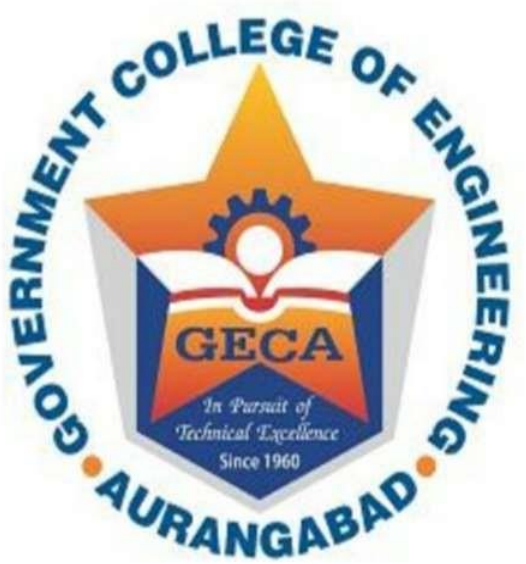

GOVERNMENT COLLEGE OF ENGINEERING AURANGABAD

(An Autonomous Institute of Govt. of Maharashtra)
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Department of Information Technology

Third Year IT Curriculum Structure (UG Program)

(Effective from: A.Y. 2021-2022)

Program Specific Outcomes (PSOs)

After successful completion of the program graduates would:

PSO I Apply core IT Knowledge to identify, formulate and solve emerging engineering problems.

PSO II Design, develop and deploy quality software products by applying knowledge of modern IT concepts and tools.

PSO III Apply the skills of IT professionals to develop novel solutions in societal and environmental contexts

Program Educational Objective(s)

After graduation and few years of graduation, the (Information Technology) graduates would

PEO I Interpret, design and analyze data for effective problem solving

PEO II Pursue advanced studies to adapt to current trends

PEO III Attain professional careers and provide services in societal and environmental context for sustainable development

PEO IV Work successfully with effective communication skills, professionalism, team work and ethical attitude

Program Outcome(s)

The program enables students to achieve by the time of graduation:

PO1 **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2 **Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3 **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4 **Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5	**Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PO6	**The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO7	**Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO8	**Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9	**Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO11	**Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO12	**Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Mapping of PEOs and POs

	Programme Educational Objective(s)	**Program Outcome(s)**
PEO I	Interpret, design and analyze data for effective problem solving	1,2,3
PEO II	Pursue advanced studies to adapt to current trends	3,4,5,6,7,9
PEO III	Attain professional careers and provide services in societal and environmental context for sustainable development	4,5,6,7,8,9,10,11,12
PEO IV	Work successfully with effective communication skills, professionalism, team work and ethical attitude	6,8,10,11,12

Government College of Engineering, Aurangabad

(An Autonomous Institute)

Teaching and Evaluation Scheme from year 2023-2024

Third Year B. Tech. Program in Information Technology

Semester V

Course				Teaching Scheme			Continuous Evaluation in terms of Marks					
Sr No	**Category**	**Course Code**	**Course Name**	**L**	**T**	**P**	**Credits**	**ISE I**	**ISE II**	**ISE III**	**ESE**	**Total**
1	PCC	ITPC3001	Theory of Computation	3	1	-	4	15	15	10	60	100
2	PCC	ITPC3002	Artificial Intelligence	3	-	-	3	15	15	10	60	100
3	PCC	ITPC3003	Machine Learning	3	-	-	3	15	15	10	60	100
4	PCC	ITPC3004	Software Engineering	3	-	-	3	15	15	10	60	100
5	HSMC	ITHS0020	Professional Ethics and Cyber Laws	3	-	-	3	15	15	10	60	100
6	OEC	ITOE0020	Data Structures and Algorithms	3	-	-	3	15	15	10	60	100
7	PCC	ITPC3005	Lab Machine Learning	-	-	2	1	25			25	50
8	PCC	ITPC3006	Lab Software Engineering	-	-	2	1	25			25	50
9	PCC	ITPC3007	Computer Programming Lab I	-	-	4	2	25			25	50
10	PR	ITPR3001	Mini Project I	-	-	4	2	50			-	50
		Total		**18**	**1**	**12**	**25**	**215**	**90**	**60**	**435**	**800**

Government College of Engineering, Aurangabad

(An Autonomous Institute)

Teaching and Evaluation Scheme from year 2023-2024

Third Year B. Tech. Program in Information Technology

Semester VI

Course				Teaching Scheme			Continuous Evaluation in terms of Marks					
Sr. No.	**Category**	**Course Code**	**Course Name**	**L**	**T**	**P**	**Credits**	**ISE I**	**ISE II**	**ISEII**	**ESE**	**Total**
												100
1	PEC		Professional Elective I	3	-	-	3	15	15	10	60	100
2	PEC		Professional Elective II	3	-	-	3	15	15	10	60	100
3	PEC		Professional Elective III	3	-	-	3	15	15	10	60	100
4	HSMC	ITHS1030	Business Intelligence	3	-	-	3	15	15	10	60	100
5	OEC	ITOE1030	Introduction to Artificial Intelligence	3	-	-	3	15	15	10	60	100
6	PCC	ITPC3010	Computer Programming Lab II	-	-	2	1	25			25	50
7	PEC		Lab Professional Elective I	-	-	2	1	25			25	50
8	PEC		Lab Professional Elective II	-	-	2	1	25			25	50
9	PR	ITPR3002	Mini Project II	-	-	4	2	50			-	50
			Total	**15**	**0**	**10**	**20**	**200**	**75**	**50**	**375**	**700**

Professional Electives

Professional Electives (I and II) (3+0+1)	**Professional Electives(III) (3+0+0)**
ITPE3001 Mobile Computing ITPE3002 Lab Mobile Computing	ITPE3031 Speech and Natural Language Processing
ITPE3003 Cryptography & Network Security ITPE3004 Lab Cryptography & Network Security	ITPE3032 Deep Learning
ITPE3005 Advanced DBMS ITPE3006 Lab Advanced DBMS	
ITPE3007 Data Mining ITPE3008 Lab Data Mining	

ITPC3001:Theory of Computation		
Teaching Scheme	**Examination Scheme**	
Lectures: 03 hrs/ week	**ISE I**	**15 Marks**
Tutorial: - 1 hr/ Week	**ISE II**	**15 Marks**
Credits: 04	**ISE III**	**10 Marks**
	End Semester Examination	**60 Marks**

Course Description: This course includes Introduction to Theory of Computation. Topics like Automata Theory, Formal Languages and Grammars, Turing machines are covered in this course.

Course Outcomes: After completing the course, students will able to:

CO1	Demonstrate Finite Automata, Pushdown Automata, and Turing Machine and their limitations
CO2	Identify formal languages and their equivalence with their respective automata
CO3	Use pumping lemmas to prove the type of language
CO4	Examine the decidability and intractability of computational problems

Detailed Syllabus:

Unit 1	**Mathematical Preliminaries and Finite Automata:** Sets, Relations and Functions, Principle of Induction, Introduction to Finite Automata, Structural Representations, Automata and Complexity, Central Concepts to Automata Theory, Deterministic finite Automata (DFA), Nondeterministic finite Automata (NFA), Equivalence of DFA and NFA, FA with epsilon transition, Applications of FA, Moore and Mealy machines
Unit 2	**Regular Expressions and Languages:** Regular Expressions, Finite Automata and Regular Expressions, Applications of Regular Expressions, Algebraic Laws for Regular Expressions, Proving languages not to be regular, Closure Properties of Regular Expressions, Decision Properties of Regular Expressions, Equivalence and minimization of Automata
Unit 3	**Context Free Grammar:** Definition, Derivations using grammar, Language of a grammar, Parse Trees, Application of CFG, Ambiguity in Grammars and Languages, Normal Forms for Context Free Grammars, Pumping Lemma for CFL, Closure and Decision Properties of Context Free Languages
Unit 4	**Pushdown Automata:** Definition of Push Down Automata, Languages of Pushdown Automata, Equivalence of PDA's and CFG's, Deterministic PDA
Unit 5	**Turing Machine:** Introduction to Turing Machine, The Turing machine, Programming Techniques of Turing Machines, Extension to Basic Turing Machine, Turing Machines and Computers, Undecidable Problems about Turing Machines

Text and Reference Books

1. John E. Hopcroft, Rajeev Motwani, Jeffrey D. Ullman, "*Introduction to Automata Theory, Languages, and Computation*" 3rd ed., Pearson Education, ISBN: 81-317-1429-2
2. K.L.P. Mishra, N. Chandrasekaran, "*Theory of Computer Science: Automata, Languages and Computation*" 3rd Edition, PHI, ISBN: 978-81-203-2968-3
3. John C Martin, "*Introduction to Languages and the Theory of Computation",* 3rd ed., Tata McGraw Hill, ISBN: 0-07-066048-4

Web Resources

1. https://nptel.ac.in/courses/106104148
2. https://onlinecourses.nptel.ac.in/noc21_cs83/preview

Mapping of Course outcomes with Program Outcomes and Program Specific Outcomes
1 – Low 2 – Medium 3 – High

Course outcomes	Program Outcomes												Program Specific Outcomes		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	3	2	1		1							1	1	1	
CO2		3	2	1	1							1	1	1	
CO3		3	1	1	1							1	1	1	
CO4		3	1	1	1							1	1	1	

Assessment:

ISE I-Maximum Marks-15
ISE II- Class Test of Maximum Marks-15
ISE III-Teacher's Assessment of Maximum Marks-10
ISE I and ISE III -May be based on one of the / or combination of few of following

1. Class Test/ Surprise test/ MCQ Test
2. Assignment
3. Quizzes
4. Attendance
5. Any other activity suggested by course coordinator

ESE-End Semester Examination of Maximum Marks-60

Assessment Pattern:

Assessment Pattern Level No.	Knowledge Level	ISE I	ISE II	ISE III	End Semester Examination
K1	Remember	5	5	2	10
K2	Understand	7	7	3	20
K3	Apply	3	3	5	20
K4	Analyze	-	-	-	10
K5	Evaluate	-	-	-	-
K6	Create	-	-	-	-
Total Marks 100		15	15	10	60

Assessment table:

Assessment Tool	K2	K2	K3	K2
	CO1	CO2	CO3	CO4
ISEI(15 Marks)	6	5	2	2
ISEII(15 Marks)	2	3	5	5
ISEIII (10 Marks)	2	2	3	3
ESE Assessment (60 Marks)	10	20	20	10
Total Marks 100	20	30	30	20

ITPC3002:Artificial Intelligence		
Teaching Scheme	**Examination Scheme**	
Lectures: 03 hrs/ week	**ISE I**	**15 Marks**
Tutorial: 0	**ISE II**	**15 Marks**
Credits:03	**ISE III**	**10 Marks**
	End Semester Examination	**60 Marks**

Course Description: This course provides the understanding of artificial intelligence including problem solving, knowledge representation, reasoning and planning.

Course Outcomes: After completing the course, students will able to:

CO1	Comprehend basic concepts of Artificial Intelligence.
CO2	Analyze and formalize the problem as a state space, graph, design heuristics and select amongst different search or game based techniques to solve them.
CO3	Attain the ability to represent various real life problem domains using logic based techniques and use this to perform inference.
CO4	Apply basic principles of AI in solutions that require inference, perception, knowledge representation.
CO5	Examine various machine learning techniques to solve real-world problems.

Syllabus:

Unit 1	**Introduction to Artificial Intelligence**: Artificial Intelligence Techniques, Level of models, criteria of success, Intelligent Agents, Nature of Agents, Learning Agents. AI Techniques, advantages, and limitations of AI, Impact and Examples of AI, Application domains of AI.
Unit 2	**Problem Solving**: State space search, control strategies, heuristic search, problem characteristics, production system characteristics, Generate and test, Hill climbing, best first search, A* search, Constraint satisfaction problem, Mean-end analysis, Min-Max Search, Alpha-Beta Pruning, Additional refinements, Iterative Deepening.
Unit 3	**Logic:** Propositional logic, predicate logic, Resolution, Resolution in proportional logic and predicate logic, Clause form, Unification algorithm.
Unit 4	**Knowledge Representation and Reasoning:** Mapping between facts and representations, Approaches to knowledge representation, Procedural and declarative knowledge, Forward and Backward chaining, Resolution, Non-monotonic reasoning, Default reasoning, Statistical reasoning.
Unit 5	**Planning:** Introduction and Components of planning, partial order planning, construction and use of planning graphs, Analysis of planning approaches, Hierarchical planning, Conditional planning, Continuous and Multi Agent planning.

Text and Reference Books

1. Stewart Russell and Peter Norvig, "Artificial Intelligence-A Modern Approach ", 2nd Edition, Pearson Education/ Prentice Hall of India, 2004.
2. Nils J. Nilsson, "Artificial Intelligence: A new Synthesis", Harcourt Asia Pvt. Ltd., 2000.
3. Elaine Rich and Kevin Knight, "Artificial Intelligence", 2nd Edition, Tata McGraw-Hill, 2003.
4. George F. Luger, "Artificial Intelligence- Structures and Strategies for Complex Problem Solving", Pearson Education / PHI, 2002.
5. A Classical Approach to Artificial Intelligence, M.C. Trivedi, Khanna Book Publishing, 2019.
6. Artificial Intelligence: A modern approach by Stuart Russel, Pearson Education, 2010.
7. Artificial Intelligence by Rich and Knight, The McGraw Hill, 2017.
8. Artificial Intelligence: A new synthesis by Nils and Nilson, Elsevier, 1997.
9. Artificial Intelligence by Luger, Pearson Education, 2002.
10. Artificial Intelligence by Padhy, Oxford Press, 2005.

Mapping of Course outcome with Program Outcomes and Program Specific Outcomes

PO/ CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO1	1	3	2										1	2	1
CO2	3	3			2								3	2	3
CO3	1	2	2	3									1	3	1
CO4	3	1	2	2									1	2	3
CO5	1	2	3	2	3								1	3	3

3- High 2- Medium 1-Low

Assessment Table:

Assessment Tool	**K2**	**K2**	**K3**	**K4**
	CO1,CO2	CO1,C02,CO3	CO3, CO4	CO5
ISE I (15 Marks)	10	05	00	00
ISE II (15 Marks)	10	05	00	00
ISE III (10 Marks)	00	00	05	05
ESE Assessment (60 Marks)	15	15	20	10
Total Marks 100				

Assessment:

ISE I-Maximum Marks-15

ISE II- Class Test of Maximum Marks-15

ISE III-Teacher's Assessment of Maximum Marks-10

ISE I and ISE III -May be based on one of the / or combination of few of following

1. Class Test/ Surprise test/ MCQ Test
2. Assignment
3. Quizzes
4. Attendance
5. Any other activity suggested by course coordinator

ESE-End Semester Examination of Maximum Marks-60

Assessment Pattern:

Assessment Pattern Level No.	**Knowledge Level**	**ISE I**	**ISE II**	**ISE III**	**End Semester Examination**
K1	Remember	05	00	00	10
K2	Understand	10	05	00	20
K3	Apply	00	10	05	20
K4	Analyse	00	00	05	10
K5	Evaluate	00	00	00	00
K6	Create	00	00	00	00
Total Marks 100		**15**	**15**	**10**	**60**

ITPC3003: Machine Learning		
Teaching Scheme	**Examination Scheme**	
Lectures: 03hrs/ week	**ISE I**	**15 Marks**
Tutorial: 0	**ISE II**	**15 Marks**
Credits:03	**ISE III**	**10 Marks**
	End Semester Examination	**60 Marks**

Course description: The course aims as providing knowledge for supervised learning, unsupervised learning and various advanced techniques of machine learning. The course also looks at several regression models, the classification techniques and clustering mechanisms and prepares students for research or industry application of machine learning techniques.The course also provides an introduction to the neural networks.

Course Outcomes: After completing the course, students will able to:

CO1	Understand basic applications and issues of Machine Learning
CO2	Apply machine learning life cycle for problem solving
CO3	Apply various algorithms to different datasets
CO4	Analyze various Machine Learning techniques and algorithms
CO5	Explain the basics of artificial neural networks

Detail Syllabus:

Unit 1	**Introduction to Machine Learning**: Introduction, Program versus machine learning algorithms, Artificial Intelligence versus Machine Learning versus Deep Learning, Basic definition of Machine Learning, Key terms, Applications, Machine Learning Techniques: Supervised Learning, Unsupervised Learning and Reinforcement Learning, Issues in Machine Learning.
Unit 2	**Evaluation and Model Selection:** Steps in developing Machine Learning Application, Statistical Learning, Data Collection, Data pre-processing, Feature Selection, Model Selection and validation, Model Evaluation, Training versus Testing, Cross Validation, Underfitting and Over fitting, Gradient decent, regularization.
Unit 3	**Supervised Learning :** Linear and Logistic Regression, Naïve Bayes classifier, K-Nearest Neighbours, Decision trees, Support Vector Machines, Ensemble Methods: Bagging, Boosting and AdaBoost; Dimensionality Reduction Techniques, Evaluation Measures: SSE, MME, R2, confusion matrix, precision, recall, F-Score, ROC-Curve.
Unit 4	**Unsupervised Learning:** Introduction to clustering, k-means, Types of Clustering: Hierarchical, Agglomerative Clustering and Divisive clustering, Density Based Clustering. Introduction to Semi-supervised Learning
Unit 5	**Fundamentals of Neural Networks**: Difference between biological neural network and artificial neural network, Models of Artificial Neuron, Learning rules and various activation functions, Neural Network Architecture (Single layer Feed-forward networks, Multilayer Feed-forward networks, Recurrent Networks). Introduction to Natural Language Processing, Introduction to Computer Vision.

Text and Reference Books:

1. Machine Learning, Tom M. Mitchell, McGraw Hill Education, 2017.
2. Machine Learning, By Rajeev Chopra, Khanna Book Publishing Co., 2021.
3. Introduction to Machine Learning (Second Edition): Ethem Alpaydın, The MIT Press (2010).
4. The Hundred-Page Machine Learning Book: Andriy Burkov
5. Understanding Machine Learning. Shai Shalev-Shwartz and Shai Ben-David. Cambridge University Press. 2017.

Web Resources:

1. https://onlinecourses.nptel.ac.in/noc22_cs85/preview
2. https://onlinecourses.nptel.ac.in/noc20_cs49/preview
3. https://www.udacity.com/course/intro-to-machine-learning--ud120
4. https://www.coursera.org/learn/machine-learning-duke
5. http://www.cs.cornell.edu/jeh/book.pdf

Mapping of Course outcome with Program Outcomes:

Course outcome	Program Outcomes												PSO's		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	1		1									1	1	1	1
CO2	2	1	3	1	2						1	1	1	2	1
CO3	2	3	2	3	2	1	1	1	1	1	1	2	2	1	2
CO4	1		2		1							1	1	2	1
CO5	1		1									1	1	1	1

3 – High 2 – Medium 1– Low

Assessment:

ISE I-Maximum Marks-15
ISE II- Class Test of Maximum Marks-15
ISE III-Teacher's Assessment of Maximum Marks-10
ISE I and ISE III -May be based on one of the / or combination of few of following

1. Class Test/ Surprise test/ MCQ Test
2. Assignment
3. Quizzes
4. Attendance
5. Any other activity suggested by course coordinator

ESE-End Semester Examination of Maximum Marks-60

Assessment Pattern:

Assessment Pattern Level No.	Knowledge Level	ISE I	ISE II	ISE III	End Semester Examination
K1	Remember	00	00	00	00
K2	Understand	03	07	05	24
K3	Apply	12	04	05	24
K4	Analyze	00	04	00	12
K5	Evaluate	00	00	00	00
K6	Create	00	00	00	00
Total Marks 100		15	15	10	60

Assessment Table:

Assessment Tool	**K2**	**K3**	**K4**
	CO1, CO5	CO2, CO3	CO4
ISE I (15 Marks)	03	12	00
ISE II (15 Marks)	07	04	04
ISE III (10 Marks)	05	05	00
ESE (60 Marks)	24	24	12

ITPC3005: Lab Machine Learning		
Teaching Scheme	**Examination Scheme**	
Practical: 2Hrs/Week	**ISE I (Term Work)**	**25 Marks**
Credits:01	**End Semester Evaluation**	**25 Marks**

Course Outcomes:

After completion of this course students will be able to:

Course Outcomes	
CO1	Implement machine learning life cycle
CO2	Implement supervised and unsupervised machine learning algorithms
CO3	Analyze the applicability of algorithms to solve problems
CO4	Design simple artificial neural network

List of the Experiments:

The student shall perform minimum ten experiments of the following using Java.

Sr. No.	Title of the Experiments	Skill / Knowledge Level	CO	Marks for ISE
Level: Basic (all)				
1	Implement simple linear regression model on a standard data set and plot the least square regression fit. Comment on the result. [One may use inbuilt data sets like Boston, Auto etc]	S2	CO1,CO2	02
2	Implement multiple regression model on a standard data set and plot the least square regression fit. Comment on the result. [One may use inbuilt data sets like Carseats, Boston etc].	S2	CO1,CO2	02
3	Fit a classification model using Logistic regression on a standard data set. [One may use inbuilt data sets like Smarket, Weekly, Auto, Boston etc].	S2	CO1,CO2	02
4	Fit a classification model using K-Nearest Neighbour (KNN) Algorithm on a given data set. [One may use inbuilt data sets like Caravan, Smarket, Weekly, Auto and Boston etc].	S2	CO1,CO2	02
5	Fit a classification model using K-means Algorithm on a given data set. [One may use inbuilt data sets like Caravan, Smarket, Weekly, Auto, Boston etc.].	S2	CO1,CO2	02
Level: Moderate (Any Four)				
6	For a given data set, split the data into two training and testing and fit the following on the training set using Linear model	S2, S3	CO1,CO2,CO3	03

	using least squares [One may use inbuilt data sets like College, Bostonetc].			
7	For a given data set, perform the following: (i) Perform the polynomial regression and make a plot of the resulting Polynomial fit to the data. (ii) Fit a step function and perform cross validation to choose the optimal number of cuts. Make a plot of the fit to the data. [One may use inbuilt data sets like Use Wage etc].	S2, S3	CO1,CO2,CO3	03
8	For a given data set, split the dataset into training and testing. Fit the model set using Random Forest on the training set and evaluate the performance on the test [One may use inbuilt data sets like Boston etc].	S2, S3	CO1,CO2,CO3	03
9	Perform the Density Based Clustering on a given data set: [One may use inbuilt data sets like NC160, USArrestsetc].	S2, S3	CO1,CO2,CO3	03
10	Perform the Hierarchical clustering on a given data set: [One may use inbuilt data sets like NC160, USArrestsetc].	S2, S3	CO1,CO2,CO3	03
Level: Complex				
11	Create a perceptron with appropriate no. of inputs and outputs. Train it using fixed increment learning algorithm until no change in weights is required. Output the final weights.	S2	CO4	03

Assessment Table:

Assessment Tool	**S1**	**S2**	**S3**
	CO1	CO2, CO3	CO4
ISE I (Term Work)	00	15	10
End Semester Evaluation (Practical Examination & Viva Voce)	05	10	10

Assessment Pattern:

Assessment Pattern Level No.	**Knowledge Level**	**ISE I**	**End Semester Examination**
S1	Imitation	00	05
S2	Manipulation	15	10
S3	Precision	10	10
S4	Articulation	00	00
S5	Naturalization	00	00
	Total Marks	25	25

Mapping of Course outcome with Program Outcomes and Program Specific Outcomes:

Course outcome	Program Outcomes												PSO's		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	1	1	2						1	1	1	1	1	1	1
CO2	1	1	2		2							1	2	1	1
CO3	1	1	2	3	2	1						1	1	1	1
CO4	1	1	2									1	2	1	

3 – High 2 – Medium 1 – Low

ITPC3004: Software Engineering		
Teaching Scheme	**Examination Scheme**	
Lectures: 03 hrs/ week	**ISE I**	**15 Marks**
	ISE II	**15 Marks**
Credits: 03	**ISE III**	**10 Marks**
	End Semester Examination	**60 Marks**

Course Description: Students should learn the concept and importance of Software Engineering. They should be able to construct software that is reasonably easy to understand, modify, maintain and reliable. They should learn strengths and weaknesses of various Software Engineering Techniques and Software testing fundamental principles used in engineering applications using an automated testing tool.

Course Outcomes: After completing the course, students will able to:

CO1	Describe process of identification of real problem.
CO2	Interpret requirements, design concepts, implementation, maintain and risks.
CO3	Prepare Project planning schedule.
CO4	Implement small size software application according to software standards.
CO5	Choose appropriate software testing techniques for software application.

Detailed Syllabus:

Unit 1	Introduction and Software Process Models: Software Engineering, Importance of SoftwareEngineering,StandardforSoftwareProcess,WaterfallModel,PrototypingModel,IterativeEnhancement Model, Spiral Model, RAD model, 4th Generation models, Formal Methods, Agile Development.
Unit 2	Requirement Engineering and Software Project Management: Software Requirements, Types of Requirements, Requirement Engineering, Requirements Specification document, Characteristics of Requirements, Requirement verification and validation, Role of Management in Software Development, Project Estimation Techniques, Staffing, Scheduling, Earned Value Analysis, Software Risks, Software Configuration Management, Project metrics.
Unit 3	Software Design and Coding :Data and Behavioral Modeling, Design Concepts, Modularity, Architectural design, Coupling and Cohesion, Top-down and bottom-up design, Object-oriented Analysis, Function-oriented and Object-Oriented Design approach, Software Design Document, Coding styles and documentation.
Unit 4	Testing and Software Quality: Testing principles, testing strategies, Black-box and White-box Testing Techniques, Levels of testing-unit, integration, system, Regression, Test Plan,TestCases,Softwaredebugging,SoftwareMaintenance,SoftwareQualityAssurance(SQA),SQAtasks,Formal Technical Reviews, Software Quality Factors, ISO 9126, SEICMM,CMMI, Software Reliability. Open Source Software Testing Tools: Selenium, Test Complete.
Unit 5	Computer Aided Software Engineering: Computer Aided Software Engineering (CASE) and its Scope, CASE support in Software Life Cycle, Architecture of CASE Environment, Upper CASE and Lower CASE, Exposure to CASE tools. Software Process Improvement, Component Based Software Engineering, Web Engineering, Reverse Engineering, Software Engineering challenges of Big Data.

Text and Reference Books

1. Software Engineering: A Practitioners Approach by Roger Pressman, McGraw-Hill Publications
2. SoftwareEngineering(3rd ed.),ByK.KAggarwal&YogeshSingh,NewAgeInternationalPublishers, 2007
3. Software Engineering – Concepts and Practices by Ugrasen Suman, Cengage Learning
4. An integrated approach to Software Engineering by Pankaj Jalote, Springer/ Narosa
5. Software Engineering by Jibitesh Mishra and Ashok Mohanty, Pearson Publications
6. Fundamentals of Software Engineering by Rajib Mall Prentice Hall India
7. Software Engineering by Ian Sommerville Pearson Education (9th edition)
8. Software Engineering Fundamentals by Ali Behfrooz and FredeickJ.Hudson, Oxford University Press

Web Resources

1. https://nptel.ac.in/courses/106/105/106105182/
2. https://onlinecourses.nptel.ac.in/noc19_cs69/preview
3. https://www.mooc-list.com/course/software-engineering-introduction-edx
4. http://vlabs.iitkgp.ac.in/se/
5. http://nptel.iitm.ac.in

Mapping of Course outcomes with Program Outcomes and Program Specific Outcomes
3 – High 2 – Medium 1 - Low

Course outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12
CO1	2	3	1	2	1	1	1	2	1	3	2	1
CO2	3	3	3	3	3	2	2	2	1	2	1	1
CO3	3	2	2	1	3	1	2	2	1	3	1	1
CO4	3	2	3	2	3	1	2	2	1	2	1	1
CO5	3	2	2	1	3	1	2	2	1	2	2	1

Assessment:

ISE I-Maximum Marks-15
ISE II- Class Test of Maximum Marks-15
ISE III-Teacher's Assessment of Maximum Marks-10
ISE I and ISE III -May be based on one of the / or combination of few of following

1. Class Test/ Surprise test/ MCQ Test
2. Assignment
3. Quizzes
4. Attendance
5. Any other activity suggested by course coordinator

ESE-End Semester Examination of Maximum Marks-60

Assessment Pattern:

Assessment Pattern Level No.	Knowledge Level	ISE I	ISE II	ISE III	End Semester Examination
K1	Remember	05	05	02	10
K2	Understand	05	05	03	25
K3	Apply	05	05	05	25
K4	Analyze	00	00	00	00
K5	Evaluate	00	00	00	00
K6	Create	00	00	00	00
Total Marks 100		**15**	**15**	**10**	**60**

Assessment table:

Assessment Tool	**K1**	**K2**	**K3**	**K1**	**K2**
	CO1	**CO2**	**CO3**	**CO4**	**CO5**
ISE I(15 Marks)	6	5	2	2	2
ISEII(15 Marks)	2	3	5	5	5
ISEIII (10 Marks)	2	2	3	3	3
ESE Assessment (60 Marks)	10	10	10	10	10
Total Marks 100	**20**	**20**	**20**	**20**	**20**

ITPC3006: Lab Software Engineering		
Teaching Scheme	**Examination Scheme**	
Practical: 2Hrs/Week	**ISE I (Term Work)**	**25 Marks**
Credits:01	**End Semester Evaluation**	**25 Marks**

Course Outcomes: After completion of this course students will be able to:

CO1	Identify problem, requirements, process model and risks.
CO2	Design software solution for the identified problem statement
CO3	Implement software solution for given problem statement
CO4	Choose appropriate software testing tool according to software solution.

List of the Experiments:

Sr. No.	Title of the Experiments	Skill / Knowledge Level	CO	Marks for ISE
Level: Basic (all)				
1.	Identify the problem and Prepare problem statement.	S1	CO1	1
2.	Identify suitable process model for the same with justification.	S1	CO1	1
3.	Prepare requirement analysis and develop Software Requirement Specification Document (SRS) in IEEE format.	S1	CO2	1
4.	Prepare size estimation, cost estimation	S1	CO2	1
5.	Prepare Project Planning.	S1	CO2	1
Level: Moderate (any four)				
6.	To perform the function oriented diagram: Data Flow Diagram (DFD) and Structured chart.	S2	CO4	1
7.	To perform the user‘s view analysis: Use case diagram.	S2	CO4	1
8.	To draw the structural view: Class diagram, object diagram.	S2	CO4	1
9.	To draw the behavioral view: State-chart diagram, Activity diagram	S2	CO4	1
10.	To perform the implementation view: Component diagram	S2	CO4	1
11.	To perform the environmental view diagram: Deployment diagram.	S2	CO4	1
Level: Complex (any two)				
11.	To study any system specifications (e.g. ATM system/ calculator) and report the various bugs.	S3	CO4	1
12.	Write the test cases for software (e.g. calculator, Banking application, GMAIL, FACEBOOK, TWITTER)	S3	CO4	1

13.	To study Software debugging tools.	S3	CO4	1
14.	To Perform Software verification and validation	S3	CO4	1
15.	To perform various testing using appropriate testing tool	S3	CO4	1
16.	To Create a test plan (e.g. Library Management System)	S3	CO4	1
17.	To Study of web testing tool (e.g. Selenium)	S3	CO4	1
18.	To Study of bug tracking tool (e.g. Bugzilla).	S3	CO4	1
19.	Project Report writing	S3	CO4	2
Application Development Level				
20.	Develop an software application on real world problem	S2	CO3	5

Mapping of Course outcome with Program Outcomes and Program Specific Outcomes
3 – High 2 – Medium 1 - Low

Course outcomes	**Program Outcomes**											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO 10**	**PO 11**	**PO 12**
CO1	2	3	1	2	1	3	2	2	1	3	1	1
CO2	3	3	3	2	3	3	2	2	1	2	2	1
CO3	3	2	2	2	3	3	2	2	1	3	2	1
CO4	3	2	3	2	3	3	2	2	1	2	2	1
CO5	3	2	2	1	3	3	2	2	1	2	3	1

Assessment Table:

Assessment Tool	**S2**	**S2**	**S3**	**S3**
	CO1	**CO2**	**CO3**	**CO4**
Term work	6	6	5	8
Practical Examination & Viva Voce(25 Marks)	6	6	5	8

Assessment:

ISE I : It shall be based on one of the / or combination of few of: Attendance, punctuality, sincerity throughout semester, performance of during practical sessions, timely completion of allotted lab work, relevant MCQ test etc. Maximum marks shall be 25.

End Semester Evaluation : It shall be based on practical examination and viva-voce. Maximum marks shall be 25

Assessment Pattern:

Assessment Pattern Level No.	Knowledge Level	ISE I	End Semester Examination
S1	Imitation	04	04
S2	Manipulation	10	10
S3	Precision	11	11
S4	Articulation	00	00
S5	Naturalization	00	00
Total Marks		25	25

ITPC3007: Computer Programming Lab I		
Teaching Scheme	**Examination Scheme**	
Practical: 4 Hrs/Week	**ISE I (Term Work)**	**50 Marks**
Credits:02		

Course Outcomes: After completion of this course students will be able to:

- **CO1** Understand Python especially the C and object oriented concepts with problems and design systems or processes.
- **CO2** Identify built-in objects of Python and requirements appropriate to its solution.
- **CO3** Classify the interpretation of loop control statements.
- **CO4** Select and apply appropriate techniques on reading data from a text file using Python.

Suggested list of Practicals (Python Programming):

Sr. No.	Title of the Experiments	Skill / Knowledge Level	CO	Marks for ISE
	Level: Basic (Any Two)			
1	**Programming List Control Statements** A. Write a program to display reverse of the entered number. B. Program to print Fibonacci series upto nth number. C.Write a program to display multiplication tables from 1 to 5. D. Read the String "Hello World" from the user. Make use of ***continue***keyword and remove space.	S1	CO1, CO3	4
2	**Programming List on Functions** A. Program to find the factorial of a number. B. Write a simple program to demonstrate the use of keyword andpositional argument. C. Write a program to pass a number and return square an cube of numbersimultaneously. D. Write a function calc_Distance(x1, y1, x2, y2) to calculate the distancebetween two points represented by Point1(x1, y1) and Point2 (x2, y2). Theformula for calculating distance is given below: Distance = $\sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$	S2	CO1, CO2	4
3	**Programs on List, Tuple and Dictionaries** A.Consider the list with 5 different Celsius values. Convert all those Celsiusvalues to Fahrenheit. B. Write a Program to traverse the tuples from a list. C. Consider the following example of tuple, T = (1, 3, 2, 4, 6, 5) Write a program to store numbers present at odd index into the new tuple.	S2	CO2, CO3	4

	D.Write a function histogram that takes string as parameter and generatesa frequency of characters contained in it. Input:S = "AAPPLE". The program should create a dictionary D= {'A': 2, 'E': 1, 'P': 2, 'L': 1}.			
Level: Moderate				
4	**Program on Module (Math Module)** A. Write a program to calculate the hypotenuse of Right angle triangle givenbelow. B. Programs on String: Write a program to print all the letters fromword1 that also appear in word2. Example: Word1 = USA North AmericaWord2= USA South America. C. Program on Class and Object-Oriented Programming. D. Write a program to calculate the volume of a box. Note: Make use of Constructor, Member variable, and Member Functions.	S3	CO2, CO3, CO4	6
5	**To use of Matplotlib library** A. Make use of Jupiter Notebook to run the codes to represent the following datain plots. (Line plot,Barplot,scatter plot). B. Draw subplot for following line equations: 1.Y=x 2.Y=x^2 3.Y=X^3. C. Draw sine wave and cosine wave in same plot.	S3	CO2, CO3, CO4	6
6	**To use of Matplotlib library** A. Make use of Jupyter Notebook to run the codes to represent the following data in plots. (Line plot, Barplot, scatter plot). B. Draw subplot for following line equations : 1. Y=x 2.Y=x^2 3.Y=X^3. C. Draw sine wave and cosine wave in same plot.	S3	CO2, CO3, CO4	6
Level: Complex				
7	**To create Graphical User interfaces (GUIs) in python using Tkinter package.**	S4	CO2, CO3, CO4	8
8	**To create connectivity between Python and MySQL DATABASE.**	S4	CO2, CO3, CO4	8
9	**To make use of Pandas Library of python for reading csv file and Missing data.**	S4	CO2, CO3, CO4	8

Text and Reference Books

1. Mark Lutz, Programming Python O'REILLY.
2. John M. Zelle Python Programming: Introduction to Computer Science.
3. https://www.geeksforgeeks.org/creating-a-pandas-series/

Mapping of Course outcome with Program Outcomes and Program Specific Outcomes

Course Outcome	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO11	PO 12	PS O1	PS O2	PS O3
CO1	3	2	3		2								3	2	1
CO2	3	3	3		3								3	2	2
CO3	3	3	3	3	2							2	1	3	1
CO4	3	3	3	1	2								2	3	3

1 –Low 2 – Medium 3 – High

Assessment Table

Assessment Tool	S1	S2	S3	S4
	CO1	CO2	CO3	CO4
Term Work (50 Marks)	12	14	12	12

Recommended Assessment pattern

Assessment Pattern Level No.	**Skill Level**	**Term Work**
S1	Imitation	12
S2	Manipulation	14
S3	Precision	12
S4	Articulation	12
S5	Naturalization	00
Total		50

ITPR3001 : MINI PROJECT I		
Teaching Scheme	**Examination Scheme**	
Practical: 4Hrs/Week	**ISE I (Term Work)**	**50 Marks**
Credits:02		

Preamble:

This is a course project. The objective of this course is to apply the fundamental concepts of Software development of an Artificial Intelligence application/research project. This course helps the learners to practice the different steps to be followed in the software development process such as literature review and problem identification, preparation of SRS, SDD, implementation, testing,and deployment.Mini project enables the students to boost their skills, extend the scope of thinking and their ability to resolve real life problems.

Course Outcomes: After completion of this course students will be able to:

CO1 Perform literature survey for identified problem
CO2 Implement software techniques for identified problem
CO3 Test and analyze the modules of implemented project
CO4 Write technical reports and deliver presentation

List of the Experiments:

Sr. No.	Title of the Experiments	Skill / Knowledge Level	CO	Marks for ISE
1.	Review of Literature for the identified problem.	S1	CO1	05
2.	Create an abstract with a problem statement, solution approach, technology, team, etc. and get department approval.	S1	CO1	03
3.	Prepare Software Requirement Specification Document (SRS)	S2	CO2	02
	Prepare Software Design Document (SDD) ● System Architecture Design ● Application Architecture Design			05
4.	Data Collection and Data Preparation ● Data Collection ● Data pre-processing	S2	CO2	05
5.	Apply appropriate methods and tools	S3	CO2	05
6.	Development 1. Set coding standards 2. Environment Setup 3. Source Code Control Setup 4. Development 5. Resolve Bugs & Retest	S3	CO2	03
7.	Compare and analysis of results obtained from system developed	S4	CO3	12
8.	Project Report writing	S3	CO4	10

Report Structure:

1. INTRODUCTION
   1.1 Introduction
   1.2 Necessity
   1.3 Objectives

2. LITERATURE SURVEY
   Related information available in standard Books, Journals, Transactions, Internet Websites *etc.* till date

3. SYSTEM DEVELOPMENT
   Detailed description of the system developed.
   i. Data Collection
   ii. Data pre-processing
   iii. Apply appropriate methods and tools

4. SYSTEM ANALYSIS
   Comparison and analysis of results obtained from system developed

5. CONCLUSION
   Conclusion, Future Scope and Applications/Utility

6. REFERENCES
   These references must be reflected in text at appropriate places in square bracket. In case of web pages complete web page address with assessing date has to be enlisted.

Guidelines for the Report preparation

A report on the mini project shall be submitted within one week after the final presentation. Minimum number of pages should be25.

- Use Times New Roman font for the entire report
  Chapter/Section Title – Times NewRoman18, Bold;
  Heading2–TimesNew Roman16, Bold;
  Heading3–TimesNew Roman14, Bold;
  Body-Times New Roman 12, Normal.
- Line Spacing–BetweenHeading2–3lines, between lines in paragraph 1.5 lines.
- Alignments –Chapter/Section Title –Center, Heading 2& 3 should be Left Aligned. Ensure that all body text is paragraph justified.
- Figures & Tables – Ensure that all Figures and Tables are suitably numbered and given proper names/ headings. Write figure title under the figure and table title above the table.

Suggestive order of documentation:

- Top Cover
- Title page
- Certification page
- Acknowledgement
- Abstract

- Table of Contents
- List of Figures and Tables
- Chapters
- Appendices, if any
- References/Bibliography

Student Groups with 1 or 2 members should identify a topic of interest in consultation with a Faculty/Advisor. Review the literature and gather information pertaining to the chosen topic. State the objectives and develop a methodology to achieve the objectives. Carry out the design and develop codes to achieve the objectives by strictly following steps specified in the teaching plan. Innovative design concepts, performance, scalability, reliability considerations, user experience and security aspects are taken care in the project shall be given due weight. The progress of the mini project is evaluated based on a minimum of two reviews. The review committee may be constituted by the Head of the Department comprising HoD or a senior faculty member, Mini Project coordinator and project guide. The internal evaluation shall be made based on the progress/outcome of the project, reports and a viva-voce examination, conducted internally by a 2-member committee. A project report is required at the end of the semester. The project has to be demonstrated for its full design specifications.

Mapping of Course outcomes with Program Outcomes and Program Specific Outcomes
3 – High 2 – Medium 1 - Low

Course outcomes	**Program Outcomes**											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO 10**	**PO 11**	**PO 12**
CO1	2	3	2	1	1	1	1	1	3	3	2	1
CO2	3	2	3	1	2	3	2	2	1	2	2	1
CO3	3	2	2	1	3	3	2	2	1	3	2	1
CO4	3	2	3	1	3	3	2	2	1	2	2	1

Assessment Table:

Assessment Tool	**S2**	**S2**	**S3**	**S3**
	CO1	**CO2**	**CO3**	**CO4**
ISE I (Term Work)	08	20	12	10

Assessment:

ISE I : It shall be based on one of the/combination of few of: Attendance, punctuality, sincerity throughout semester, performance of during sessions, timely completion of allotted work.

Evaluation by the Committee (will be evaluating the level of completion and demonstration of functionality /specifications, presentation, Oral examination, work knowledge and involvement) shall be based on Demo, Presentation and viva-voce. Maximum marks shall be 50.

Assessment Pattern:

Assessment Pattern Level No.	Knowledge Level	ISE I
S1	Imitation	00
S2	Manipulation	10
S3	Precision	15
S4	Articulation	15
S5	Naturalization	10
Total Marks		50

ITPC3010: Computer Programming Lab II		
Teaching Scheme	**Examination Scheme**	
Practical: 4Hrs/Week	**ISE I (Term Work)**	**25 Marks**
Credits:02	**ESE**	**25 Marks**

Course Outcomes:

After completion of this course students will be able to:

	Course Outcomes
CO1	Use HTML,CSS for Front-End Web UI using modern Frameworks and Tools
CO2	Implement JavaScript and Query for manipulation of the DOM
CO3	Experiment with Node JS, Angular, Express, and MongoDB for server-side development
CO4	Develop a fully-functional website

List of the Experiments (Full Stack Web Development) :

Sr. No.	Title of the Experiments	Skill / Knowledge Level	CO	Marks for ISE
Front-End Web UI Development Frameworks and Tools(HTML5, CSS3, BOOTSTRAP5)				
1	Create a webpage with HTML describing your department with following specification: a. Change the background color of page. At the bottom create a link to take user to the top of the page. b. Insert an image and create a link such that clicking on image takes user to other page. c. Also apply font styling like italics, underline, and two other fonts to words you find appropriate. Also use header tags.	S2	CO1	2
2	Design a web page using for a Technical Festival, responsive with media queries	S2	CO1	2
BASICS OF JS, DOM, JQUERY				
3	Create a web pages of e-commerce website using Bootstrap framework. 1.Index page 2. Login page with validations.	S2	CO2	2
4	Create a web page for a Game	S3	CO2	2
NODEJS, EXPRESS JS				
5	Install node js and create a server using express js and create a weather application using weather api from rapid api.	S3	CO3	2
6	Create a news webpage using html, css, bootstrap with node js and express js at backend with news api	S3	CO3	3
REACTJS, GIT, GITHUB				
7	Create keeper app using react js using react components	S3	CO3	2

	Or Create a calculator using react.js			
8	Upgrade keeper app using react props, react devtools, mapping components, etc	S4	CO3	2
MONGODB, DEPLOYMENT				
9	Design and develop MongoDB Queries using CRUD operations	S3,S4	CO3	2
10	Build Mini website and deploy it Example : Design a website for the Tourism Sites of a given City. There should be at least 10 web-pages present in the web-site. There should be: ● One Home page that leads to other pages. The Home page should contain the name of the City as heading along with a logo. There should be a tab with the following links: ● Home ● Heritage ● Hotel Booking ● Gallery	S5	CO4	7

Assessment Table:

Assessment Tool				
	CO1	CO2	CO3	CO4
Term work(25Marks)	04	04	11	07

Assessment Pattern: Use the relevant table for assessment pattern.

Assessment Pattern Level No.	**Knowledge Level**	**ISE I**
S1	Imitation	00
S2	Manipulation	05
S3	Precision	07
S4	Articulation	06
S5	Naturalization	07
Total Marks		25

Mapping of Course outcome with Program Outcomes and Program Specific Outcomes

Course outcome	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	1			1	3							2		1	
CO2	1	2	2		3							2	3	2	
CO3		2	2	2	3							2	1	2	
CO4		3	3	2	3							2	2	1	3

3 – High 2 – Medium 1 - Low

Assessment Table:

Assessment Tool	**S2**	**S2**	**S3**	**S3**
	CO1	**CO2**	**CO3**	**CO4**
Term work	6	6	5	8

Assessment:

ISE I : It shall be based on one of the/combination of few of: Attendance, punctuality, sincerity throughout semester, performance of during practical sessions and timely completion of allotted lab work Maximum marks shall be 50.

Assessment Pattern Level No.	**Knowledge Level**	**ISE I**
S1	Imitation	00
S2	Manipulation	05
S3	Precision	07
S4	Articulation	08
S5	Naturalization	05
Total Marks		25

ITPR3002 :MINI PROJECT II		
Teaching Scheme	**Examination Scheme**	
Practical: 4Hrs/Week	**ISE I (Term Work)**	**50 Marks**
Credits:02		

Preamble:

The objective of this course is to apply the fundamental concepts of effective Software development of an application/research project. This course helps the learners to practice the different steps to be followed in the software development process such as literature review and problem identification, preparation of SRS, SDD, implementation, testing, and deployment. Mini-project enables the students to boost their skills, extend the scope of thinking and their ability to resolve real life problems.

Course Outcomes: After completion of this course students will be able to:

CO1 Perform literature survey and identify problem
CO2 Implement software techniques for identified problem
CO3 Test and analyze the modules of the implemented project.
CO4 Write technical reports and deliver presentation

List of the Experiments:

Sr. No.	Title of the Experiments	Skill / Knowledge Level	CO	Marks for ISE
1.	Review of Literature and Identification of a problem.	S1	CO1	05
2.	Create an abstract with a problem statement, solution approach, technology stack, team, etc. and get department approval. Register Online course/Collect study materials.	S1	CO1	05
3.	Prepare Software Requirement Specification Document (SRS)	S1	CO 2	05
	Prepare Software Design Document (SDD) ● System Architecture Design ● Application Architecture Design ● GUI Design(Mockups) ● API Design ● Database Design ● Technology Stack			
4.	Prepare size estimation, cost estimation	S1	CO 2	05
5.	Create a Project Plan (with Modules, Tasks, Resources, Time schedule) [May use any project management tool or excel for this] – Choose and follow agile or waterfall models.	S1	CO 2	05
6.	Development 6. Set coding standards 7. Environment Setup 8. Source Code Control Setup (Like Sub version(SVN), Git) 9. Development 10. Unit Testing	S2	CO 3	05

	11. Integration Testing 12. Testing/Quality Assurance(QA) ● Functional Testing ● Load Testing ● Report Bugs 13. Resolve Bugs & Retest			
7.	Create Test Plan, Test Scenarios and Test Cases (Test Case Document) & Traceability Matrix	S2	CO 3	05
8.	Deployment	S2	CO 3	05
9.	Test Run & Get Results	S2	CO 4	05
10.	Project Report writing	S2	CO 4	05

Report Structure:

1. INTRODUCTION
2. LITERATURE SURVEY
3. SYSTEM DEVELOPMENT
4. SYSTEM ANALYSIS
5. CONCLUSION
6. REFERENCES

Guidelines for the Report preparation

A report on the mini project shall be submitted within one week after the final presentation. Minimum number of pages should be25.

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  Chapter/Section Title – Times New Roman18, Bold;
  Heading2–Times New Roman16, Bold;
  Heading3–Times New Roman14, Bold;
  Body-Times New Roman 12, Normal.
- Line Spacing–BetweenHeading2–3 lines, between lines in paragraph 1.5 lines.
- Alignments –Chapter/Section Title –Center, Heading 2& 3 should be Left Aligned. Ensure that all body text is paragraph justified.
- Figures & Tables – Ensure that all Figures and Tables are suitably numbered and given proper names/ headings. Write Figure title under the figure and table title above the table.

Suggestive order of documentation:

- Top Cover
- Title page
- Certification Page
- Acknowledgement
- Abstract
- Table of Contents

- List of Figures and Tables
- Chapters
- Appendices, if any
- References/Bibliography

Student Groups with maximum 4 members should identify a topic of interest based on the courses studied in **VI semester** in consultation with a Project guide. Review the literature and gather information pertaining to the chosen topic. State the objectives and develop a methodology to achieve the objectives. Carry out the design and develop codes to achieve the objectives by strictly following steps specified in the teaching plan. Innovative design concepts, performance, scalability, reliability considerations, user experience and security aspects are taken care in the project shall be given due weight. The progress of the mini project is evaluated based on a minimum of two reviews. The review committee may be constituted by the Head of the Department comprising HoD or a senior faculty member, Mini Project coordinator and project guide. The internal evaluation shall be made based on the progress/outcome of the project, reports and a viva-voce examination, conducted internally by a 2 or 3 member committee. A project report is required at the end of the semester. The project has to be demonstrated for its full design specifications.

Mapping of Course outcomes with Program Outcomes and Program Specific Outcomes
3 – High 2 – Medium 1 - Low

Course outcomes	**Program Outcomes**											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO 10**	**PO 11**	**PO 12**
CO1	2	3	2	1	1	1	1	1	3	3	2	1
CO2	3	2	3	1	2	3	2	2	1	2	2	1
CO3	3	2	2	1	3	3	2	2	1	3	2	1
CO4	3	2	3	1	3	3	2	2	1	2	2	1

Assessment Table:

Assessment Tool	**S2**	**S2**	**S3**	**S3**
	CO1	**CO2**	**CO3**	**CO4**
ISE I (Term Work)	10	15	15	10

Assessment:

ISE I : It shall be based on one of the/combination of few of: Attendance, punctuality, sincerity throughout semester, performance of during practical sessions, timely completion of allotted lab work.

: Evaluation by the Committee (will be evaluating the level of completion and demonstration of functionality /specifications, presentation, Oral examination, work knowledge and involvement) shall be based on Demo, Presentation and viva-voce. Maximum marks shall be 50.

Assessment Pattern:

Assessment Pattern Level No.	Knowledge Level	ISE I
S1	Imitation	00
S2	Manipulation	10
S3	Precision	15
S4	Articulation	15
S5	Naturalization	10
Total Marks		50

ITPE3001 : Mobile Computing		
Teaching Scheme	**Examination Scheme**	
Lectures: 03 hrs/ week	**ISE I**	**15 Marks**
Tutorial: 0	**ISE II**	**15 Marks**
Credits:03	**ISE III**	**10 Marks**
	End Semester Examination	**60 Marks**

Prerequisites: Computer Networks

Course Description:

With the increasing popularity of mobile devices, mobile computing has become part of our daily life. This course will cover various topics of mobile computing, networking, and mobile OS including but not limited to: architecture and applications of mobile computing, cellular networks, GSM, Mobile Network Layer, Mobile Transport Layer and Android programming. The course will combine lectures, student presentations, and in-class exercises. For some lectures, students are expected to read lecture materials beforehand, to provide written answers to questions, or to develop code that will be then discussed in class.

Course Outcome:
After completion of this course students will be able to:

CO1 Interpret the basic concepts of mobile computing, mobile OS and Android programming
CO2 Summarize aspects of wireless transmission and medium access control
CO3 Illustrate the concepts of mobile network layer, transport layer and Android programming
CO4 Identify various mobile operating systems
CO5 Apply programming skills to design and develop the android applications to fulfill real world requirements

Detailed Syllabus:

Unit 1 **Introduction to Mobile Computing:** Beginning of wireless era, Mobile computing, Architecture of mobile computing, A simplified reference model, Evolution of Computing Devices, Mobile and wireless devices, Cellular systems, Wireless Transmission: Frequencies for Radio Transmission, Signals, Antennas, Signal propagation, Multiplexing, Modulation and Demodulation, Spread Spectrum, Medium Access Control: Motivation, SDMA, FDMA, TDMA, CDMA, Handoffs, GSM, 5G Network Concepts

Unit 2 **Mobile Network Layer:** Mobile IP : Evolution of Mobile IP, requirements, IP packet delivery, Agent discovery, Registration, Tunnelling and encapsulation, Optimization, Reverse tunnelling, Mobile IPv6, Dynamic host configuration protocol, Mobile ad-hoc networks, Routing, Destination sequence distance vector, Dynamic source routing, Alternative metrics, Overview ad-hoc routing protocols.

Unit 3 **Mobile Transport Layer:** Traditional TCP, Congestion control, Slow start, Fast retransmit/fast recovery, Implications of mobility, Classical TCP improvements: Indirect TCP, Snooping TCP, Mobile TCP, Fast retransmit/fast recovery, Transmission/time-out freezing, Selective retransmission , Transaction-oriented TCP

Unit 4 **Mobile Operating Systems:** Introduction to Android, iOS, Windows Phone, Firefox OS (History and Versions, Feature, Architecture etc.)
Android Programming Part-1: Android - History and Versions, Features of Android, Architecture of Android, Dalvik Virtual Machine (DVM), Installing required software's, Creating Android Virtual Devices (AVDs), The Android Developer Community, Creating First Android application - "Hello World", Debugging Android Application, Publishing Android Application: Generating a Signed APK, Anatomy of Android Application, Android Activity life cycle, UI Layouts

Unit 5 **Android Programming Part-2:** Working with UI Widgets/controls: Button, Toast, Toggle Switch, Image button, Checkbox, Radio button, Spinner, Progress bar, ListView etc, Android Core Building Blocks: Activity, Intent, Services, Broadcast Receivers, Fragments, Content Providers, Views, Manifest.xml file, Storing Data to internal and external storage, Creating and Using Databases (SQLite), Working with: SMS messaging, Google map, Bluetooth connectivity, Multithreading in Android: AsyncTask, Working with network: Consuming Web Services Using HTTP, Downloading Binary and Text data from web.

Text Books & Reference Books

1. J. Schiller, *Mobile Communications*, 2nd edition, Pearson Education, 2003.
2. Asoke K Talukder and Roopa R. Yavagal, *Mobile Computing –Technology, Applications and Service Creation,* TMH Pub., New Delhi, 2006
3. Handbook of Wireless Networks and Mobile Computing, a Wiley-Interscience Publicatio, John Wiley & Sons, Inc. 2002
4. Saad Z. Asif, *5G Mobile Communications Concepts and Technologies*, CRC Press Taylor & Francis Group
5. F. DiMarzio, *Beginning Android® Programming with Android Studio*, , Publication, John Wiley & Sons, Inc.
6. Chryssa Aliferi, *Android Programming Cookbook*, , Exelixis Media P.C., 2016

Web Resources

- Mobile Computing NPTEL Course: https://nptel.ac.in/courses/106106147
- Advanced 3G and 4G Wireless Mobile Communications NPTEL Course: https://nptel.ac.in/courses/117104099

Mapping of Course outcome with Program Outcomes and Program Specific Outcomes

Course outcome	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	2	3	1										2	1	
CO2	1	3	2										2	1	
CO3	2	3	1	1									3	2	
CO4	2	3	1	1	1								3	2	
CO5			2	1	3					2	1	3	2	1	3

3– High 2 – Medium 1 – Low

Assessment:

ISE I : It shall be based on one of the / or combination of few of: Class test, MCQs test, Surprise test, Mini project etc. Maximum marks shall be 15.

ISE II : It shall be based on class test of maximum 15 marks

ISE III : It shall be based on one of the / or combination of few of: Power point presentation, Question & answer / Numerical solution, Surprise test/classroom activity, Attendance, punctuality and sincerity throughout semester, assignments etc. Maximum marks shall be 10

ESE : It shall be based on examination of maximum 60 marks

Assessment Pattern:

Assessment Pattern Level No.	Knowledge Level	ISE I	ISE II	ISE III	End Semester Examination
K1	Remember	00	00	02	10
K2	Understand	10	10	04	25
K3	Apply	05	05	04	25
K4	Analyze	00	00	00	00
K5	Evaluate	00	00	00	00
K6	Create	00	00	00	00
Total Marks 100		15	15	10	60

Assessment table:

Assessment Tool	**K2**	**K2**	**K3**
	CO1	CO2	CO3,CO4,CO5
ISE I (15 Marks)	00	10	05
ISE II (15 Marks)	00	10	05
ISE III (10 Marks)	02	04	04
ESE Assessment (60 Marks)	10	25	25
Total Marks 100			

Special Instructions if any: Nil

ITPE3002 : Lab - Mobile Computing		
Teaching Scheme	**Examination Scheme**	
Practical: 2Hrs/Week	**ISE I (Term Work)**	**25 Marks**
Credits:01	**End Semester Evaluation**	**25 Marks**

Course Outcomes: After completion of this course students will be able to:

CO1	Interpret architecture of various mobile operating systems
CO2	Develop android applications comprising of various UI controls, layouts with event handling
CO3	Construct android applications to work with SMS message, database connectivity, internal storage, android core building blocks etc.
CO4	Experiment with Google maps and web server through android applications
CO5	Design and implement android applications for real world requirements

List of the Experiments:

Sr. No.	Title of the Experiments	Skill / Knowledge Level	CO	Marks for ISE
Level: Basic (all)				
1.	To study Android OS architecture, Android Studio Installation and to create "Hello World" program.	S1	CO1	1
2.	To study architecture of ***i****OS* and Windows mobile OS.	S1	CO1	1
3.	To create an application to demonstrate Android Activity Lifecycle	S2	CO2	1
4.	To create an android application with UI controls/Widgets with event handling	S3	CO2	2
5.	To create an android application various Android Layouts	S2	CO2	1
Level: Moderate (any four)				
6.	To develop an application to Send SMS message	S3	CO3	2
7.	To develop an android application to save data to internal storage as text file	S3	CO3	2
8.	To develop an android application for database operations using SQLite Database	S3	CO3	2
9.	To develop an android application to implement Broadcast Receivers/Android Service	S3	CO3	2
10.	To develop an android application to implement Android Fragments/Intents	S3	CO3	2

Level: Complex (any two)				
11.	To develop an android application to locate the user's current location and to show map information (Latitude and Longitude)	S4	CO4	3
12.	To Develop an application to search places on Google Map	S4	CO4	3
13.	To develop an android application with client-server architecture which accepts data from client application and store it on server	S4	CO4	3
Application Development Level				
14.	Develop an Android of your choice for real world requirements	S4	CO5	5

Assessment Table:

Assessment Tool	**S2**	**S3**	**S3**	**S3**	**S6**
	CO1	**CO2**	**CO3**	**CO4**	**CO5**
Term work	2	4	8	6	5
Practical Examination & Viva Voce(25 Marks)	2	4	8	6	5

Assessment:

ISE I : It shall be based on one of the / or combination of few of: Attendance, punctuality, sincerity throughout semester, performance of during practical sessions, timely completion of allotted lab work, relevant MCQ test etc. Maximum marks shall be 25

End Semester Evaluation : It shall be based on practical examination and viva-voce. Maximum marks shall be 25

Assessment Pattern:

Assessment Pattern Level No.	**Knowledge Level**	**ISE I**	**End Semester Examination**
S1	Imitation	02	02
S2	Manipulation	02	02
S3	Precision	10	10
S4	Articulation	11	11
S5	Naturalization	00	00
Total Marks		25	25

Mapping of Course outcome with Program Outcomes and Program Specific Outcomes

Course outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	2	3										1	3	3
CO2		2	1	3									1	3	3
CO3		3	2		1								1	3	3
CO4			3	1	2								1	3	3
CO5						2			1	2	3		1	3	3

3 – High 2 – Medium 1 - Low

ITPE3003: Cryptography and Network Security		
Teaching Scheme	**Examination Scheme**	
Lectures: 03 hrs/ week	**ISE I**	**15 Marks**
Tutorial: -	**ISE II**	**15 Marks**
Credits: 03	**ISE III**	**10 Marks**
	End Semester Examination	**60 Marks**

Course description:
This course aims at introducing the concepts of data security starting with the goals of data security, mechanisms for implementing data security and associated problems of identity establishment, access controls. The course also provides introduction to cryptographic techniques for authentication, confidentiality, integrity and associated mechanisms. The course also introduces the concepts of cryptographic algorithms and security protocols to provide security over the Internet.

Course Outcomes:

CO1	Demonstrate the basic mathematical foundations of cryptography
CO2	Summarize classical and modern symmetric key and public key algorithms
CO3	Demonstrate Encryption and Decryption using symmetric key and public key algorithm
CO4	Analyze algorithms for difficulty of attacking
CO5	Examine the design and analysis of information security protocols

Detailed Syllabus:

Unit 1	**Introduction and Symmetric Key Ciphers** Security attacks, Security Services and Security Mechanisms. **Symmetric Ciphers**: Symmetric Cipher Model, Classical encryption techniques like Substitution and Transposition. Block cipher Principle: The Data Encryption Standard, Linear and Differential Cryptanalysis, triple DES, Linear and Differential Cryptanalysis
Unit 2	**Number Theory and Public Key Encryption Introduction to Number Theory**: Fermat's and Euler's Theorem, The Chinese Remainder Theorem, Euclidean Algorithm, Extended Euclidean Algorithm. **Public Key Cryptosystem**: Encryption Principles, the RSA Algorithm, Key Management, Diffie-Hellman Key Exchange
Unit 3	**Authentication and Network Security Applications:** Authentication Requirements, Authentication Functions, Digital Signatures, Authentication Protocols, Digital Signature Standards. Kerberos, X.509 Authentication service, E- mail Security: Pretty Good Privacy, S/MIME.
Unit 4	**IP Security and Web Security:** Overview, IP security architecture, Authentication header, Web Security: Web security requirements, Secure Socket Layer (SSL): Functionality, Transport layer security TLS, Secure electronic Transactions TES.
Unit 5	**System Security:** Intruders, Intrusion Detection, Password Management, Viruses, Virus countermeasures. Firewalls: Firewall Design Principles, Trusted Systems, Cloud Security and Mobile Security : Challenges , attacks and counter measures

Text and Reference Books

1. William Stallings, "Cryptography and Network Security" Pearson Education, Fourth Edition
2. Behrouz A. Forouzan & Debdeep Mukhopadhyay, Cryptography and Network Security" Mc Graw Hill Publication , 2nd Edition
3. Robberta Bragg, Mark Phodes-Ousley &Keith Strassberge "The Complete Reference Book of Network Security", Tata McGraw-Hill Publication
4. Neal Krawetz, "Introduction to Network Security", Cengage Learning Pub

Web Resources:

1. https://nptel.ac.in/courses/106106221 : Foundations of Cryptography, IIIT Bangalore Prof. Ashish Choudhury
2. https://nptel.ac.in/courses/106105162 : Cryptography And Network Security, IIT Kharagpur, Prof. Sourav Mukhopadhyay

Mapping of Course outcomes with Program Outcomes and Program Specific Outcomes
3– High 2 – Medium 1 - Low

Course outcomes	Program Outcomes												Program Specific Outcomes		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1		2										1	1		
CO2	2		1		1							1	1	1	
CO3					1	3						2		1	2
CO4		2	1					1				3			2
CO5												2			2

Assessment:

ISE I-Maximum Marks-15
ISE II- Class Test of Maximum Marks-15
ISE III-Teacher's Assessment of Maximum Marks-10
ISE I and ISE III -May be based on one of the / or combination of few of following

1) Class Test/ Surprise test/ MCQ Test
2) Assignment
3) Quizzes
4) Any other activity suggested by course coordinator

ESE-End Semester Examination of Maximum Marks-60

Assessment Pattern:

Assessment Pattern Level No.	Knowledge Level	ISE I	ISE II	ISE III	End Semester Examination
K1	Remember	5	5	2	10
K2	Understand	7	3	3	20
K3	Apply	3	3	6	20
K4	Analyze	-	4	4	10
K5	Evaluate	-	-	-	-
K6	Create	-	-	-	-
Total Marks 100		15	15	10	60

Assessment table:

Assessment Tool	K2	K3	K3	K3
	CO1	CO2	CO3	CO4
ISE I(15 Marks)	6	5	2	2
ISEII (15 Marks)	2	3	5	5
ISEIII (10 Marks)	2	2	3	3
ESE Assessment (60 Marks)	10	20	20	10
Total Marks 100	20	30	30	20

ITPE3004: Lab Cryptography and Network Security		
Teaching Scheme	**Examination Scheme**	
Practical: 2Hrs/Week	**ISE (Term Work)**	**25 Marks**
Credits:01	**End Semester Evaluation**	**25 Marks**

Course Outcomes:

After completion of this course students will be able to:

Course Outcomes	
CO1	Solve problems using mathematical fundamentals for cryptography
CO2	Implement symmetric key and public key cryptographic algorithm
CO3	Identify attacks and implement defense mechanisms
CO4	Study modern tools for web and system security

List of the Experiments:

The student shall perform minimum ten experiments of the following using Java.

Sr. No.	Title of the Experiments	Skill / Knowledge Level	CO	Marks for ISE
	Level: Basic **Implement programs on Fundamentals of cryptography**			
1	**Write a program for implementation of Euclid's and Extended Euclid's Algorithm**	S1	CO1	02
2	**Write a program for finding frequency of letters of a given file.** Take three different text/ doc files as an input analyze frequency of letters (a-z or A-Z) from each file and analyze the result.	S2	CO1	02
	Level: Moderate			
3	**Mono-alphabetic Substitution cipher :** Demonstrate Caesar Cipher with the help of a program Sender's Side(Encryption) B. Receiver's Side(Decryption) The algorithm for encryption takes the message m as input and the secret key k and outputs the ciphertext c. The algorithm for decryption Dec inputs the ciphertext c and the key k and outputs the message m. Analyze input and output using Frequency of letters	S2	CO2	03
4	**Transposition cipher** Demonstrate Columnar Transposition Cipher with the help of a program Sender's Side(Encryption) B. Receiver's Side(Decryption) The algorithm for encryption (E) takes as inputs the message (M) and the secret key (K) and outputs the ciphertext (C). The algorithm for decryption (D) inputs the ciphertext (C) and the key (K) and outputs the message (M). Analyze input and output using Frequency of letters	S2	CO2	03

5	Write a program for implementation of Radix -64	S2	CO1	03
Level: Complex (Any three)				
6	Implement Key generation , Encryption and Decryption using RSA Algorithm	S2	CO2	04
7	Write a program for implementation of DH Algorithm also find the solution for man – in- the middle attack	S3	CO3	04
8	Write a program for implementation of a Digital Signature: The signature is to be formed by taking the hash of the message and encrypting the message with the creator's private key. The signature shall guarantee the source and integrity of the message.	S3	CO3	04
9	Use open PGP freeware for the implementation of email security	S3	CO4	04
10	Case study: System Security tools	S3	CO4	04

Assessment:

ISE I : It shall be based on one of the / or combination of few of: Attendance, punctuality, sincerity throughout semester, performance of during practical sessions, timely completion of allotted lab work, relevant test etc. Maximum marks shall be 25

End Semester Evaluation : It shall be based on practical examination and viva-voce. Maximum marks shall be 25

Assessment Table:

Assessment Tool	**S1**	**S2**	**S3**
	CO1	CO2, CO3	CO4
ISE I (Term Work)	05	10	10
End Semester Evaluation (Practical Examination & Viva Voce)	05	10	10

Assessment Pattern:

Assessment Pattern Level No.	**Knowledge Level**	**ISE I**	**End Semester Examination**
S1	Imitation	05	05
S2	Manipulation	10	10
S3	Precision	10	10
S4	Articulation	00	00
S5	Naturalization	00	00
	Total Marks	25	25

Mapping of Course outcome with Program Outcomes and Program Specific Outcomes:

Course outcome	Program Outcomes												PSO's		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	1												1		
CO2	1	1											2		1
CO3		1	2		3									2	
CO4		1	3		3		1	1	1	1	1	1		2	

3 – High 2 – Medium 1 – Low

ITPE3005 : Advanced Database Management System		
Teaching Scheme	**Examination Scheme**	
Lectures: 03 hrs/ week	**ISE I**	**15 Marks**
Tutorial: 0	**ISE II**	**15 Marks**
Credits:03	**ISE III**	**10 Marks**
	End Semester Examination	**60 Marks**

Prerequisites: Database Management System

Course Description: Advanced Database Management System. In short, a ADBMS is a database program. Technically speaking, it is a software system that uses a standard method of cataloging, retrieving, and running queries on data. ADBMS contain comprehensive contents on various concepts related to database systems, database design and management, broadly it discuss about parallel and distributed database systems. The students will get a detailed introduction about database administration and management. This course includes study if structured and unstructured database like MangoDB, SQL and XML of data management.

Course Outcome:

CO1 Understand the basic concepts and architecture associated with ADBMS

CO2 Interpret and explain the impact of emerging database standards

CO3 Make use of object oriented and Advanced XML queries on Database

CO4 Apply Parallel and distributed database techniques in given situation

CO5 Develop a data mart or data warehouse for any organization

Detailed Syllabus:

Unit 1 **Object and Object Relational Databases** : Concepts for Object Databases: Object Identity ,Object structure ,Type Constructors ,Encapsulation of Operations ,Methods ,Persistence, Type and Class Hierarchies Inheritance , Complex Objects ,Object Database Standards, Languages and Design: ODMG Model, ODL , OQL Object Relational and Extended – Relational Systems : Object Relational features in SQL/Oracle – Case Studies XML – Structure of XML, Document Schema, Querying and Transformation, API in XML, XML applications

Unit 2 **Parallel Databases** :Database System Architectures: Centralized and Client- Server Architectures – Server System Architectures – Parallel Systems- Distributed Systems – Parallel Databases: I/O Parallelism – Inter and Intra Query Parallelism – Inter and Intra operation Parallelism

Unit 3 **Distributed Data Base** : Distributed database concepts, distributed DBMS architecture, distributed database design, top-down and bottom design, fragmentation, fragment allocation, distributed query processing, transaction management in distributed database, distributed concurrency control, reliability issues in distributed DBMS.

Unit 4 **NO SQL**-Introduction to NoSQL Database, Types and examples of NoSQL Database- Key value store, document store, graph, Performance, Structured verses unstructured data, Distributed Database Model, CAP theorem and BASE Properties, Comparative study of SQL and NoSQL, NoSQL Data Models, Case Study-unstructured data from social media, **Introduction to MongoDB**, concepts, environment, schema design

Unit 5 **Introduction to Data Ware House**, Differences between operational data base systems and data Ware House, Data Ware House characteristics, Data Ware House Architecture and its components, Extraction-Transformation-Loading, Logical (MulitDimensional), Data Modeling, Schema Design, star and snow-Flake Schema, Fact Constellation, Fact Table, Fully Addictive, Semi-Addictive, Non-Addictive Measures; FactLess-Facts, Dimension Table characteristics; Fact-Less-Facts, Dimension Table characteristics; OLAP cube, OLAP Operations, OLAP Server Architecture-ROLAP, MOLAP and HOLAP.

Text Books & Reference Books

1. Silberschatz A., Korth H., Sudarshan S., *Database System Concepts*, McGraw Hill Publishers, ISBN 0-07-120413-X, 6th edition
2. Pramod J. Sadalage and Martin Fowler, *NoSQL Distilled*, Addison Wesley, ISBN10:0321826620, ISBN-13: 978-0321826626
3. Paulraj Ponniah, *Data Warehousing Fundamentals*, Wiley Publications
4. C J Date, *An Introduction to Database Systems*, Addison-Wesley
5. Kristina Chodorow, Michael Dirolf, *MangoDB: The Definitive Guide*, O'ReillyPublications, ISBN: 978-1-449-34468-9

Web Resources

https://mongodb.com/mannueal/tutorial/install-mongodb-on-windows/

Mapping of Course outcome with Program Outcomes and Program Specific Outcomes

Course outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1		2	2										1		
CO2	2	3	2	1									3	2	
CO3	1	2	3	1									2	3	2
CO4	1	3	3	2	1								1		2
CO5	2	2	3	3	1								2	3	3

3– High 2 – Medium 1 - Low

Assessment:

ISE I : It shall be based on one of the / or combination of few of: Class test, MCQs test, Surprise test, Mini project etc. Maximum marks shall be 15.

ISE II : It shall be based on class test of maximum 15 marks

ISE III : It shall be based on one of the / or combination of few of: Power point presentation, Question & answer / Numerical solution, Surprise test/classroom activity, Attendance, punctuality and sincerity throughout semester, assignments etc. Maximum marks shall be 10

ESE : It shall be based on examination of maximum 60 marks

Assessment Pattern:

Assessment Pattern Level No.	**Knowledge Level**	**ISE I**	**ISE II**	**ISE III**	**End Semester Examination**
K1	Remember	05	05	00	10
K2	Understand	10	10	05	25
K3	Apply	00	00	05	25
K4	Analyze	00	00	00	00
K5	Evaluate	00	00	00	00
K6	Create	00	00	00	00
Total Marks 100		15	15	10	60

Assessment table:

Assessment Tool	**K1,K2**	**K3**
	CO1,CO2	CO3,CO4,CO5
ISE I (15 Marks)	05	10
ISE II (15 Marks)	05	10
ISE III (10 Marks)	05	05
ESE Assessment (60 Marks)	35	25
Total Marks 100		

Special Instructions if any: Nil

ITPE3006 : Lab Advanced Database Management System		
Teaching Scheme	**Examination Scheme**	
Practical: 2Hrs/Week	**ISE I* (Term Work)**	**25 Marks**
Credits:01	**End Semester Evaluation**	**25 Marks**

Course Outcomes:

After completion of this course students will be able to:

	Course Outcomes
CO1	Identify and resolve physical database design and implementation issues
CO2	Design, develop and implement a mid-scale relational database for an application domain using a commercial-grade DBMS
CO3	Demonstrate capacity to perform a self directed piece of practical work that requires the application of data warehousing techniques
CO4	Design and implement a complete problem solution using current database technology

List of the Experiments:

Sr. No.	**Title of the Experiments**	**Skill / Knowledge Level**	**CO**	**Marks for ISE**
Level: Basic (all)				
1	**Group A:** Introduction to Databases (Study assignment) Study and design a database with suitable example using following database systems: Relational: SQL / PostgreSQL / MySQL Key-value: Riak / Redis (different database systems based on points like efficiency, scalability, characteristics and performance.)	S1,S2	CO1, CO2	2
2	**Group B:** Design any database with at least 3 entities and relationships between them. Apply DCL and DDL commands. Draw suitable ER/EER diagram for the system.	S2,S3	CO1, CO2	2
3	Design and implement a database and apply at least 10 different DML queries for the following task. For a given input string display only those records which match the given pattern or a phrase in the search string. Make use of wild characters and LIKE operator for the same. Make use of Boolean and arithmetic operators wherever necessary	S3	CO1, CO2, CO4	2
4	Implement nested sub queries. Perform a test for set membership (in, not in), set comparison (<some, >=some, <all etc.) and set cardinality (unique, not unique	S4	CO1, CO2	2
5	Write and execute suitable database triggers .Consider row level and statement level Triggers.	S3	CO1, CO2	2
Level: Moderate (any six)				
6	**Group C:** Study of Open Source NOSQL Database: MongoDB (Installation, Basic CRUD operations, Execution)	S1	CO1, CO2, CO4	2
7	Design and Develop MongoDB Queries using CRUD operations. (Use CRUD operations, SAVE method, logical operators)	S2	CO1, CO2, CO4	2

8	Implement aggregation and indexing with suitable example using MongoDB.	S2	CO1, CO2, CO4	2
9	Design and Implement any 5 query using MongoDB	S3	CO1, CO2, CO4	2
10	Create simple objects and array objects using JSON	S2	CO1, CO2, CO4	2
11	Encode and Decode JSON Objects using Java/Perl/PHP/Python/Ruby	S2,S3	CO1, CO2, CO4	2
12	Implement Fact Tables	S3	CO1, CO2, CO3	2
13	Implement star schema	S3	CO1, CO2, CO3	2
Level: Complex (any one)				
14	**Group D:** Write a program to implement MogoDB database connectivity with PHP/ python/Java Implement Database navigation operations (add, delete, edit etc.) using ODBC/JDBC .	S3,S4	CO1, CO2, CO3, CO4	3
15	Implement MYSQL/Oracle database connectivity with PHP/ python/Java Implement Database navigation operations (add, delete, edit,) using ODBC/JDBC	S3,S4	CO1, CO2, CO3, CO4	3

Assessment:
ISE I (Term Work) : In-Semester Evaluation of 25 marks each will be based on practical assignments completed and timely submission

End Semester Evaluation: The ESE will be based on oral / practical performance of the students

Assessment Table:

Assessment Tool	S3	S3	S1	S6
	CO1	CO2	CO3	CO4
Term work(25Marks)	06	07	06	06
Practical Examination & Viva Voce(25 Marks)	06	07	06	06

Assessment Pattern: Use the relevant table for assessment pattern.

Assessment Pattern Level No.	**Knowledge Level**	**ISE I**	**End Semester Examination**
S1	Imitation	06	06
S2	Manipulation	07	07
S3	Precision	06	06
S4	Articulation	06	06
S5	Naturalization	00	00
Total Marks		25	25

Mapping of Course outcome with Program Outcomes and Program Specific Outcomes

Course outcome	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1		3	2	1									1		
CO2		2	3	2	1								2	3	3
CO3	1	2	2											2	
CO4		2	3	3	1								1	3	3

3 – High 2 – Medium 1 – Low

ITPE3007 : Data Mining		
Teaching Scheme	**Examination Scheme**	
Lectures: 03 hrs/ week	**ISE I**	**15 Marks**
Tutorial: 0	**ISE II**	**15 Marks**
Credits:03	**ISE III**	**10 Marks**
	End Semester Examination	**60 Marks**

Prerequisites: Database Management System

Course Description: Data Mining studies algorithms and computational paradigms that allow computers to find patterns and regularities in databases, perform prediction and forecasting, and generally improve their performance through interaction with data. It is currently regarded as the key element of a more general process called Knowledge Discovery that deals with extracting useful knowledge from raw data. The knowledge discovery process includes data selection, cleaning, coding, using different statistical and machine learning techniques, and visualization of the generated structures. The course will cover all these issues and will illustrate the whole process by examples. Special emphasis will be give to the Machine Learning methods as they provide the real knowledge discovery tools

Course Outcome:	
CO1	Identify the key areas and issues in data mining
CO2	Remove redundancy and incomplete data from the dataset using data preprocessing methods.
CO3	Discover interesting patterns from large amounts of data to analyze for predictions and classification
CO4	Apply the techniques of clustering, classification, association finding, feature selection and visualization to real world data
CO5	Develop a data mining application for data analysis using various tools.

Detailed Syllabus:

Unit 1	**Introduction:** Introduction to Data Mining Techniques, Stages of the Knowledge Discovery Process. Knowledge Representation Methods, Applications, Major Issues in Data Mining. **Data Preprocessing**: Descriptive data summarization, Data Cleaning, Data Integration and Data Transformation and Data Reduction
Unit 2	**Mining Frequent Patterns and Associations:** Basic Concepts, Frequent Item Set Generation Mining Methods, Generating rules efficiently, mining association rules, Interesting patterns, Pattern Evaluation Methods
Unit 3	**Classification and Prediction:** Basic Concepts, Decision Tree Induction, Bayes Classification Methods, Rule-Based Classification, , Advanced classification Methods Model Selection and Evaluation. Accuracy and error measures. **Prediction: Regression and correlation**
Unit 4	**Cluster Analysis:** Basic Concepts and Methods, Overview of Basic Clustering Methods, **Partitioning Methods,** Hierarchical Methods: Agglomerative versus Divisive Hierarchical Clustering, Distance Measures in Algorithmic Methods, BIRCH: Multiphase Hierarchical Clustering Using Clustering Feature Trees. Density-Based Methods: DBSCAN: Density-Based Clustering Based on Connected Regions with High Density, OPTICS: Ordering Points to Identify the Clustering Structure, Grid-Based methods
Unit 5	**Knowledge Discovery,** innovative techniques for knowledge discovery, application of those techniques to practical tasks in areas such as fraud detection, scientific data analysis, and web mining **Outlier Detection**: Outliers and Outlier Analysis

Text Books & Reference Books

1. Han J & Kamber M, "Data Mining: Concepts and Techniques", Third Edition, Elsevier, 2011
2. Pang-Ning Tan, Michael Steinback, Vipin Kumar, "Introduction to Data Mining", Pearson Education, 2008
3. Kargupta, Joshi,etc., "Data Mining: Next Generation Challenges and Future Directions", Prentice Hall of India Pvt Ltd, 2007
4. Dunham, Margaret H, Data Mining: Introductory and Advanced Topics, Prentice Hall.

Web Resources

https://nptel.ac.in/courses/106105174

Mapping of Course outcome with Program Outcomes and Program Specific Outcomes

Course outcome	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	1	2											1		
CO2		1	2	1										2	
CO3		2	2	3									2	1	
CO4			2	2	3								2	2	3
CO5		2	3	3	2								2	3	2

3– High 2 – Medium 1 - Low

Assessment:

ISE I-Maximum Marks-15
ISE II- Class Test of Maximum Marks-15
ISE III-Teacher's Assessment of Maximum Marks-10

ISE I and ISE III -May be based on one of the / or combination of few of following

1) Class Test/ Surprise test/ MCQ Test
2) Assignment
3) Quizzes
4) Any other activity suggested by course coordinator

ESE-End Semester Examination of Maximum Marks-60

Assessment Pattern:

Assessment Pattern Level No.	**Knowledge Level**	**ISE I**	**ISE II**	**ISE III**	**End Semester Examination**
K1	Remember	05	05	00	05
K2	Understand	10	10	05	15
K3	Apply	00	00	05	30
K4	Analyze	00	00	00	10
K5	Evaluate	00	00	00	00
K6	Create	00	00	00	00
Total Marks 100		15	15	10	60

Assessment table:

Assessment Tool	**K1,K2**	**K3**	**K4**
	CO2	CO1,CO4,CO5	CO3
ISE I (15 Marks)	05	10	
ISE II (15 Marks)	00	08	07
ISE III (10 Marks)	02	03	05
ESE Assessment (60 Marks)	15	30	15
Total Marks 100			

ITPE3008: Lab Data Mining		
Teaching Scheme	**Examination Scheme**	
Practical: 2Hrs/Week	**ISE I (Term Work)**	**25 Marks**
Credits:01	**End Semester Evaluation**	**25 Marks**

Course Outcomes:

After completion of this course students will be able to:

	Course Outcomes
CO1	Apply statistical methods for the interpretation of data in order analyze patterns and trends
CO2	Implement data preprocessing methods for preparing data for mining
CO3	Apply association, classification, clustering and regression methods appropriate to solve the problem
CO4	Use modern tools for data mining

List of the Experiments:

Sr. No.	**Title of the Experiments**	**Skill / Knowledge Level**	**CO**	**Marks for ISE**
Level: Basic				
1	Write program for implementation of statistical methods on 1D and grouped data	S2	CO1	2
2	Write a program for implementation of Data Normalization Techniques	S2	CO2	2
3	Write a program for implementation of Data Preprocessing Techniques	S2	CO2	2
Level: Moderate (Any Two)				
3	Design a data model for data smoothing and data prediction using regression.	S4	CO3	3
4	Write a program solve the classification problem in which each leaf node corresponds to a class label and attributes are represented on the internal node of the tree.	S3	CO3	3
5	Write a program to find similarities / dissimilarities between data items	S3	CO3	3
Level: Complex				
8	Write a program finding interesting associations and relationships among sets of data items	S4	CO3	4
9	Write a program to divide the given data into different groups by combining similar objects into a group. Use different distant measures for finding similarity between given data objects	S3,S4	CO3	4
10	Design and develop a solution for real world problem and implement using a modern tool	S5	CO4	5

Assessment Table:

Assessment Tool	S3	S3	S4	S5
	CO1	CO2	CO3	CO4
Term work(25Marks)	02	04	14	05
Practical Examination & Viva Voce(25 Marks)	02	04	14	05

Assessment:

ISE I : It shall be based on one of the / or combination of few of: Attendance, punctuality, sincerity throughout semester, performance of during practical sessions, timely completion of allotted lab work, relevant test etc. Maximum marks shall be 25

End Semester Evaluation : It shall be based on practical examination and viva-voce. Maximum marks shall be 25

Assessment Pattern: Use the relevant table for assessment pattern.

Assessment Pattern Level No.	**Knowledge Level**	**ISE I**	**End Semester Examination**
S1	Imitation	00	00
S2	Manipulation	03	03
S3	Precision	06	06
S4	Articulation	11	11
S5	Naturalization	05	05
Total Marks		25	25

Mapping of Course outcome with Program Outcomes and Program Specific Outcomes
3 – High 2 – Medium 1 – Low

Course outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2			1										1	
CO2	2	3	3										3	2	
CO3		2	3	3	1								1	2	
CO4		3	3	2	1							1	2	1	3

ITPE3031 : Speech and Natural Language Processing		
Teaching Scheme	**Examination Scheme**	
Lectures: 03 hrs/ week	**ISE I**	**15 Marks**
Tutorial: -00hr/ Week	**ISE II**	**15 Marks**
Credits: 03	**ISE III**	**10 Marks**
	End Semester Examination	**60 Marks**

Prerequisites: -

Course description: This course introduces the concepts in speech and natural language processing. Students can learn various NLP tasks, algorithms and methods for processing languages.

Course Outcomes: After completing the course, students will able to:

CO1	Explain basic text processing techniques in NLP and language models	K2
CO2	Demonstrate morphological analyzers and stemmers	K3
CO3	Describe statistical constituency parsing and dependency parsing	K4
CO4	Demonstrate Word Sense Disambiguation using WordNet and semantic role labeling	K3

Detailed Syllabus:

Unit 1	Introduction: Stages in NLP, Classical machine learning view of NLP, Regular Expressions, Text Normalization, Edit Distance, Regular Expressions, Words, Corpora, Text Normalization, Minimum Edit Distance, N-gram Language Models, N-Grams, Evaluating Language Models, Generalization and Zeros, Smoothing
Unit 2	Part-of-Speech Tagging, HMM Part-of-Speech, Maximum Entropy Markov Models, Bidirectionality, Part-of-Speech Tagging for Morphological Rich Languages
Unit 3	Constituency Grammars, Constituency Parsing, CKY Parsing, Partial Parsing, Statistical Constituency Parsing, Probabilistic Context-Free Grammars, Probabilistic CKY Parsing of PCFGs, Probabilistic Lexicalized CFGs, Probabilistic CCG Parsing, Dependency Parsing, Dependency Relations, Dependency Formalisms, Dependency Treebanks, Transition-Based Dependency Parsing, Graph-Based Dependency Parsing
Unit 4	Information Extraction, Named Entity Recognition, Relation Extraction, Word Senses and WordNet, Word Senses, Relations Between Senses, WordNet: A Database of Lexical Relations, Word Sense Disambiguation, Alternate WSD algorithms and Tasks
Unit 5	Semantic Role Labeling, Lexicons for Sentiment, Defining Emotion, Available Sentiment and Affect Lexicons, Creating Affect Lexicons by Human Labeling, Semi-supervised Induction of Affect Lexicons, Supervised Learning of Word Sentiment, Machine translation tools like GIZA++, Moses

Text Books and Reference Books:

1. Daniel Jurafsky and James H. Martin, "Speech and Language Processing", Second Edition, Prentice Hall, 2008, ISBN: 978-0131873216.
2. Allen James, "Natural Language Understanding", Second Edition, Benjamin/Cumming, 1994, ISBN: 978-0805303346.

1. Chris Manning and HinrichSchuetze, "Foundations of Statistical Natural Language Processing", MIT Press, ISBN: 978-0262133609.
2. Journals: Computational Linguistics, Natural Language Engineering, Machine Learning, Machine Translation, Artificial Intelligence

Mapping of Course outcomes with Program Outcomes and Program Specific Outcomes

Course outcomes	Program Outcomes												Program Specific Outcomes		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	3	3	1	3	1							1	1	3	2
CO2	2	1	1	3	3							1	1	3	2
CO3	2	1	1	3	3							1	1	3	2
CO4	2	1	1	3	3							1	1	3	2

1– Low2 – Medium 3 – High

Assessment:

ISE I-Maximum Marks-15
ISE II- Class Test of Maximum Marks-15
ISE III-Teacher's Assessment of Maximum Marks-10

ISE I and ISE III -May be based on one of the / or combination of few of following

1) Class Test/ Surprise test/ MCQ Test
2) Assignment
3) Quizzes
4) Any other activity suggested by course coordinator

ESE-End Semester Examination of Maximum Marks-60

Assessment Pattern:

Assessment Pattern Level No.	Knowledge Level	ISE I	ISE II	ISE III	End Semester Examination
K1	Remember	5	5	2	10
K2	Understand	7	7	3	20
K3	Apply	3	3	5	20
K4	Analyze	-	-	-	10
K5	Evaluate	-	-	-	-
K6	Create	-	-	-	-
Total Marks 100		15	15	10	60

Assessment table:

Assessment Tool	K2	K2	K3	K2
	CO1	CO2	CO3	CO4
ISE I(15 Marks)	6	5	2	2
ISEII (15 Marks)	2	3	5	5
ISEIII (10 Marks)	2	2	3	3
ESE Assessment (60 Marks)	10	20	20	10
Total Marks 100	20	30	30	20

ITPE3032: Deep Learning		
Teaching Scheme	**Examination Scheme**	
Lectures: 03 hrs/ week	**ISE I**	**15 Marks**
Tutorial: -00hr/ Week	**ISE II**	**15 Marks**
Credits: 03	**ISE III**	**10 Marks**
	End Semester Examination	**60 Marks**

Course description: The course Deep Learning covers the basics of deep learning first and then move to modern Deep Learning architectures like Convolutional Neural Networks, Sequence Modeling, Auto encoders etc. On completion of this course, students will acquire the knowledge of applying Deep Learning techniques to solve various real life problems.

Course Outcomes: After completing the course, students will able to:

CO1	Describe the feedforward and Deep Networks
CO2	Apply the Convolution Neural Networks
CO3	Analyze the Recursive Neural Networks, Recurrent Neural Networks, LSTM, GRU, and various types of Auto encoders
CO4	Solve the functionalities using Deep Generative Models

Detailed Syllabus:

Unit 1	**Introduction to Deep Learning:** Historical context and motivation for deep learning, Feedforward Neural Networks, Deep Networks, Gradient Based learning, Regularization for Deep Network, Optimization for training Deep models
Unit 2	**Convolution Neural Networks:** The Convolution operation, Pooling layers, Transfer learning, Image Classification using transfer learning
Unit 3	**Sequence Modeling:** Unfolding Computational Graphs, Recurrent Neural Networks (RNNs), Bidirectional RNNs, Encoder-Decoder Sequence to Sequence Architectures, Deep Recurrent Networks, Recursive Neural Networks
Unit 4	**Deep Learning Architectures:** LSTM, GRU, Autoencoders- Undercomplete, Regularized, Denoising, Contractive, Deep Generative Model- Deep Boltzmann Machines
Unit 5	**Applications of Deep Learning:** Case Studies using- Recurrent Neural Networks, Recursive Neural Networks, Convolutional Neural Networks, LSTMs.

Text Books:

6. Ian Good Fellow, Yoshua Bengio, Aaron Courville, "Deep Learning", MIT Press, 2017.
7. Jeff Heaton, Deep Learning and Neural Networks, Heaton Research Inc, 2015.
8. Michael Nielsen, Neural Networks and Deep Learning, Determination Press, 2015.

Reference Books

1. Cosma Rohilla Shalizi, Advanced Data Analysis from an Elementary Point of View, 2015.
2. Deng & Yu, Deep Learning: Methods and Applications, Now Publishers, 2013.

Web Resources

1. https://www.deeplearningbook.org/

Mapping of Course outcomes with Program Outcomes and Program Specific Outcomes

Course outcomes	Program Outcomes												Program Specific Outcomes		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	3	3		2	2							1	2	3	1
CO2	2	2	3	3	3							1	2	3	1
CO3	2	2	2	3	3							1	2	3	1
CO4	2	2	2	3	3							1	2	3	1

1– Low 2 – Medium 3 – High

Assessment:

ISE I-Maximum Marks-15
ISE II- Class Test of Maximum Marks-15
ISE III-Teacher's Assessment of Maximum Marks-10

ISE I and ISE III -May be based on one of the / or combination of few of following

1) Class Test/ Surprise test/ MCQ Test
2) Assignment
3) Quizzes
4) Any other activity suggested by course coordinator

ESE-End Semester Examination of Maximum Marks-60

Assessment Pattern:

Assessment Pattern Level No.	Knowledge Level	ISE I	ISE II	ISE III	End Semester Examination
K1	Remember	5	5	2	10
K2	Understand	7	7	3	20
K3	Apply	3	3	5	20
K4	Analyze	-	-	-	10
K5	Evaluate	-	-	-	-
K6	Create	-	-	-	-
Total Marks 100		15	15	10	60

Assessment table:

Assessment Tool	K2	K2	K3	K2
	CO1	CO2	CO3	CO4
ISE I(15 Marks)	6	5	2	2
ISEII (15 Marks)	2	3	5	5
ISEIII (10 Marks)	2	2	3	3
ESE Assessment (60 Marks)	10	20	20	10
Total Marks 100	20	30	30	20