VISVESVARAYA TECHNOLOGICAL UNIVERSITY
BELAGAVI

Scheme of Teaching and Examinations and Syllabus

M.Tech in Artificial Intelligence and Machine Learning (SAM)

(Effective from Academic year 2020 - 21)

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI
Scheme of Teaching and Examinations – 2020 - 21
M.Tech in Artificial Intelligence and Machine Learning (SAM)
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)

I SEMESTER

SL. No.	Course	Course Code	Course Title	Teaching Hours / Week			Examination				Credits
				Theory	Practical / Seminar	Skill Development Activity	Duration in Hours	CIE Marks	SEE Marks	Total Marks	
1	PCC	20SAM11	Mathematical Foundations of Computer Science	03	--	02	03	40	60	100	4
2	PCC	20SAM12	Artificial Intelligence and Machine Learning	03	--	02	03	40	60	100	4
3	PCC	20SAM13	Cognitive Science	03	--	02	03	40	60	100	4
4	PCC	20SAM14	Data Science	03	--	02	03	40	60	100	4
5	PCC	20SAM15	Cloud Computing and Intelligence	03	--	02	03	40	60	100	4
6	PCC	20SAML16	Data Science and Analytics LAB	--	04	--	03	40	60	100	2
7	PCC	20RMI17	Research Methodology and IPR	01	--	02	03	40	60	100	2
			TOTAL	**16**	**04**	**12**	**21**	**280**	**420**	**700**	**24**

Note: PCC: Profession Core

Skill development activities:

Students and course instructor/s to involve either individually or in groups to interact together to enhance the learning and application skills. The students should interact with industry (small, medium and large), understand their problems or foresee what can be undertaken for study in the form of research/ testing / projects, and for creative and innovative methods to solve the identified problem. The students shall

1. Gain confidence in modelling of systems and algorithms.
2. Work on different software/s (tools) to Simulate, analyze and authenticate the output to interpret and conclude. Operate the simulated system under changed parameter conditions to study the system with respect to thermal study, transient and steady state operations, etc.
3. Handle advanced instruments to enhance technical talent.
4. Involve in case studies and field visits/ field work.
5. Accustom with the use of standards/codes etc., to narrow the gap between academia and industry.

All activities should enhance student's abilities to employment and/or self-employment opportunities, management skills, Statistical analysis, fiscal expertise, etc.

Internship: All the students have to undergo mandatory internship of 6 weeks during the vacation of I and II semesters and /or II and III semesters. A University examination shall be conducted during III semester and the prescribed credit shall be counted for the same semester. Internship shall be considered as a head of passing and shall be considered for the award of degree. Those, who do not take-up/complete the internship shall be declared as fail in internship course and have to complete the same during the subsequent University examination after satisfying the internship requirements.

Note: (i) Four credit courses are designed for 50 hours Teaching – Learning process.
(ii) Three credit courses are designed for 40 hours Teaching – Learning process.

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M.Tech in Artificial Intelligence and Machine Learning (SAM)
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II SEMESTER

SL. No.	Course	Course Code	Course Title	Teaching Hours / Week			Examination				Credits
				Theory	Practical / Seminar	Skill Development Activity	Duration in Hours	CIE Marks	SEE Marks	Total Marks	
1	PCC	20SAM21	Machine Learning Techniques	03	--	02	03	40	60	100	4
2	PCC	20SAM22	Soft and Evolutionary Computing	03	--	02	03	40	60	100	4
3	PCC	20SAM23	Natural Language Processing	03	--	02	03	40	60	100	4
4	PEC	20SAM24X	Professional elective 1	04	--	--	03	40	60	100	4
5	PEC	20SAM25X	Professional elective 2	04	--	--	03	40	60	100	4
6	PCC	20SAML26	MLT Laboratory	--	04	--	03	40	60	100	2
7	PCC	20SAM27	Technical Seminar	--	02	--	--	100	--	100	2
			TOTAL	**17**	**06**	**06**	**18**	**340**	**360**	**700**	**24**

Note: PCC: Profession Core, PEC: Professional Elective Course

Professional Elective-1		**Professional Elective-2**	
Course Code 20SAM24X	**Course Title**	**Course Code 20SAM25X**	**Course Title**
20SAM241	Computer Vision	20SAM251	Robotics and Automation
20SAM242	Biometric Security	20SAM252	Human Computer Interaction
20SAM243	Probabilistic GraphicalModels	20SAM253	Pattern Recognition
20SAM244	Cyber Security and Cyber law	20SAM254	Blockchain Technology

Note:

1. Technical Seminar: CIE marks shall be awarded by a committee comprising of HoD as Chairman, Guide/co-guide, if any, and a senior faculty of the department. Participation in the seminar by all postgraduate students of the program shall be mandatory.
The CIE marks awarded for Technical Seminar, shall be based on the evaluation of Seminar Report, Presentation skill and performance in Question and Answer session in the ratio 50:25:25.

2. Internship: All the students shall have to undergo mandatory internship of 6 weeks during the vacation of I and II semesters and /or II and III semesters. A University examination shall be conducted during III semester and the prescribed internship credit shall be counted in the same semester. Internship shall be considered as a head of passing and shall be considered for the award of degree. Those, who do not take-up/complete the internship shall be declared as fail in internship course and have to complete the same during the subsequent University examination after satisfying the internship
requirements.

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III SEMESTER

SL. No.	Course	Course Code	Course Title	Teaching Hours / Week			Examination				Credits
				Theory	Practical / Seminar	Skill Development Activity	Duration in Hours	CIE Marks	SEE Marks	Total Marks	
1	PCC	20SAM31	Deep Learning	03	--	02	03	40	60	100	4
2	PEC	20SAM32X	Professional elective 3	03	--	--	03	40	60	100	3
3	PEC	20SAM33X	Professional elective 4	03	--	--	03	40	60	100	3
4	Project	20SAM34	Project work phase - 1	--	02	--	--	100	--	100	2
5	PCC	20SAM35	Mini-Project	--	02	--	--	100	--	100	2
6	Internship	20SAMI36	Internship	(Completed during the intervening vacation of I and II semesters and /or II and III semesters.)			03	40	60	100	6
			TOTAL	**09**	**04**	**02**	**12**	**360**	**240**	**600**	**20**

Note: PCC: Profession Core, PEC: Professional Elective Course

Professional Elective-3		**Professional Elective-4**	
Course Code 20SAM32X	**Course Title**	**Course Code 20SAM33X**	**Course Title**
20SAM321	Virtual Reality	20SAM331	Game Theory
20SAM322	Agile Technologies	20SAM332	Semantic Web and Social Networks
20SAM323	Internet of Things and Applications	20SAM333	Multidisciplinary Design Optimization
20SAM324	Software Defined Networks	20SAM334	Speech Processing

Note:

1. Project Work Phase-1: Students in consultation with the guide/co-guide if any, shall pursue literature survey and complete the preliminary requirements of selected Project work. Each student shall prepare relevant introductory project document and present a seminar.

CIE marks shall be awarded by a committee comprising of HoD as Chairman, Guide/co-guide if any, and a senior faculty of the department. The CIE marks awarded for project work phase -1, shall be based on the evaluation of Project Report, Project Presentation skill and Question and Answer session in the ratio 50:25:25. SEE (University examination) shall be as per the University norms.

2. Internship: Those, who have not pursued /completed the internship shall be declared as fail in 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 University norms.

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IV SEMESTER

SL. No.	Course	Course Code	Course Title	Teaching Hours / Week			Examination				Credits
				Theory	Practical / Seminar	Skill Development Activity	Duration in Hours	CIE Marks	SEE Marks	Total Marks	
1	Project	20SAM41	Project work phase 2	--	04	03	03	40	60	100	20
			TOTAL	**--**	**04**	**03**	**03**	**40**	**60**	**100**	**20**

Note:
Project Work Phase-2:
CIE marks shall be awarded by a committee comprising of HoD as Chairman, Guide/co-guide, if any, and a Senior faculty of the department. The CIE marks awarded for project work phase -2, shall be based on the evaluation of Project Report subjected to plagiarism check, Project Presentation skill and Question and Answer session in the ratio 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 University norms.

M.TECH IN NETWORK AND INTERNET ENGINEERING (LNI)
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER -I

MATHEMATICAL FOUNDATION OF COMPUTER SCIENCE

Course Code	20LNI11, 20SCS11, 20SCE11, 20SFC11, 20SCN11, 20SSE11, 20SIT11, 20SAM11, 20SIS11	CIE Marks	40
Teaching Hours/Week (L:P:S)	3:0:2	SEE Marks	60
Credits	04	Exam Hours	03

Module-1

Vector Spaces: Vector spaces; subspaces Linearly independent and dependent vectors Basis and dimension; coordinate vectors-Illustrative examples. Linear transformations, Representation of transformations by matrices;
(RBT Levels: **L1 & L2)** (Textbook:1)

Module-2

Orthogonality and least squares: Inner product, orthogonal sets, orthogonal projections, orthogonal bases. Gram-Schmidt orthogonalization process. QR factorizations of a matrices, least square problems, applications to linear models (least square lines and least square fitting of other curves).
(RBT Levels: **L2 & L3)** (Textbook:1)

Module-3

Symmetric and Quadratic Forms: Diagonalization, Quadratic forms, Constrained Optimization, The Singular value decomposition. Applications to image processing and statistics, Principal Component Analysis
(RBT Levels: **L2 & L3)** (Textbook:1)

Module-4

Statistical Inference: Introduction to multivariate statistical models: Correlation and Regression analysis, Curve fitting (Linear and Non-linear)
(RBT Levels: **L2 & L3)** (Textbook:3)

Module-5

ProbabilityTheory: Random variable (discrete and continuous), Probability mass function (pmf), Probability density function (pdf), Mathematical expectation, Sampling theory: testing of hypothesis by ***t***-test, χ^2- test.
(RBT Levels: **L1 & L2)** (Textbook:3)

Course Outcomes:

On completion of this course, students are able to:

1. Understand the numerical methods to solve and find the roots of the equations.
2. Apply the technique of singular value decomposition for data compression, least square approximation in solving inconsistent linear systems
3. Understand vector spaces and related topics arising in magnification and rotation of images.
4. Utilize the statistical tools in multi variable distributions.
5. Use probability formulations for new predictions with discrete and continuous RV's.

Question Paper Pattern:

- The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60.
- The question paper will have ten full questions carrying equal marks.
- Each full question consisting of 20 marks.
- There will be two full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Textbooks:

Sl No	Title of the book	Name of the Author/s	Publisher Name	Edition and year

1	Linear Algebra and its Applications	David C.Lay, Steven R.Lay and J.J.McDonald	Pearson Education Ltd	5th Edition2015.
2	Numerical methods for Scientific and Engg. Computation	M K Jain, S.R.K Iyengar, R K. Jain	New Age International	6th Ed., 2014
3	Probability, Statistics and Random Process	T.Veerarajan	Tata Mc-Graw Hill Co	3rd Edition2016
Reference books:				
Sl No	**Title of the book**	**Name of the Author/s**	**Publisher Name**	**Edition and year**
1	Optimization: Theory & Applications Techniques	Rao. S.S	Wiley Eastern Ltd New Delhi.	
2	Signals, Systems, and Inference	Alan V. Oppenheim and George C. Verghese	Spring	2010.
3	Foundation Mathematics for Computer Science	John Vince	Springer International	
4	Higher Engineering Mathematics	B.S. Grewal	Khanna Publishers	44th Ed.,2017

M.TECH IN COMPUTER SCIENCE AND ENGINEERING (SCS) **Choice Based Credit System (CBCS) and Outcome Based Education (OBE)** **SEMESTER –I**			
ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING			
Course Code	**20SAM12,** 20SCS12, 20SSE254, 20SIS31	CIE Marks	40
Teaching Hours/Week (L:P:S)	3:0:2	SEE Marks	60
Credits	04	Exam Hours	03
Module-1			
Introduction, problem Solving: state space search and control strategies			
Module-2			
Problem reduction and Game playing, Logic concepts and logic programming			
Module-3			
Advanced problem-solving paradigm: planning Knowledge representation			
Module-4			
Uncertainty Measure: Probability Theory, Bayesian Belief Networks, Machine Learning Paradigms: Machine learning system, supervised and unsupervised learnings, Inductive, deductive learning, Clustering			
Module-5			
Support vector Machine, case-based reasoning and learning. ANN: Single Layer, Multilayer. RBF, Design issues in ANN, Recurrent Network			
Course outcomes: At the end of the course the student will be able to: ● Define Artificial intelligence and identify problems for AI. Characterize the search techniques to solve problems and recognize the scope of classical search techniques ● Define knowledge and its role in AI. Demonstrate the use of Logic in solving AI problems ● Demonstrate handling of uncertain knowledge and reasoning in probability theory. ● Understanding of Learning methods			
Question paper pattern: The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60. ● The question paper will have ten full questions carrying equal marks. ● Each full question is for 20 marks. ● There will be two full questions (with a maximum of four sub questions) from each module. ● Each full question will have sub question covering all the topics under a module. ● The students will have to answer five full questions, selecting one full question from each module.			
Textbook/ Textbooks			

Sl No	Title of the book	Name of the Author/s	Publisher Name	Edition and year
1	Artificial Intelligence:	Saroj Kaushik	Cengage Learning	2014 Edition
Reference Books				
1	Artificial Intelligence: Structures and Strategies for Complex Problem Solving	George F Luger	Pearson Addison Wesley	6th Ed, 2008
2	Artificial Intelligence	E Rich, K Knight, and S B Nair	Tata Mc-Graw Hill	3rd Ed, 2009
3	Artificial Intelligence: A Modern Approach	Stuart Russell and Peter Norvig	Prentice Hall	3rd, 2009

M.TECH ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING (SAM)
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER – I

COGNITIVE SCIENCE

Course Code	**20SAM13**	CIE Marks	40
Teaching Hours/Week (L:P:S)	3:0:2	SEE Marks	60
Credits	04	Exam Hours	03

Module-1

The prehistory of cognitive science, The reaction against behaviorism in psychology, The theory of computation and the idea of an algorithm, Linguistics and the formal analysis of language, Information-processing models in psychology, The discipline matures: Three milestones: Language and micro-worlds, How do mental images represent?, An interdisciplinary model of vision

Module 2

The turn to the brain : Cognitive systems as functional systems , The anatomy of the brain and the primary visual pathway , Extending computational modeling to the brain , Mapping the stages of lexical processing ,THE INTEGRATION CHALLENGE, Cognitive science and the integration challenge; Cognitive science: An interdisciplinary endeavor, Levels of explanation: The contrast between psychology and neuroscience, The integration challenge, Local integration I: Evolutionary psychology and the psychology of reasoning, Local integration II: Neural activity and the BOLD signal

Module 3

INFORMATION-PROCESSING MODELS OF THE MIND , Physical symbol systems and the language of thought ; The physical symbol system hypothesis , From physical symbol systems to the language of thought , The Chinese room argument , Applying the symbolic paradigm ; Expert systems, machine learning, and the heuristic search hypothesis , ID3: An algorithm for machine learning , WHISPER: Predicting stability in a block world ,

Module 4

Neural networks and distributed information processing ; Neurally inspired models of information processing , Single-layer networks and Boolean functions , Multilayer networks, Information processing in neural networks: Key features, Neural network models of cognitive processes; Language and rules: The challenge for information-processing models, Language learning in neural networks, Object permanence and physical reasoning in infancy, Neural network models of children's physical reasoning

Module 5

THE ORGANIZATION OF THE MIND , How are cognitive systems organized?; Architectures for intelligent agents , Fodor on the modularity of mind , The massive modularity hypothesis , Strategies for brain mapping ; Structure and function in the brain , , Studying cognitive functioning: Techniques from neuroscience , Combining resources I: The locus of selection problem , Combining resources II: Networks for attention , From data to maps: Problems and pitfalls.

Course outcomes: At the end of the course the student will be able to:

- Synthesize and analyze information from a variety of sources concerning foundational concepts and arguments in cognitive science and philosophy.
- Engage in philosophical discussion and debate on the various philosophical issues relating to cognitive science.
- Critically assess arguments about the nature of cognition, the methodology of cognitive science and the role of cognitive sciences in society.
- Clearly articulate their own position with respect to contemporary real world debates aboutphilosophy and cognitive science.
- Critically evaluate evidence from a broad range of disciplines including cognitive science, psychology and neuroscience.

Question paper pattern:

- The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60.
- The question paper will have ten full questions carrying equal marks.
- Each full question is for 20 marks.
- There will be two full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Textbook/ Textbooks:

Sl.No	Title of the book	Name of the Author/s	Publisher Name	Edition and year
1	An Introduction to the Science of the Mind	Jose Luis Bermudez	Cambridge University Press	Second Edition
Reference Books:				
1	Cognition	Reisberg	W. W. Norton & Co. price	2005
2	Why Everyone (Else) Is a Hypocrite	Kurzban	Princeton University Press; ISBN: 978-0-691-15439-8.	2012

M.TECH IN COMPUTER SCIENCE AND ENGINEERING (SCS)
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER – I

DATA SCIENCE

Course Code	**20SAM14,** 20SCS21, 20SIS22	CIE Marks	40
Teaching Hours/Week (L:P:S)	3:0:2	SEE Marks	60
Credits	04	Exam Hours	03

Module-1

Introduction: What is Data Science? Big Data and Data Science hype – and getting past the hype, Why now? – Datafication, Current landscape of perspectives, Skill sets. NeededStatistical Inference: Populations and samples, Statistical modelling, probability distributions, fitting a model, - Introduction to R

Module-2

Exploratory Data Analysis and the Data Science Process: Basic tools (plots, graphs and summary statistics) of EDA, Philosophy of EDA,The Data Science Process, Case Study: RealDirect (online real estate firm). Three Basic Machine Learning Algorithms: Linear Regression, k-Nearest Neighbours (k-NN), k-means

Module-3

One More Machine Learning Algorithm and Usage in Applications: Motivating application: Filtering Spam, Why Linear Regression and k-NN are poor choices for Filtering Spam, Naive Bayes and why it works for Filtering Spam, Data Wrangling: APIs and other tools for scrapping the Web
Module-4
Feature Generation and Feature Selection (Extracting Meaning from Data): Motivating application: user (customer) retention. Feature Generation (brainstorming, role of domain expertise, and place for imagination), Feature Selection algorithms. Filters; Wrappers; Decision Trees; Random Forests. Recommendation Systems: Building a User-Facing Data Product, Algorithmic ingredients of a Recommendation Engine, Dimensionality Reduction, Singular Value Decomposition, Principal Component Analysis, Exercise: build your own recommendation system
Module-5
Mining Social-Network Graphs: Social networks as graphs, Clustering of graphs, Direct discovery of communities in graphs, Partitioning of graphs, Neighbourhood properties in graphs, Data Visualization: Basic principles, ideas and tools for data visualization. Data Science and Ethical Issues, Discussions on privacy, security, ethics, Next-generation data scientists
Course outcomes: At the end of the course the student will be able to:
• Define data science and its fundamentals • Demonstrate the process in data science • Explain machine learning algorithms necessary for data sciences • Illustrate the process of feature selection and analysis of data analysis algorithms • Visualize the data and follow of ethics
Question paper pattern: The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60. • The question paper will have ten full questions carrying equal marks. • Each full question is for 20 marks. • There will be two full questions (with a maximum of four sub questions) from each module. • Each full question will have sub question covering all the topics under a module. • The students will have to answer five full questions, selecting one full question from each module.

Textbook/ Textbooks

Sl No	Title of the book	Name of the Author/s	Publisher Name	Edition and year
1	Doing Data Science	Cathy O'Neil and Rachel Schutt	Straight Talk from The Frontline.O'Reilly	2014
2	Mining of Massive Datasets. V2.1	Jure Leskovek, AnandRajaraman and Jeffrey Ullman	Cambridge University Press	2014
Reference Books				
3	Data Mining: Concepts and Techniques	Jiawei Han, MichelineKamber and Jian Pei	ThirdEdition	2012.
4	Machine Learning: A Probabilistic Perspective	Kevin P. Murphy		2013

M.TECH IN ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING (SAM) **Choice Based Credit System (CBCS) and Outcome Based Education (OBE)** **SEMESTER – I**			
CLOUD COMPUTING AND INTELLIGENCE			
Course Code	**20SAM15**	CIE Marks	40
Teaching Hours/Week (L:P:S)	3:0:2	SEE Marks	60
Credits	04	Exam Hours	03

Module-1

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 lock-in, Energy use and ecological impact, Service level agreements, User experience and software licensing. Exercises and problems.

Module 2

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 cloud computing.

Module 3

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

Module 4

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 MapReduce applications subject to deadlines, Resource management and dynamic scaling, Exercises and problems.

Module 5

Azure Analytics:
The Analytics Data Pipeline, Data Lakes, Lambda Architecture, Kappa Architecture, Choosing Between Lambda and Kappa, The Azure Analytics Pipeline, Introducing the Analytics Scenarios, Azure Machine Learning, R Server on HDInsight,SQL R Services, Microsoft Cognitive Services

Course outcomes:
At the end of the course the student will be able to:

- Compare the strengths and limitations of cloud computing
- Identify the architecture, infrastructure and delivery models of cloud computing
- Apply suitable virtualization concept.
- Choose the appropriate cloud player
- Address the core issues of cloud computing such as security, privacy and interoperability
- Design Cloud Services And Azure Analytics:

Question paper pattern:

- The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60.
- The question paper will have ten full questions carrying equal marks.
- Each full question is for 20 marks.
- There will be two full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Textbook/ Textbooks:				
Sl.No	**Title of the book**	**Name of the Author/s**	**Publisher Name**	**Edition and year**
1	Cloud Computing Theory and Practice	Dan C Marinescu	Elsevier(MK)	2013.
2	Mastering Azure Analytics	ZoinerTejada	O Reilly	2017
Reference Books:				
1	RajkumarBuyya , James Broberg, AndrzejGoscinski	Computing Principles and Paradigms	Willey	2014
2	Cloud Computing Implementation, Management and Security	John W Rittinghouse, James F Ransome	CRC Press	2013

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SEMESTER – I

DATA SCIENCE & ANALYTICS LAB

Course Code	**20SAML16**	CIE Marks	40
Teaching Hours/Week (L:P:S)	0:4:0	SEE Marks	60
Credits	02	Exam Hours	03

List of experiments

Part –A

1. Write a program to implement decision trees using any data sets (Ex: Heart disease data set)
2. Write a program to demonstrate association analysis
3. Implement any clustering technique.
4. Implement linear and logistic regression
5. Implement an Map reduce program that processes a weather data set
6. Data analytics: write a program that transposes the original data set, find all pairs products reviewed together; Writes on the output folder all the pairs of products that appear more than once and their frequencies. The pairs of products must be sorted by frequency.

PART –B

Implement a mini project using any data mining technique.

Instructions : programs can be implemented using any of frame works like Weka, Orange, R, Hadoop etc.

Course outcomes:

At the end of this course the students will be able to:

- Design and deploy appropriate data mining techniques
- Apply data mining and analytics techniques for large data sets.
- Creating applications for data analytics

Conduction of Practical Examination:

All laboratory experiments (nos) are to be included for practical examination.
Evaluation: 50% of the marks allotted for lab experiment execution and remaining 50% marks for the project demo.
Students are allowed to pick one experiment from **the list**
Strictly follow the instructions as printed on the cover page of answer script for breakup of marks
Change of experiment is allowed only once and marks allotted to the procedure part to be made

zero.

RESEARCH METHODOLOGY AND IPR			
Course Code	20RMI17	CIE Marks	40
Teaching Hours/Week (L:P:SDA)	1:0:2	SEE Marks	60
Credits	02	Exam Hours	03

Module-1

Research Methodology: Introduction, Meaning of Research, Objectives of Research, Motivation in Research, Types of Research, Research Approaches, Significance of Research, Research Methods versus Methodology, Research and Scientific Method, Importance of Knowing How Research is Done, Research Process, Criteria of Good Research, and Problems Encountered by Researchers in India.

Defining the Research Problem: Research Problem, Selecting the Problem, Necessity of Defining the Problem, Technique Involved in Defining a Problem, An Illustration.

Module-2

Reviewing the literature: Place of the literature review in research, Bringing clarity and focus to your research problem, Improving research methodology, Broadening knowledge base in research area, Enabling contextual findings, How to review the literature, searching the existing literature, reviewing the selected literature, Developing a theoretical framework, Developing a conceptual framework, Writing about the literature reviewed.

Research Design: Meaning of Research Design, Need for Research Design, Features of a Good Design, Important Concepts Relating to Research Design, Different Research Designs, Basic Principles of Experimental Designs, Important Experimental Designs.

Module-3

Design of Sampling: Introduction, Sample Design, Sampling and Non-sampling Errors, Sample Survey versus Census Survey, Types of Sampling Designs.

Measurement and Scaling: Qualitative and Quantitative Data, Classifications of Measurement Scales, Goodness of Measurement Scales, Sources of Error in Measurement Tools, Scaling, Scale Classification Bases, Scaling Technics, Multidimensional Scaling, Deciding the Scale.

Data Collection: Experimental and Surveys, Collection of Primary Data, Collection of Secondary Data, Selection of Appropriate Method for Data Collection, Case Study Method.

Module-4

Testing of Hypotheses: Hypothesis, Basic Concepts Concerning Testing of Hypotheses, Testing of Hypothesis, Test Statistics and Critical Region, Critical Value and Decision Rule, Procedure for Hypothesis Testing, Hypothesis Testing for Mean, Proportion, Variance, for Difference of Two Mean, for Difference of Two Proportions, for Difference of Two Variances, P-Value approach, Power of Test, Limitations of the Tests of Hypothesis.

Chi-square Test: Test of Difference of more than Two Proportions, Test of Independence of Attributes, Test of Goodness of Fit, Cautions in Using Chi Square Tests.

Module-5

Interpretation and Report Writing: Meaning of Interpretation, Technique of Interpretation, Precaution in Interpretation, Significance of Report Writing, Different Steps in Writing Report, Layout of the Research Report, Types of Reports, Oral Presentation, Mechanics of Writing a Research Report, Precautions for Writing Research Reports.

Intellectual Property: The Concept, Intellectual Property System in India, Development of TRIPS Complied Regime in India, Patents Act, 1970, Trade Mark Act, 1999,The Designs Act, 2000, The Geographical Indications of Goods (Registration and Protection) Act1999, Copyright Act,1957,The Protection of Plant Varieties and Farmers' Rights Act, 2001,The Semi-Conductor Integrated Circuits Layout Design Act, 2000, Trade Secrets, Utility Models, IPR and Biodiversity, The Convention on Biological Diversity (CBD) 1992, Competing Rationales for Protection of IPRs, Leading International Instruments Concerning IPR, World Intellectual Property Organisation (WIPO),WIPO and WTO, Paris Convention for the Protection of Industrial Property, National Treatment, Right of Priority, Common Rules, Patents, Marks, Industrial Designs, Trade Names, Indications of Source, Unfair Competition, Patent Cooperation Treaty (PCT), Advantages of PCT Filing, Berne Convention for the Protection of Literary and Artistic Works, Basic Principles, Duration of Protection, Trade Related Aspects of Intellectual Property Rights(TRIPS) Agreement, Covered under TRIPS Agreement, Features of the Agreement, Protection of Intellectual Property under TRIPS, Copyright and Related Rights, Trademarks, Geographical indications, Industrial Designs, Patents, Patentable Subject Matter, Rights Conferred, Exceptions, Term of protection, Conditions on Patent Applicants, Process Patents, Other Use without Authorization of the Right Holder, Layout-Designs of Integrated Circuits, Protection of Undisclosed Information, Enforcement of Intellectual Property Rights, UNSECO.

Course outcomes:

At the end of the course the student will be able to:

- Discuss research methodology and the technique of defining a research problem
- Explain the functions of the literature review in research, carrying out a literature search, developing theoretical and conceptual frameworks and writing a review.
- Explain various research designs, sampling designs, measurement and scaling techniques and also different methods of data collections.
- Explain several parametric tests of hypotheses, Chi-square test, art of interpretation and writing research reports
- Discuss various forms of the intellectual property, its relevance and business impact in the changing global business environment and leading International Instruments concerning IPR.

Question paper pattern:

- The question paper will have ten questions.
- Each full question is for 20 marks.
- There will be 2full questions (with a maximum of four sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module.

Textbooks

(1) Research Methodology: Methods and Techniques, C.R. Kothari, Gaurav Garg,New Age International,4th Edition, 2018.

(2) Research Methodology a step-by-step guide for beginners. (For the topic Reviewing the literature under module 2), RanjitKumar,SAGE Publications,3rd Edition, 2011.

(3) Study Material (For the topic Intellectual Property under module 5),
Professional Programme Intellectual Property Rights, Law and Practice, The Institute of Company Secretaries of India, Statutory Body Under an Act of Parliament, September 2013

Reference Books

(1) Research Methods: the concise knowledge base, Trochim, Atomic Dog Publishing, 2005.

(2) Conducting Research Literature Reviews: From the Internet to Paper, Fink A, Sage Publications, 2009.

M.TECH IN NETWORK AND INTERNET ENGINEERING (LNI)
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER - II

MACHINE LEARNING TECHNIQUES

Course Code	**20SAM21,** 20LNI322, 20SCE321, 20SCN324, 20SFC254, 20SIT322	CIE Marks	40
Teaching Hours/Week (L:P:S)	3:0:2	SEE Marks	60
Credits	04	Exam Hours	03

Module-1

INTRODUCTION, CONCEPT LEARNING AND DECISION TREES
Learning Problems – Designing Learning systems, Perspectives and Issues – Concept Learning – Version Spaces and Candidate Elimination Algorithm – Inductive bias – Decision Tree learning – Representation – Algorithm – Heuristic Space Search

Module -2

NEURAL NETWORKS AND GENETIC ALGORITHMS: Neural Network Representation – Problems – Perceptrons – Multilayer Networks and Back Propagation Algorithms – Advanced Topics – Genetic Algorithms – Hypothesis Space Search – Genetic Programming – Models of Evolution and Learning.

Module – 3

BAYESIAN AND COMPUTATIONAL LEARNINGL Bayes Theorem – Concept Learning – Maximum Likelihood – Minimum Description Length Principle – Bayes Optimal Classifier – Gibbs Algorithm – Naïve Bayes Classifier– Bayesian Belief Network – EM Algorithm – Probably Learning – Sample Complexity for Finite and Infinite Hypothesis Spaces – Mistake Bound Model.

Module-4

INSTANT BASED LEARNING AND LEARNING SET OF RULES: K- Nearest Neighbor Learning – Locally Weighted Regression – Radial Basis Functions –Case-Based Reasoning – Sequential Covering Algorithms – Learning Rule Sets – Learning First Order Rules – Learning Sets of First Order Rules – Induction as Inverted Deduction – Inverting Resolution

Module-5

ANALYTICAL LEARNING AND REINFORCED LEARNING: Perfect Domain Theories – Explanation Based Learning – Inductive-Analytical Approaches - FOCL Algorithm – Reinforcement Learning – Task – Q-Learning – Temporal Difference Learning

Course outcomes:
At the end of the course the student will be able to:

- Choose the learning techniques with this basic knowledge.
- Apply effectively neural networks and genetic algorithms for appropriate applications.
- Apply Bayesian techniques and derive effectively learning rules.
- Choose and differentiate reinforcement and analytical learning techniques

Question paper pattern:
The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60.

- The question paper will have ten full questions carrying equal marks.
- Each full question is for 20 marks.
- There will be two full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Textbook/ Textbooks

Sl No	Title of the book	Name of the Author/s	Publisher Name	Edition and year
1	Machine Learning	Tom M. Mitchell	McGraw-Hill Education	2013
Reference Books				
1	Introduction to Machine Learning	EthemAlpaydin	PHI Learning Pvt.	2nd Ed., 2013

			Ltd	
2	The Elements of Statistical Learning	T. Hastie, R. Tibshirani, J. H. Friedman	Springer	1st edition, 2001

M.TECH COMPUTER SCIENCE AND ENGINEERING (SCS) **Choice Based Credit System (CBCS) and Outcome Based Education (OBE)** **SEMESTER – II**			
SOFT AND EVOLUTIONARY COMPUTING			
Course Code	**20SAM22,** 20SCS323, 20SSE31	CIE Marks	40
Teaching Hours/Week (L:P:S)	3:0:2	SEE Marks	60
Credits	04	Exam Hours	03

Module-1

Introduction to Soft computing: Neural networks, Fuzzy logic, Genetic algorithms, Hybrid systems and its applications.
Introduction to classical sets and fuzzy sets: Classical relations and fuzzy relations, Membership functions.

Module 2

Defuzzification, Fuzzy decision making, and applications.

Module 3

Genetic algorithms: Introduction, Basic operations, Traditional algorithms, Simple GA General genetic algorithms, The schema theorem, Genetic programming, applications.

Module 4

Swarm Intelligence System: Introduction, background of SI, Ant colony system
Working of ant colony optimization, ant colony for TSP.
(Textbook 2)

Module 5

Unit commitment problem, particle Swarm Intelligence system
Artificial bee colony system, Cuckoo search system.
(Textbook 2)

Course outcomes:
At the end of the course the student will be able to:

- Implement machine learning through neural networks.
- Design Genetic Algorithm to solve the optimization problem.
- Develop a Fuzzy expert system.

Model Neuro Fuzzy system for clustering and classification

Question paper pattern:
The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60.

- The question paper will have ten full questions carrying equal marks.
- Each full question is for 20 marks.
- There will be two full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Textbook/ Textbooks

Sl No	Title of the book	Name of the Author/s	Publisher Name	Edition and year
1	Principles of Soft computing	Shivanandam, Deepa S. N	Wiley India	2011
2	Soft Computing with MATLAB Programming	N. P. Padhy S.P. Simon	Oxford	2015

Reference Books

1	Neuro-fuzzy and soft computing	.S.R. Jang, C.T. Sun, E. Mizutani	Phi (EEE edition),	2012
2	Soft Computing	SarojKaushik SunitaTiwari	McGrawHill	2018

M.TECH IN COMPUTER SCIENCE AND ENGINEERING (SCS) Choice Based Credit System (CBCS) and Outcome Based Education (OBE) SEMESTER - II			
NATURAL LANGUAGE PROCESSING			
Course Code	**20SAM23,** 20SCS242, 20SCE243	CIE Marks	40
Teaching Hours/Week (L:P:S)	3:0:2	SEE Marks	60
Credits	04	Exam Hours	03
Module-1			
OVERVIEW AND LANGUAGE MODELING: Overview: Origins and challenges of NLP-Language and Grammar-Processing Indian Languages- NLP Applications-Information Retrieval. Language Modeling: Various Grammar- based Language Models-Statistical Language Model.			
Module -2			
WORD LEVEL AND SYNTACTIC ANALYSIS: Word Level Analysis: Regular Expressions-Finite-State Automata-Morphological Parsing-Spelling Error Detection and correction-Words and Word classes-Part-of Speech Tagging. Syntactic Analysis: Context-free Grammar-Constituency- Parsing-Probabilistic Parsing.			
Module - 3			
Extracting Relations from Text: From Word Sequences to Dependency Paths: Introduction, Subsequence Kernels for Relation Extraction, A Dependency-Path Kernel for Relation Extraction and Experimental Evaluation. Mining Diagnostic Text Reports by Learning to Annotate Knowledge Roles: Introduction, Domain Knowledge and Knowledge Roles, Frame Semantics and Semantic Role Labelling, Learning to Annotate Cases with Knowledge Roles and Evaluations. A Case Study in Natural Language Based Web Search: InFact System Overview, The GlobalSecurity.org Experience.			
Module-4			
Evaluating Self-Explanations in iSTART: Word Matching, Latent Semantic Analysis, and Topic Models: Introduction, iSTART: Feedback Systems, iSTART: Evaluation of Feedback Systems, Textual Signatures: Identifying Text-Types Using Latent Semantic Analysis to Measure the Cohesion of Text Structures: Introduction, Cohesion, Coh-Metrix, Approaches to Analysing Texts, Latent Semantic Analysis, Predictions, Results of Experiments. Automatic Document Separation: A Combination of Probabilistic Classification and Finite-State Sequence Modelling: Introduction, Related Work, Data Preparation, Document Separation as a Sequence Mapping Problem, Results. Evolving Explanatory Novel Patterns for Semantically based Text Mining: Related Work, A Semantically Guided Model for Effective Text mining.			
Module-5			
INFORMATION RETRIEVAL AND LEXICAL RESOURCES: Information Retrieval: Design features of Information Retrieval Systems-Classical, Non classical, Alternative Models of Information Retrieval – valuation Lexical Resources: World Net-Frame Net- Stemmers-POS Tagger- Research Corpora.			
Course outcomes: At the end of the course the student will be able to:			
• Analyse the natural language text. • Generate the natural language. • Demonstrate Text mining. • Apply information retrieval techniques.			
Question paper pattern: The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60. • The question paper will have ten full questions carrying equal marks.			

- Each full question is for 20 marks.
- There will be two full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Textbook/ Textbooks

Sl No	Title of the book	Name of the Author/s	Publisher Name	Edition and year
1	Natural Language Processing and Information Retrieval	TanveerSiddiqui, U.S. Tiwary	Oxford University Press	2008
2	Anne Kao and Stephen R. Potee	Natural LanguageProcessing andText Mining	Springer-Verlag London Limited	2007
Reference Books				
1	Speech and Language Processing: Anintroduction to Natural Language Processing, Computational Linguistics and SpeechRecognition	Daniel Jurafsky and James H Martin	Prentice Hall	2008 2nd Edition
2	Natural Language Understanding	James Allen	Benjamin/Cummingsp ublishing company	2nd edition, 1995
3	Information Storage and Retrieval systems	Gerald J. Kowalski and Mark.T. Maybury	Kluwer academic Publishers	2000.
4	Natural Language Processing with Python	Steven Bird, Ewan Klein, Edward Loper	O'Reilly Media	2009
5	Foundations of Statistical Natural Language Processing	Christopher D.Manning and HinrichSchutze	MIT Press	1999

M.TECH IN COMPUTER ENGINEERING (SCE)
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER - II

COMPUTER VISION

Course Code	**20SAM241,** 20SCE254, 20SIS324	CIE Marks	40
Teaching Hours/Week (L:P:S)	4:0:0	SEE Marks	60
Credits	04	Exam Hours	03

Module-1

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, Interreflections: Global Shading Models, Color: The Physics of Color, Human Color Perception, Representing Color, A Model for Image Color, Surface Color from Image Color.

Module -2

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.

Module – 3

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,

Module-4

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.

Module-5

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.

Course outcomes:

At the end of the course the student will be able to:

- Implement fundamental image processing techniques required for computer vision
- Perform shape analysis
- Implement boundary tracking techniques
- Apply chain codes and other region descriptors
- Apply Hough Transform for line, circle, and ellipse detections.
- Apply 3D vision techniques.
- Implement motion related techniques.
- Develop applications using computer vision techniques

Question paper pattern:

The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60.

- The question paper will have ten full questions carrying equal marks.
- Each full question is for 20 marks.
- There will be two full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Textbook/ Textbooks

Sl No	Title of the book	Name of the Author/s	Publisher Name	Edition and year
1	Computer Vision – A Modern Approach	David A. Forsyth and Jean Ponce	PHI Learning	2009
Reference Books				
1	Computer and Machine Vision – Theory, Algorithms and Practicalities	E. R. Davies	Elsevier	4th edition, 2013

M.TECH IN CYBER FORENSICS AND INFORMATION SECURITY (SFC)
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER - II

BIOMETRIC SECURITY

Course Code	**20SAM242,** 20SFC242	CIE Marks	40
Teaching Hours/Week (L:P:S)	4:0:0	SEE Marks	60
Credits	04	Exam Hours	03

Module 1

Biometrics: Introduction, benefits of biometrics over traditional authentication systems, benefits of biometrics in identification systems, selecting a biometric for a system, Applications, Key biometric terms and processes, biometric matching methods, Accuracy inbiometric systems.

Module 2

Physiological Biometric Technologies: Fingerprints: Technical description, characteristics, Competing technologies, strengths, weaknesses, deployment. Facial scan: Technical description, characteristics, weaknesses, deployment. Iris scan: Technical description, characteristics, strengths, weaknesses, deployment. Retina vascular pattern: Technical description, characteristics, strengths, weaknesses, deployment. Hand scan: Technical description, characteristics, strengths, weaknesses, deployment , DNA biometrics.

Module 3

Behavioral Biometric Technologies: Handprint Biometrics, DNA Biometrics, signature and handwriting technology, Technical description, classification, keyboard / keystroke
Dynamics, Voice, data acquisition, feature extraction, characteristics, strengths, weaknesses deployment.

Module 4

Multi biometrics: Multi biometrics and multi factor biometrics, two-factor authentication with passwords, tickets and tokens, executive decision, implementation plan.

Module 5

Case studies on Physiological, Behavioral and multifactor biometrics in identification systems.

Course outcomes:
At the end of the course the student will be able to:

- Visualize traditional and biometric systems.
- Analyze different algorithms of biometric systems.
- Compare strengths and weaknesses of different biometric systems.
- Design different biometric system.
- Design multimodal biometric systems.

Question paper pattern:
The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60.

- The question paper will have ten full questions carrying equal marks.
- Each full question is for 20 marks.
- There will be two full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Textbook/ Textbooks

Sl No	Title of the book	Name of the Author/s	Publisher Name	Edition and year
1	Biometrics –Identity verification in a networked World	Samir Nanavathi, Michel Thieme, and Raj Nanavathi	Wiley Eastern	2002
2	Implementing Biometric Security	John Chirillo and Scott Blaul	Wiley Eastern Publications	2005
Reference Books				
1	Biometrics for Network Security	John Berger	Prentice Hall	2004

M.TECH IN ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING (SAM)
Choice Based Credit System (CBCS) and Outcome Based Education(OBE)
SEMESTER – II

PROBABILISTIC GRAPHICAL MODELS

Course Code	**20SAM243**	CIE Marks	40
Teaching Hours/Week (L:P:S)	4:0:0	SEE Marks	60
Credits	04	Exam Hours	03

Module-1

Intro and Refresher of Probabilities, Bayesian Networks (directed graphical models)

Module-2

Excurse Causality , Markov Networks (undirected graphical models) Factor graphs, Parameter

Estimation

Module-3

Maximum-A-Posteriori Estimation, Bayesian Inference, EM, Inference and Learning in Hidden Markov Models Maximum Entropy Models, (Loopy) Belief Propagation

Module-4

Approximate Inference Conditional Random Field Learning , Energy Minimization, Structured Loss Functions

Module-5

Structured Support Vector Machines , Graph cuts

Course outcomes:

At the end of the course the student will be able to:

- Link the PGM techniques with the real applications in various research areas and show students how such techniques can lead to the state-of-the-art methods.
- Deepen students understanding by research paper reading and presentation, in-class discussion, quiz, and assignments.
- Provide students an opportunity to explore how to link PGMs with their own research through the semester-long course project. "Toy" projects are not acceptable.

Question paper pattern:

- The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60.
- The question paper will have ten full questions carrying equal marks.
- Each full question is for 20 marks.
- There will be two full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Textbook/ Textbooks:

Sl.No	Title of the book	Name of the Author/s	Publisher Name	Edition and year
1	Probabilistic graphical models – Principles and techniques	Daphne Koller and Nir Friedman	MIT press.	MIT press.
Reference Books:				
1	Introduction to Probability (Chapman & Hall/CRC Texts in Statistical Science)	Joseph K. Blitzstein , Jessica Hwang		1st Edition
2	Probability: For the Enthusiastic Beginner	David J. Morin	Tata Mc-Graw Hill	1st Edition

M.TECH IN NETWORK AND INTERNET ENGINEERING (LNI)
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER - II

CYBER SECURITY AND CYBER LAW

Course Code	**20SAM244,** 20LNI244, 20SCE244, 20SIT244	CIE Marks	40
Teaching Hours/Week (L:P:S)	4:0:0	SEE Marks	60
Credits	04	Exam Hours	03

Module-1

Introduction to Cybercrime: Cybercrime: Definition and Origins of the Word, Cybercrime and Information Security, Who are Cybercriminals?, Classifications of Cybercrimes, Cybercrime: The Legal Perspectives, Cybercrimes: An Indian Perspective, Cybercrime and the Indian ITA 2000, A Global Perspective on Cybercrimes, Cybercrime Era: Survival Mantra for the Netizens. Cyberoffenses: How

Criminals Plan Them: How Criminals Plan the Attacks, Social Engineering, Cyberstalking, Cybercafe and Cybercrimes, Botnets: The Fuel for Cybercrime, Attack Vector, Cloud Computing.

Module -2

Cybercrime: Mobile and Wireless Devices: Introduction, Proliferation of Mobile and Wireless Devices, Trends in Mobility, Credit Card Frauds in Mobile and Wireless Computing Era, Security Challenges Posed by Mobile Devices, Registry Settings for Mobile Devices, Authentication Service Security, Attacks on Mobile/Cell Phones, Mobile Devices: Security Implications for organizations, Organizational Measures for Handling Mobile, Organizational Security Policies and Measures in Mobile Computing Era, Laptops

Module – 3

Tools and Methods Used in Cybercrime: Introduction, Proxy Servers and Anonymizers, Phishing, Password Cracking, Keyloggers and Spywares, Virus and Worms, Trojan Horses and Backdoors, Steganography, DoS and DDoS Attacks, SQL Injection, Buffer Overflow, Attacks on Wireless Networks. Phishing and Identity Theft: Introduction, Phishing, Identity Theft (ID Theft).

Module-4

Understanding Computer Forensics: Introduction, Historical Background of Cyberforensics, Digital Forensics Science, The Need for Computer Forensics, Cyberforensics and Digital Evidence, Forensics Analysis of E-Mail, Digital Forensics Life Cycle, Chain of Custody Concept, Network Forensics, Approaching a Computer Forensics Investigation, Setting up a Computer Forensics Laboratory: Understanding the Requirements, Computer Forensics and Steganography, Relevance of the OSI 7 Layer Model to Computer Forensics, Forensics and Social Networking Sites: The Security/Privacy Threats, Computer Forensics from Compliance Perspective, Challenges in Computer Forensics, Special Tools and Techniques, Forensics Auditing, Antiforensics.

Module-5

Introduction to Security Policies and Cyber Laws: Need for An Information Security Policy, Information Security Standards – Iso, Introducing Various Security Policies and Their Review Process, Introduction to Indian Cyber Law, Objective and Scope of the it Act, 2000, Intellectual Property Issues, Overview of Intellectual - Property - Related Legislation in India, Patent, Copyright, Law Related to Semiconductor Layout and Design, Software License.

Course outcomes:

At the end of the course the student will be able to:

- Define cyber security, cyber law and their roles
- Demonstrate cyber security cybercrime and forensics.
- Infer legal issues in cybercrime,
- Demonstrate tools and methods used in cybercrime and security.
- Illustrate evidence collection and legal challenges

Question paper pattern:

The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60.

- The question paper will have ten full questions carrying equal marks.
- Each full question is for 20 marks.
- There will be two full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Textbook/ Textbooks

Sl No	Title of the book	Name of the Author/s	Publisher Name	Edition and year
1	Cyber Security: Understanding Cyber Crimes, Computer Forensics And Legal Perspectives	SunitBelapure and Nina Godbole	Wiley India Pvt Ltd	2013
2	Introduction to information security and cyber laws	Surya PrakashTripathi, RitendraGoyal, Praveen Kumar	Dreamtech Press	2015

		Shukla		
Reference Books				
1	Cybersecurity: Managing Systems, Conducting Testing, and Investigating Intrusions	Thomas J. Mowbray	John Wiley & Sons,	
2	Cyber Security Essentials	James Graham, Ryan Olson, Rick Howard	CRC Press	2010

M.TECH IN COMPUTER SCIENCE AND ENGINEERING (SCS) **Choice Based Credit System (CBCS) and Outcome Based Education (OBE)** **SEMESTER - II**			
ROBOTICS AND AUTOMATION			
Course Code	**20SAM251**, 20SCS332, 20SIS253	CIE Marks	40
Teaching Hours/Week (L:P:S)	4:0:0	SEE Marks	60
Credits	04	Exam Hours	03
Module-1			
History of Automation, Reasons for automation, Disadvantages of automation, Automation systems, Types of automation – Fixed, Programmable and Flexible automation, Automation strategies Automated Manufacturing Systems: Components, classification and overview of manufacturing Systems, Flexible Manufacturing Systems (FMS), Types of FMS, Applications and benefits of FMS.			
Module-2			
Definition of Robot, History of robotics, Robotics market and the future prospects, Robot Anatomy, Robot configurations: Polar, Cartesian, cylindrical and Jointed-arm configuration. Robot motions, Joints, Work volume, Robot drive systems, Precision of movement – Spatial resolution, Accuracy, Repeatability, End effectors – Tools and gripper			
Module-3			
Basic Control System concepts and Models, Transfer functions, Block diagrams, characteristic equation, Types of Controllers: on-off, Proportional, Integral, Differential, P-I, P-D, P-I-D controllers. Control system and analysis. Robot actuation and feedback components Position sensors – Potentiometers, resolvers, encoders, velocity sensors. Actuators - Pneumatic and Hydraulic Actuators, Electric Motors, Stepper motors, Servomotors, Power Transmission systems			
Module-4			
Robot Sensors and Machine vision system Sensors in Robotics - Tactile sensors, Proximity and Range sensors, use of sensors in robotics. Machine Vision System: Introduction to Machine vision, the sensing and digitizing function in Machine vision, Image processing and analysis, Training and Vision systems.			
Module-5			
Robots Technology of the future: Robot Intelligence, Advanced Sensor capabilities, Telepresence and related technologies, Mechanical design features, Mobility, locomotion and navigation, the universal hand, system integration and networking. Artificial Intelligence: Goals of AI research, AI techniques – Knowledge representation, Problem representation and problem solving, LISP programming, AI and Robotics, LISP in the factory.			
Course outcomes: At the end of the course the student will be able to:			
• Classify various types of automation & manufacturing systems • Discuss different robot configurations, motions, drive systems and its performance parameters. • Describe the basic concepts of control systems, feedback components, actuators and power transmission systems used in robots. • Explain the working of transducers, sensors and machine vision systems • Discuss the future capabilities of sensors, mobility systems and Artificial Intelligence in the field of robotics.			
Question paper pattern:			

The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60.

- The question paper will have ten full questions carrying equal marks.
- Each full question is for 20 marks.
- There will be two full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Textbook/ Textbooks

Sl No	Title of the book	Name of the Author/s	Publisher Name	Edition and year
1	Automation, Production Systems and Computer Integrated Manufacturing	M.P. Groover	Pearson Education	2nd Edition, 2007
Reference Books				
1	Robotics, control vision and Intelligence	Fu, Lee and Gonzalez	McGraw Hill International	2nd Edition, 2007.
2	Robotic Engineering - An Integrated approach	Klafter, Chmielewski and Negin	Prentice Hall of India	1st Edition, 2009.

M.TECH IN ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING (SAM)
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER – II

HUMAN COMPUTER INTERACTION

Course Code	**20SAM252**	CIE Marks	40
Teaching Hours/Week (L:P:S)	4:0:0	SEE Marks	60
Credits	04	Exam Hours	03

Module-1

The User Interface: Introduction, Importance of the User Interface, Importance and benefits of Good Design History of Human Computer Interface. Characteristics of Graphical and Web User Interface: Graphical User Interface, popularity of graphics, concepts of Direct Manipulation, Graphical System advantage and disadvantage, Characteristics of GUI. Web User Interface, popularity of web, Characteristics of Web Interface, Merging of Graphical Business systems& the Web, Principles of User Interface Design

Module-2

The User Interface Design Process: Obstacles and Pitfall in the development Process, Usability, The Design Team, Human Interaction with Computers, Important Human Characteristics in Design, Human Consideration in Design, Human Interaction Speeds, Performance versus Preference, Methods for Gaining and Understanding of Users.

Module-3

Understanding Business Functions: Business Definitions & Requirement analysis, Determining Business Functions, Design standards or Style Guides, System Training and Documentation, Principles of Good Screen Design: Human considerations in screen Design, interface design goals, test for a good design, screen meaning and purpose, Technological considerations in Interface Design System Menus and Navigation Schemes: Structure, Functions, Context, Formatting, Phrasing and Selecting, Navigating of Menus, Kinds of Graphical Menus Windows Interface: Windows characteristic, Components of Window, Windows Presentation Styles, Types of Windows, Window Management, Web systems.

Module-4

Device and Screen-Based Control: Device based controls, Operable Controls, Text entry/read- Only Controls, Section Controls, Combining Entry/Selection Controls, Other Operable Controls and Presentation Controls, Selecting proper controls.

Module-5

Effective Feedback Guidance and Assistance: Providing the Proper Feedback, Guidance and Assistance Effective Internationalization and Accessibility- International consideration, Accessibility, Create meaningful Graphics, Icons and Images, Colors-uses, possible problems

with colors, choosing colors.

Course outcomes:

At the end of the course the student will be able to:

- Demonstrate basic knowledge on theories of psychology and on how the human being interacts with (computer) systems.
- Give insight on how knowledge of the human capabilities can influence the way in which we construct technical systems.
- Apply Methods and techniques for design and construction of user interfaces.

Question paper pattern:

- The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60.
- The question paper will have ten full questions carrying equal marks.
- Each full question is for 20 marks.
- There will be two full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Textbook/ Textbooks:

Sl.No	Title of the book	Name of the Author/s	Publisher Name	Edition and year
1	Fundamentals of Human-Computer Interaction	Andrew Monk		1st Edition,
2	The Essential Guide to User Interface Design	Wilbert O. Galitz	Wiley India Edition	
Reference Books:				
1	Sharps Interaction Design	Prece, Rogers	Wiley India	
2	Designing the user interfaces	Ben Shneidermann	Pearson Education Asia	3rd Edition
3	User Interface Design	SorenLauesen	Pearson Education	
4	Essentials of Interaction Design	Alan Cooper, Robert Riemann, David Cronin	Wiley	
5	Human Computer Interaction	Alan Dix, Janet Fincay, GreGoryd, Abowd, Russell, Bealg	Pearson Education.	

M.TECH IN COMPUTER SCIENCE AND ENGINEERING (SCS)
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER - II

PATTERN RECOGNITION

Course Code	**20SAM253,** 20SCS244, 20SCE242	CIE Marks	40
Teaching Hours/Week (L:P:S)	4:0:0	SEE Marks	60
Credits	04	Exam Hours	03

Module-1

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

Module -2

Representation: Data structures for PR, Representation of clusters, proximity measures, size of patterns, Abstraction of Data set, Feature extraction, Feature selection, Evaluation

Module – 3

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

Module-4

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

Module-5

Clustering: Hierarchical (Agglomerative, single/complete/average linkage, wards, Partitional (Forgy's, k-means, Isodata), clustering large data sets, examples, An application: Handwritten Digit recognition

Course outcomes:

At the end of the course the student will be able to:

- Explain pattern recognition principals
- Develop algorithms for Pattern Recognition.
- Develop and analyse decision tress.
- Design the nearest neighbour classifier.
- Apply Decision tree and clustering techniques to various applications

Question paper pattern:

The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60.

- The question paper will have ten full questions carrying equal marks.
- Each full question is for 20 marks.
- There will be two full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Textbook/ Textbooks

Sl No	Title of the book	Name of the Author/s	Publisher Name	Edition and year
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.
Reference Books				
1	Pattern Classification	Duda R. O., P.E. Hart, D.G. Stork	John Wiley and sons	2000.

M.TECH IN **COMPUTER NETWORK ENGINEERING (SCN), COMPUTER SCIENCE & ENGINEERING(SCS) ARTIFICIAL INTELLIGENCE & MACHINE LEARNING(SAM)**

Choice Based Credit System (CBCS) and Outcome Based Education (OBE) SEMESTER - I

BLOCKCHAIN TECHNOLOGY

Course Code	20SCN15, 20SCS23, 20SAM254,	CIE Marks	40
Teaching Hours/Wee(L:P:S)	3:0:2	SEE Marks	60
Credits	04	Exam Hours	03

Course Objectives:

The blockchain technology course allows the students to explore the driving force behind the cryptocurrency Bitcoin. Along with the Decentralization, Cryptography, Bitcoins with its alternative coins, Smart contracts and outside of currencies.

Module-1

Blockchain 101: Distributed systems, History of blockchain, Introduction to blockchain, Types of blockchain, CAP theorem and blockchain, Benefits and limitations of blockchain.

Module-2

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

Module-3

Bitcoin and Alternative Coins A: Bitcoin, Transactions, Blockchain, Bitcoin payments B: Alternative Coins, Theoretical foundations, Bitcoin limitations, Namecoin, Litecoin, Primecoin, Zcash

Module-4

Smart Contracts and Ethereum 101: Smart Contracts: Definition, Ricardian contracts. Ethereum 101:Introduction, Ethereum blockchain, Elements of the Ethereum blockchain, Precompiled contracts.

Module-5

Alternative Blockchains: Blockchains Blockchain-Outside of Currencies: Internet of Things, Government, Health, Finance, Media

Course outcomes:

At the end of the course the student will be able to:

1. Understand the types, benefits and limitation of blockchain.
2. Explore the blockchain decentralization and cryptography concepts.
3. Enumerate the Bitcoin features and its alternative options.

4. Describe and deploy the smart contracts
5. Summarize the blockchain features outside of currencies.

Question paper pattern:
The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60.

- The question paper will have ten full questions carrying equal marks.
- Each full question is for 20 marks.
- There will be two full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.
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Textbook/ Textbooks

1 Mastering Blockchain - Distributed ledgers, decentralization and smart contracts explained, Author- Imran Bashir, Packt Publishing Ltd, Second Edition, ISBN 978-1- 78712-544-5, 2017

Reference Books

1 Bitcoin and Cryptocurrency Technologies, Author- Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller, Steven Goldfeder, Princeton University, 2016

2 Blockchain Basics: A Non-Technical Introduction in 25 Steps, Author- Daniel Drescher, Apress, First Edition, 2017

3 Mastering Bitcoin: Unlocking Digital Cryptocurrencies, Andreas M. Antonopoulos, O'Reilly Media, First Edition, 2014

M.TECH IN ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING (SAM) **Choice Based Credit System (CBCS) and Outcome Based Education (OBE)** **SEMESTER – II**			
MACHINE LEARNING LABORATORY			
Course Code	**20SAML26**	CIE Marks	40
Teaching Hours/Week (L:P:S)	0:4:0	SEE Marks	60
Credits	04	Exam Hours	03
Course objectives: This course will enable students to 1. Make use of Data sets in implementing the machine learning algorithms 2. Implement the machine learning concepts and algorithms in any suitable language of choice.			
Description (If any): 1. The programs can be implemented in either JAVA or Python. 2. For Problems 1 to 6 and 10, programs are to be developed without using the built-in classes or APIs of Java/Python. 3. Data sets can be taken from standard repositories (https://archive.ics.uci.edu/ml/datasets.html) or constructed by the students.			
Lab Experiments: 1. Implement and demonstrate the **FIND-S algorithm** for finding the most specific hypothesis based on a given set of training data samples. Read the training data from a .CSV file.			

2. For a given set of training data examples stored in a .CSV file, implement and demonstrate the **Candidate-Elimination algorithm** to output a description of the set of all hypotheses consistent with the training examples.
3. Write a program to demonstrate the working of the decision tree based **ID3 algorithm**. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.
4. Build an Artificial Neural Network by implementing the **Back propagation algorithm** and test the same using appropriate data sets.
5. Write a program to implement the **naïve Bayesian classifier** for a sample training data set stored as a .CSV file. Compute the accuracy of the classifier, considering few test data sets.
6. Assuming a set of documents that need to be classified, use the **naïve Bayesian Classifier** model to perform this task. Built-in Java classes/API can be used to write the program. Calculate the accuracy, precision, and recall for your data set.
7. Write a program to construct a **Bayesian network** considering medical data. Use this model to demonstrate the diagnosis of heart patients using standard Heart Disease Data Set. You can use Java/Python ML library classes/API.
8. Apply **EM algorithm** to cluster a set of data stored in a .CSV file. Use the same data set for clustering using ***k*-Means algorithm**. Compare the results of these two algorithms and comment on the quality of clustering. You can add Java/Python ML library classes/API in the program.
9. Write a program to implement ***k*-Nearest Neighbor algorithm** to classify the iris data set. Print both correct and wrong predictions. Java/Python ML library classes can be used for this problem.
10. Implement the non-parametric **Locally Weighted Regression algorithm** in order to fit data points. Select appropriate data set for your experiment and draw graphs.
Study Experiment / Project:
Course outcomes: At the end of the course the student will be able to: • Understand the implementation procedures for the machine learning algorithms. • Design Java/Python programs for various Learning algorithms. • Apply appropriate data sets to the Machine Learning algorithms. • Identify and apply Machine Learning algorithms to solve real world problems.-
Conduction of Practical Examination:
• All laboratory experiments are to be included for practical examination. • Students are allowed to pick one experiment from the lot. • Strictly follow the instructions as printed on the cover page of answer script **Change of experiment is allowed only once and marks allotted to the procedure part to be made zero.**

TECHNICAL SEMINAR			
Course Code	20SAM27	CIE Marks	100
Number of contact Hours/week (L:P:SDA)	0:0:2	SEE Marks	--
Credits	02	Exam Hours	--

Course objectives:

The objective of the seminar is to inculcate self-learning, face audience confidently, enhance communication skill, involve in group discussion and present and exchange ideas.

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

- Choose, preferably through peer reviewed journals, a recent topic of his/her interest relevant to the Course of Specialization.
- Carryout literature survey, organize the Course topics in a systematic order.
- Prepare the report with own sentences.
- Type the matter to acquaint with the use of Micro-soft equation and drawing tools or any such facilities.
- Present the seminar topic 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.

The CIE marks for the seminar shall be awarded (based on the relevance of the topic, presentation skill, participation in the question and answer session and quality of report) by the committee constituted for the purpose by the Head of the Department. The committee shall consist of three faculties from the department with the senior most acting as the Chairperson.

Marks distribution for CIE of the course 20XXX27 seminar:

Seminar Report: 30 marks

Presentation skill:50 marks

Question and Answer:20 marks

M.TECH IN COMPUTER SCIENCE AND ENGINEERING (SCS)
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER - III

DEEP LEARNING			
Course Code	**20SAM31,** 20SCS31, 20SIS334	CIE Marks	40
Teaching Hours/Week (L:P:S)	3:0:2	SEE Marks	60
Credits	04	Exam Hours	03

Module-1

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 Decent, building a Machine Learning Algorithm, Challenges Motivating Deep Learning.

Module-2

Deep Feedforward Networks: Gradient-Based Learning, Hidden Units, Architecture Design, Back-Propagation. **Regularization:** Parameter Norm Penalties, Norm Penalties as Constrained Optimization, Regularization and Under-Constrained Problems, Dataset Augmentation, Noise Robustness, Semi-Supervised Learning, Multi-Task Learning, Early Stopping, Parameter Tying and Parameter Sharing, Sparse Representations, Bagging, Dropout.

Module-3

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.

Module-4

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

Module-5

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.

Course outcomes:
At the end of the course the student will be able to:

- Identify the deep learning algorithms which are more appropriate for various types of learning tasks in various domains.
- Implement deep learning algorithms and solve real-world problems.
- Execute performance metrics of Deep Learning Techniques.

Question paper pattern:
The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60.

- The question paper will have ten full questions carrying equal marks.
- Each full question is for 20 marks.
- There will be two full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Textbook/ Textbooks

Sl No	Title of the book	Name of the Author/s	Publisher Name	Edition and year
1	Deep Learning	Lan Good fellow and YoshuaBengio and Aaron Courville	MIT Press https://www.deeplearningbook.org/	2016.
Reference Books				
1	Neural Networks:Asystematic Introduction	Raúl Rojas		1996.
2	Pattern Recognition and machine Learning	Chirstopher Bishop		2007.

M.TECH IN COMPUTER SCIENCE AND ENGINEERING (SCS)
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER - III

VIRTUAL REALITY

Course Code	**20SAM321,** 20SCS322	CIE Marks	40
Teaching Hours/Week (L:P:S)	4:0:0	SEE Marks	60
Credits	04	Exam Hours	03

Module-1

Definition of VR, modern experiences, historical perspective.

Hardware, sensors, displays, software, virtual world generator, game engines, human senses, perceptual psychology, psychophysics.

Geometric modelling, transforming rigid bodies, yaw, pitch, roll, axis-angle representation, quaternions, 3D rotation inverses and conversions, homogeneous transforms, transforms to displays, look-at and eye transforms, canonical view and perspective transforms, viewport transforms.

Module-2

Light propagation, lenses and images, diopters, spherical aberrations, optical distortion; more lens aberrations; spectral properties; the eye as an optical system; cameras; visual displays. Parts of the human eye, photoreceptors and densities, scotopic and photopic vision, display resolution requirements, eye movements, neural vision structures, sufficient display resolution, other implications of physiology on VR.

Depth perception, motion perception, vection, stroboscopic apparent motion, color perception, combining information from multiple cues and senses, implications of perception on VR.

Module-3

Graphical rendering, ray tracing, shading, BRDFs, rasterization, barycentric coordinates, VR rendering problems, anti-aliasing, distortion shading, image warping (time warp), panoramic rendering.

Velocities, acceleration, vestibular system, virtual world physics, simulation, collision detection, avatar motion, vection

Module-4

Tracking systems, estimating rotation, IMU integration, drift errors, tilt and yaw correction, estimating position, camera-feature detection model, perspective n-point problem, sensor fusion, lighthouse approach, attached bodies, eye tracking, inverse kinematics, map building, SLAM.

Remapping, locomotion, manipulation, social interaction, specialized interaction mechanisms.

Module-5

Sound propagation, ear physiology, auditory perception, auditory localization; Fourier analysis; acoustic modelling, HRTFs, rendering, auralization.

Perceptual training, recommendations for developers, best practices, VR sickness, experimental methods that involve human subjects

Touch, haptics, taste, smell, robotic interfaces, telepresence, brain-machine interfaces.

Course outcomes:

At the end of the course the student will be able to:

- Explain fundamentals of virtual reality systems
- Summarize the hardware and software of the VR
- Analyse the applications of VR

Question paper pattern:

The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60.

- The question paper will have ten full questions carrying equal marks.
- Each full question is for 20 marks.
- There will be two full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Textbook/ Textbooks

Sl No	Title of the book	Name of the Author/s	Publisher Name	Edition and year
1	VIRTUAL REALITY http://vr.cs.uiuc.edu/book.html	Steven M. LaValle.	Cambridge University Press	2016
Reference Books				
1	HANDBOOK OF VIRTUAL ENVIRONMENTS: Design, Implementation, and Applications	Kelly S. Hale Kay M. Stanney	CRC Press	2nd Edition, 2015

M.TECH IN COMPUTER ENGINEERING (SCE)
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER - III

AGILE TECHNOLOGIES

Course Code	**20SAM322,** 20SCE324, 20SIT331	CIE Marks	40

Teaching Hours/Week (L:P:S)	4:0:0	SEE Marks	60
Credits	04	Exam Hours	03

Module-1

Why Agile?: Understanding Success, Beyond Deadlines, The Importance of Organizational Success, Enter Agility, **How to Be Agile?:** Agile Methods, Don't Make Your Own Method, The Road to Mastery, Find a Mentor

Module -2

Understanding XP: The XP Lifecycle, The XP Team, XP Concepts, **Adopting XP:** Is XP Right for Us?, Go!, Assess Your Agility

Module – 3

Practicing XP: Thinking: Pair Programming, Energized Work, Informative Workspace, Root-Cause Analysis, Retrospectives, **Collaborating:** Trust, Sit Together, Real Customer Involvement, Ubiquitous Language, Stand-Up Meetings, Coding Standards, Iteration Demo, Reporting, **Releasing:** "Done Done", No Bugs, Version Control, Ten-Minute Build, Continuous Integration, Collective Code Ownership, Documentation. **Planning:** Vision, Release Planning, The Planning Game, Risk Management, Iteration Planning, Slack, Stories, Estimating. **Developing:** Incremental requirements, Customer Tests, Test-Driven Development, Refactoring, Simple Design, Incremental Design and Architecture, Spike Solutions, Performance Optimization, Exploratory Testing

Module-4

Mastering Agility: Values and Principles: Commonalities, About Values, Principles, and Practices, Further Reading, **Improve the Process:** Understand Your Project, Tune and Adapt, Break the Rules, **Rely on People :**Build Effective Relationships, Let the Right People Do the Right Things, Build the Process for the People, **Eliminate Waste :**Work in Small, Reversible Steps, Fail Fast, Maximize Work Not Done, Pursue Throughput

Module-5

Deliver Value: Exploit Your Agility, Only Releasable Code Has Value, Deliver Business Results, Deliver Frequently, **Seek Technical Excellence :**Software Doesn't Exist, Design Is for Understanding, Design Trade-offs, Quality with a Name, Great Design, Universal Design Principles, Principles in Practice, Pursue Mastery

Course outcomes:

At the end of the course the student will be able to:

- Define XP Lifecycle, XP Concepts, Adopting XP
- Evaluate on Pair Programming, Root-Cause Analysis, Retrospectives, Planning, Incremental Requirements, Customer Tests
- Demonstrate concepts to Eliminate Waste

Question paper pattern:

The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60.

- The question paper will have ten full questions carrying equal marks.
- Each full question is for 20 marks.
- There will be two full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Textbook/ Textbooks

Sl No	Title of the book	Name of the Author/s	Publisher Name	Edition and year
1	The Art of Agile Development	James shore, Chromatic,	O'Reilly	2007
Reference Books				
1	Agile Software Development, Principles, Patterns, and Practices	Robert C. Martin	Prentice Hall	1st edition, 2002
2	Agile and Iterative Development A Manger's Guide	Craig Larman	Pearson Education	First Edition, India, 2004

M.TECH IN COMPUTER SCIENCE AND ENGINEERING (SCS)
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER – III

INTERNET OF THINGS AND APPLICATIONS

Course Code	**20SAM323,** 20SCS15, 20LNI22, 20SCE23, 20SCN14, 20SIS14	CIE Marks	40
Teaching Hours/Week (L:P:S)	4:0:0	SEE Marks	60
Credits	04	Exam Hours	03

Module-1

What is The Internet of Things? Overview and Motivations, Examples of Applications, IPV6 Role, Areas of Development and Standardization, Scope of the Present Investigation.Internet of Things Definitions and frameworks-IoT Definitions, IoT Frameworks, Basic Nodal Capabilities. Internet of Things Application Examples-Overview, Smart Metering/Advanced Metering Infrastructure-Health/Body Area Networks, City Automation, Automotive Applications, Home Automation, Smart Cards, Tracking, Over-The-Air-Passive Surveillance/Ring of Steel, Control Application Examples, Myriad Other Applications.

Module -2

Fundamental IoT Mechanism and Key Technologies-Identification of IoT Object and Services, Structural Aspects of the IoT, Key IoT Technologies. Evolving IoT Standards-Overview and Approaches, IETF IPV6 Routing Protocol for RPL Roll, Constrained Application Protocol, Representational State Transfer, ETSI M2M,Third Generation Partnership Project Service Requirements for Machine-Type Communications, CENELEC, IETF Ipv6 Over Low power WPAN, Zigbee IP(ZIP),IPSO

Module – 3

Layer ½ Connectivity: Wireless Technologies for the IoT-WPAN Technologies for IoT/M2M, Cellular and Mobile Network Technologies for IoT/M2M,Layer 3 Connectivity:Ipv6 Technologies for the IoT: Overview and Motivations. Address Capabilities,Ipv6 Protocol Overview, Ipv6 Tunnelling, Ipsec in Ipv6,Header Compression Schemes, Quality of Service in Ipv6, Migration Strategies to Ipv6.

Module-4

Case Studies illustrating IoT Des
ign-Introduction, Home Automation, Cities, Environment, Agriculture, Productivity Applications.

Module-5

Data Analytics for IoT – Introduction, Apache Hadoop, Using HadoopMapReduce for Batch Data Analysis, Apache Oozie, Apache Spark, Apache Storm, Using Apache Storm for Real-time Data Analysis, Structural Health Monitoring Case Study.

Course outcomes:
At the end of the course the student will be able to:

- Develop schemes for the applications of IOT in real time scenarios
- Manage the Internet resources
- Model the Internet of things to business
- Understand the practical knowledge through different case studies

Understand data sets received through IoT devices and tools used for analysis

Question paper pattern:
The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60.

- The question paper will have ten full questions carrying equal marks.
- Each full question is for 20 marks.
- There will be two full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Textbook/ Textbooks

Sl No	Title of the book	Name of the Author/s	Publisher Name	Edition and year
1	Building the Internet of Things with Ipv6 and MIPv6:The Evolving World of M2M Communications	Daniel Minoli	Wiley	2013

2	Internet of Things: A Hands-on Approach	ArshdeepBahga, Vijay Madisetti	Universities Press	2015
Reference Books				
1	The Internet of Things	Michael Miller	Pearson	2015 First Edition
2	Designing Connected Products	Claire Rowland,Elizabeth Goodman et.al	O'Reilly	First Edition, 2015

M.TECH IN COMPUTER SCIENCE AND ENGINEERING (SCS) Choice Based Credit System (CBCS) and Outcome Based Education (OBE) SEMESTER - III			
SOFTWARE DEFINED NETWORKS			
Course Code	**20SAM324,** 20SCS253, 20LNI31, 20SCE333, 20SCN243, 20SIS243	CIE Marks	40
Teaching Hours/Week (L:P:S)	4:0:0	SEE Marks	60
Credits	04	Exam Hours	03
Module-1			
Introduction, Centralized and Distributed Control and Data Planes, OpenFlow			
Module-2			
SDN Controllers, Network Programmability,			
Module-3			
Data Centre Concepts and Constructs, Network Function Virtualization			
Module-4			
Network Topology and Topological Information Abstraction, Building an SDN Framework			
Module-5			
Use Cases for Bandwidth Scheduling, Manipulation, and Calendaring, Use Cases for Input Traffic Monitoring, Classification, and Triggered Actions			
Course outcomes: At the end of the course the student will be able to: ● Explain the fundamentals of SDN and make use of open flow tool ● Illustrate the concepts of controllers and network programmability ● Explain data centre and NFV ● Build an SDN framework ● Report use case			
Question paper pattern: The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60. ● The question paper will have ten full questions carrying equal marks. ● Each full question is for 20 marks. ● There will be two full questions (with a maximum of four sub questions) from each module. ● Each full question will have sub question covering all the topics under a module. ● The students will have to answer five full questions, selecting one full question from each module.			

Textbook/ Textbooks

Sl No	Title of the book	Name of the Author/s	Publisher Name	Edition and year
1	SDN: Software Defined Networks	Ken Gray, Thomas D. Nadeau	O'Reilly	2013
Reference Books				
2	Software Defined Networks	Paul Goransson Chuck Black Timothy Culver	Elsevier	2nd Edition 2016

M.TECH IN ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING (SAM)
CHOICE BASED CREDIT SYSTEM (CBCS) AND OUTCOME BASED EDUCATION (OBE)
SEMESTER – III

GAME THEORY

Course Code	**20SAM331**	CIE Marks	40
Teaching Hours/Week (L:P:S)	4:0:0	SEE Marks	60
Credits	04	Exam Hours	03

Module-1

INTRODUCTION 9 Elements of Game Play – Artificial Intelligence – Getting Input from the Player - Sprite Programming – Sprite Animation - Multithreading – Importance of Game Design – Game Loop.

Module-2

3D GRAPHICS FOR GAME PROGRAMMING 9 Coordinate Systems, Ray Tracing, Modeling in Game Production, Vertex Processing, Rasterization, Fragment Processing and Output Merging, Illumination and Shaders, Parametric Curves and Surfaces.

Module-3

GAME DESIGN PRINCIPLES 9 Character Development, Story Telling, Narration, Game Balancing, Core mechanics, Principles of level design, Genres of Games, Collision Detection, Game Logic, Game AI, Path Finding, Case study : Tetris.

Module-4

GAMING ENGINE DESIGN 9 Renderers, Software Rendering, Hardware Rendering, and Controller Based Animation, Spatial Sorting, Level of Detail, Collision Detection, Standard Objects, and Physics, Case study : The Sims

Module-5

GAME DEVELOPMENT 9 Developing 2D and 3D Interactive Games Using OpenGL, DirectX – Isometric and Tile Based Games, Puzzle Games, Single Player Games, Multi-Player Games. Case study: Mine craft.

Course outcomes:

At the end of the course the student will be able to:

- Develop game programming skills and create interactive games.

Question paper pattern:

- The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60.
- The question paper will have ten full questions carrying equal marks.
- Each full question is for 20 marks.
- There will be two full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Textbook/ Textbooks:

Sl.No	Title of the book	Name of the Author/s	Publisher Name	Edition and year
1	3D Game Engine Design: A Practical Approach to Real-Time Computer Graphics	David H. Eberly	Second Edition, Morgan Kaufmann, 2010.	Second Edition, 2010.
2	3D Graphics for Game Programming	Jung Hyun Han	Chapman and Hall/CRC	First Edition, 2011.
Reference Books:				
1	Beginning Game Programmingl,	Jonathan S. Harbour	Third Edition	Third Edition

	Course Technology		PTR, 2009.	PTR, 2009.
2	Fundamentals of Game Design‖	Ernest Adams and Andrew Rollings	Pearson Education	Third Edition, 2014.
3	Level Up: The Guide to Great Video Game Design‖	Scott Rogers	Wiley	First Edition, Wiley, 2010.
4	Game Design: Principles, Practice, and Techniques - The Ultimate Guide for the Aspiring Game Designer‖	Jim Thompson, Barnaby Berbank-Green, and NicCusworth	Wiley	First Edition, Wiley, 2008.

M.TECH IN COMPUTER SCIENCE AND ENGINEERING (SCS) **Choice Based Credit System (CBCS) and Outcome Based Education (OBE)** **SEMESTER – III**			
SEMANTIC WEB AND SOCIAL NETWORKS			
Course Code	**20SAM332,** 20SCS22, 20LNI12	CIE Marks	40
Teaching Hours/Week (L:P:S)	4:0:0	SEE Marks	60
Credits	04	Exam Hours	03
Module-1			
Web Intelligence Thinking and Intelligent Web Applications, The Information age,The World Wide Web, Limitations of Today's Web, The Next Generation Web, Machine Intelligence, Artificial Intelligence, Ontology, Inference engines, Software Agents, Berners-Lee www, Semantic Road Map, Logic on the semantic Web.			
Module 2			
Knowledge Representation for the Semantic Web Ontologies and their role in the semantic web, Ontologies Languages for the Semantic Web – Resource Description Framework(RDF) / RDF Schema, Ontology Web Language(OWL), UML, XML/XML Schema.			
Module 3			
Ontology Engineering, Ontology Engineering, Constructing Ontology, Ontology Development Tools, Ontology Methods, Ontology Sharing and Merging, Ontology Libraries and Ontology Mapping, Logic, Rule and Inference Engines.			
Module 4			
Semantic Web Applications, Services and Technology Semantic Web applications and services, Semantic Search, e-learning, Semantic Bioinformatics, Knowledge Base, XML Based Web Services, Creating an OWL-S Ontology for Web Services, Semantic Search Technology, Web Search Agents and Semantic Methods.			
Module 5			
Social Network Analysis and semantic web What is social Networks analysis, development of the social networks analysis, Electronic Sources for Network Analysis – Electronic Discussion networks, Blogs and Online Communities, Web Based Networks. Building Semantic Web Applications with social network features.			
Course outcomes: At the end of the course the student will be able to:			
● Demonstrate the semantic web technologies like RDF Ontology and others ● Learn the various semantic web applications ● Identify the architectures and challenges in building social networks ● Analyse the performance of social networks using electronic sources			
Question paper pattern: The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60.			

- The question paper will have ten full questions carrying equal marks.
- Each full question is for 20 marks.
- There will be two full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Textbook/ Textbooks

Sl No	Title of the book	Name of the Author/s	Publisher Name	Edition and year
1	Thinking on the Web	Berners Lee, Godel and Turing	Wiley inter science	2008
2	Social Networks and the Semantic Web	Peter Mika	Springer	2007
Reference Books				
1	Semantic Web and Semantic Web Services	Liyang Lu Chapman and Hall	CRC Publishers	
2	Semantic Web Technologies, Trends and Research in Ontology Based Systems.			
3	Programming the Semantic Web	T.Segaran, C.Evans, J.Taylor	O'Reilly.	

M.TECH IN ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING (SAM)
CHOICE BASED CREDIT SYSTEM (CBCS) AND OUTCOME BASED EDUCATION(OBE)
SEMESTER – III

MULTIDISCIPLINARY DESIGN OPTIMIZATION

Course Code	**20SAM333**	CIE Marks	40
Teaching Hours/Week (L:P:S)	4:0:0	SEE Marks	60
Credits	04	Exam Hours	03

Module-1

Basic Concepts: Optimal Design Problem Formulation, Solution Existence and Uniqueness, Functions of One Variable: Concepts and Newton's Method, Polynomial Fit and Golden Section Search

Module-2

Unconstrained Functions in N Variables: Zero-Order Methods, First-Order Methods, Scaling and Convergence, Conjugate Direction and Variable Metrics (DFP and BFGS), Newton's Method, Variable Scaling Issues, Constrained Functions in N Variables - Sequential Unconstrained Minimization Techniques: Exterior Penalty Methods, Interior and Extended Interior Penalty Methods,

Module-3

Variable Penalty Function, Comparison of Penalty Methods, Constraint Scaling, Augmented Lagrange Method (ALM) for Equality Constraints, ALM for Inequality Constraints and Generalized ALM ; Linear Programming: Simplex Method; Constrained Functions in N Variables - Direct Methods: Overview, Zero-Order Methods, Feasible Directions,

Module-4

Zoutendjik's Feasible Directions, Reduced Gradient, Sequential Quadratic Programming, Sequential Quadratic Programming , Global Optimization: Simulated Annealing, Nelder-Mead Simplex, Genetic Algorithm

Module-5

Multiobjective Optimization: Pareto Optimality, Global Function /Weighted Sum, Epsilon-Constraint or Gaming Approach , Min-Max, Goal Attainment, Recent MDO Techniques: Approximations and Response Surface Methodology in MDO, problem decomposition strategies

Course outcomes:

At the end of the course the student will be able to:

- Use relevant engineering optimization concepts,
- Implement gradient-based and derivative free algorithms,
- Describe appropriate surrogate optimization frameworks,
- Formulate MDO problem and Architectures
- Describe non-hierarchical and hierarchical coordination methods.

Question paper pattern:

- The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60.
- The question paper will have ten full questions carrying equal marks.
- Each full question is for 20 marks.
- There will be two full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Textbook/ Textbooks:

Sl.No	Title of the book	Name of the Author/s	Publisher Name	Edition and year
1	Multidiscipline Design Optimization (ISBN: 0-944956-04-1)	Vanderplaats, G. N	VR&D, 2007.	
2	Introduction to Optimum Design (ISBN: 9780-12-800806-5)	Arora, J. S.,	Elsevier Academic Press, San Diego, CA, 2016.	Fourth Edition, 2016
Reference Books:				
1	Multidisciplinary Design Optimization Supported by Knowledge Based Engineering	JaroslawSobieszczanski–Sobieski and Alan Morris		
2	Advances in Collaborative Civil Aeronautical Multidisciplinary Design Optimization 233 (Progress in Astronautics and Aeronautics)"	Ernst Kesseler and Marin D Guenov		

M.TECH IN COMPUTER SCIENCE AND ENGINEERING (SCS)
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER - III

SPEECH PROCESSING

Course Code	**20SAM334,** 20SCS333	CIE Marks	40
Teaching Hours/Week (L:P:S)	4:0:0	SEE Marks	60
Credits	04	Exam Hours	03

Module-1

Introduction, Fundamentals of Digital Speech Processing

Module-2

Digital models for the speech signals, Time domain models for speech processing

Module-3

Digital representation of the speech waveform, short term Fourier analysis

Module-4

Homomorphic speech processing, Linear predictive coding of speech: Introduction, Basic principles of LP analyse, Computation of gain for the model, solution of LPC equation, Comparison between the methods of solution of the LPC analysis equation, the prediction error signal.

Module-5

Linear predictive coding of speech: Frequency domain interpretation of LP analysis, Relation of LP analysis, Relations between various speech parameters, applications

Digital speech for man machine communication by voice

Course outcomes:
At the end of the course the student will be able to:

- Explain the fundamentals of speech processing
- Summarize the models of speech processing
- Infer the linear predictive coding
- Illustrate the application of speech processing

Question paper pattern:
The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60.

- The question paper will have ten full questions carrying equal marks.
- Each full question is for 20 marks.
- There will be two full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Textbook/ Textbooks

Sl No	Title of the book	Name of the Author/s	Publisher Name	Edition and year
1	Digital Processing of Speech Signals	Lawrence R. Rabiner , Ronald W. Schafer	Pearson	

Reference Books

1	**Speech And Audio Signal Processing: Processing And Perception Of Speech And Music**	**Ben Gold,**	**WILEY INDIA**	

PROJECT WORK PHASE – 1			
Course Code	20SAM34	CIE Marks	100
Number of contact Hours/Week	2	SEE Marks	--
Credits	02	Exam Hours	--

Course objectives:

- Support independent learning.
- Guide to select and utilize adequate information from varied resources maintaining ethics.
- Guide to organize the work in the appropriate manner and present information (acknowledging the sources) clearly.
- Develop interactive, communication, organisation, time management, and presentation skills.
- Impart flexibility and adaptability.
- Inspire independent and team working.
- Expand intellectual capacity, credibility, judgement, intuition.
- Adhere to punctuality, setting and meeting deadlines.
- Instil responsibilities to oneself and others.
- 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 student will be able to:

- Demonstrate a sound technical knowledge of their selected project topic.
- Undertake problem identification, formulation, and solution.
- Design engineering solutions to complex problems utilising a systems approach.
- Communicate with engineers and the community at large in written an oral forms.
- Demonstrate the knowledge, skills and attitudes of a professional engineer.

Continuous Internal Evaluation

CIE marks for the project report (50 marks), seminar (30 marks) and question and answer (20 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. The committee shall consist of three faculty from the department with the senior most acting as the Chairperson.

MINI PROJECT			
Course Code	20SAM35	CIE Marks	40
Number of contact Hours/Week	2	SEE Marks	60
Credits	02	Exam Hours/Batch	03

Course objectives:

- To support independent learning and innovative attitude.
- To guide to select and utilize adequate information from varied resources upholding ethics.
- To guide to organize the work in the appropriate manner and present information (acknowledging the sources) clearly.
- To develop interactive, communication, organisation, time management, and presentation skills.
- To impart flexibility and adaptability.
- To inspire independent and team working.
- To expand intellectual capacity, credibility, judgement, intuition.
- To adhere to punctuality, setting and meeting deadlines.
- To instil 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.

Mini-Project: 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.

Course outcomes:

At the end of the course the student will be able to:

- Present the mini-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.

CIE procedure for Mini - Project:

The CIE marks awarded for Mini - Project, shall be based on the evaluation of Mini - Project Report, Project Presentation skill and Question and Answer session in the ratio 50:25:25.The marks awarded for Mini - Project report shall be the same for all the batch mates.

Semester End Examination

SEE marks for the mini-project shall be awarded based on the evaluation of Mini-Project Report, Presentation skill and Question and Answer session in the ratio 50:25:25 by the examiners appointed by the University.

INTERNSHIP / PROFESSIONAL PRACTICE			
Course Code	20SAMI36	CIE Marks	40
Number of contact Hours/Week	2	SEE Marks	60
Credits	06	Exam Hours	03

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,

To put theory into practice.

To expand thinking and broaden the knowledge and skills acquired through course work in the field.

To relate to, interact with, and learn from current professionals in the field.

To gain a greater understanding of the duties and responsibilities of a professional.

To understand and adhere to professional standards in the field.

To gain insight to professional communication including meetings, memos, reading, writing, public speaking, research, client interaction, input of ideas, and confidentiality.

To identify personal strengths and weaknesses.

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 student 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.

Continuous Internal Evaluation

CIE marks for the Internship/Professional practice report (20 marks), seminar (10 marks) and question and answer session (10 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. The committee shall consist of three faculty from the department with the senior most acting as the Chairperson.

Semester End Examination

SEE marks for the internship report (30 marks), seminar (20 marks) and question and answer session (10 marks) shall be awarded (based on the quality of report and presentation skill, participation in the question and answer session) by the examiners appointed by the University.

PROJECT WORK PHASE -2			
Course Code	20SAM41	CIE Marks	40
Number of contact Hours/Week	4	SEE Marks	60
Credits	20	Exam Hours	03

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, organisation, time management, and presentation skills.
- To impart flexibility and adaptability.
- To inspire independent and team working.
- To expand intellectual capacity, credibility, judgement, intuition.
- To adhere to punctuality, setting and meeting deadlines.
- To instil 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.

Course outcomes:

At the end of the course the student 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.

Continuous Internal Evaluation:

Project Report: 20 marks. The basis for awarding the marks shall be the involvement of the student in the project and in the preparation of project report. To be awarded by the internal guide in consultation with external guide if any.

Project Presentation: 10 marks.

The Project Presentation marks of the Project Work Phase -II shall be awarded by the committee constituted for the purpose by the Head of the Department. The committee shall consist of three faculty from the department with the senior most acting as the Chairperson.

Question and Answer: 10 marks.

The student shall be evaluated based on the ability in the Question and Answer session for 10 marks.

Semester End Examination

SEE marks for the project report (30 marks), seminar (20 marks) and question and answer session (10 marks) shall be awarded (based on the quality of report and presentation skill, participation in the question and answer session) by the examiners appointed by the University.