MOOGAMBIGAI CHARITABLE AND EDUCATIONAL TRUST

Rajarajeswari College of Engineering

(An Autonomous Institution under Visvesvaraya Technological University, Belagavi)
#14, Ramohalli Cross, Kumbalagodu, Mysore Road, Bengaluru–560074

M.Tech in Computer Science and Engineering

Scheme and Syllabus of III & IV Semester

(2024 Scheme)

VISION

To empower young minds through technology, research and innovation, to produce technically competent and socially responsible professionals in higher education.

MISSION

1. To deliver excellence in education through innovative teaching, impactful research, and continuous skill development, preparing students to meet global challenges with technical expertise and ethical responsibility.
2. To foster a transformative learning environment that integrates technology, research and practical experience, empowering students to become skilled professionals and socially conscious leaders.
3. To cultivate a culture of lifelong learning and professional excellence by encouraging creativity, research, and community engagement, equipping students with the skills to thrive in a dynamic world.
4. To provide a holistic educational experience that combines advanced technology, hands-on research, and community-focused learning, shaping students into competent, ethical professionals who contribute positively to society.

QUALITY POLICY

Rajarajeswari College of Engineering is committed to imparting quality technical education that nurtures competent, ethical professionals with global relevance. We ensure academic excellence through a dynamic, outcome-based curriculum, experienced faculty, and cutting-edge infrastructure. Continuous improvement is driven by innovation, research and strong industry collaboration. We foster holistic development and a progressive environment that supports lifelong learning, teamwork, and professional growth.

CORE VALUES

Academic Excellence, Integrity, Innovation, Global Competence, Continuous Improvement.

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MOOGAMBIGAI CHARITABLE AND EDUCATIONAL TRUST

Rajarajeswari College of Engineering

(An Autonomous Institution under Visvesvaraya Technological University, Belagavi)

M. Tech in Computer Science and Engineering

Scheme of Teaching and Examinations – 2024

(Effective from the Academic Year 2025-26)

III Semester

S. No	Course Category and Course Code		Course Title	TD/PSB	Teaching Hours/ Week			Examination				Credits
					Lecture	Tutorial/ SDA	Practical/ Seminar	SEE Duration in Hours	CIE Marks	SEE Marks	Total Marks	
					L	T/S	P					
1.	PCC	P24SCS301	Cloud Computing	CSE	**3**	**0**	**0**	**3**	**50**	**50**	**100**	**3**
2.	PEC	P24SCSX312	Professional Elective -III	CSE	**3**	**0**	**0**	**3**	**50**	**50**	**100**	**3**
3.	PEC	P24SCSX313	Professional Elective-IV	CSE	**3**	**0**	**0**	**3**	**50**	**50**	**100**	**3**
4.	PROJ	P24SCSP304	Project Work phase -I	CSE	**0**	**20**	**0**	**3**	**50**	**50**	**100**	**10**
5.	AEC	P24SCS305	Research Methodology and IPR	CSE	**Online Certification**							**PP**
								TOTAL	**200**	**200**	**400**	**19**

PCC: Professional core Course, IPCC-Integrated Professional Core Courses, PCC(PB): Professional Core Courses (Project Based), PCCL-Professional Core Course lab ,NCMC- None Credit Mandatory Course, ,L-Lecture, T/SDA-Tutorial / Skill Development Activities, P-Practical, Proj: Project.

Professional Elective-III		Professional Elective-IV	
P24 SCSA312	Cloud Security	P24 SCSA313	Managing Big Data
P24 SCSB312	Cyber Forensics	P24 SCSB313	Pattern Recognition
P24 SCSC312	Soft and Evolutionary Computing	P24 SCSC313	Computer Vision
P24 SCSD312	Advances in Storage Area Network	P24 SCSD313	Deep Learning
P24 SCSE312	Business Intelligence and its Applications	P24 SCSE313	Block chain Technology

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Project Work Phase-I: The project work shall be carried out individually. However, in case a disciplinary or interdisciplinary project requires more participants, then a group consisting of not more than three shall be permitted. Students in consultation with the guide in disciplinary project or guides/co-guides of all departments in case of multidisciplinary projects shall pursue a literature survey and complete the preliminary requirements of the selected Project work. Each student shall prepare a relevant introductory project document, and present a seminar. CIE marks shall be awarded by a committee comprising of HoD as Chairman, all Guides and a senior faculty of the concerned departments. The CIE marks awarded for project work phase -I shall be based on the evaluation of Project Report, Project Presentation skill, and performance in the Question and Answer session in the ratio of 50:25:25.

P24SCS305 – Research Methodology and IPR-Non- Credit Mandatory Course (NCMC) if Students have not studied this course in their undergraduate program then he/she has to take this course compulsory before completion of the minimum duration of the program (two years), however, this will not be considered for vertical progression.

HoD **Dean-Academics** **Principal**

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M. Tech in Computer Science and Engineering

Scheme of Teaching and Examinations – 2024

(Effective from the Academic Year 2025-26)

Semester: IV

S. No	Course Category and Course Code		Course Title	TD/PSB	Teaching Hours/ Week			Examination				Credits
					Lecture	Tutorial/ SDA	Practical/ Seminar	SEE Duration in Hours	CIE Marks	SEE Marks	Total Marks	
					L	T/S	P					
1.	PROJ	P24SCSP401	Project work Phase-II	CSE	0	0	20	3	100	100	200	10
2.	INT	P24SCSI402	Internship	CSE	13 Weeks			3	100	100	200	11
								TOTAL	200	200	400	21

PCC: Professional core Course, IPCC-Integrated Professional Core Courses, PCC(PB): Professional Core Courses (Project Based), PCCL-Professional Core Course lab ,NCMC- None Credit Mandatory Course, ,L-Lecture, T/SDA-Tutorial / Skill Development Activities, P-Practical, Proj: Project.

Project Work Phase-II: Students in consultation with the guide and continue the Project phase –I to complete the Project work Phase- II. Each student shall prepare project document, and present a seminar. CIE marks shall be awarded by a committee comprising of HoD as Chairman, all Guide and a senior faculty of the concerned departments. The CIE marks awarded for project work phase -II, shall be based on the evaluation of Project Report, Project Presentation skill, and performance in the Question and Answer session in the ratio of 50:25:25. SEE shall be at the end of IV semester. Project work evaluation and Viva-Voce examination (SEE), after satisfying the plagiarism check, shall be as per the institution norms.

Internship: Those, who have not completed the internship, shall be declared as fail in the internship course and have to complete the same during subsequent University examinations after satisfying the internship requirements. Internship SEE (University examination) shall be as per the Institution norms. CIE marks shall be awarded by a committee comprising of HoD as Chairman, Guide and a senior faculty of the department. The CIE marks awarded for internship shall be based on the evaluation of Report, Presentation skill, and performance in the Question and Answer session in the ratio of 50:25:25.

HoD **Dean-Academics** **Principal**

SEMESTER-III					
CLOUD COMPUTING **Category: PCC**					
Course Code	:	P24SCS301	CIE	:	50 Marks
Teaching Hours L:P: SDA	:	3:0:0	SEE	:	50 Marks
Total Hours	:	45(T)	Total	:	100 Marks
Credits	:	3	SEE Duration	:	3 Hrs.

Course Objectives	
1.	Discuss the concepts, characteristics, delivery models and benefits of cloud computing
2.	Explore the key technical, organizational and compliance challenges of cloud computing
3.	Grasp the concepts of virtualization efficiently.
4.	Explore the security issues that arise from cloud computing architectures intended for delivering Cloud based enterprise IT services.

Module - 1	**No. of Hours**
Introduction, Cloud Infrastructure: Cloud computing, Cloud computing delivery models and services, Ethical issues, Cloud vulnerabilities, Cloud computing at Amazon, Cloud computing the Google perspective, Microsoft Windows Azure and online services, Open-source software platforms for private clouds, Cloud storage diversity and vendor lockin, Energy use and ecological impact, Service level agreements, User experience and software licensing. Exercises and problems.	9
Module - 2	**No. of Hours**
Cloud Computing: Application Paradigms.: Challenges of cloud computing, Architectural styles of cloud computing, Workflows: Coordination of multiple activities, Coordination based on a state machine model: The Zookeeper, The Map Reduce programming model, A case study: The Gre The Web application, Cloud for science and engineering, High-performance computing on a cloud, Cloud computing for Biology research, Social computing, digital content and.	9
Module - 3	**No. of Hours**
Cloud Resource Virtualization: Virtualization, Layering and virtualization, Virtual machine monitors, Virtual Machines, Performance and Security Isolation, Full virtualization and paravirtualization, Hardware support for virtualization, Case Study: Xen a VMM based paravirtualization, Optimization of network virtualization, vBlades, Performance comparison of virtual machines, The dark side of virtualization, Exercises and problems	9
Module - 4	**No. of Hours**
Cloud Resource Management and Scheduling: Policies and mechanisms for resource management, Application of control theory to task scheduling on a cloud, Stability of a two-level resource allocation architecture, Feedback control based on dynamic thresholds, Coordination of specialized autonomic performance managers, A utility-based model for cloud-based Web services, Resourcing bundling: Combinatorial auctions for cloud resources, Scheduling algorithms for computing clouds, Fair queuing, Start-time fair queuing, Borrowed virtual time, Cloud scheduling subject to deadlines, Scheduling Map Reduce applications subject to deadlines, Resource management and dynamic scaling, Exercises and problems	9
Module - 5	**No. of Hours**
Cloud Security, Cloud Application Development: Cloud security risks, Security: The top concern for cloud users, Privacy and privacy impact assessment, Trust, Operating system security, Virtual machine Security, Security of virtualization, Security risks posed by shared images, Security risks posed by a management OS, A trusted virtual machine monitor, Amazon web services: EC2 instances, Connecting clients to cloud instances through firewalls, Security rules for application and transport layer protocols in EC2, How to launch an EC2 Linux instance and connect to it, How to use S3 final091220232 in java, Cloud-based simulation of a distributed trust algorithm, A trust management service, A cloud service for adaptive data streaming, Cloud based optimal FPGA synthesis .Exercises and problems.	9

Course Outcomes: At the end of the course, the students will be able to	
CO1	Compare the strengths and limitations of cloud computing
CO2	Identify the architecture, infrastructure and delivery models of cloud computing
CO3	Demonstrate the working of VM and VMM on any cloud platforms (public/private), and run a software service on that.
CO4	Identify the known threats, risks, vulnerabilities and privacy issues associated with Cloud Based IT services.

Text Books	
1.	Cloud Computing: Theory and Practice, Dan C Marinescu Elsevier (MK), 2013.

Reference Text Books	
1.	Computing Principles and Paradigms, Rajkumar Buyya , James Broberg, AndrzejGoscinsk,I Willey, 2014.
2.	Cloud Computing Implementation, Management and Security John W Rittinghouse, James F Ransome, CRC Press, 2013.

ASSESSMENT DETAILS (BOTH CIE AND SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing marks for the CIE is 50% of the maximum marks and Minimum passing marks for the SEE is 40% of the maximum marks of SEE. The minimum passing marks is 50% i.e. sum of the CIE and SEE together.

CONTINUOUS INTERNAL EVALUATION (CIE):

Component	Type of Assessment	Max. Marks	Max. Marks Scaling Down to	Total Marks
Theory	Internal Assessment1	50	30 (Average of Best Two Assessments)	50
	Internal Assessment2	50		
	Internal Assessment3	50		
Self Learning	Two Assignments	20	10	
	Seminar Presentation	20	10	
SEE	Semester End Examination	100	50	50
Grand Total				100

SEMESTER END EXAMINATION

1. The question paper shall be set for 100 marks and duration of SEE is 3 hours.
2. Two questions of 20 marks (with minimum of 3 sub questions) from each module with internal choice.
3. Students should answer five full questions, selecting one full question from each module.
4. Question papers to be set as per the Blooms Taxonomy levels.

CO-PO Mapping

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

3-High, 2-Moderate, 1-Low

SEMESTER-III					
CLOUD SECURITY **Category: PEC**					
Course Code	:	P24SCSA312	CIE	:	50 Marks
Teaching Hours L:P: SDA	:	3:0:0	SEE	:	50 Marks
Total Hours	:	45(T)	Total	:	100 Marks
Credits	:	3	SEE Duration	:	3 Hrs.

Course Objectives	
1.	Define core cloud computing concepts and fundamental principles, the Impact of Cloud Computing on Users.
2.	Explore Infrastructure Security and Application-Level Data Security.
3.	Explain Identity and Access management.
4.	Explore Security Management in the Cloud.
5.	Illustrate Security Management in the Cloud.

Module - 1	**No. of Hours**
WHAT IS CLOUD COMPUTING? Cloud Computing Defined, The SPI Framework for Cloud Computing, The Traditional Software Model, The Cloud Services Delivery Model, Cloud Deployment Models, Key Drivers to Adopting the Cloud, The Impact of Cloud Computing on Users, Governance in the Cloud, Barriers to Cloud Computing Adoption in the Enterprise.	9
Module - 2	**No. of Hours**
Infrastructure Security: Infrastructure Security: The Network Level, Infrastructure Security: The Host Level, Infrastructure Security: The Application Level Data Security and Storage: Aspects of Data Security, Data Security Mitigation, Provider Data and Its Security.	9
Module - 3	**No. of Hours**
Identity and Access Management: Trust Boundaries and IAM, Why IAM?, IAM Challenges, IAM Definitions, IAM Architecture and Practice, Getting Ready for the Cloud, Relevant IAM Standards and Protocols for Cloud Services, IAM Standards, Protocols, and Specifications for Consumers, Comparison of Enterprise and Consumer Authentication Standards and Protocols, IAM Practices in the Cloud, Cloud Authorization Management, Cloud Service Provider IAM Practice	9
Module - 4	**No. of Hours**
Security Management in the Cloud: Security Management Standards, Security Management in the Cloud, Availability Management, SaaS Availability Management, PaaS Availability Management, IaaS Availability Management, Access Control	9
Module - 5	**No. of Hours**
Audit and Compliance: Internal Policy Compliance, Governance, Risk, and Compliance (GRC) , Illustrative Control Objectives for Cloud Computing, Incremental CSP-Specific Control Objectives, Additional Key Management Control Objectives, Control Considerations for CSP Users, Regulatory/External Compliance, Other Requirements, Cloud Security Alliance, Auditing the Cloud for Compliance	9

Course Outcomes: At the end of the course, the students will be able to	
CO1	Explore the impact of Cloud Computing on Users
CO2	Explain the Infrastructure Security and Application Level Data Security
CO3	Define Identity Management
CO4	Explore the Security Management in the cloud
CO5	Illustrate Security Management in the Cloud

Text Books	
1.	Vic (J.R.) Winkler, Securing the Cloud, Cloud Computer Security Techniques and Tactics, Syngress, 2011

Reference Text Books	
1.	Tim Mather, SubraKumaraswamy , ShahedLatif , Cloud Security and Privacy, An Enterprise Perspective on Risks and Compliance, Oreilly Media, 2009

ASSESSMENT DETAILS (BOTH CIE AND SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing marks for the CIE is 50% of the maximum marks and Minimum passing marks for the SEE is 40% of the maximum marks of SEE. The minimum passing marks is 50% i.e. sum of the CIE and SEE together.

CONTINUOUS INTERNAL EVALUATION (CIE):

Component	Type of Assessment	Max. Marks	Max. Marks Scaling Down to	Total Marks
Theory	Internal Assessment1	50	30 (Average of Best Two Assessments)	50
	Internal Assessment2	50		
	Internal Assessment3	50		
Self Learning	Two Assignments	20	10	
	Seminar Presentation	20	10	
SEE	Semester End Examination	100	50	50
Grand Total				100

SEMESTER END EXAMINATION

1. The question paper shall be set for 100 marks and duration of SEE is 3 hours.
2. Two questions of 20 marks (with minimum of 3 sub questions) from each module with internal choice.
3. Students should answer five full questions, selecting one full question from each module.
4. Question papers to be set as per the Blooms Taxonomy levels.

CO-PO Mapping

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

3-Highly mapped 2-Moderately mapped 1-Slightly mapped

SEMESTER-III					
CYBER FORENSICS **Category: PEC**					
Course Code	:	P24SCSB312	CIE	:	50 Marks
Teaching Hours L:P: SDA	:	3:0:0	SEE	:	50 Marks
Total Hours	:	45(T)	Total	:	100 Marks
Credits	:	3	SEE Duration	:	3 Hrs.

Course Objectives	
1.	Define computer forensics and computer investigation
2.	Illustrate the Data Acquisition
3.	Explain how Live Acquisition, Email Investigation is carried out.
4.	Explore Foot printing and Social Engineering

Module - 1	**No. of Hours.**
Computer Forensics and Investigation as a Profession, Understanding Computer Investigation.	9
Module - 2	**No. of Hours.**
Data Acquisition , Processing Crime and incident Scenes	9
Module - 3	**No. of Hours.**
Virtual machines, Network Forensics and Live Acquisition, Email Investigation.	9
Module - 4	**No. of Hours.**
Introduction to Ethical Hacking – Foot printing and Social Engineering- Scanning and Enumeration	9
Module - 5	**No. of Hours.**
System Hacking- Sniffers, Denial of Service - Session Hijacking.	9

Course Outcomes: At the end of the course, the students will be able to	
CO1	Explain the basics of computer forensics
CO2	Demonstrate the data Acquisition
CO3	Explore the Email investigation
CO4	Identify the vulnerabilities in a given network infrastructure.
CO5	Implement real-world hacking techniques to test system security

Text Books	
1.	Bill Nelson, Amelia Phillips, Frank Enfinger, Christopher Steuart, —Computer Forensics and Investigations‖, Cengage Learning, India Edition, 2016.
2.	CEH official Certfied Ethical Hacking Review Guide, Wiley India Edition, 2015.

Reference Text Books	
1.	John R.Vacca, —Computer Forensics‖, Cengage Learning, 2005
2.	MarjieT.Britz, —Computer Forensics and Cyber Crime‖: An Introduction‖, 3rd Edition, Prentice Hall, 2013

ASSESSMENT DETAILS (BOTH CIE AND SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing marks for the CIE is 50% of the maximum marks and Minimum passing marks for the SEE is 40% of the maximum marks of SEE. The minimum passing marks is 50% i.e. sum of the CIE and SEE together.

CONTINUOUS INTERNAL EVALUATION (CIE):

Component	**Type of Assessment**	**Max. Marks**	**Max. Marks Scaling Down to**	**Total Marks**
Theory	**Internal Assessment1**	**50**	**30 (Average of Best Two Assessments)**	**50**
	Internal Assessment2	**50**		
	Internal Assessment3	**50**		
Self Learning	**Two Assignments**	**20**	**10**	
	Seminar Presentation	**20**	**10**	
SEE	**Semester End Examination**	**100**	**50**	**50**
Grand Total				**100**

SEMESTER END EXAMINATION

1. The question paper shall be set for 100 marks and duration of SEE is 3 hours.
2. Two questions of 20 marks (with minimum of 3 sub questions) from each module with internal choice.
3. Students should answer five full questions, selecting one full question from each module.
4. Question papers to be set as per the Blooms Taxonomy levels.

CO-PO Mapping

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

3-Highly mapped 2-Moderately mapped 1-Slightly mapped

SEMESTER-III					
SOFT AND EVOLUTIONARY COMPUTING **Category: PEC**					
Course Code	:	P24SCSC312	CIE	:	50 Marks
Teaching Hours L:P: SDA	:	3:0:0	SEE	:	50 Marks
Total Hours	:	45(T)	Total	:	100 Marks
Credits	:	3	SEE Duration	:	3 Hrs.

Course Objectives	
1.	To Understand soft computing techniques
2.	Able to apply the learned techniques to solve realistic problems
3.	Able to Differentiate soft computing with hard computing techniques

Module - 1	**No. of Hours**
Introduction to soft computing: ANN, FS, GA, SI, ES, Comparing among intelligent systems. **ANN**: introduction, biological inspiration, BNN&ANN, classification, first Generation NN, perceptron, illustrative problems.	9
Module - 2	**No. of Hours**
Adaline, Medaline, ANN: (2nd generation), introduction, BPN, KNN,HNN, BAM, RBF,SVM and illustrative problem.	9
Module - 3	**No. of Hours**
Fuzzy logic: introduction, human learning ability, undecidability, probability theory, classical set and fuzzy set, fuzzy setoperations, fuzzy relations, fuzzy compositions, natural language and fuzzy interpretations, structure of fuzzy inference system, illustrative problems.	9
Module - 4	**No. of Hours**
Introduction to GA, GA, procedures, working of GA, GA applications, applicability, evolutionary programming, working of EP, GA based Machine learning classifier system, illustrative problems.	9
Module - 5	**No. of Hours**
Swarm Intelligent system: Introduction, Background of SI, Ant colony system Working of ACO, Particle swarm Intelligence (PSO).	9

Course Outcomes: At the end of the course, the students will be able to	
CO1	Demonstrate the working of soft computing techniques
CO2	Apply the learned techniques to solve realistic problems
CO3	Differentiate soft computing with hard computing techniques

Text Books	
1.	Soft computing : N. P Padhy and S P Simon , Oxford University Press 2015

Reference Text Books	
1.	Principles of Soft Computing, Shivanandam, Deepa S. N Wiley India, 2011

ASSESSMENT DETAILS (BOTH CIE AND SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing marks for the CIE is 50% of the maximum marks and Minimum passing marks for the SEE is 40% of the maximum marks of SEE. The minimum passing marks is 50% i.e. sum of the CIE and SEE together.

CONTINUOUS INTERNAL EVALUATION (CIE):

Component	**Type of Assessment**	**Max. Marks**	**Max. Marks Scaling Down to**	**Total Marks**
Theory	**Internal Assessment1**	**50**	**30 (Average of Best Two Assessments)**	**50**
	Internal Assessment2	**50**		
	Internal Assessment3	**50**		
Self Learning	**Two Assignments**	**20**	**10**	
	Seminar Presentation	**20**	**10**	
SEE	**Semester End Examination**	**100**	**50**	**50**
Grand Total				**100**

SEMESTER END EXAMINATION

1. The question paper shall be set for 100 marks and duration of SEE is 3 hours.
2. Two questions of 20 marks (with minimum of 3 sub questions) from each module with internal choice.
3. Students should answer five full questions, selecting one full question from each module.
4. Question papers to be set as per the Blooms Taxonomy levels.

CO-PO Mapping

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	3	3	3	2	-	-	-	-	-	1
CO2	3	3	3	3	2	-	-	-	-	-	1
CO3	3	3	3	3	2	-	-	-	-	-	1

3-Highly mapped, 2-Moderately mapped, 1-Slightly mapped

SEMESTER-III					
ADVANCED IN STORAGE AREA NETWORK **Category: PEC**					
Course Code	:	P24SCSD312	CIE	:	50 Marks
Teaching Hours L:P: SDA	:	3:0:0	SEE	:	50 Marks
Total Hours	:	45(T)	Total	:	100 Marks
Credits	:	3	SEE Duration	:	3 Hrs.

Course Objectives	
1.	Explore contrast storage centric and server centric systems.
2.	Define metrics used for Designing storage area networks.
3.	Discuss the data centers for maintaining the data with the concepts of backup mainly remote mirroring concepts.

Module - 1	**No. of Hours**
Introduction: Server Centric IT Architecture and its Limitations; Storage – Centric IT Architecture and its advantages. Case study: Replacing a server with Storage Networks The Data Storage and Data Access problem; The Battle for size and access. Intelligent Disk Subsystems: Architecture of Intelligent Disk Subsystems; Hard disks and Internal I/O Channels; JBOD, Storage virtualization using RAID and different RAID levels; Caching: Acceleration of Hard Disk Access; Intelligent disk subsystems, Availability of disk subsystems.	9
Module - 2	**No. of Hours**
I/O Techniques: The Physical I/O path from the CPU to the Storage System; SCSI; Fibre Channel Protocol Stack; FibreChannel SAN; IP Storage. Network Attached Storage: The NAS Architecture, The NAS hardware Architecture, The NAS Software Architecture, Network connectivity, NAS as a storage system. File System and NAS: Local File Systems; Network file Systems and file servers; Shared Disk file systems; Comparison of fibre Channel and NAS.	9
Module - 3	**No. of Hours**
Storage Virtualization: Definition of Storage virtualization; Implementation Considerations; Storage virtualization on Block or file level; Storage virtualization on various levels of the storage Network; Symmetric and Asymmetric storage virtualization in the Network..	9
Module - 4	**No. of Hours**
SAN Architecture and Hardware devices: Overview, Creating a Network for storage; SAN Hardware devices; The fibrechannel switch; Host Bus Adaptors; Putting the storage in SAN; Fabric operation from a Hardware perspective. Software Components of SAN: The switch's Operating system; Device Drivers; Supporting the switch's components; Configuration options for SANs	9
Module - 5	**No. of Hours**
Management of Storage Network: System Management, Requirement of management System, Support by Management System, Management Interface, Standardized Mechanisms, Property Mechanisms, Inband Management, Use of SNMP, CIM and WBEM, Storage Management Initiative Specification (SMIS), CMIP and DMI, Optional Aspects of the Management of Storage Networks, Summary.	9

Course Outcomes: At the end of the course, the students will be able to	
CO1	Identify the need for performance evaluation and the metrics used for it
CO2	Apply the techniques used for data maintenance
CO3	Realize strong virtualization concepts
CO4	Illustrate RAID concepts, policies for LUN masking, file systems

Text Books	
1.	Storage Networks Explained, Ulf Troppens, Rainer Erkens and Wolfgang Muller, Wiley India, 2013.
2.	Storage Networks The Complete Reference, Robert Spalding, Tata McGrawHill, 2011.
3.	Storage Networking Fundamentals: An Introduction to Storage Devices Subsystems, Applications, Management, and File Systems, Marc Farley, Cisco Press, 2005.

ASSESSMENT DETAILS (BOTH CIE AND SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing marks for the CIE is 50% of the maximum marks and Minimum passing marks for the SEE is 40% of the maximum marks of SEE. The minimum passing marks is 50% i.e. sum of the CIE and SEE together.

CONTINUOUS INTERNAL EVALUATION (CIE):

Component	Type of Assessment	Max. Marks	Max. Marks Scaling Down to	Total Marks
Theory	Internal Assessment1	50	30 (Average of Best Two Assessments)	50
	Internal Assessment2	50		
	Internal Assessment3	50		
Self Learning	Two Assignments	20	10	
	Seminar Presentation	20	10	
SEE	Semester End Examination	100	50	50
Grand Total				100

SEMESTER END EXAMINATION

1. The question paper shall be set for 100 marks and duration of SEE is 3 hours.
2. Two questions of 20 marks (with minimum of 3 sub questions) from each module with internal choice.
3. Students should answer five full questions, selecting one full question from each module.
4. Question papers to be set as per the Blooms Taxonomy levels.

CO-PO Mapping

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

3-Highly mapped 2-Moderately mapped 1-Slightly mapped

SEMESTER-III					
BUSINESS INTELLIGENCE AND ITS APPLICATIONS **Category: PEC**					
Course Code	:	P24SCSE312	CIE	:	50 Marks
Teaching Hours L:P: SDA	:	3:0:0	SEE	:	50 Marks
Total Hours	:	45(T)	Total	:	100 Marks
Credits	:	3	SEE Duration	:	3 Hrs.

Course Objectives	
1.	Define the fundamental concepts of Business Intelligence and its implementation
2.	Appreciate the importance of Business reporting and performance measurement
3.	Gain the knowledge and skills for using data warehouses and data mining techniques for business intelligence purposes.

Module - 1	**No. of Hours**
Development Steps, BI Definitions, BI Decision Support Initiatives, Development Approaches, Parallel Development Tracks, BI Project Team Structure, Business Justification, Business Divers, Business Analysis Issues, Cost – Benefit Analysis, Risk Assessment, Business Case Assessment Activities, Roles Involved In These Activities, Risks Of Not Performing Step, Hardware, Middleware, DBMS Platform, Non Technical Infrastructure Evaluation	9
Module - 2	**No. of Hours**
Managing The BI Project, Defining And Planning The BI Project, Project Planning Activities, Roles And Risks Involved In These Activities, General Business Requirement, Project Specific Requirements, Interviewing Process	9
Module - 3	**No. of Hours**
Differences in Database Design Philosophies, Logical Database Design, Physical Database Design, Activities, Roles And Risks Involved In These Activities, Incremental Rollout, Security Management, Database Backup And Recovery	9
Module - 4	**No. of Hours**
Growth Management, Application Release Concept, Post Implementation Reviews, Release Evaluation Activities, The Information Asset and Data Valuation, Actionable Knowledge – ROI, BI Applications, The Intelligence Dashboard	9
Module - 5	**No. of Hours**
Business View of Information technology Applications: Business Enterprise excellence, Key purpose of using IT, Type of digital data, basics f enterprise reporting, BI road ahead.	9

Course Outcomes: At the end of the course, the students will be able to	
CO1	Explain the complete life cycle of BI/Analytical development
CO2	Illustrate technology and processes associated with Business Intelligence framework
CO3	Demonstrate a business scenario, identify the metrics, indicators and make L2 recommendations to achieve the business goal

Text Books	
1.	Larissa T Moss and ShakuAtre, Business Intelligence Roadmap: The Complete Project Lifecycle for Decision Support Applications, Addison Wesley Information Technology Series, 2003
2.	R N Prasad, SeemaAcharya, Fundamentals of Business Analytics, Wiley India, 2011

Reference Text Books	
1.	David Loshin, Business Intelligence: The Savvy Manager's Guide, Morgan Kaufmann
2.	Brian Larson, Delivering Business Intelligence with Microsoft SQL Server 2005, McGraw Hill, 2006
3.	Lynn Langit, Foundations of SQL Server 2008 Business Intelligence, Apress, 2011

ASSESSMENT DETAILS (BOTH CIE AND SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing marks for the CIE is 50% of the maximum marks and Minimum passing marks for the SEE is 40% of the maximum marks of SEE. The minimum passing marks is 50% i.e. sum of the CIE and SEE together.

CONTINUOUS INTERNAL EVALUATION (CIE):

Component	Type of Assessment	Max. Marks	Max. Marks Scaling Down to	Total Marks
Theory	Internal Assessment1	50	30 (Average of Best Two Assessments)	50
	Internal Assessment2	50		
	Internal Assessment3	50		
Self Learning	Two Assignments	20	10	
	Seminar Presentation	20	10	
SEE	Semester End Examination	100	50	50
Grand Total				100

SEMESTER END EXAMINATION

1. The question paper shall be set for 100 marks and duration of SEE is 3 hours.
2. Two questions of 20 marks (with minimum of 3 sub questions) from each module with internal choice.
3. Students should answer five full questions, selecting one full question from each module.
4. Question papers to be set as per the Blooms Taxonomy levels.

CO-PO Mapping

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	3	3	3	2	-	-	-	-	-	1
CO2	3	3	3	3	2	-	-	-	-	-	1
CO3	3	3	3	3	2	-	-	-	-	-	1

3-Highly mapped 2-Moderately mapped 1-Slightly mapped

SEMESTER-III					
MANAGING BIG DATA **Category: PEC**					
Course Code	:	P24SCSA313	CIE	:	50 Marks
Teaching Hours L:P: SDA	:	3:0:0	SEE	:	50 Marks
Total Hours	:	45(T)	Total	:	100 Marks
Credits	:	3	SEE Duration	:	3 Hrs.

Course Objectives	
1.	Explore and apply the Big Data analytic techniques for business applications.
2.	Discuss the overview of Apache Hadoop
3.	Able to implement basic technologies that forms the foundations of Big Data

Module - 1	**No. of Hours**
Meet Hadoop: Data!, Data Storage and Analysis, Querying All Your Data, Beyond Batch, Comparison with Other Systems: Relational Database Management Systems, Grid Computing, Volunteer Computing Hadoop Fundamentals MapReduce A Weather Dataset: Data Format, Analyzing the Data with Unix Tools, Analyzing the Data with Hadoop: Map and Reduce, Java MapReduce, Scaling Out: Data Flow, Combiner Functions, Running a Distributed MapReduce Job, Hadoop Streaming The Hadoop Distributed Filesystem The Design of HDFS, HDFS Concepts: Blocks, Namenodes and Datanodes, HDFS Federation, HDFS High-Availability, The Command-Line Interface, Basic Filesystem Operations, HadoopFilesystems Interfaces, The Java Interface, Reading Data from a Hadoop URL, Reading Data Using the FileSystem API, Writing Data, Directories, Querying the Filesystem, Deleting Data, Data Flow: Anatomy of a File Read, Anatomy of a File Write.,	9
Module - 2	**No. of Hours**
YARN Anatomy of a YARN Application Run: Resource Requests, Application Lifespan, Building YARN Applications, YARN Compared to MapReduce, Scheduling in YARN: The FIFO Scheduler, The Capacity Scheduler, The Fair Scheduler, Delay Scheduling, Dominant Resource Fairness Hadoop I/O Data Integrity, Data Integrity in HDFS, Local File System, ChecksumFileSystem, Compression, Codecs, Compression and Input Splits, Using Compression in MapReduce, Serialization, The Writable Interface, Writable Classes, Implementing a Custom Writable, Serialization Frameworks, File-Based Data Structures: SequenceFile	9
Module - 3	**No. of Hours**
Developing a MapReduce Application The Configuration API, Combining Resources, Variable Expansion, Setting Up the Development Environment, Managing Configuration, GenericOptionsParser, Tool, and ToolRunner, Writing a Unit Test with MRUnit: Mapper, Reducer, Running Locally on Test Data, Running a Job in a Local Job Runner, Testing the Driver, Running on a Cluster, Packaging a Job, Launching a Job, The MapReduce Web UI, Retrieving the Results, Debugging a Job, Hadoop Logs, Tuning a Job, Profiling Tasks, MapReduce Workflows: Decomposing a Problem into MapReduce Jobs, JobControl, Apache Oozie How MapReduce Works Anatomy of a MapReduce Job Run, Job Submission, Job Initialization, Task Assignment, Task Execution, Progress and Status Updates, Job Completion, Failures: Task Failure, Application Master Failure, Node Manager Failure, Resource Manager Failure, Shuffle and Sort: The Map Side The Reduce Side, Configuration Tuning, Task Execution: The Task Execution Environment, Speculative Execution, Output Committers	9
Module - 4	**No. of Hours**
MapReduce Types and Formats:MapReduce Types, Input Formats: Input Splits and Record's Text Input, Binary Input, Multiple Inputs, Database Input (and Output) Output Formats: Text Output, Binary Output, Multiple Outputs, Lazy Output, Database Output, Flume Installing Flume, An Example: Transactions and Reliability, Batching, The HDFS Sink, Partitioning and Interceptors, File Formats, Fan Out, Delivery Guarantees, Replicating and Multiplexing Selectors, Distribution: Agent Tiers, Delivery Guarantees, Sink Groups, Integrating Flume with Applications, Component Catalog	9
Module - 5	**No. of Hours**
Pig Installing and Running Pig, Execution Types, Running Pig Programs, Grunt, Pig Latin Editors, An Example: Generating Examples, Comparison with Databases, Pig Latin: Structure, Statements, Expressions, Types, Schemas, Functions, Data Processing Operators: Loading and Storing Data, Filtering Data, Grouping and Joining Data, Sorting Data, Combining and Splitting Data. Spark An Example: Spark Applications, Jobs, Stages and Tasks, A Java Example, A Python Example, Resilient	9

Distributed Datasets: Creation, Transformations and Actions, Persistence, Serialization, Shared Variables, Broadcast Variables, Accumulators, Anatomy of a Spark Job Run, Job Submission, DAG Construction, Task Scheduling, Task Execution, Executors and Cluster Managers: Spark on YARN	

Course Outcomes: At the end of the course, the students will be able to	
CO1	Managing big data using Hadoop and SPARK technologies
CO2	Explain HDFS and MapReduce concepts
CO3	Install, configure, and run Hadoop and HDFS
CO4	Apply Big Data Solutions using Hadoop Eco System

Reference Text Books	
1.	Hadoop: The Definitive Guide, Tom White, O'Reilley, 3rd Edition, 2012
2.	SPARK: The Definitive Guide, MateiZaharia and Bill Chambers, Oreilly, 2018
3.	Apache Flume: Distributed Log Collection for Hadoop, D'Souza and Steve Hoffman Oreilly, 2014

ASSESSMENT DETAILS (BOTH CIE AND SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing marks for the CIE is 50% of the maximum marks and Minimum passing marks for the SEE is 40% of the maximum marks of SEE. The minimum passing marks is 50% i.e. sum of the CIE and SEE together.

CONTINUOUS INTERNAL EVALUATION (CIE):

Component	Type of Assessment	Max. Marks	Max. Marks Scaling Down to	Total Marks
Theory	**Internal Assessment1**	**50**	**30 (Average of Best Two Assessments)**	**50**
	Internal Assessment2	**50**		
	Internal Assessment3	**50**		
Self Learning	**Two Assignments**	**20**	**10**	
	Seminar Presentation	**20**	**10**	
SEE	**Semester End Examination**	**100**	**50**	**50**
Grand Total				**100**

SEMESTER END EXAMINATION

1. The question paper shall be set for 100 marks and duration of SEE is 3 hours.
2. Two questions of 20 marks (with minimum of 3 sub questions) from each module with internal choice.
3. Students should answer five full questions, selecting one full question from each module.
4. Question papers to be set as per the Blooms Taxonomy levels.

CO-PO Mapping

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

3-Highly mapped 2-Moderately mapped 1-Slightly mapped

SEMESTER-III					
PATTERN RECOGNITION **Category: PEC**					
Course Code	:	P24 SCSB313	CIE	:	50 Marks
Teaching Hours L:P: SDA	:	3:0:0	SEE	:	50 Marks
Total Hours	:	45(T)	Total	:	100 Marks
Credits	:	3	SEE Duration	:	3 Hrs.

Course Objectives	
1.	Explain pattern recognition principals
2.	Able to implement algorithms for Pattern Recognition
3.	Ability to analyze decision tress.

Module - 1	**No. of Hours**
Introduction: Definition of PR, Applications, Datasets for PR, Different paradigms for PR, Introduction to probability, events, random variables, Joint distributions and densities, moments. Estimation minimum risk estimators, problems	9
Module - 2	**No. of Hours**
Representation: Data structures for PR, Representation of clusters, proximity measures, size of patterns, Abstraction of Data set, Feature extraction, Feature selection, Evaluation	9
Module - 3	**No. of Hours**
Nearest Neighbour based classifiers & Bayes classifier: Nearest neighbour algorithm, variants of NN algorithms, use of NN for transaction databases, efficient algorithms, Data reduction, prototype selection, Bayes theorem, minimum error rate classifier, estimation of probabilities, estimation of probabilities, comparison with NNC, Naive Bayes classifier, Bayesian belief network	9
Module - 4	**No. of Hours**
Naive Bayes classifier, Bayesian belief network, Decision Trees: Introduction, DT for PR, Construction of DT, splitting at the nodes, Over fitting & Pruning, Examples , Hidden Markov models: Markov models for classification, Hidden Markov models and classification using HMM	9
Module - 5	**No. of Hours**
Clustering: Hierarchical (Agglomerative, single/complete/average linkage, wards, Partitional (Forgy's, kmeans, Isodata), clustering large data sets, examples, An application: Handwritten Digit recognition	9

Course Outcomes: At the end of the course, the students will be able to	
CO1	Choose appropriate algorithms for Pattern Recognition.
CO2	Apply nearest neighbour classifier.
CO3	Apply Decision tree and clustering techniques to various applications
CO4	Get acquainted with recent developments in pattern recognition and its applications.

Reference Text Books	
1.	Pattern Recognition (An Introduction), V Susheela Devi, M Narsimha Murthy. Universities press, 2011.
2.	Pattern Recognition & Image Analysis, Earl Gose, Richard Johnsonbaugh, Steve Jost . PH, 1996.
3.	Pattern Classification, Duda R. O., P.E. Hart, D.G. Stork. John Wiley and sons, 2000

ASSESSMENT DETAILS (BOTH CIE AND SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing marks for the CIE is 50% of the maximum marks and Minimum passing marks for the SEE is 40% of the maximum marks of SEE. The minimum passing marks is 50% i.e. sum of the CIE and SEE together.

CONTINUOUS INTERNAL EVALUATION (CIE):

Component	**Type of Assessment**	**Max. Marks**	**Max. Marks Scaling Down to**	**Total Marks**
Theory	**Internal Assessment1**	**50**	**30 (Average of Best Two Assessments)**	**50**
	Internal Assessment2	**50**		
	Internal Assessment3	**50**		

Self Learning	**Two Assignments**	**20**	**10**	
	Seminar Presentation	**20**	**10**	
SEE	**Semester End Examination**	**100**	**50**	**50**
Grand Total				**100**

SEMESTER END EXAMINATION

1. The question paper shall be set for 100 marks and duration of SEE is 3 hours.
2. Two questions of 20 marks (with minimum of 3 sub questions) from each module with internal choice.
3. Students should answer five full questions, selecting one full question from each module.
4. Question papers to be set as per the Blooms Taxonomy levels.

CO-PO Mapping

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

3-Highly mapped 2-Moderately mapped 1-Slightly mapped

SEMESTER-III					
COMPUTER VISION **Category: PEC**					
Course Code	:	P24SCSC313	CIE	:	50 Marks
Teaching Hours L:P: SDA	:	3:0:0	SEE	:	50 Marks
Total Hours	:	45(T)	Total	:	100 Marks
Credits	:	3	SEE Duration	:	3 Hrs.

Course Objectives	
1.	Explore the fundamentals of image formation.
2.	Discuss the major ideas, methods, and techniques of computer vision and pattern recognition.
3.	Able to implement algorithms and techniques to analyze and interpret the visible world around us.

Module - 1	**No. of Hours**
CAMERAS: Pinhole Cameras, Radiometry – Measuring Light: Light in Space, Light Surfaces, Important Special Cases, Sources, Shadows, And Shading: Qualitative Radiometry, Sources and Their Effects, Local Shading Models, Application: Photometric Stereo, Inter-reflections: Global Shading Models, Color: The Physics of Color, Human Color Perception, Representing Color, A Model for Image Color, Surface Color from Image Color the File system, Deleting Data, Data Flow: Anatomy of a File Read, Anatomy of a File Write.,	9
Module - 2	**No. of Hours**
Linear Filters: Linear Filters and Convolution, Shift Invariant Linear Systems, Spatial Frequency and Fourier Transforms, Sampling and Aliasing, Filters as Templates, Edge Detection: Noise, Estimating Derivatives, Detecting Edges, Texture: Representing Texture, Analysis (and Synthesis) Using Oriented Pyramids, Application: Synthesis by Sampling Local Models, Shape from Texture.	9
Module - 3	**No. of Hours**
The Geometry of Multiple Views: Two Views, Stereopsis: Reconstruction, Human Stereposis, Binocular Fusion, Using More Cameras, Segmentation by Clustering: What Is Segmentation?, Human Vision: Grouping and Getstalt, Applications: Shot Boundary Detection and Background Subtraction, Image Segmentation by Clustering Pixels, Segmentation by Graph-Theoretic Clustering,	9
Module - 4	**No. of Hours**
Segmentation by Fitting a Model: The Hough Transform, Fitting Lines, Fitting Curves, Fitting as a Probabilistic Inference Problem, Robustness, Segmentation and Fitting Using Probabilistic Methods: Missing Data Problems, Fitting, and Segmentation, The EM Algorithm in Practice, Tracking With Linear Dynamic Models: Tracking as an Abstract Inference Problem, Linear Dynamic Models, Kalman Filtering, Data Association, Applications and Examples.	9
Module - 5	**No. of Hours**
Geometric Camera Models: Elements of Analytical Euclidean Geometry, Camera Parameters and the Perspective Projection, Affine Cameras and Affine Projection Equations, Geometric Camera Calibration: Least-Squares Parameter Estimation, A Linear Approach to Camera Calibration, Taking Radial Distortion into Account, Analytical Photogrammetry, An Application: Mobile Robot Localization, Model- Based Vision: Initial Assumptions, Obtaining Hypotheses by Pose Consistency, Obtaining Hypotheses by pose Clustering, Obtaining Hypotheses Using Invariants, Verification, Application: Registration In Medical Imaging Systems, Curved Surfaces and Alignment.	9

Course Outcomes: At the end of the course, the students will be able to	
CO1	Implement fundamental image processing techniques required for computer vision
CO2	Perform shape analysis
CO3	Implement boundary tracking techniques
CO4	Apply chain codes and other region descriptors

Reference Text Books	
1.	Computer Vision – A Modern Approach, David A. Forsyth and Jean Ponce, PHI Learning, 2009
2.	Computer and Machine Vision – Theory, Algorithms and Practicalities, E. R. Davies, Elsevier 4th Edition, 2013

ASSESSMENT DETAILS (BOTH CIE AND SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing marks for the CIE is 50% of the maximum marks and Minimum passing marks for the SEE is 40% of the maximum marks of SEE. The minimum passing marks is 50% i.e. sum of the CIE and SEE together.

CONTINUOUS INTERNAL EVALUATION (CIE):

Component	Type of Assessment	Max. Marks	Max. Marks Scaling Down to	Total Marks
Theory	Internal Assessment1	50	30 (Average of Best Two Assessments)	50
	Internal Assessment2	50		
	Internal Assessment3	50		
Self Learning	Two Assignments	20	10	
	Seminar Presentation	20	10	
SEE	Semester End Examination	100	50	50
Grand Total				100

SEMESTER END EXAMINATION

1. The question paper shall be set for 100 marks and duration of SEE is 3 hours.
2. Two questions of 20 marks (with minimum of 3 sub questions) from each module with internal choice.
3. Students should answer five full questions, selecting one full question from each module.
4. Question papers to be set as per the Blooms Taxonomy levels.

SEMESTER-III					
DEEP LEARNING **Category: PEC**					
Course Code	:	P24SCSD313	CIE	:	50 Marks
Teaching Hours L:P: SDA	:	3:0:0	SEE	:	50 Marks
Total Hours	:	45(T)	Total	:	100 Marks
Credits	:	3	SEE Duration	:	3 Hrs.

Course Objectives	
1.	Discuss the context of neural networks and deep learning
2.	Have a working knowledge of neural networks and deep learning
3.	Explore the parameters for neural networks.

Module - 1	**No. of Hours**
Machine Learning Basics: Learning Algorithms, Capacity, Overfitting and Underfitting, Hyperparameters and Validation Sets, Estimator, Bias and Variance, Maximum Likelihood Estimation, Bayesian Statistics, Supervised Learning Algorithms, Unsupervised Learning Algorithms, Stochastic Gradient Descent, building a Machine Learning Algorithm, Challenges Motivating Deep Learning	9
Module - 2	**No. of Hours**
Deep Feedforward Networks: Gradient-Based Learning, Hidden Units, Architecture Design, BackPropagation. Regularization: Parameter Norm Penalties, Norm Penalties as Constrained Optimization, Regularization and UnderConstrained Problems, Dataset Augmentation, Noise Robustness, SemiSupervised Learning, Multi-Task Learning, Early Stopping, Parameter Tying and Parameter Sharing, Sparse Representations, Bagging, Dropout	9
Module - 3	**No. of Hours**
Optimization for Training Deep Models: How Learning Differs from Pure Optimization, Challenges in Neural Network Optimization, Basic Algorithms. Parameter Initialization Strategies, Algorithms with Adaptive Learning Rates. **Convolutional Networks**: The Convolution Operation, Motivation, Pooling, Convolution and Pooling as an Infinitely Strong Prior, Variants of the Basic Convolution Function, Structured Outputs, Data Types, Efficient Convolution Algorithms, Random or Unsupervised Features..	9
Module - 4	**No. of Hours**
Sequence Modelling: Recurrent and Recursive Nets: Unfolding Computational Graphs, Recurrent Neural Networks, Bidirectional RNNs, Encoder-Decoder Sequence-to-Sequence Architectures, Deep Recurrent Networks, Recursive Neural Networks. Long short-term memory	9
Module - 5	**No. of Hours**
Practical Methodology: Performance Metrics, Default Baseline Models, Determining Whether to Gather More Data, Selecting Hyperparameters, Debugging Strategies, Example: Multi-Digit Number Recognition. Applications: Vision, NLP, Speech.	9

Course Outcomes: At the end of the course, the students will be able to	
CO1	Identify the deep learning algorithms which are more appropriate for various types of learning tasks in various domains.
CO2	Implement deep learning algorithms and solve real-world problems.
CO3	Execute performance metrics of Deep Learning Techniques.
CO4	Compare modeling aspects of various neural network architectures..

Text Books	
1.	Deep Learning, Lan Good fellow and YoshuaBengio, MIT Press https://www.deeplearn ingbook.org/ 2016.
2.	Neural Networks:Asystematic Introduction, Raúl Rojas, 1996..
3.	Pattern Recognition and machine Learning, Chirstopher Bishop, 2007.

ASSESSMENT DETAILS (BOTH CIE AND SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing marks for the CIE is 50% of the maximum marks and Minimum passing marks for the SEE is 40% of the maximum marks of SEE. The minimum passing marks is 50% i.e. sum of the CIE and SEE together.

CONTINUOUS INTERNAL EVALUATION (CIE):

Component	Type of Assessment	Max. Marks	Max. Marks Scaling Down to	Total Marks
Theory	Internal Assessment1	50	30 (Average of Best Two Assessments)	50
	Internal Assessment2	50		
	Internal Assessment3	50		
Self Learning	Two Assignments	20	10	
	Seminar Presentation	20	10	
SEE	Semester End Examination	100	50	50
Grand Total				100

SEMESTER END EXAMINATION

1. The question paper shall be set for 100 marks and duration of SEE is 3 hours.
2. Two questions of 20 marks (with minimum of 3 sub questions) from each module with internal choice.
3. Students should answer five full questions, selecting one full question from each module.
4. Question papers to be set as per the Blooms Taxonomy levels.

CO-PO Mapping

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

3-Highly mapped 2-Moderately mapped 1-Slightly mapped

SEMESTER-III					
BLOCK CHAIN TECHNOLOGY **Category: PEC**					
Course Code	:	P24SCSE313	CIE	:	50 Marks
Teaching Hours L:P: SDA	:	3:0:0	SEE	:	50 Marks
Total Hours	:	45(T)	Total	:	100 Marks
Credits	:	3	SEE Duration	:	3 Hrs.

Course Objectives	
1.	Explain the strong technical knowledge of Blockchain technologies.
2.	Analyzing the blockchain decentralization and cryptography concepts.
3.	Explore the driving force behind the cryptocurrencyBitcoin, along with the Decentralization.

Module - 1	**No. of Hours**
Blockchain 101: Distributed systems, History of blockchain, Introduction to blockchain, Types of blockchain, CAP theorem and blockchain, Benefits and limitations of blockchain	9
Module - 2	**No. of Hours**
Decentralization and Cryptography: Decentralization using blockchain, Methods of decentralization, Routes to decentralization, Decentralized organizations. Cryptography and Technical Foundations: Cryptographic primitives, Asymmetric cryptography, Public and private keys	9
Module - 3	**No. of Hours**
Bitcoin and Alternative Coins A: Bitcoin, Transactions, Blockchain, Bitcoin payments B: Alternative Coins, Theoretical foundations, Bitcoin limitations, Namecoin, Litecoin, Primecoin, Zcash	9
Module - 4	**No. of Hours**
Smart Contracts and Ethereum 101: Smart Contracts: Definition, Ricardian contracts. Ethereum 101:Introduction, Ethereumblockchain, Elements of the Ethereumblockchain, Precompiled contracts	9
Module - 5	**No. of Hours**
Alternative Blockchains: Blockchains, Blockchain-Outside of Currencies: Internet of Things, Government, Health, Finance, Media	9

Course Outcomes: At the end of the course, the students will be able to	
CO1	Identify the deep learning algorithms which are more appropriate for various types of learning tasks in various domains.
CO2	Implement deep learning algorithms and solve real-world problems.
CO3	Execute performance metrics of Deep Learning Techniques.
CO4	Compare modeling aspects of various neural network architectures..

Text Books	
1.	Bitcoin and Cryptocurrency Technologies, Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller, Steven Goldfeder, Princeton University, 2016

Reference Text Books	
1.	Blockchain Basics: A Non-Technical Introduction in 25 Steps, Daniel Drescher, Apress, First Edition, 2017
2.	Mastering Bitcoin: Unlocking Digital Cryptocurrencies, Andreas M. Antonopoulos, O'Reilly Media, First Edition, 2014

ASSESSMENT DETAILS (BOTH CIE AND SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing marks for the CIE is 50% of the maximum marks and Minimum passing marks for the SEE is 40% of the maximum marks of SEE. The minimum passing marks is 50% i.e. sum of the CIE and SEE together.

CONTINUOUS INTERNAL EVALUATION (CIE):

Component	Type of Assessment	Max. Marks	Max. Marks Scaling Down to	Total Marks
Theory	**Internal Assessment1**	**50**	**30**	

	Internal Assessment2	**50**	**(Average of Best Two Assessments)**	**50**
	Internal Assessment3	**50**		
Self Learning	**Two Assignments**	**20**	**10**	
	Seminar Presentation	**20**	**10**	
SEE	**Semester End Examination**	**100**	**50**	**50**
Grand Total				**100**

SEMESTER END EXAMINATION

1. The question paper shall be set for 100 marks and duration of SEE is 3 hours.
2. Two questions of 20 marks (with minimum of 3 sub questions) from each module with internal choice.
3. Students should answer five full questions, selecting one full question from each module.
4. Question papers to be set as per the Blooms Taxonomy levels.

CO-PO Mapping

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

3-Highly mapped 2-Moderately mapped 1-Slightly mapped

SEMESTER-III					
PROJECT WORK PHASE -I **Category: PROJ**					
Course Code	:	P24SCSP304	CIE	:	50 Marks
Teaching Hours L:P:S	:	0:20:0	SEE	:	50 Marks
Total Hours	:	-	Total	:	100 Marks
Credits	:	10	SEE Duration	:	3 Hrs.

Course Objectives	
1.	Support independent learning
2.	Guide to select and utilize adequate information from varied resources maintaining ethics.
3.	Guide to organize the work in the appropriate manner and present information (acknowledging the sources) clearly.
4.	Develop interactive, communication, organization, time management, and presentation skills.
5.	Impart flexibility and adaptability.
6.	Inspire independent and team working
7.	Expand intellectual capacity, credibility, judgment, intuition
8.	Adhere to punctuality, setting and meeting deadlines.
9.	Instil responsibilities to oneself and others.
10.	Train students to present the topic of project work in a seminar without any fear, face audience confidently, enhance communication skill, involve in group discussion to present and exchange ideas.

Project Phase-1 Students in consultation with the guide/s shall carry out literature survey/ visit industries to finalize the topic of the Project. Subsequently, the students shall collect the material required for the selected project, prepare synopsis and narrate the methodology to carry out the project work.

Seminar: Each student, under the guidance of a Faculty, is required to

- Present the seminar on the selected project orally and/or through power point slides.
- Answer the queries and involve in debate/discussion.
- Submit two copies of the typed report with a list of references.

The participants shall take part in discussion to foster friendly and stimulating environment in which the students are motivated to reach high standards and become self-confident.

Course Outcomes: At the end of the course, the students will be able to	
CO1	Demonstrate a sound technical knowledge of their selected project topic
CO2	Undertake problem identification, formulation, and solution.
CO3	Design engineering solutions to complex problems utilising a systems approach
CO4	Communicate with engineers and the community at large in written an oral forms
CO5	Demonstrate the knowledge, skills and attitudes of a professional engineer.

CIE procedure for Project Work: The CIE marks shall be awarded by a committee consisting of the Head of the concerned Department and two senior faculty members of the Department, one of whom shall be the Guide. The CIE marks awarded for the project work shall be based on the evaluation of the project work Report, project presentation skill, and question and answer session in the ratio 50:25:25. The marks awarded for the project report shall be the same for all the batch mates.

SEE procedure for Project Work: SEE for project work will be conducted by the two examiners appointed by the BOS Chairman and get the approval from the principal / COE. The SEE marks awarded for the project work shall be based on the evaluation of project work Report, project presentation skill, and question and answer session in the ratio 50:25:25.

CO-PO Mapping

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

3-Highly mapped 2-Moderately mapped 1-Slightly mapped

SEMESTER-IV					
PROJECT WORK PHASE - II **Category: PROJ**					
Course Code	:	P24SCSP401	CIE	:	100 Marks
Teaching Hours L:P: SDA	:	0:20:0	SEE	:	100Marks
Total Hours	:	-	Total	:	200 Marks
Credits	:	10	SEE Duration	:	3

Course Objectives:

- To support independent learning.
- To guide to select and utilize adequate information from varied resources maintaining ethics.
- To guide to organize the work in the appropriate manner and present information (acknowledging the sources) clearly.
- To develop interactive, communication, organization, time management, and presentation skills.
- To impart flexibility and adaptability.
- To inspire independent and team working.
- To expand intellectual capacity, credibility, judgment, intuition.
- To adhere to punctuality, setting and meeting deadlines
- To instill responsibilities to oneself and others.
- To train students to present the topic of project work in a seminar without any fear, face audience confidently, enhance communication skill, involve in group discussion to present and exchange ideas

Project Work Phase - II:

- Each student of the project batch shall involve in carrying out the project work jointly in constant consultation with internal guide, co-guide, and external guide and prepare the project report as per the norms avoiding plagiarism.
- Follow the Software Development life cycle
- Data Collection ,Planning
- Design the Test cases
- Validation and verification of attained results
- Significance of parameters w.r.t scientific quantified data.
- Publish the project work in reputed Journal.

Course Outcomes: At the end of the course, the students will be able to

- Present the project and be able to defend it.
- Make links across different areas of knowledge and to generate, develop and evaluate ideas and information so as to apply these skills to the project task.
- Habituated to critical thinking and use problem solving skills
- Communicate effectively and to present ideas clearly and coherently in both the written and oral forms.
- Work in a team to achieve common goal.
- Learn on their own, reflect on their learning and take appropriate actions to improve it. Identify areas for future knowledge and skill development.
- Expand intellectual capacity, credibility, judgment, intuition.
- Acquire the knowledge of administration, marketing, finance and economics

CIE procedure for Project Work: The CIE marks shall be awarded by a committee consisting of the Head of the concerned Department and two senior faculty members of the Department, one of whom shall be the Guide. The CIE marks awarded for the project work shall be based on the evaluation of the project work Report, project presentation skill, and question and answer session in the ratio 50:25:25. The marks awarded for the project report shall be the same for all the batch mates.

SEE procedure for Project Work: SEE for project work will be conducted by the two examiners appointed by the BOS Chairman and get the approval from the principal / COE. The SEE marks awarded for the project work shall be based on the evaluation of project work Report, project presentation skill, and question and answer session in the ratio 50:25:25.

CO-PO Mapping

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

3-Highly mapped, 2-Moderately mapped, 1-Slightly mapped

SEMESTER-IV					
INTERNSHIP **Category: INT**					
Course Code	:	P24SCSI402	CIE	:	100 Marks
Teaching Hours L:P: SDA	:	-	SEE	:	100 Marks
Total Hours	:	13 Weeks	Total	:	200 Marks
Credits	:	11	SEE Duration	:	3 Hrs.

Course Objectives:

Internship/Professional practice provide students the opportunity of hands-on experience that include personal training, time and stress management, interactive skills, presentations, budgeting, marketing, liability and risk management paperwork, equipment ordering, maintenance, responding to emergencies etc. The objective are further:

1. To put theory into practice.
2. To expand thinking and broaden the knowledge and skills acquired through course work in the field.
3. To relate to, interact with, and learn from current professionals in the field.
4. To gain a greater understanding of the duties and responsibilities of a professional.
5. To understand and adhere to professional standards in the field.
6. To gain insight to professional communication including meetings, memos, reading, writing, public speaking, research, client interaction, input of ideas, and confidentiality.
7. To identify personal strengths and weaknesses.
8. To develop the initiative and motivation to be a self-starter and work independently.

Internship/Professional practice:

Students under the guidance of internal guide/s and external guide shall take part in all the activities regularly to acquire as much knowledge as possible without causing any inconvenience at the place of internship.

Seminar: Each student, is required to

- Present the seminar on the internship orally and/or through power point slides.
- Answer the queries and involve in debate/discussion.
- Submit the report duly certified by the external guide.
- The participants shall take part in discussion to foster friendly and stimulating environment in which the students are motivated to reach high standards and become self-confident.

Course Outcomes: At the end of the course, the students will be able to

- Gain practical experience within industry in which the internship is done.
- Acquire knowledge of the industry in which the internship is done.
- Apply knowledge and skills learned to classroom work.
- Develop a greater understanding about career options while more clearly defining personal career goals.
- Experience the activities and functions of professionals.
- Develop and refine oral and written communication skills.
- Identify areas for future knowledge and skill development.
- Expand intellectual capacity, credibility, judgment, intuition.
- Acquire the knowledge of administration, marketing, finance and economics.

ASSESSMENT STRUCTURE:

At the beginning of IV Semester of the program the students undergone the internship-Research Internship /Industrial Internship. The mandatory Research internship /Industry internship is for 14 to 20 weeks. The internship shall be considered as a head of passing and shall be considered for the award of a degree. Those, who do not take up/complete the internship shall be declared to fail and shall have to complete it during the subsequent institution examination after satisfying the internship requirements.

Research internship: A research internship is intended to offer the flavor of current research going on in the research field. It helps students get familiarized with the field and imparts the skill required for carrying out research.

Industry internship: Is an extended period of work experience undertaken by students to supplement their degree for professional development. It also helps them learn to overcome unexpected obstacles and successfully navigate organizations, perspectives, and cultures. Dealing with contingencies helps students recognize, appreciate, and adapt to organizational realities by tempering their knowledge with practical constraints.

CONTINUOUS INTERNAL EVALUATION:

CIE marks for the Internship/Professional practice report (60 marks) and seminar (40 marks) shall be awarded (based on the quality of report and presentation skill, participation in the question and answer session by the student) by the committee constituted for the purpose by the Head of the Department and the two senior faculty members.

SEMESTER END EXAMINATION:

SEE for Internship will be conducted by the two examiners appointed by the BOS Chairman and gets the approval from the principal / COE. The SEE marks awarded to the students for the internship shall be based on the evaluation of Report, presentation skill, and question and answer session in the ratio 50:25:25.

CO-PO Mapping

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

3-Highly mapped 2-Moderately mapped 1-Slightly mapped