilly Publishers, 2013. 5. Bart Baesens, "Analytics in a Big Data World: The Essential Guide to Data Science and its Applications", Wiley Publishers, 2014.

MCA/CSE/4/DSC/553(ii): Big Data Analytics								
Course Type	Course Credits	Contact Hours/ Week	Delivery Mode	Maximum Marks			Exam Duration	Assessment Methods
				External	Internal			
DSE Theory	04	04	Lecture/ Tutorial	70	30		3 Hours	TEE/MTE/ Assignment/ Attendance
					20	5 5		

Instructions for Mid-Term examination: The mid-term examination shall cover the first two units of the course content. The question paper will be set by the internal teacher.

Instructions to paper setter for term-end examination: The term-end examination shall cover the whole content of the course. The total number of questions shall be nine. Question number one will be compulsory and will be consisting of short/objective-type questions from the complete syllabus. In addition to the compulsory first question, there shall be four units in the question paper each consisting of two questions. The student will attempt one question from each unit in addition to the compulsory question. All questions will carry equal marks.

Course Objectives: The objective of this course is to get the students familiar with different concepts of Big Data and their realization/implementation using Hadoop and Map Reduce tool sets.

Course Content
MCA/CSE/4/DSC/553(ii): Big Data Analytics

Unit I	Introduction to Big Data and Hadoop**:** Types of digital data, introduction to Big Data,Vs of Big Data, Big Data Analytics, History of Hadoop, Apache Hadoop, analysing Data with Unix tools, Analysing Data with Hadoop, Hadoop Streaming, Hadoop Echo System, IBM Big Data Strategy, Big Data applications.
Unit – II	Hadoop Distributed File System (HDFS):The design of HDFS, HDFS concepts, command line interface, Hadoop file system interfaces, data flow, data ingest with flume and Scoop and Hadoop archives, Hadoop I/O: compression, serialization, Avro and file-based data structures.
Unit – III	Map Reduce:Anatomy of a Map Reduce job run, failures, job scheduling, shuffle and sort, task execution, Map Reduce types and formats, Map Reduce features.
Unit – IV	Hadoop Ecosystem: Pig: Introduction to Pig, execution modes of Pig, comparison of Pig with databases, grunt, Pig latin, user defined functions, data processing operators. Hive: Hive shell, Hive services, Hive metastore, comparison with traditional databases, HiveQL, tables, querying data and user defined functions. Hbase: HBasics, concepts, clients, example, Hbaseversus RDBMS. Big SQL: Introduction

Text/Reference Books

Text Books	1. Tom White “Hadoop: The Definitive Guide” Third Edit on, O’reily Media, 2012. 2. SeemaAcharya, SubhasiniChellappan, "Big Data Analytics", Wiley 2015. 3. ArvindSathi, “BigDataAnalytics: Disruptive Technologies for Changing the Game”, MC Press.
Reference Books	1. Michael Berthold, David J. Hand, "Intelligent Data Analysis”, Springer, 2007. 2. Jay Liebowitz, “Big Data and Business Analytics” AuerbachPublications, CRC press (2013) 3. AnandRajaraman and Jeffrey David Ulman, “Mining of Massive Datasets”, Cambridge University Press, 2012. 4. Bill Franks, “Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics”, John Wiley &Sons, 2012.

MCA/CSE/4/DSC/554(i): Soft Computing								
Course Type	Course Credit	Contact Hours/ Week	Delivery Mode	Maximum Marks			Exam Duration	Assessment Methods
				External	Internal			
DSE Theory	04	04	Lecture/ Tutorial	70	30		3 Hours	TEE/MTE/ Assignment/ Attendance
					20	5 5		

Instructions for Mid-Term examination: The mid-term examination shall cover the first two units of the course content. The question paper will be set by the internal teacher.

Instructions to paper setter for term-end examination: The term-end examination shall cover the whole content of the course. The total number of questions shall be nine. Question number one will be compulsory and will be consisting of short/objective-type questions from the complete syllabus. In addition to the compulsory first question, there shall be four units in the question paper each consisting of two questions. The student will attempt one question from each unit in addition to the compulsory question. All questions will carry equal marks.

Course Objectives: The objective of this course is to cover fundamental soft computing concepts with an exposure to ANN, fuzzy Logic, optimization techniques using Genetic Algorithm (GA).

Course Outcomes	By the end of this course, the student will be able to:
CO1	recognize the concept of: soft computing and hard computing, simple genetic a fuzzy set, neuron, neural network and activation function.
CO2	understand and describe: the role of genetic algorithm operators, representatior set and its operation, types of neural network and activation function including and cons.
CO3	use: genetic algorithm, fuzzy logic , ANN and their constituents for solving optimization problem.
CO4	differentiate: soft computing and hard computing, operators of genetic algor activation functions of ANN. Analyze: fuzzification and defuzzification.
CO5	compare: soft computing and hard computing, operators of genetic algor different activation functions of ANN.

CO-PEO Mapping Matrix for Course MCA/CSE/4/DSC/554(i)

COs	PEO1	PEO2	PEO3	PEO4	PEO5
CO1	1	3	1	3	3
CO2	2	3	1	3	3
CO3	3	3	1	3	3
CO4	3	3	1	3	3
CO5	3	3	1	3	3
Average	2.4	3	1	3	3

CO-PO Mapping Matrix for Course MCA/CSE/4/DSC/554(i)

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12

CO1	1	3	1	1	1	-	3	-	-	-	-	-
CO2	2	1	1	3	1	-	3	-	-	-	-	-
CO3	3	1	1	3	3	-	3	-	-	-	-	-
CO4	2	1	1	3	1	-	3	-	-	-	-	-
CO5	2	1	3	1	3	-	3	-	-	-	-	-
Average	2	1.4	1.4	2.2	1.8	-	3	-	-	-	-	-

CO-PSO Mapping Matrix for Course MCA/CSE/4/DSC/554(i)

COs	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	1	3	1	-
CO2	3	1	3	2	-
CO3	3	1	3	3	-
CO4	3	1	3	3	-
CO5	3	1	3	3	-
Average	3	1	3	2.6	-

Course Content
MCA/CSE/4/DSC/554(i): Soft Computing

Unit – I	Introduction to Soft Computing: Overview of Soft Computing, difference between soft and hard computing, brief descriptions of different components of soft computing including artificial neural networks, fuzzy logic, genetic algorithms.
Unit – II	Genetic Algorithm- Introduction to genetic algorithm, simple genetic algorithm, its representation. Selection: Roulette wheel selection, random, rank, tournament, Boltzmann selection. Crossover and its types: Single point crossover, two point crossover, multipoint crossover, ordered crossover, uniform crossover, crossover for real-valued representation. Mutation and its types: Flipping, Interchanging, reversing, replacement, mutation for real-valued representation, crossover rate, mutation rate and convergence criteria.
Unit – III	Fuzzy Logic: Introduction to fuzzy logic, representation of a classical set, representation of fuzzy set, basic properties of fuzzy sets. Fuzzy set operation: Intersection of fuzzy sets, union of fuzzy sets, complement of fuzzy sets, important terminologies in fuzzy set operations, properties of fuzzy sets, fuzzy arithmetic. Fuzzy Composition: Max-Min composition, max-star composition, max-product composition, max-average composition. fuzzification and de-fuzzification.
Unit - IV	Artificial Neural Network: Basic of neural network: neuron, artificial neuron, neural network, artificial neural network , perceptron, feed forward, multilayer perceptron neural network, advantage and disadvantage of ANNs. activation function and types of activation function. perceptron network, XOR problem.
Text/Reference Books	
Text Books	1. David E. Goldberg, Genetic Algorithms in Search, Optimization and machine learning, Addison Wesley. 2. ZbigniewMichalewicz, Genetic algorithms +Data Structures = Evolution

	Programs, SpringerVerlag.
Reference Books	1. M. Mitchell, An Introduction to Genetic Algorithms, Prentice-Hall. 2. S. Rajasekaran& G. A. VijayalakshmiPai, Neural Networks, Fuzzy Logic and Genetic Algorithms: Synthesis & Applications, PHI. 3. S. N. Sivanandam& S. N. Deepa, Principles of Soft Computing, Wiley - India.

MCA/CSE/4/DSC/554(ii): Bioinspired Computing

Course Type	Course Credit	Contact Hours/ Week	Delivery Mode	Maximum Marks				Exam Duration	Assessment Methods
				External	Internal				
DSE Theory	04	04	Lecture/ Tutorial	70	30			3 Hours	TEE/MTE/ Assignment/ Attendance
					20	5	5		

Instructions to paper setter for term-end examination: The term-end examination shall cover the whole content of the course. The total number of questions shall be nine. Question number one will be compulsory and will be consisting of short/objective-type questions from the complete syllabus. In addition to the compulsory first question, there shall be four units in the question paper each consisting of two questions. The student will attempt one question from each unit in addition to the compulsory question. All questions will carry equal marks.

Course Outcomes	At the end of this course, the student will be able to :
CO1	Define: the terms Nature Computing ,neural network, Computing inspired by nature, Immuno computing.
CO2	explain: Genetic Algorithms, Complexity,Ant Colony Optimization, SACO and scope of ACO algorithms.
CO3	Appy: Simulated Annealing, Evolutionary Computing, Genetics Principles, Ant Colony Algorithm (ACA), Swarm Robotics, Forest's Algorithm, Artificial Immune Networks, DNA Computing
CO4	Classify: Forest's Algorithm, DNA Computing, DNA Molecule, Genetic Algorithms, Adaptation Feedback , Nature Computing
CO5	compare: GA operations, DNA Molecule, Artificial Immune Networks. Evaluation Interaction Immune Algorithms

CO-PEO Mapping Matrix for Course MCA/CSE/4/DSC/554(ii)

COs	PEO1	PEO2	PEO3	PEO4	PEO5
CO1	1	3	1	3	3
CO2	2	3	1	3	3
CO3	3	3	1	3	3
CO4	3	3	1	3	3
CO5	3	3	1	3	3
Average	2.4	3	1	3	3

CO-PO Mapping Matrix for Course MCA/CSE/4/DSC/554(ii)

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	3	1	1	1	-	3	-	-	-	-	-

CO2	2	1	1	3	1	-	3	-	-	-	-	-
CO3	3	1	1	3	3	-	3	-	-	-	-	-
CO4	2	1	1	3	1	-	3	-	-	-	-	-
CO5	2	1	3	1	3	-	3	-	-	-	-	-
Average	2	1.4	1.4	2.2	1.8	-	3	-	-	-	-	-

CO-PSO Mapping Matrix for Course MCA/CSE/4/DSC/554(ii)

COs	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	1	3	1	-
CO2	3	1	3	2	-
CO3	3	1	3	3	-
CO4	3	1	3	3	-
CO5	3	1	3	3	-
Average	3	1	3	2.6	-

Course Content
MCA/CSE/4/DSC/554(ii): Bioinspired Computing

Unit – I	**Introduction**- Nature to Nature Computing, Philosophy, Three Branches of Computing: A Brief Overview, Individuals, Entities and agents. **Artificial Neural Network:** Basic of neural network: neuron, artificial neuron, neural network, artificial neural network. Adaptation Feedback : Self-Organization-Complexity, Emergence and Bottom-up Vs Top-Down- Determination, Chaos and Fractals.
Unit – II	**Computing inspired by nature**: Evolutionary Computing, Hill Climbing and Simulated Annealing, Darwin's Dangerous Idea, Genetics Principles, Standard Evolutionary Algorithm -Genetic Algorithms, Reproduction-Crossover, Mutation.
Unit – III	**Swarm intelligence**: Introduction - Ant Colonies, Ant Foraging Behavior, Ant Colony Optimization, SACO and scope of ACO algorithms, Ant Colony Algorithm (ACA), Swarm Robotics, Foraging for food, Social Adaptation of Knowledge, Particle Swarm Optimization (PSO)
Unit – IV	**Immuno computing:** Introduction- Immune System, Physiology and main components, Pattern Recognition and Binding, Immune Network Theory-Danger Theory, Evaluation Interaction Immune Algorithms, Introduction – Genetic algorithms, Bone Marrow Models, Forest's Algorithm, Artificial Immune Networks. **Computing with new natural materials** : DNA Computing: Motivation, DNA Molecule.

Text/Reference Books

Text Books	1. Floreano D. and Mattiussi C. (2008). Bio-Inspired Artificial Intelligence: Theories, Methods and Technologies. MIT Press, Cambridge, MA. 2. Leandro Nunes de Castro. (2007). Fundamentals of Natural Computing, Basic Concepts, Algorithms and Applications. Chapman & Hall/ CRC, Taylor and Francis Group. 3. Marco Dorrigo, Thomas Stutzle, Ant Colony Optimization, PHI,2005

Reference Books	4. Sam Jones. (2015). Bio-Inspired Computing, Recent Innovations and Applications. Publisher: CLANRYE INTERNATIONAL 5. Tao Song, Pan Zheng, Mou Ling Dennis, Wong and Xun Wang. (2019). Bio-Inspired, Computing Models and Algorithms.

MCA/CSE/4/DSC/555: R Programming

Course Type	Course Credit	Contact Hours/ Week	Delivery Mode	Maximum Marks		Exam Duration	Assessment Methods
				External	Internal		
DSC Theory + Practical	04	06 (2T+4P)	Lecture/ Practical	30 Theory	20 (10, 5, 5)	3 Hours	TEE/MTE/ Assignment/ Attendance
				50 Practical	-	3 Hours	TEE (Experiment, Practical file, Viva)

Instructions for Mid-Term examination: The mid-term examination shall cover the first two units of the course content. The question paper will be set by the internal teacher.

Instructions to paper setter for term-end theory examination: The term-end examination of theory part the total number of questions shall be NINE. Question number one will be compulsory and will be consisting of SIX short/objective-type questions from the complete syllabus. In addition to the compulsory question, there shall be EIGHT questions (two questions from each unit). The student will attempt one question from each unit in addition to the compulsory question. All questions will be of SIX marks each.

Course Objectives: To study the fundamental concepts in R programming language, data types, operators, decision making statements and iteration, functions, different data structures like list, vectors, matrices, data frames, charts and graphs, graphics functions and statistical analysis.

Course Outcomes	At the end of this course, the student will be able to:
CO1	list : data types, functions in R programming, visualization.
CO2	describe: the syntax ofdecision making statements, loops, user defined functions,used define packages; explain: the process of import and export of data in text file, excel file and MYSQL .
CO3	use: various in built ,user defined function and packages . apply: R programming constructs to solve real world problems.
CO4	categorize:datatypes,conditional& control statements, in built and user defined functions and packages.
CO5	compare: datatypes, conditional & control statements,functions, packages in R programming.
CO6	design:basic and advanced applications in R programming.

CO-PEO Mapping Matrix for Course MCA/CSE/4/DSC/555

COs	PEO1	PEO2	PEO3	PEO4	PEO5
CO1	1	1	3	3	3
CO2	2	2	3	3	3
CO3	3	3	3	3	3

CO4	3	3	3	3	3
CO5	3	3	3	3	3
CO6	3	3	3	3	3
Average	2.5	2.5	3	3	3

CO-PO Mapping Matrix for Course MCA/CSE/4/DSC/555

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	3	1	1	1	-	-	-	-	-	1	3
CO2	2	1	1	3	1	-	-	-	-	-	2	3
CO3	3	1	1	3	3	-	-	-	-	-	3	3
CO4	3	3	1	3	1	-	-	-	-	-	3	3
CO5	3	1	1	3	3	-	-	-	-	-	3	3
CO6	3	3	3	3	3	-	-	-	-	-	3	3
Average	2.5	2	1.3	2.6	2	-	-	-	-	-	2.5	3

CO-PSO Mapping Matrix for Course MCA/CSE/4/DSC/555

COs	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	1	-	3
CO2	3	3	2	-	3
CO3	3	3	3	-	3
CO4	3	3	3	-	3
CO5	3	3	3	-	3
CO6	3	3	3	-	3
Average	3	3	2.5	-	3

Course Content
MCA/CSE/4/DSC/555: R Programming

Unit - I	Basic of R: Introduction to R, Features of R, Variables in R, In-Built Functions in R (mathematical, trigonometric, logarithmic, Date and Time, Sequence, I/O). Data Types in R: Vectors, Matrices, Arrays, Lists, Factors, Data Frames.
Unit – II	Programming in R: Decision making structures (if, Switch), Loops (For, while, repeat), User Defined functions (with argument without argument), User Defined Package. Reports using remark down (direct rendering, in-direct rendering).
Unit - III	Data Exploration and Manipulation: Missing Data Management, Data reshaping through melting and casting, special functions across data elements. Import and Export of data: Import and Export of data in text files, excel files and MySQL.
Unit - IV	Basic Visualization: Pie chart, bar chart, Histogram, Line chart, Dot Chart, Bubble plot, Image Plot, Violin Plot. Advanced Visualization: Scatter plot, corrgrams, star and segment plots, tree maps, heat map.

Text/Reference Books

Text Books	1. Christian Heumann, Michael Schomaker and Shalabh, Introduction to Statistics and Data Analysis - with Exercises, Solutions and Applications in R, Springer, 2016. 2. Pierre Lafaye de Micheaux, RémyDrouilhet, Benoit Liquet, The R Software-Fundamentals of Programming and Statistical Analysis, Springer 2013.

Reference Books	1. Alain F. Zuur, Elena N. Ieno, Erik H.W.G. Meesters, Use R - A Beginner's Guide to R, Springer 2009.

MCA/CSE/4/PRW/551: Project Work						
Course Type	Course Credit	Contact Hours/Week	Delivery Mode	Maximum Marks	Exam Duration	Assessment Methods
SEC/ Project Work	04	-	Project work	100	-	Training Report/ Presentation/ Viva Voce

Instructions for evaluation: The evaluation of project work will be conducted by a panel of internal and external examiners. Examinees will be evaluated on the bases of the Internship/Training Report and a presentation-based viva voce exam.

Course Objectives: The objective of this course is to enable students to undertake independent project-based work or practical investigation in their area of study. Through systematic exploration, students will apply theoretical knowledge and technical or analytical tools to address real-world problems or academic questions. The course aims to foster critical thinking, creativity, problem-solving skills, and effective communication, culminating in a well-documented project report or thesis that demonstrates scholarly depth and professional competence.

Course Outcomes	At the end of this course, the student would be able to:
CO1	identify and formulate a project problem or objective based on a critical understanding of existing knowledge, technological needs, or real-world challenges.
CO2	develop a structured project plan including methodology, tools, timelines, and resource requirements, aligned with academic or industry standards.
CO3	implement the project using appropriate techniques and tools**,** demonstrating technical proficiency, problem-solving abilities, and innovative thinking.
CO4	analyze and interpret project outcomes**,** drawing meaningful conclusions and relating them to theoretical or practical frameworks.
CO5	communicate project findings effectivelythrough a detailed project report and oral presentation, adhering to academic or professional documentation standards.

CO-PEO Mapping Matrix for Course MCA/CSE/4/PRW/551

COs	PEO1	PEO2	PEO3	PEO4	PEO5
CO1	1	3	3	3	3
CO2	2	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Average	2.4	3	3	3	3

CO-PO Mapping Matrix for Course MCA/CSE/4/PRW/551

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	2	2	3	3	3	3	3	3	-	3	3
CO2	2	2	2	3	3	3	3	3	3	-	3	3
CO3	3	2	2	3	3	3	3	3	3	-	3	3
CO4	3	2	2	3	3	3	3	3	3	-	3	3
CO5	3	2	2	3	3	3	3	3	3	-	3	3
Average	2.4	2	2	3	3	3	3	3	3	-	3	3

CO-PSO Mapping Matrix for Course MCA/CSE/4/PRW/551

COs	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Average	3	3	3	3	3

MCA 1-Year Program
Semester II
Option 2

<table>
<tr><th colspan="8">MCA/CSE/4/SEC/551:Research Methodology</th></tr>
<tr><td rowspan="2">Course Type</td><td rowspan="2">Course Credit</td><td rowspan="2">Contact Hours/ Week</td><td rowspan="2">Delivery Mode</td><td colspan="2">Maximum Marks</td><td rowspan="2">Exam Duration</td><td rowspan="2">Assessment Methods</td></tr>
<tr><td>External</td><td>Internal</td></tr>
<tr><td rowspan="3">SEC Theory + Practical</td><td rowspan="3">04</td><td rowspan="3">05 (3T+2P)</td><td rowspan="3">Lecture/ Practical</td><td rowspan="2">50 Theory</td><td>25</td><td>3 Hours</td><td rowspan="2">TEE/MTE/ Assignment/ Attendance</td></tr>
<tr><td>15 | 5 | 5</td><td></td></tr>
<tr><td>25Practical</td><td>-</td><td>3 Hours</td><td>TEE (Experiment, Practical file, Viva)</td></tr>
<tr><td colspan="8">Instructions for Mid-Term examination: The mid-term examination shall cover the first two units of the course content. The question paper will be set by the internal teacher.

Instructions to paper setter for term-end theory examination: The term-end examination of theory part the total number of questions shall be NINE. Question number one will be compulsory and will be consisting of FIVE short/objective-type questions from the complete syllabus. In addition to the compulsory question, there shall be EIGHT questions (two questions from each unit). The student will attempt one question from each unit in addition to the compulsory question. All questions will be of TEN marks each.</td></tr>
<tr><td colspan="8">Course Objectives: The objective of this course is to get the students familiar with different aspects of research methodology, namely, research design, collection and analysis of data, and interpretation of results.</td></tr>
<tr><td colspan="8"><table>
<tr><th>Course Outcomes</th><td>By the end of this course, the student will be able to:</td></tr>
<tr><td>CO1</td><td>define: objectives, hypothesis, interpretation, data analysis, data collection, research design and method, interpretation, data analysis</td></tr>
<tr><td>CO2</td><td>describe: objectives, hypothesis, interpretation, data analysis, data collection, research design and method, interpretation, data analysis</td></tr>
<tr><td>CO3</td><td>illustrate: measurement, data collection, processing, sampling, analysis and its strategies, reports.</td></tr>
<tr><td>CO4</td><td>categorize:research,samplingmethods,datacollectiontechniques, reportsand data processing strategies. perform: data analysis..</td></tr>
<tr><td>CO5</td><td>compare: sampling methods, data collection techniques, reports and data processing strategies.</td></tr>
<tr><td>CO6</td><td>create: thesis, reports. design: research tool . interpret(drive):results.</td></tr>
</table></td></tr>
<tr><td colspan="8">CO-PEO Mapping Matrix for Course MCA/CSE/4/SEC/551</td></tr>
</table>

COs	PEO1	PEO2	PEO3	PEO4	PEO5
CO1	1	1	3	3	3
CO2	2	2	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Average	2.5	2.5	3	3	3

CO-PO Mapping Matrix for Course MCA/CSE/4/SEC/551

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	3	1	1	1	-	-	3	-	3	1	3
CO2	2	1	1	3	1	-	-	3	-	3	2	3
CO3	3	1	1	3	3	-	-	3	-	3	3	3
CO4	3	3	1	3	1	-	-	3	-	3	3	3
CO5	3	1	1	3	3	-	-	3	-	3	3	3
Average	3	3	3	3	3	-	-	3	-	3	3	3

CO-PSO Mapping Matrix for Course MCA/CSE/4/SEC/551)

COs	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	1	3	3
CO2	3	3	2	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Average	3	3	3	3	3

Course Content
MCA/CSE/4/SEC/551:Research Methodology

Unit – I	Objectives and types of research: motivation and objectives- research methods vs. methodology, types of research- descriptive vs. analytical, applied vs. fundamental, quantitative vs. qualitative, conceptual vs empirical research formulation: defining and formulating the research problem-. selecting the problem, necessity of defining the problem, importance of literature review in defining a problem, literature review- primary and secondary source reviews, hypothesis- definition, qualities of a good hypothesis, null hypothesis and alternatives.
Unit – II	Research design and methods: basic principles, need of research design-features of good design, important concepts relating to research design, criteria of selecting a sampling procedure, characteristics of a good sample design, sampling methods, measurement: concept of measurement, problems in measurement in research - validity and reliability. levels of measurement-

	nominal, ordinal, interval, ratio.
Unit – III	Data collection and analysis: execution of the research, observation and collection of data, methods of data collection, data processing and analysis strategies, data analysis with statistical packages, hypothesis testing, generalization and interpretation, univariate analysis (frequencytables, bar charts, pie charts, percentages).
Unit - IV	Meaning of interpretation, need of interpretation, technique of interpretation, precaution in interpretation, layout of a research paper, journals in computer science, impact factor of journals, ethical issues related to publishing, plagiarism and self-plagiarism. reports and thesis writing: structureand componentsof scientificreports, types of report-technicalreportsandthesis,writing-synopsis,abstract,illustrationsand tables, results, summary, reference citing and listing.
Text/Reference Books	
Text Books	1. J.Garg,B.L,Karadia,R,AggarwalF,AnIntroductiontoResearchMethodology,RBSA Publishers, 2002. 2. Kothari, Chakravanti Rajagopalachari. Research methodology: Methods and techniques. New Age International, 2004. 3. SantoshGupta,ResearchMethodologyandStatisticalTechniques,Deep& Deep Publications Pvt. Ltd., 2008
Reference Books	1. N. Gurumani, Scientific Thesis Writing and Paper Presentation, MJP Publishers. Montgomery, Douglas C, Design and Analysis of Experiments, Wiley India Pvt. Ltd.

MCA/CSE/4/RPR/552:Research Project						
Course Type	Course Credit	Contact Hours/Week	Delivery Mode	Maximum Marks	Exam Duration	Assessment Methods
Research	20	-	-	500	-	-

Instructions for evaluation: The evaluation of Research Thesis will be conducted by a panel of internal and external examiners. Examinees will be evaluated on the bases of the documentation and a presentation based viva voce exam.

Course Objectives: To develop students' capacity for independent, original research by engaging them in the systematic investigation of a significant academic or practical problem. Through this course, students will learn to apply appropriate research methodologies, critically analyze data, and effectively communicate their findings in the form of a well-structured thesis adhering to academic standards.

Course Outcomes	At the end of this course, the student would be able to:
CO1	identify and formulate a research problem through critical literature review, gap analysis, and topic selection aligned with academic and societal relevance.
CO2	design a coherent research plan by defining objectives, selecting appropriate methodologies, and justifying ethical and theoretical frameworks in a structured synopsis.
CO3	conduct independent research using appropriate tools for data collection, organization, and analysis to generate valid and reliable findings.
CO4	interpret and synthesize research outcomes in the context of existing knowledge, drawing meaningful conclusions and implications for theory and/or practice.
CO5	communicate research effectively through a well-structured thesis, adhering to academic writing standards, ethical guidelines, and disciplinary conventions.

CO-PEO Mapping Matrix for Course MCA/CSE/4/RPR/552

COs	PEO1	PEO2	PEO3	PEO4	PEO5
CO1	1	3	3	3	3
CO2	2	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Average	2.4	3	3	3	3

CO-PO Mapping Matrix for Course MCA/CSE/4/RPR/552

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	2	2	3	3	3	3	3	3	-	3	3
CO2	2	2	2	3	3	3	3	3	3	-	3	3
CO3	3	2	2	3	3	3	3	3	3	-	3	3
CO4	3	2	2	3	3	3	3	3	3	-	3	3
CO5	3	2	2	3	3	3	3	3	3	-	3	3
Average	2.4	2	2	3	3	3	3	3	3	-	3	3

CO-PSO Mapping Matrix for Course MCA/CSE/4/RPR/552					
COs	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Average	3	3	3	3	3

MCA 1-Year Program

Semester I

Option 3

MCA/CSE/3/SEC/501:Research Methodology							
Course Type	Course Credit	Contact Hours/ Week	Delivery Mode	Maximum Marks		Exam Duration	Assessment Methods
				External	Internal		
SEC Theory + Practical	04	05 (3T+2P)	Lecture/ Practical	50 Theory	25 (15 / 5 / 5)	3 Hours	TEE/MTE/ Assignment/ Attendance
				25 Practical	-	3 Hours	TEE (Experiment, Practical file, Viva)

Instructions for Mid-Term examination: The mid-term examination shall cover the first two units of the course content. The question paper will be set by the internal teacher.

Instructions to paper setter for term-end theory examination: The term-end examination of theory part the total number of questions shall be NINE. Question number one will be compulsory and will be consisting of FIVE short/objective-type questions from the complete syllabus. In addition to the compulsory question, there shall be EIGHT questions (two questions from each unit). The student will attempt one question from each unit in addition to the compulsory question. All questions will be of TEN marks each.

Course Objectives: The objective of this course is to get the students familiar with different aspects of research methodology, namely, research design, collection and analysis of data, and interpretation of results.

Course Outcomes	By the end of this course, the student will be able to:
CO1	define: objectives, hypothesis, interpretation, data analysis, data collection, research design and method, interpretation, data analysis
CO2	describe: objectives, hypothesis, interpretation, data analysis, data collection, research design and method, interpretation, data analysis
CO3	Illustrate: measurement, data collection, processing, sampling,analysis And its strategies, reports.
CO4	categorize:research,samplingmethods,datacollectiontechniques, reports,and data processing strategies. perform: data analysis..
CO5	compare: sampling methods, data collection techniques, reports and dataprocessing strategies.
CO6	create: thesis, reports. design: research tool. Interpret(derive)results.

CO-PEO Mapping Matrix for Course MCA/CSE/3/SEC/501					
COs	PEO1	PEO2	PEO3	PEO4	PEO5
CO1	1	1	3	3	3
CO2	2	2	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Average	2.5	2.5	3	3	3

CO-PO Mapping Matrix for Course MCA/CSE/3/SEC/501												
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	3	1	1	1	-	-	3	-	3	1	3
CO2	2	1	1	3	1	-	-	3	-	3	2	3
CO3	3	1	1	3	3	-	-	3	-	3	3	3
CO4	3	3	1	3	1	-	-	3	-	3	3	3
CO5	3	1	1	3	3	-	-	3	-	3	3	3
Average	3	3	3	3	3	-	-	3	-	3	3	3

CO-PSO Mapping Matrix for Course MCA/CSE/3/SEC/501)					
COs	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	1	3	3
CO2	3	3	2	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Average	3	3	3	3	3

Course Content
MCA/CSE/3/SEC/501:Research Methodology

Unit – I	Objectives and types of research: motivation and objectives- research methods vs. methodology, types of research- descriptive vs. analytical, applied vs. fundamental, quantitative vs. qualitative, conceptual vs empirical research formulation: defining and formulating the research problem-. selecting the problem, necessity of defining the problem, importance of literature review in defining a problem, literature review- primary and secondary source reviews, hypothesis- definition, qualities of a good hypothesis, null hypothesis and alternatives.
Unit – II	Research design and methods: basic principles, need of research design-features of good design, important concepts relating to research design, criteria of selecting a sampling procedure, characteristics of a good sample design, sampling methods, measurement: concept of measurement, problems in measurement in research - validity and reliability. levels of measurement-nominal, ordinal, interval, ratio.
Unit – III	Data collection and analysis: execution of the research, observation and collection of data, methods of data collection, data processing and analysis strategies, data analysis with statistical packages, hypothesis testing, generalization and interpretation, univariate analysis (frequency tables, bar charts, pie charts, percentages).
Unit - IV	Meaning of interpretation, need of interpretation, technique of interpretation, precaution in interpretation, layout of a research paper, journals in computer science, impact factor of journals, ethical issues related to publishing, plagiarism and self-plagiarism. reports and thesis writing: structure and

	components of scientific reports, types of report-technicalreportsandthesis,writing-synopsis,abstract, Illustrationsand tables, results, summary, reference citing and listing.
Text/Reference Books	
Text Books	4. J. Garg, B.L, Karadia, R, Aggarwal F, An Introduction to Research Methodology, RBSA Publishers, 2002. 5. Kothari,ChakravantiRajagopalachari. Researchmethodology: Methods and techniques. New Age International, 2004. 6. Santosh Gupta, Research Methodology and Statistical Techniques, Deep & Deep Publications Pvt. Ltd., 2008
Reference Books	2. N. Gurumani, Scientific Thesis Writing and Paper Presentation, MJP Publishers. Montgomery, Douglas C, Design and Analysis of Experiments, Wiley India Pvt. Ltd.

MCA/CSE/3/RPR/502: Research Project (Synopsis)						
Course Type	Course Credit	Contact Hours/Week	Delivery Mode	Maximum Marks	Exam Duration	Assessment Methods
Research	20	-	-	500	-	-

Instructions for evaluation: At the end, and as a part of the third semester, students who opted for Option 3 shall submit a Research Synopsis of at least 50 pages comprising a Literature Survey, identification of the Research Problem, Plan of Work, Methodology, and Practical Work (if any), which will be evaluated by internal and external examiners.

Course Objectives: To guide students through the processes of literature review, problem identification, research gap analysis, and methodology selection, culminating in the preparation and presentation of a well-structured research synopsis.

Course Outcomes	At the end of this course, the student will be able to:
CO1	conduct a comprehensive literature reviewto identify research gaps and formulate relevant, researchable questions.
CO2	select and refine a viable research topic aligned with disciplinary relevance, feasibility, and originality.
CO3	define clear research objectives and hypotheses, establishing the scope, rationale, and significance of the proposed study.
CO4	demonstrate familiarity with appropriate research methodologies**,** including qualitative, quantitative, or mixed-method approaches, and justify their selection.
CO5	develop a structured research synopsis that includes background, objectives, methodology, expected outcomes, and a preliminary bibliography, following academic conventions.

CO-PEO Mapping Matrix for Course MCA/CSE/3/RPR/502

COs	PEO1	PEO2	PEO3	PEO4	PEO5
CO1	1	3	3	3	3
CO2	2	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Average	2.4	3	3	3	3

CO-PO Mapping Matrix for Course MCA/CSE/3/RPR/502

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	2	2	3	3	3	3	3	3	-	3	3
CO2	2	2	2	3	3	3	3	3	3	-	3	3
CO3	3	2	2	3	3	3	3	3	3	-	3	3
CO4	3	2	2	3	3	3	3	3	3	-	3	3
CO5	3	2	2	3	3	3	3	3	3	-	3	3
Average	2.4	2	2	3	3	3	3	3	3	-	3	3

CO-PSO Mapping Matrix for Course MCA/CSE/3/RPR/502					
COs	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Average	3	3	3	3	3

MCA 1-Year Program
Semester II
Option 3

MCA/CSE/4/SEC/551: LLM &Generative AI and Research& Publication Ethics							
Course Type	Course Credit	Contact Hours/ Week	Delivery Mode	Maximum Marks		Exam Duration	Assessment Methods
				External	Internal		
SEC Theory + Practical	04	05 (3T+2P)	Lecture/ Practical	50 Theory	25 (15 / 5 / 5)	3 Hours	TEE/MTE/ Assignment/ Attendance
				25 Practical	-	3 Hours	TEE (Experiment, Practical file, Viva)

Instructions for Mid-Term examination: The mid-term examination shall cover the first two units of the course content. The question paper will be set by the internal teacher.

Instructions to paper setter for term-end theory examination: The term-end examination of the theory part will have a total of NINE questions. Question number one will be compulsory and will consist of FIVEshort/objective-type questions from the complete syllabus. In addition to the compulsory question, there shall be EIGHT questions (two questions from each unit). The student will attempt one question from each unit in addition to the compulsory question. All questions will be of TEN marks each.

Course Objectives: The objective of this course is to make the students capable of understanding and using LLM and generative AIs and to instill ethical awareness and integrity in academic research and scholarly publication. It introduces students to key concepts such as plagiarism, authorship criteria, data falsification, peer review ethics, and responsible conduct of research. The course aims to prepare students to uphold ethical standards in designing, conducting, reporting, and publishing research across disciplines.

Course Outcomes	By the end of this course, the student will be able to:
CO1	understand the foundational concepts and applications of Large Language Mod (LLMs) and Generative AI in research.
CO2	analyze the capabilities, limitations, and ethical concerns of LLMs and other ge technologies.
CO3	apply knowledge of LLMs to enhance academic research, writing, and publicat practices responsibly.
CO4	understand key ethical principles, standards, and practices in academic publishi scientific research.
CO5	identify, evaluate, and prevent unethical research practices such as plagiarism, fabrication, and authorship misconduct.

CO-PEO Mapping Matrix for Course MCA/CSE/4/SEC/551					
COs	PEO1	PEO2	PEO3	PEO4	PEO5
CO1	1	1	3	3	3
CO2	2	2	3	3	3
CO3	3	3	3	3	3

CO4	3	3	3	3	3
CO5	3	3	3	3	3
Average	2.5	2.5	3	3	3

CO-PO Mapping Matrix for Course MCA/CSE/4/SEC/551

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	-	-	3	-	-	-	-	1	-	2
CO2	3	3	2	2	3	-	-	-	-	2	-	2
CO3	3	3	-	-	2	2	-	3	1	2	-	2
CO4	2	3	-	-	2	2	1	3	2	3	-	3
CO5	2	2	-	-	2	3	-	3	-	3	-	3

CO-PSO Mapping Matrix for Course MCA/CSE/4/SEC/551)

COs	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	1	3	3
CO2	3	3	2	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3

Course Content
MCA/CSE/4/SEC/551: LLM & Generative AI and Research & Publication Ethics

Unit – I	Introductionto LLMs and Generative AI: Basics of Artificial Intelligence and Machine Learning; Evolution of Large Language Models (LLMs); architecture of transformer-based models; key concepts: tokens, embeddings, attention mechanisms, pre-training and fine-tuning; comparison of popular LLMs (GPT, BERT, PaLM, LLaMA). Introduction to Generative AI across modalities – text, image, audio, code. Applications of LLMs in academic research: summarization, language translation, idea generation, citation support, and literature review automation. Prompt engineering basics. Overview of model limitations, bias, and hallucinations.
Unit – II	Applications, Opportunities and Ethical Challenges of AI in Research: Use of generative AI tools in research design and dissemination; authorship issues in AI-generated content; ethical concerns: originality, bias, hallucinated data, overreliance, misuse. Review of guidelines from COPE, IEEE, Elsevier, and UGC on AI usage. Role of disclosure and transparency in AI-assisted research. Case studies of AI's role in knowledge production and missteps. Discussion on accountability and responsible innovation. Understanding alignment and safety in generative AI.
Unit – III	Research and Publication Ethics – Principles and Misconduct: Definition, importance, and historical development of research ethics. Ethical principles: honesty, objectivity, integrity, carefulness, openness, respect for intellectual property. Types of scientific misconduct: plagiarism, falsification, fabrication, redundant publication, unethical authorship. Understanding authorship criteria and contributorship. Citation ethics and proper referencing. UGC and COPE guidelines for ethical research practices. Peer review ethics, conflict of interest, and

	whistleblower protection.
Unit - IV	Academic Integrity, Publication Standards, and Institutional Mechanisms: Ethics in data collection, use, and sharing. Tools for plagiarism detection and content originality (e.g., Turnitin, Grammarly, AI-detection tools). Identifying predatory journals; impact factor, h-index, and other publication metrics. Ethical issues in collaborative, funded, and interdisciplinary research. IRBs, Ethics Committees, and institutional ethical clearance. Research reporting: structure of thesis, dissertations, and research papers; writing synopsis, abstracts, references (APA/MLA), tables, illustrations, and results. UGC and institutional policies on research integrity.
Text/Reference Books	
Text Books	1. Brian Christian, *The Alignment Problem: Machine Learning and Human Values*, W. W. Norton & Company, 2020. 2. S. Russell and P. Norvig, *Artificial Intelligence: A Modern Approach*, Pearson, 4th edition, 2020. 3. Terence Parr and Keith Instone, *The Definitive Guide to GPT-3 and LLMs*, Manning Publications, 2023.
Reference Books	4. N. Gurumani, Scientific Thesis Writing and Paper Presentation, MJP Publishers. Montgomery, Douglas C, Design and Analysis of Experiments, Wiley India Pvt. Ltd. 5. Brian Christian, *The Alignment Problem: Machine Learning and Human Values*, W. W. Norton & Company, 2020.

MCA/CSE/4/RPR/552: Research Project (Final)						
Course Type	Course Credit	Contact Hours/Week	Delivery Mode	Maximum Marks	Exam Duration	Assessment Methods
Research	20	-	-	500	-	-

Instructions for evaluation: The students going for Option 3 shall continue their research work in the fourth semester based on the project work/synopsis submitted at the end of the third semester. The final Research Thesis will be evaluated by the internal and external examiners.

Course Objectives: The objective of this course is to enable students to carry out independent and in-depth research based on their approved synopsis. It focuses on the systematic execution of the research plan, data collection and analysis, interpretation of findings, and the scholarly presentation of results in the form of a comprehensive thesis that meets academic and ethical standards.

Course Outcomes	At the end of this course, the student will be able to:
CO1	implement the approved research design by systematically collecting, organizing, and analyzing data using appropriate tools and techniques.
CO2	apply critical thinking and analytical skills to interpret results in relation to the stated research objectives and hypotheses.
CO3	integrate theoretical frameworks and empirical findings to build coherent, evidence-based arguments.
CO4	maintain academic integrity and ethical standards throughout the research process, including data management, authorship, and citation practices.
CO5	draft and revise the thesis in accordance with disciplinary standards, demonstrating clarity, originality, and scholarly depth.

CO-PEO Mapping Matrix for Course MCA/CSE/4/RPR/552

COs	PEO1	PEO2	PEO3	PEO4	PEO5
CO1	1	3	3	3	3
CO2	2	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Average	2.4	3	3	3	3

CO-PO Mapping Matrix for Course MCA/CSE/4/RPR/552

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	2	2	3	3	3	3	3	3	-	3	3
CO2	2	2	2	3	3	3	3	3	3	-	3	3
CO3	3	2	2	3	3	3	3	3	3	-	3	3
CO4	3	2	2	3	3	3	3	3	3	-	3	3
CO5	3	2	2	3	3	3	3	3	3	-	3	3
Average	2.4	2	2	3	3	3	3	3	3	-	3	3

CO-PSO Mapping Matrix for Course MCA/CSE/4/RPR/552					
COs	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Average	3	3	3	3	3