Scheme of Examination & Detailed Syllabus of B.Tech. (CSE) IV Year

(VII & VIII Semester)

B.Tech. (Computer Science & Engineering) Credit Scheme – Semester VII & VIII

Semester	Basic Sciences' Courses BSC (BSC/X-T/P)		Engineering Sciences' Core/ Elective/ Open Courses ESC (PC/CSE/X-T/P)/ (PE/CSE/X-T/P)/ (OE/CSE/X-T/P)		Humanities, Social Sciences, Management Courses HSMC (HSMC/X-T/P)		Mandatory Courses (MC/X-T/P)		Industrial Training (EEC/CSE/xx-P)		Grand Total Credit
	No. of Courses	Total Credits	No. of Courses	Total Credits	No. of Courses	Total Credits	No. of Courses	Total Credits	No. of Courses	Total Credits	
VII	00	00	06	16	00	00	00	00	02	06	22
VIII	00	00	05	11	01	02	00	00	01	06	17

SEMESTER VII

#	Course Code	Course Title	Workload/Credit			
			Theory	Tutorial	Practical	Total
1.	PC/CSE/19-T	Compiler Design	3/3	-/-	-	3/3
2.	PC/CSE/20-T	Artificial Intelligence	3/3	-/-	-	3/3
3.	PE/CSE/7-T to PE/CSE/11-T	Professional Elective Course-II to be opted by students	3/3	-/-	-	3/3
4.	PE/CSE/12-T to PE/CSE/16-T	Professional Elective Course-III to be opted by students	3/3	-/-	-	3/3
5.	OEC-III	Open Elective Course be opted by Students from another branch	3/3	-/-	-	3/3
6.	PE/CSE/12-P to PE/CSE/16-P	Professional/ Programme Elective Course - III Lab.	-/-	-/-	2/1	2/1
7.	EEC/CSE/2-P	Mini Project using open sourcetools/.NET	-/-	-/-	4/2	4/2
8.	EEC/CSE/3-P	Major Project-I	-/-	-/-	8/4	8/4
		TOTAL CREDITS	15/15	-/-	14/7	29/22

***The students will have to prepare and submit a Mini Project report of the Industrial Training/ Internship of 6-8 weeks done during summer vacations after the examination of VI semester under the supervision of faculty during VII semester.

Professional/ Programme Elective Course II

6. PE/CSE/7-T: Software Project Management
7. PE/CSE/8-T: Soft Computing
8. PE/CSE/9-T: Distributed Operating Systems
9. PE/CSE/10-T: Cloud Computing
10. PE/CSE/11-T: Digital Marketing

Professional/ Programme Elective Course III

6. PE/CSE/12-T: Mobile Application Development
7. PE/CSE/13-T: Multimedia Technologies
8. PE/CSE/14-T: Digital Image Processing
9. PE/CSE/15-T: Blockchain Technology
10. PE/CSE/16-T: Natural Language Processing

Professional/ Programme Elective Course III (Labs)

6. PE/CSE/12-P: Mobile Application Development (Lab.)
7. PE/CSE/13-P: Multimedia Technologies (Lab.)
8. PE/CSE/14-P: Digital Image Processing (Lab.)
9. PE/CSE/15-P: Blockchain Technology (Lab.)
10. PE/CSE/16-P: Natural Language Processing (Lab.)

SEMESTER VIII

#	Course Code	Course Title	Workload/Credit			
			Theory	Tutorial	Practical	Total
1.	PC/CSE/21-T	Data Mining Techniques	3/3	-/-	-	3/3
2.	HSMC/2-T	Human Values and Personality Development	2/2	-/-	-	2/2
3.	PE/CSE/17-T to PE/CSE/21-T	Professional/ Programme Elective Course-IV to be opted by students	3/3	-/-	-	3/3
4.	PE/CSE/22-T to PE/CSE/26-T	Professional/ Programme Elective Course-V tobe opted by students	3/3	-/-	-	3/3
5.	PE/CSE/17-P to PE/CSE/21-P	Professional/ Programme Elective Course - IV Lab.	-/-	-/-	2/1	2/1
6.	PE/CSE/22-P to PE/CSE/26-P	Professional/ Programme Elective Course-V Lab.	-/-	-/-	2/1	2/1
7.	EEC/CSE/4-P	Major Project-II	-/-	-/-	12/4	12/4
Total Credit			11/11		16/6	27/17

Professional/ Programme Elective Course IV

1. PE/CSE/17-T: Internet of Things
2. PE/CSE/18-T: Network Administration and Management
3. PE/CSE/19-T: Software Testing and Quality Assurance
4. PE/CSE/20-T: Pattern Recognition
5. PE/CSE/21-T: Artificial Neural Network

Professional/ Programme Elective Course IV (Labs)

6. PE/CSE/17-P: Internet of Things (Lab.)
7. PE/CSE/18-P: Network Administration and Management (Lab.)
8. PE/CSE/19-P: Software Testing and Quality Assurance (Lab.)
9. PE/CSE/20-P: Pattern Recognition (Lab.)
10. PE/CSE/21-P: Artificial Neural Network (Lab.)

Professional/ Programme Elective Course V

6. PE/CSE/22-T: .Net Using C#
7. PE/CSE/23-T: Big Data Analytics
8. PE/CSE/24-T: Web Development
9. PE/CSE/25-T: Statistical Computing
10. PE/CSE/26-T: Digital Forensics

Professional/ Programme Elective Course V (Labs)

6. PE/CSE/22-P: .Net Using C# (Lab)
7. PE/CSE/23-P: Big Data Analytics (Lab)
8. PE/CSE/24-P: Web Development (Lab)
9. PE/CSE/25-P: Statistical Computing (Lab)
10. PE/CSE/26-P: Digital Forensics (Lab)

Policy Document for providing exemptions in attendance to the B.Tech. students of the University/ Institute/ College for undertaking various internships/trainings during their final/penultimate semester

1. Background:

It has been realized that the students pursuing B. Tech. programmes offered by the University/affiliated Institutes/Colleges are facing challenges as under:

1. Students selected in industry during their programme are asked to join the industry for internship/training of duration up to one semester.

2. The provision is not there in these programmes to allow the students to join the internship by way of getting the required attendance of semester from internship/training.

3. So, students are not able to join such internship/training consequential to two-fold loss:
   (a) Job opportunity.
   (b) Skill development in industry environment.

But, presently, in the B. Tech. Programmes run by the University, there is no provision for the students to join the industry for such internship/training of/for more than 6–8-week duration. To facilitate the students for joining longer duration internships/trainings, a need for framing a policy document was felt.

Keeping in view the above challenges/statutory position and to avoid hardship to students and to improve the employability of the students, Ch. Devi Lal University, Sirsa has framed a policy to accord exemptions in attendance to students undertaking various internships/trainings during their final/penultimate semester of the B. Tech. Programmes.

2. Applicability of the policy with following Provisions:

The policy is applicable to the students studying in the final semester/ penultimate semester of B. Tech. programmes.

2.1 Provisions:

Student covered as per section title 'Applicability of the Policy' will be governed by the following provisions:

1. The student will be allowed to join the organization for internship/training in the final semester/ penultimate semester of the course for a period of up to one semester only if he/she must be passed/ cleared in all courses/subjects in all the semester examination whose results have been declared.

2. The student will earn his attendance from the organization during the period of internship.

3. Attendance will be certified by the organization, failing which student will be debarred from appearing in the University examinations of that semester.

4. The student will have to give an undertaking that he/she will appear in all the internal/external examination/practical as per requirements of the Programme and as per Schedule of the University examination for that programme. For this he/she will have to do the necessary preparation by himself/herself and Institute/department will not be responsible for the same.

5. If the student is selected in a company/industry/organization etc., and is asked to join the organization in the final semester/ penultimate semester for a period of upto one semester; then formally constituted Internship Facilitation Committee (IFC) will examine and give its recommendation as deemed fit.

1.2 Composition of Internship Facilitation Committee (IFC):

The composition of IFC will be as under:

1. Dean, Faculty of Engg. & Tech./Director/ Principal (or Nominee) (Chairperson)
2. Chairperson/Head/ In-charge of the concerned Department/Branch (Member)
3. In-Charge Academic Branch/Academic In-charge of Institute (Member)
4. Senior most faculty of the department other than Chairperson/ Director/Head of the Department/Branch (Member)
5. Training and Placement officer/ In-Charge TPO of the Institute /College/Department (Member Secretary)

Any offer by the organisations providing internship on demanding charges from a student will be discouraged by the Internship Facilitation Committee (IFC). Member Secretary of the IFC will schedule the meeting and maintain all the records.

3. Conclusion:

The students can only be allowed to join the internship/training in company/ industry/ organization etc. with exemptions in attendance on the final recommendation of Internship Facilitation Committee (IFC) of the Institute / Department and permission given by the Department/Institute/College authority.

Detailed Syllabus of B. Tech. (CSE) VII and VIII Semester

Compiler Design

General Course Information

Course Code: PC/CSE/19-T Course Credits: 3 Type: Professional Core Contact Hours: 3 hours/week Mode: Lectures (L) Examination Duration:3 hours	**Course Assessment Methods (internal: 30; external: 70)** Three minor tests each of 20 marks will be conducted. The average of the highest marks obtained by a student in the any of the two minor examinations will be considered. Class Performance will be measured through percentage of lectures attended (04 marks). Assignments, quiz etc. will have weightage of 06 marks For the end semester examination, nine questions are to be set by the examiner. A candidate is required to attempt 5 questions in all. All questions carry equal marks. Question number 1 will be compulsory and based on the entire syllabus. It will contain seven parts of 2 marks each. Question numbers 2 to 9 will be given by setting two questions from each of the four units of the syllabus. A candidate is required to attempt the remaining four questions by selecting one question from each of the four units.

Pre-requisites: Brief knowledge of programming languages, Data Structure, and Algorithm Design.

About the Course:
Compilers have become part and parcel of today's computer systems. These are responsible for making the user's computing requirements, specified as a piece of program, understandable tothe underlying machine. There tools work as interface between the entities of two different domains – the human being and the machine. The actual process involved in this transformation is quite complex. Compiler design covers basic translation mechanism and, error detection and recovery. It includes lexical, syntax, and semantic analysis as front end, and code generation and optimization as back-end.

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

CO1. **state** principles of compiler design. (LOTS: Level 1: Remember)
CO2. **illustrate** the essential phases for automatically converting source code into objectcode. (LOTS: Level 2: Understand)
CO3. **apply** lexical analysis, syntax analysis and code optimization techniques forsolving problems. (LOTS: Level 3: Apply)
CO4. **analyse** a parse tree and a given BNF grammar. (LOTS: Level 4: Analyse)
CO5. **compare and contrast** syntax-oriented translation schemes (LOTS: Level 5:Evaluate)
CO6. **design** a lexical analyser from the specification of a language's lexical rules. (LOTS:Level 6: Create)

Course Content

Unit I
Introduction To Compilers: Compilers and translators, need of translators, structure of compiler its different phases, Compiler construction tools.
Lexical Analysis: Role of lexical analyzer, design of lexical analyzer, regular expressions, Specification and recognition of tokens, input buffering, A language specifying lexical analyzer. Finite automata, conversion from regular expression to finite automata, and vice versa, minimizing number of states of DFA, Implementation of lexical analyzer.

Unit II
Syntax Analysis: Role of parsers, context free grammars, definition of parsing. Parsing Technique: Shift- reduce parsing, operator precedence parsing, top down parsing, predictive parsing.

Unit III
LR parsers, SLR, LALR and Canonical LR parser. Syntax Directed Translations: Syntax directed definition, construction of syntax trees, syntax directed translation scheme, implementation of syntax

directed translation, three address code, quadruples and triples.

Unit IV

Symbol Table & Error Detection and Recovery: Symbol tables, its contents and data structure for symbol tables; trees, arrays, linked lists, hash tables. Errors, lexical phase error, syntactic phase error, semantic error.

Code Optimization & Code Generation: Code generation, forms of objects code, machine dependent code, optimization, register allocation for temporary and user defined variables.

Text and Reference Books:

1. Alfread V. AHO, Ravi Sethi and J.D. Ullman, *Compilers Principle, Techniquesand Tools*, AddisonWesley, 2007.
2. Tremblay and Sorenson, *Theory and practice of compiler writing*, Mc. Graw Hill, 1985.
3. Dhamdare, *System software*, MGH, 1986.
4. Alfred V. Aho, Jeffrey D. Ullman, *Principles of Compiler Design*, Narosa Publication,2002.

CO-PO Articulation Matrix Compiler Design Course (PC/CSE/19-T)

List of Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO1. **State** principles of compiler design. (LOTS: Level 1: Remember)	1	–	–	–	–	–	–	–	–	–	–	–	2	–	–
CO2. **Illustrate** the essential phases for automatically converting source code into object code. (LOTS: Level 2: Understand)	1	–	–	–	–	–	–	–	–	–	–	–	3	–	–
CO3. **Apply** lexical analysis, syntax analysis and code Optimization techniques for solving problems. (LOTS: Level 3: Apply)	2	1	–	–	–	–	–	–	–	–	–	–	3	–	–
CO4. **Analyse** a parse tree and a given BNF grammar. (LOTS:Level 4: Analyse)	3	2	1		2	–	–	–	–	–	–	–	3	–	–
CO5. **Compare and contrast** syntax-oriented translation schemes (LOTS: Level 5: Evaluate)	2	2	1		2	–	–	–	–	–	–	–	3	–	–
CO6. **Design** a lexical analyser from the specification of a language's lexical rules. (LOTS: Level 6: Create)	3	3	2	2	3	–	–	–	–	–	–	–	3	–	–
Level of Attainments PC/CSE/19-T														_	_

Artificial Intelligence

General Course Information

Course Code: PC/CSE/20-T Course Credits: 3 Type: Professional Core Contact Hours: 3 hours/week Mode: Lectures (L) Examination Duration:3 hours	**Course Assessment Methods (internal: 30; external: 70)** Three minor tests each of 20 marks will be conducted. The average of the highest marks obtained by a student in the any of the two minor examinations will be considered. Class Performance will be measured through percentage of lectures attended (04 marks). Assignments, quiz etc. will have weightage of 06 marks For the end semester examination, nine questions are to be set by the examiner. A candidate is required to attempt 5 questions in all. All questions carry equal marks. Question number 1 will be compulsory and based on the entire syllabus. It will contain seven parts of 2 marks each. Question numbers 2 to 9 will be given by setting two questions from each of the four units of the syllabus. A candidate is required to attempt the remaining four questions by selecting one question from each of the four units.

Pre-requisites: Basic knowledge of Algorithms and probability.

About the Course:
Artificial Intelligence is a core and an essential course for every graduate in Computer Science and Engineering. This course introduces the concepts of Artificial Intelligence and challenges inherent in building intelligent systems. It includes the role of knowledge representation in problem solving and how these are used in making intelligent machine. Further it incorporates the concepts of expert system and its applications.

Course Outcomes: By the end of the course students will be able to:
CO1. **outline** various Artificial Intelligence techniques. (LOTS: Level 1: Remember)
CO2. **illustrate** reasoning under uncertainty. (LOTS:Level 2: understand)
CO3. **apply** search and knowledge representation techniques to solve AI problems. (LOTS: Level 3: Apply)
CO4. **compare** strengths and weaknesses of AI algorithms (LOTS: Level 4: Analyse).
CO5. combine various AI techniques to solve intelligent systems' problems. (LOTS: Level6: Create)

Course Content

Unit I

Introduction to AI: Introduction, Turing Test, AI problems, State Space Search, production system
Problem Solving Using Search: Blind search techniques - Breadth first search, Depth first search. Heuristic search techniques - Generate and test, Hill Climbing, Best first search, A* Algorithm, AO* Algorithm, The Minimax Search Procedure, Adding Alpha-Beta Cut-offs.

Unit II

Knowledge Representation: Introduction, Knowledge Representation- Representation and Mappings, Symbolic Logic - Propositional logic, Predicate logic- Representing simple facts in logic, Representing Instances and ISA Relationship, Computable functions and Predicates, Unification, Resolution.

Representing Knowledge Using Rules: Procedural versus Declarative Knowledge, Logic Programming, Forward versus Backward Reasoning, Matching, Control Knowledge.

Unit III

Reasoning Under Uncertainty: Introduction to Nonmonotonic Reasoning, Probability and Baye's Theorem, Certainty Factors and Rule-based Systems, Bayesian Networks.
Fuzzy logic system: Introduction, Crisp Set, Fuzzy Sets, Fuzzy Membership Functions, Operations on Fuzzy Sets, Fuzzy Relations.

Unit IV

Planning: Introduction, Components of Planning System, Goal Stack Planning, Nonlinear Planning using Constraint Posting, Hierarchical Planning.

Expert System and Applications: Introduction, Architecture, Rule based Expert Systems, Applications of Expert Systems.

Text and Reference Books:

1. Elaine Rich, Kevin Knight and Shivashankar B Nair, *Artificial intelligence*, McGraw Hill Education.3rd edition, 2009.
2. Stuart Russel and Peter Norvig, *Artificial intelligence: A modern Approach*, Pearson Education, 3rdedition, 2015.
3. Dan W. Patterson, *Introduction to Artificial Intelligence and Expert System*, Pearson Education.1stedition, 2007.
4. Deepak Khemani, *A first course in Artificial Intelligence*, McGraw Hill Education. 3rd edition, 1stedition, 2013.
5. George F. Luger, *Artificial Intelligence: Structures and Strategies for Complex Problem Solving*,Pearson Education, 5th edition, 2009.

CO-PO Articulation Matrix Artificial Intelligence Course (PC/CSE/20-T)

List of Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO1	PSO2	PSO3
CO1. **Outline** various Artificial Intelligence techniques. (LOTS: Level 1: Remember)	1	–	–	–	–	–	–	–	–	–	–	–	–	–	3
CO2. **Illustrate** reasoning under uncertainty. (LOTS: Level 2: Understand)	1	–	–	–	–	–	–	–	–	–	–	–	–	–	3
CO3. **Apply** search and knowledge representation techniques to solve AI problems. (LOTS: Level 3: Apply)	2	2	–	2	2	–	–	–	–	–	–	–	–	–	3
CO4. **Compare** strengths and weaknesses of AI algorithms (LOTS: Level 4: Analyse).	2	2	2	2	–	–	–	–	–	–	–	–	–	–	3
CO5. **Combine** various AI techniques to solve intelligent systems 'problems. (LOTS: Level 6: Create)	3	3	3	3	2	2	–	–	–	–	–	3	–	–	3
Level of Attainments PC/CSE/20-T															

Software Project Management

General Course Information

Course Code: PE/CSE/7-T Course Credits: 3 Type: Professional Core Contact Hours: 3 hours/week Mode: Lectures (L) Examination Duration:3 hours	**Course Assessment Methods (internal: 30; external: 70)** Three minor tests each of 20 marks will be conducted. The average of the highest marks obtained by a student in the any of the two minor examinations will be considered. Class Performance will be measured through percentage of lectures attended (04 marks). Assignments, quiz etc. will have weightage of 06 marks For the end semester examination, nine questions are to be set by the examiner. A candidate is required to attempt 5 questions in all. All questions carry equal marks. Question number 1 will be compulsory and based on the entire syllabus. It will contain seven parts of 2 marks each. Question numbers 2 to 9 will be given by setting two questions from each of the four units of the syllabus. A candidate is required to attempt the remaining four questions by selecting one question from each of the four units.

Pre-requisites: Preliminary knowledge of Software Engineering.

About the Course:
The course involves training students in software project management and project planning. It focuses on the need for careful planning, monitoring and control for delivering quality projectsin time. Besides this student learn to measure the success of a project in meeting its objectives.

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

CO1. **outline** basic concepts related to stepwise project planning. (LOTS: Level 1:Remember)
CO2. **demonstrate** the knowledge about Quality Control, Standard and Risk Management. (LOTS: Level2: Understand)
CO3. **illustrate** the Activity Planning, and Resource Allocation Process. (LOTS:Level 2: Understand)
CO4. **apply** the concept of team structure and organization structure. (LOTS: Level 3:Apply)
CO5. **compare** various Project Evaluation and Estimation Techniques. (LOTS: Level 4:Analyse)
CO6. **plan** activities necessary for completing the software projects successfully. (LOTS:Level 6: Create)

Course Content

Unit I

Introduction to Software Project Management (SPM): Definition of Software Project, Software Project Vs Other types of projects, activities covered by SPM, categorizing software projects, project as system, management control, Requirement specification, Information and control in organization, project management lifecycle.
Stepwise Project Planning: Introduction, selecting a project, identifying project scope and objectives, identifying project infrastructure, analysing project characteristics, identifying the project products and activities, estimate efforts for each activity, identifying activity risk, allocate resources, review/publicize plan.

Unit II

Project Evaluation and Estimation: Cost-Benefit analysis, cash flow forecasting, cost benefit evaluation techniques, Selection of an appropriate project, choosing technologies, choice of process models, rapid application development, waterfall model, V process model and spiral model, Albrecht function point analysis.
Activity Planning: Objectives of activity planning, project schedule, projects and activities, sequencing and scheduling activities, network planning model.

Unit III

Risk Management: Introduction, the nature of risk, managing risk, risk identification, risk analysis, reducing the risks, evaluating risks to schedule, calculating z-values**.**
Resource Allocation: Introduction, the nature of resources, identifying resource requirements, scheduling resources, creating critical paths.

Unit IV

Managing Contracts and People: Introduction, types of contract, stages in contract placement, terms of contract, contract management, acceptance, managing people and organizing teams: Introduction, understanding organization behaviour: a back ground, selecting the right person for job, instruction in best methods, motivation, working in groups, becoming a team, decision making, leadership, organization structures.
Software Quality: Introduction, the place of software quality in project planning, the importance of software quality, defining software quality, McCall's software quality factors, product versus process quality management, external standards, techniques to enhance software quality.

Text and Reference Books:

1. Bob Hughes and Mike Cotterell , *Software Project Management*, Sixth Edition, TMH,2018.
2. Walker Royce , *Software Project Management*, , Addison Wesley, 1998.
3. Pankaj Jalote , *Software Project Management in Practice*, Pearson, 2002.
4. Ramesh, *Managing Global Software Projects*, TMH, 2005.

CO-PO Articulation Matrix Software Project Management Course (PE/CSE/7-T)

List of Course Outcomes	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. **Outline** basic concepts related to stepwise project planning. (LOTS: Level 1: Remember)	1	–	–	–	–	–	–	–	–	–	–	–	2	–	–
CO2. **Demonstrate** the knowledge about Quality Control, Standard and Risk Management. (LOTS: Level 2: Understand)	1	–	–	–	–	–	–	–	–	–	–	–	3	–	–
CO3. **Illustrate** the Activity Planning, and Resource Allocation Process. (LOTS: Level 2: Understand)	1	–	–	–	2	–	–	–	–	–	–	–	3	–	–
CO4. **Apply** the concept of team structure and organization structure. (LOTS: Level 3: Apply)	2	2	–	–	2	–	–	–	2	–	–	–	3	–	–
CO5. **Compare** various Project Evaluation and Estimation Techniques. (LOTS: Level 4: Analyse)	2	2	2	2	2	–	–	–	–	–	2	_	3	–	–
CO6. **Plan** activities necessary for completing the software projects successfully. (LOTS: Level 6: Create)	3	3	_	3	3	_	_	_	_	2	3	2	3	_	_
Level of Attainments PE/CSE/7-T															

Soft Computing

General Course Information

Course Code: PE/CSE/8-T Course Credits: 3 Type: Professional Core Contact Hours: 3 hours/week Mode: Lectures (L) Examination Duration:3 hours	**Course Assessment Methods (internal: 30; external: 70)** Three minor tests each of 20 marks will be conducted. The average of the highest marks obtained by a student in the any of the two minor examinations will be considered. Class Performance will be measured through percentage of lectures attended (04 marks). Assignments, quiz etc. will have weightage of 06 marks For the end semester examination, nine questions are to be set by the examiner. A candidate is required to attempt 5 questions in all. All questions carry equal marks. Question number 1 will be compulsory and based on the entire syllabus. It will contain seven parts of 2 marks each. Question numbers 2 to 9 will be given by setting two questions from each of the four units of the syllabus. A candidate is required to attempt the remaining four questions by selecting one question from each of the four units.

Pre-requisites: Basic knowledge of Probability Theory, Set Theory and, Data Structure and Computer Algorithms

About the Course:

We need to learn soft computing techniques to make intelligent machines that possess human like abilities to reason, learn and handle the uncertainty and vagueness often inherent in real world problems. Unlike conventional computing, soft computing techniques are tolerant of imprecision, uncertainty and approximations, and provide low cost, robust and tractable solutions to the complex real-world problems where conventional methods fail to do so. This introductory course on soft computing is going to cover Genetic Algorithms, Artificial Neural Networks and Fuzzy Logic.

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

CO1. **define** the terminology and concepts related to soft computing techniques. (LOTS:Level 1: Remember)
CO2. **discuss** soft computing techniques including genetic algorithms, fuzzy systems and neuralnetworks. (LOTS: Level 2: Understand)
CO3. **solve** problems related to Genetic algorithms, Fuzzy logic and Neural Networks.(LOTS: Level 3: Apply)
CO4. **analyse** the design of Genetic Algorithms, Neural Networks and Fuzzy Systems.(LOTS: Level 4: Analyse)
CO5. **justify** the design of a soft computing algorithm for a given problem. (LOTS: Level 5:Evaluate)
CO6. **design** Genetic Algorithms and Neural Networks to solve optimization and patternrecognition problems. (LOTS: Level 6: Create)

Course Content

Unit I

Introduction to Soft Computing and related definitions: Defining soft computing, Differentiating the situations for application of hard and soft computing; Working of a simple Genetic Algorithm: Representation/Encoding Schemes, initializing a GA population, evaluationfunction, genetic operators, Function optimization using GA. Study of parameters of genetic algorithms and its performance, sampling and selection mechanisms. Scaling of GA population.

Unit II

Designing Genetic Algorithms for different applications: Different types encoding schemes, role of fitness function, different types of genetic operators, Designing GAs for numerical optimization, knapsack problem andtravelling salesperson and other similar problems.

Unit III

Fuzzy sets: Basic terminology and definitions, Operations on Fuzzy sets, MF formulations and parameterisation, MFs of one and two dimensions, Derivatives of parameterised MFs, Fuzzy numbers, Extension principle and fuzzy relations, Operations on Fuzzy relations, Linguistic variables, Fuzzy If-Then Rules, Compositional rule of inference.

Unit IV

Neural networks: Basic terminology and definitions, Model of an artificial neuron, Sigmoid function, Neural Network Architectures, Rosenblatt's Perceptron, Fixed increment perceptronlearning algorithm for a classification problem, Examples of learning of AND/OR gate by perceptron, XOR problem. Back Propagation Neural Networks: Architecture of a backpropagation network, Model for multi-layer perceptron, Back propagation learning, Delta or gradient descent learning rule and effect of learning rate, Back propagation learning algorithm.

Text and Reference Books:

1. David. E. Goldberg, *Genetic Algorithms in Search, Optimization and machine learning*, Addison Wesley,1999.
2. Zbigniew Michalewicz, *Genetic algorithms + Data Structures = Evolution Programs*, Springers-Verlag,1999.
3. M. Mitchell, *An Introduction to Genetic Algorithms*, Prentice-Hall, 1998.
4. S. Rajasekaran & G. A. Vijayalakshmi Pai, *Neural Networks, Fuzzy Logic and Genetic Algorithms:Synthesis & Applications*, PHI, 2003.
5. S. N. Sivanandam & S. N. Deepa, *Principles of Soft Computing*, Wiley - India, 2007.
6. J-S. R. Jang, C.-T. Sun, E. Mizutani, *Neuro-Fuzzy and Soft Computing*, PHI, 1997.
7. Simon O. Haykin, *Neural Networks, A Comprehensive Foundation*, PHI, 1994.

CO-PO Articulation Matrix Soft Computing Course (PE/CSE/8-T)

List of Course Outcomes		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CO1.	**Define** the terminology and concepts related to soft computing techniques. (LOTS: Level 1: Remember)	1	–	–	–	–	–	–	–	–	–	–	–	–	–	3
CO2.	**Discuss** soft computing techniques including genetic algorithms, fuzzy systems and neural networks. (LOTS: Level 2: Understand)	1	–	–	–	–	–	–	–	–	–	–	–	–	–	3
CO3.	**Solve** problems related to Genetic algorithms, Fuzzy logic and Neural Networks. (LOTS: Level3: Apply)	3	3	–	–	2	–	–	–	–	–	–	–	–	–	3
CO4.	**Analyse** the design of Genetic Algorithms, Neural Network and Fuzzy Systems. (LOTS: Level 4: Analyse)	3	3	–	2	2	–	–	–	–	–	–	–	–	–	3
CO5.	**Justify** the design of a soft computing algorithmfor a given problem. (LOTS: Level 5: Evaluate)	3	3	2	2	–	–	–	–	–	–	–	–	–	–	3
CO6.	**Design** Genetic Algorithms and Neural Networks to solve optimization and pattern recognition problems. (LOTS: Level 6: Create)	3	3	3	3	3	–	–	–	–	–	–	–	–	–	3
Level of Attainments PE/CSE/8-T																

Distributed Operating System

General Course Information

Course Code: PE/CSE/9-T Course Credits: 3 Type: Professional Core Contact Hours: 3 hours/week Mode: Lectures (L) Examination Duration:3 hours	**Course Assessment Methods (internal: 30; external: 70)** Three minor tests each of 20 marks will be conducted. The average of the highest marks obtained by a student in the any of the two minor examinations will be considered. Class Performance will be measured through percentage of lectures attended (04 marks). Assignments, quiz etc. will have weightage of 06 marks For the end semester examination, nine questions are to be set by the examiner. A candidate is required to attempt 5 questions in all. All questions carry equal marks. Question number 1 will be compulsory and based on the entire syllabus. It will contain seven parts of 2 marks each. Question numbers 2 to 9 will be given by setting two questions from each of the four units of the syllabus. A candidate is required to attempt the remaining four questions by selecting one question from each of the four units.

Pre-requisites: Knowledge of operating system, computer networks and a programming language

About the Course:
This course focuses on the study of distributed system concepts and its applications. In this course various advantages of distributed computing system are studied. After studying this course, a student will be expected to understand the design issues of the distributed operating systems and propose solutions for problems specific to the domain.

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

CO1. **state** the basic concepts of distributed systems and their advantages over simple clientserverbased computer networks. (LOTS: Level 1: Remember)
CO2. **explain** strategies for synchronization, scheduling policies and deadlock avoidance indistributed environment. (LOTS: Level 2: Understand)
CO3. **apply** distributed operating system's concepts to solve the problems inherent indistributed systems. (LOTS: Level 3: Apply)
CO4. **analyse** trends in distributed file systems. (LOTS: Level 4: Analyse)
CO5. **compare** and **contrast** strategies for synchronization, scheduling policies anddeadlock avoidance and distributed file systems. (LOTS: Level 5: Evaluate)

Course Content

Unit I
Introduction: Introduction to distributed system, Goals of distributed system, Hardware and Software concepts, Design issues, Communication in distributed system: Layered protocols, ATM networks, Client- Server model, Remote Procedure Calls and Group Communication, Middleware and Distributed Operating Systems.

Unit II
Synchronization in Distributed System: Clock synchronization, Mutual Exclusion, Election algorithm, Bully algorithm, Ring algorithm, Atomic Transactions, Deadlock in Distributed Systems, Distributed Deadlock Prevention, Distributed Deadlock Detection.

Unit-III
Processes and Processors in distributed systems: Threads, System models, Processors Allocation, Schedulingin Distributed System, Real Time Distributed Systems.

Unit IV
Distributed file systems: Distributed file system design, Distributed file system Implementation, Trends in Distributed file systems. Distributed Shared Memory: What is shared memory, Consistency models, Page based distributed shared memory, shared variables distributed shared memory.

Text and Reference Books:

1. Tanenbaum A.S., Van Steen M., *Distributed Systems: Principles and Paradigms*, Pearson Education,
2. Pradeep K Sinha, *Distributed Operating Systems: Concepts and Design*, Prentice Hall ofIndia, 2007.
3. Liu M.L., *Distributed Computing, Principles and Applications*, Pearson Education,2004.
4. Nancy A Lynch, *Distributed Algorithms*, Morgan Kaufman Publishers, USA, 2003.

CO-PO Articulation Matrix Distributed Operating System Course (PE/CSE/9-T)

List of Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CO1. **State** the basic concepts of distributed systems and their advantages over simple client server- based computer networks. (LOTS: Level 1: Remember)	1	–	–	–	–	–	–	–	–	–	–	–	2	–	–
CO2. **Explain** strategies for synchronization, scheduling policies and deadlock avoidance in distributed environment. (LOTS: Level 2: Understand)	1	–	–	–	–	–	–	–	–	–	–	–	3	–	–
CO3. **Apply** distributed operating system's concepts to solve the problems inherent in distributed systems. (LOTS: Level 3: Apply)	2	1	–	–	–	–	–	–	–	–	–	–	3	–	–
CO4. **Analyse** trends in distributed file systems. (LOTS: Level 4: Analyse)	2	2	2	2	–	–	–	–	–	–	–	–	3	–	–
CO5. **Compare** and **contrast** strategies for synchronization, scheduling policies and deadlock avoidance and distributed file systems. (LOTS: Level 5: Evaluate)	2	2	3	3	–	–	–	–	–	–	–	–	3	–	–
Level of Attainments PE/CSE/9-T															

Cloud Computing

General Course Information

Course Code: PE/CSE/10-T Course Credits: 3 Type: Professional Core Contact Hours: 3 hours/week Mode: Lectures (L) Examination Duration:3 hours	**Course Assessment Methods (internal: 30; external: 70)** Three minor tests each of 20 marks will be conducted. The average of the highest marks obtained by a student in the any of the two minor examinations will be considered. Class Performance will be measured through percentage of lectures attended (04 marks). Assignments, quiz etc. will have weightage of 06 marks For the end semester examination, nine questions are to be set by the examiner. A candidate is required to attempt 5 questions in all. All questions carry equal marks. Question number 1 will be compulsory and based on the entire syllabus. It will contain seven parts of 2 marks each. Question numbers 2 to 9 will be given by setting two questions from each of the four units of the syllabus. A candidate is required to attempt the remaining four questions by selecting one question from each of the four units.

Pre-requisites: Basics of Computer Network, Distributed System.

About the Course:

The objective of the course is to give students a comprehensive view of storage and networking infrastructures for highly virtualized cloud ready deployments. The course discusses the concepts and features related to Virtualized data-centre and cloud, information storage and design of applications.

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

CO1. **define** concepts related to cloud computing. (LOTS: Level 1: Remember)
CO2. **express** deployment models for clouds. (LOTS: Level 2: Understand)
CO3. **apply** cloud computing techniques for various applications. (LOTS: Level 3: Apply)
CO4. **analyse** cloud computing services used at various levels. (LOTS: Level 4: Analyse)
CO5. **assess** real time cloud services. (LOTS: Level 5: Evaluate)

Course Content

Unit I

Introduction: Distributed Computing, Cluster Computing, Grid Computing, Overview of Cloud Computing, History of Cloud Computing, Defining a Cloud, Benefits of Cloud Computing, Cloud Computing Architecture, Services Models (XaaS), Infrastructure as a Service, Platform as a Service, Software as a Service.

Unit II

Deployment Models, Public Cloud, Private Cloud, Hybrid Cloud, Community Cloud, Dynamic Provisioning and Resource Management, Virtualization: Characteristics of Virtualized Environment, Taxonomy of Virtualization Techniques, Pros and Cons of Virtualization, Xen, VMware, Hyper-V.

Unit III

Cloud Platform in Industry: Amazon Web Services- Compute Services, Storage Services, Communication Services, Additional Services, Google App Engine- Architecture and Core Concepts, Application Life Cycle, Cost Model, Microsoft Azure – Azure Core Concepts, SQL Azure, Windows Azure Platform Appliance.

Unit IV

Cloud Application: Scientific Applications- ECG Analysis in cloud, Protein StructurePrediction, Gene Expression data analysis for Cancer Diagnosis, Satellite Image Processing, Business and Consumer Applications-CRM and ERP, Productivity, Social Networking, Media Applications, Multiplayer Online gaming. Cloud Security.

Text and Reference Books:

1. Rajkumar Buyya, Christian Vecchiola and S ThamaraiSelvi, *Mastering Cloud Computing*, TataMcGraw Hill Education Pvt. Ltd., 2013.
2. Kai Hwang, Geofferyu C. Fox and Jack J. Dongarra, *Distributed and Cloud Computing*,Elsevier, 2012.
3. John W. Ritting and James F. Ransome, *Cloud Computing: ImplementationManagement and Security*,CRC press, 2012.

CO-PO Articulation Matrix Cloud Computing Course (PE/CSE/10-T)

List of Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CO1. **Define** concepts related to cloud computing. (LOTS: Level1: Remember)	1	_	_	_	_	_	_	_	_	_	_	_	_	2	_
CO2. **Express** deployment models for clouds. (LOTS: Level 2: Understand)	1	_	_	_	_	_	_	_	_	_	_	_	_	3	_
CO3. **Apply** cloud computing techniques for various applications. (LOTS: Level 3: Apply)	2	2	2	_	2	_	_	_	_	_	_	_	_	3	_
CO4. **Analyse** cloud computing services used at various levels. (LOTS: Level 4: Analyse)	3	3	2	3	2	_	_	_	_	_	_	_	_	3	_
CO5. **Assess** real time cloud services. (LOTS: Level 5: Evaluate)	3	3	3	3	3	2	_	_	_	_	_	2	_	3	_
Level of Attainments PE/CSE/10-T															

Digital Marketing

General Course Information

Course Code: PE/CSE/11-T Course Credits: 3 Type: Professional Core Contact Hours: 3 hours/week Mode: Lectures (L) Examination Duration: 3 hours	**Course Assessment Methods (internal: 30; external: 70)** Three minor tests each of 20 marks will be conducted. The average of the highest marks obtained by a student in the any of the two minor examinations will be considered. Class Performance will be measured through percentage of lectures attended (04 marks). Assignments, quiz etc. will have weightage of 06 marks For the end semester examination, nine questions are to be set by the examiner. A candidate is required to attempt 5 questions in all. All questions carry equal marks. Question number 1 will be compulsory and based on the entire syllabus. It will contain seven parts of 2 marks each. Question numbers 2 to 9 will be given by setting two questions from each of the four units of the syllabus. A candidate is required to attempt the remaining four questions by selecting one question from each of the four units.

Pre-requisites: No Prerequisite

About the Course:

To understand digital marketing, important conceptual insights and perspectives. To demonstrate the use of tools required for effective digital marketing**.** To analyze the market impact from digital marketing. To apply the tools of digital marketing to get best visibilityin market.

Course Outcomes:

By the end of the course students will be able to:

CO1: Understanding digital marketing along with technical acumen will be an added tool as a problem solver and solution provider. (LOTS: Level 1:Remember)

CO2: Demonstrate the use of search engine optimization keyword planner Tools.(LOTS: Level 3: Apply)

CO3: Assist and advice the marketer to take right decision (LOTS: Level 5: Evaluate)

CO4: Apply various social media platform for marketing such as Facebook, Twitter,LinkedIn etc. (LOTS: Level 6: Create)

Course Content

Unit I

Introduction to Digital Marketing and its Significance Traditional Marketing Vs Digital Marketing Digital Marketing Process. Website Planning and Development: Types of websites Website Planning and Development, Understanding Domain and Webhosting Building Website/Blog using CMS Word Press, Using Word Press Plug-ins.

Unit II

Introduction to Search Engine Optimization Keyword Planner Tools on Page SEO Techniques-Indexing and Key Word Placement, On Page SEO Techniques- Content Optimization on Page SEO: Yoast, SEO Plug-in, Off –Page SEO Techniques, Email Marketing- Introduction and Significance, Designing e-mail marketing campaigns using Mail Chimp.

Unit III

Building E-mail List and Signup Forms, Email Marketing Strategy and Monitoring Email – Atomization. Pay Per Click Advertising: Introduction Pay Per Click Advertising: Google Ad word, Types of Bidding strategies Designing and Monitoring search campaigns, Designing and Monitoring Display campaigns.

Unit VI

Designing and Monitoring Video campaigns Designing and Monitoring Universal App Campaigns Google Analytics: Introduction and Significance Google Analytics Interface and Setup Understanding Goals and Conversions. Monitoring Traffic Behavior and preparing Reports Social Media Marketing: Introduction and Significance Facebook Marketing, Types of Various Ad Formats.

Text and Reference Books:

- The Art of Digital Marketing: The Definitive Guide to Creating Strategic, Targeted,and Measurable
- Online Campaigns by Ian Dodson, Wiley; 1st edition (2016)
- Digital Marketing for Dummies by Ryan Deiss and Russ Henneberry, For Dummies. Understanding Digital Marketing: Marketing Strategies for Engaging the Digital Generation by Damian Ryan, Kogan Page Publisher
- Digital Marketing by Seema Gupta, McGraw Hill Education

CO-PO Articulation Matrix Components of Digital Marketing Course (PE/CSE/11-T)

List of Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1: Understanding digital marketing along with technical acumen will be an added toolas a problem solver and solution provider. (LOTS: Level 1: Remember)	2	2	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2: Demonstrate the use of search engine optimization keyword planner Tools(LOTS: Level 3: Apply)	-	2	2	-	-	-	2	-	3	-	-	-	-	-	-
CO3: Assist and advice the marketer to take right decision (LOTS: Level 5: Evaluate)	-	-	-	1	-	1	-	-	1	-	-	-	-	-	-
CO4: Apply various social media platform for marketing such as Facebook, Twitter, LinkedIn etc. (LOTS: Level 6: Create)	-	-	2	-	2	-	3	-	-	2	-	-	-	-	-
Level of Attainment: PE/CSE/11-T															

Mobile Application Development

General Course Information

Course Code: PE/CSE/12-T Course Credits: 3 Type: Professional Core Contact Hours: 3 hours/week Mode: Lectures (L) Examination Duration:3 hours	**Course Assessment Methods (internal: 30; external: 70)** Three minor tests each of 20 marks will be conducted. The average of the highest marks obtained by a student in the any of the two minor examinations will be considered. Class Performance will be measured through percentage of lectures attended (04 marks). Assignments, quiz etc. will have weightage of 06 marks For the end semester examination, nine questions are to be set by the examiner. A candidate is required to attempt 5 questions in all. All questions carry equal marks. Question number 1 will be compulsory and based on the entire syllabus. It will contain seven parts of 2 marks each. Question numbers 2 to 9 will be given by setting two questions from each of the four units of the syllabus. A candidate is required to attempt the remaining four questions by selecting one question from each of the four units.

Pre-requisites: Java Programming and Object-Oriented programming, Knowledge of RDBMS and OLTP.

About the Course:
Mobile Application Development has been introduced as a Professional Elective course for Students of BTech (CSE/IT) keeping in view the Employers' requirements. Android Platform forms the basis for developing Mobile Applications since the last decade as compared to IOS Platform for Apple Products. The Environment requires User Interface to be developed using Buttons, Check-Boxes, Alert Dialog and its kind.

Course Outcomes: By the end of the course students will be able to:
CO1. state basic of Android , its Evolution and its Architecture. (LOTS: Level 1: Remember)
CO2. demonstrate the Lifecycle of Software for Android Mobile Applications. (LOTS: Level 2: Understand)
CO3. prepare Mobile Applications on the Android Platform. (LOTS: Level 3: Apply)
CO4. compare working with Buttons and other Widgets for Visual Environment. (LOTS: Level 4: Analyse)
CO5. develop Mobile Applications using data storage in SQLite Database and evaluate its Performance. (LOTS: Level 6: Create)

Course content

Unit I
Mobile OS Architecture: Android, Blackberry OS, Firefox OS, IOS, Window OS, ARM and MIPS processor, Challenges of the mobile platform, Hello Android example, Internal Details, Dalvik VM, Software Stack, Android Core Building Blocks, Android Emulator, AndroidManifest.xml, R.java file, Hide Title Bar, Screen Orientation.

Unit II
UI Widgets: Working with Button, Toast, Custom Toast, Button, Toggle Button, Switch Button, Image Button, Check Box, Alert Dialog, Spinner, Auto Complete Text View, Rating Bar, Date Picker, Time Picker, Progress Bar, Quick Contact Budge, Analog Clock and Digital Clock, Working with hardware Button, File Download.

Unit III
Activity, Intent & Fragment: Activity Lifecycle, Activity Example, Implicit Intent, ExplicitIntent, Fragment Lifecycle, Fragment Example, Dynamic Fragment.
Android Menu: Option Menu, Context Menu, Popup Menu
Layout Manager: Relative Layout, Linear Layout, Table Layout, Grid Layout.

Unit VI:
Adaptor: Array Adaptor, Array List Adaptor, Base Adaptor.
View: Grid View, WebView, Scroll View, Search View, Tab Host, Dynamic List View, ExpandedList View.
SQLite: SQLite API, SQLite Spinner, SQLite List View
XML & JSON: XML Parsing SAX, XML Parsing DOM, XML Pull Parser, JSON basics, JSONParsing.

Text and Reference Books:

1. Redazione Io Programmo, *Android Programming*, 2011
2. John Horton, *Android Programming for Beginners*, packt publishing, 2015
3. Jason Wei, *Android Database Programming*, packt publishing, 2012
4. Mark L Murphy, *Android Programming Tutorials*, 3rd Edition, 2010
5. Bill Phillips et al., *Android Programming - The "Big Nerd Ranch*" Guide 2017
6. Rick Rogers et al., *Android Application Development: Programming with the Google SDK*,2009

CO-PO Articulation Matrix Mobile Application Development Course (PE/CSE/12-T)

List of Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CO1. **State** basic of Android, its Evolution and its Architecture. (LOTS: Level 1: Remember)	1	–	–	–	–	–	–	–	–	–	–	–	3	–	–
CO2. **Demonstrate** the Lifecycle of Software for Android Mobile Applications. (LOTS: Level 2: Understand)	1	–	–	–	–	–	–	–	–	–	–	–	3	–	–
CO3. **Prepare** Mobile Applications on the Android Platform. (LOTS: Level 3: Apply)	2	2	2	–	2	–	–	–	–	–	–	–	3	2	–
CO4. **Compare** working with Buttons and other Widgets for Visual Environment. (LOTS: Level 4: Analyse)	–	–	2	–	1	–	–	–	–	–	–	–	3	–	–
CO5. **Develop** Mobile Applications using data storage in SQLite Database and evaluate its Performance. (LOTS: Level 6: Create)	3	2	2	3	3	3	–	–	2	–	1	2	3	3	–
Level of Attainments PE/CSE/12-T															

Multimedia Technologies

General Course Information

Course Code: PE/CSE/13-T Course Credits: 3 Type: Professional Core Contact Hours: 3 hours/week Mode: Lectures (L) Examination Duration:3 hours	**Course Assessment Methods (internal: 30; external: 70)** Three minor tests each of 20 marks will be conducted. The average of the highest marks obtained by a student in the any of the two minor examinations will be considered. Class Performance will be measured through percentage of lectures attended (04 marks). Assignments, quiz etc. will have weightage of 06 marks For the end semester examination, nine questions are to be set by the examiner. A candidate is required to attempt 5 questions in all. All questions carry equal marks. Question number 1 will be compulsory and based on the entire syllabus. It will contain seven parts of 2 marks each. Question numbers 2 to 9 will be given by setting two questions from each of the four units of the syllabus. A candidate is required to attempt the remaining four questions by selecting one question from each of the four units.

Pre-requisites: Basics of Computer Graphics

About the Course:
Multimedia is a core and an essential course for every graduate in Computer Science and Engineering The objective of this course is to make students learn how to develop multimedia programs and demonstrate how still images, sound, and video can be digitized on the computer.

Course Outcomes: By the end of the course students will be able to:
CO1. **outline** the basic concepts of multimedia technology. (LOTS: Level 1: Remember)
CO2. **discuss the concepts** of animation, digitized sound, video control, and scanned images. (LOTS: Level 2: Understand)
CO3. **use** basic instructional design principles in the development of Multimedia. (LOTS: Level 3: Apply)
CO4. **compare** various audio and video file formats. (LOTS: Level 4: Analyse)
CO5. **devise** solutions for multimedia problems. (LOTS: Level 6: Create)

Course Content

Unit 1

Introduction to Multimedia concepts, Types of Multi-media Applications, Methods to deliver Multimedia, Introduction to Multimedia Database, Multimedia Input and Output Devices.

Unit II

Introduction about font and faces, Using Text in Multimedia, Applying different types of text in multimedia Font Editing and Design tools, Hypermedia and Hypertext application.

Unit III
The power of images, Making Still Images, Colouring, Image File Formats (GIF, JPEG, PNG etc.) The power of sound, MIDI Vs. Digital Audio, Audio File Formats (AIFF, WAV, MPEG, MOV etc.)Adding Sound to multimedia project.

Unit IV

Working of a Video and its Display, Digital Video Containers (Codecs & Video Format Converters) Obtaining Video Clips, Shooting and editing Video, Non Linear Editing(NLE) in Videos The stages of Multimedia Project, Hardware and Software requirements ,Authoring Systems Team for Multimedia Development, Different stages of multimedia, The internet and multimedia

Text and Reference Books:

1. Tay Vaughan, *Multimedia: Making It Work*, Tata McGraw Hills, 2008.
2. James E Shuman, *Multimedia in Action*, Vikas Publishing House, 1997.
3. Andreas Holzinger, *Multimedia Basics Technology*, *Volume* 1, Firewall Media, 2005.
4. Rangan Parekh, *Principles of Multimedia*, Tata McGraw Hills, 2007.

CO-PO Articulation Matrix Multimedia Technologies Course (PE/CSE/13-T)

List of Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CO1. **Outline** the basic concepts of multimedia technology. (LOTS: Level 1: Remember)	1	–	–	–	–	–	–	–	–	–	–	–	2	–	–
CO2. **Discuss the concepts** of animation, digitized sound, video control, and scanned images. (LOTS: Level 2: Understand)	1	–	–	–	–	–	–	–	–	–	–	–	3	–	–
CO3. **Use** basic instructional design principles in the development of Multimedia. (LOTS: Level 3: Apply)	2	2	2	–	–	–	–	–	–	–	–	–	3	–	–
CO4. **Compare** various audio and video file formats. (LOTS: Level 4: Analyse)	2	2	2	–	2	–	–	–	–	–	–	–	3	–	–
CO5. **Devise** solutions for multimedia problems.(LOTS: Level 6: Create)	3	3	2	3	3	–	–	–	–	–	–	–	3	–	–
Level of Attainments PE/CSE/13-T															

Digital Image Processing

General Course Information

Course Code: PE/CSE/14-T Course Credits: 3 Type: Professional Core Contact Hours: 3 hours/week Mode: Lectures (L) Examination Duration:3 hours	**Course Assessment Methods (internal: 30; external: 70)** Three minor tests each of 20 marks will be conducted. The average of the highest marks obtained by a student in the any of the two minor examinations will be considered. Class Performance will be measured through percentage of lectures attended (04 marks). Assignments, quiz etc. will have weightage of 06 marks For the end semester examination, nine questions are to be set by the examiner. A candidate is required to attempt 5 questions in all. All questions carry equal marks. Question number 1 will be compulsory and based on the entire syllabus. It will contain seven parts of 2 marks each. Question numbers 2 to 9 will be given by setting two questions from each of the four units of the syllabus. A candidate is required to attempt the remaining four questions by selecting one question from each of the four units.

Pre-requisites: knowledge of basic linear algebra, basic probability theory, basic programming techniques, and Fourier Transforms.

About the Course:

Digital Image Processing is a Professional Elective course that provides a theoretical foundation of digital image processing concepts. This course provides a mathematical foundation for digital manipulation of images, image acquisition, pre-processing, enhancement, segmentation and compression. Students learn algorithms that perform basic image processing operations (e.g., histogram processing, noise removal and image enhancement and restoration). Algorithms for image analysis (e.g., image compression, image segmentation and image representation) are explained.

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

CO1. **state** concepts related to image acquisition and processing. (LOTS: Level 1: Remember)
CO2. **illustrate** the principles and methods in image processing. (LOTS: Level 2: Understand)
CO3. **apply** mathematical functions for digital manipulation of images such as image acquisition, pre- processing, segmentation, compression and representation. (LOTS: Level 3: Apply)
CO4. compare various image processing techniques. (LOTS: Level 4: Analyse)
CO5. **assess** the various image processing techniques for a given problem. (LOTS: Level 5: Evaluate)
CO6. **design** and implement algorithms for digital image processing operations such as histogram equalization, filtering, enhancement, restoration and denoising, segmentation, compression. (LOTS: Level 6: Create)

Course contents

Unit I

Introduction and fundamental to digital image processing: What is digital image processing, Origin of digital image processing, Examples that use digital image processing, Fundamental steps in digital image processing, Components of digital image processing system, Image sensing and acquisition, Image sampling, Quantization and representation, Basic relationship between pixels.Image enhancement in spatial domain and frequency domain: Background, Basicgray level transformation,
Histogram processing, Basics of spatial filtering, Smoothing and sharpening spatial and the frequency domain filters.

Unit II

Image Restoration: Image degradation/restoration Process, Noise models, Restoration in presence of noise, Inverse filtering, Minimum mean square filtering, Geometric mean filter, Geometric transformations. Color Image Processing: Color fundamentals, Color models, Basics of full color image processing, Color transformations.

Unit III

Image Compression: Fundamentals, Image compression models, Error free compression, Lossy compression. Image Segmentation: Detection of discontinuities, Edge linking and boundary detection, Thresholding, Region based segmentation.

Unit IV

Representation, Description and Recognition: Representation-chain codes, polygonal approximation and skeletons, Boundary descriptors-simple descriptors, shape numbers, Regional descriptors- simple, topological descriptors. Recognition: Pattern and Pattern classes

Text and Reference Books:

1. Rafael C. Gonzalez and Richard E. Woods, *Digital Image Processing*, PearsonEducation, Ed, 2001.
2. Anil K. Jain, *Fundamentals of Digital Image Processing*, Pearson Education, PHI, 2001.
3. Tinku Acharya and Ajoy K. Ray, *Image Processing-Principles and Applications*, John Wiley & Sons,4. Inc., 2005.
4. Chanda and D. Dutta Majumdar, *Digital Image Processing and Analysis*, PHI, 2003.
5. Milan Sonka, Vaclav Hlavac, Roger Boyle, *Image Processing, Analysis, andMachine Vision*, 2ndedition, PWS Publishing Company, Thomson Learning, 1999.

CO-PO Articulation Matrix Digital Image Processing Course (PE/CSE/14-T)

List of Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CO1. **State** concepts related to image acquisition and processing. (LOTS: Level 1: Remember)	1	3	–	–	–	–	–	–	–	–	–	–	–	–	2
CO2. **Illustrate** the principles and methods in image processing. (LOTS: Level 2: Understand)	1	–	–	–	–	–	–	–	–	–	–	–	–	–	3
CO3. **Apply** mathematical functions for digital manipulation of images such as image acquisition,pre-processing, segmentation, compression and representation. (LOTS: Level3: Apply)	3	–	–	–	–	–	–	–	–	–	–	–	–	–	3
CO4. **Compare** various image processing techniques. (LOTS: Level 4: Analyse)	2	3	2	2	–	–	–	–	–	–	–	–	–	–	3
CO5. **Assess** the various image processing techniquesfor a given problem. (LOTS: Level 5: Evaluate)	3	3	2	2	–	–	–	–	–	–	–	–	–	–	3
CO6. **Design** and implement algorithms for digital image processing operations such as histogram equalization, filtering, enhancement, restoration and denoising, segmentation, compression. (LOTS: Level 6: Create)	3	3	2	3	3	–	–	–	–	–	–	2	–	–	3
Level of Attainments PE/CSE/14-T															

Blockchain Technology

General Course Information

Course Code: PE/CSE/15-T Course Credits: 3 Type: Professional Core Contact Hours: 3 hours/week Mode: Lectures (L) Examination Duration: 3 hours	**Course Assessment Methods (internal: 30; external: 70)** Three minor tests each of 20 marks will be conducted. The average of the highest marks obtained by a student in the any of the two minor examinations will be considered. Class Performance will be measured through percentage of lectures attended (04 marks). Assignments, quiz etc. will have weightage of 06 marks For the end semester examination, nine questions are to be set by the examiner. A candidate is required to attempt 5 questions in all. All questions carry equal marks. Question number 1 will be compulsory and based on the entire syllabus. It will contain seven parts of 2 marks each. Question numbers 2 to 9 will be given by setting two questions from each of the four units of the syllabus. A candidate is required to attempt the remaining four questions by selecting one question from each of the four units.

Pre-requisites: Discrete Mathematics

About the Course:

To understand the function of Blockchain as a method of securing distributed ledgers. To familiarize the functional/operational aspects of cryptocurrency ecosystem. To demonstrate about wallets and learn their utilization of wallet during transaction. To analyze and apply that how to write and apply theSmart Contracts.

Course Outcomes:

By the end of the course students will be able to:

CO1: explain the blockchain Technology in real life(LOTS: Level 2: Understand)

CO2: Apply the smart contracts on Ethereum platform. (LOTS: Level 3: Apply)

CO3: Develop the use cases on Hyperledger. (LOTS: Level 6: Create)

CO4: Analyze the major research challenges and technical gaps existing between theory and practice in Blockchain (LOTS: Level 5: Evaluate)

Course Content

Unit I

Introduction to Cryptography, Introduction to graph, ring and field, prime and relative prime numbers, modular arithmetic, Fermat's and Euler's theorem, Euclid's Algorithm, RSA algorithm, Diffie-Hellman key exchange algorithm, ElGamal Encryption, Elliptic curve cryptography, SHA 256, Digital Signature, Zero Knowledge Proof (ZKP)

Unit II

Introduction from barter system to Cryptocurrency, fundamental of Blockchain, Block structure, Genesis Block, Orphaned Blocks, Stale Block, Uncle Block, Distributed Ledger Technology (DLT), peer-to- peer network, Merkle Tree, Lifecycle of Blockchain, Evolutions of Blockchain, Fork, double spending money, Transactions and UTXO's, Types of Blockchain. Need of Blockchain, Benefits of Blockchain.

Unit III

Cryptocurrencies: BitCoin (BTC), Ethereum (ETH), Ripple (XRP), LiteCoin (LTC), Bitcoin Cash (BCH), Mining pools, Mining, Difficulty Level, Current Target, Nonce, how miners picks transactions, How do mempools work, 51% attack.Consensus Algorithms: Proof of Work (PoW), Asynchronous Byzantine Agreement, Proof of Stake (PoS), Hybrid models (PoW + PoS),

Unit VI

Wallets, Types of wallets-Hardware, Software, Paper, Web, Desktop.

Ethereum - Ethereum network, Ethereum Virtual Machine (EVM), Wallets for Ethereum, Solidity-Smart Contracts, Truffle, Web3, some attacks on smart contracts, Design and issue Cryptocurrency ICO, Mining, Gas - Transactional Fee & Incentivisations, DApps, Decentralized Autonomous Organizations (DAO).

Text and Reference Books:

- Mastering Blockchain, Imran Bashir, Packt Publishing
- https://bitcoinbook.cs.princeton.edu/ Bitcoin and Cryptocurrency Technologies, Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller, Steven Goldfeder Princeto University Press.
- Grokking Bitcoin, Kalle Rosenbaum, Manning Publications.
- Blockchain Basics, Daniel Drescher, Apress Publication

CO-PO Articulation Matrix Components of Blockchain Technology Course (PE/CSE/15-T)

List of CourseOutcomes	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1: explain the blockchain Technology in real life(LOTS: Level 2: Understand)	2	2	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2: Apply the smart contracts on Ethereum platform. (LOTS: Level 3: Apply)	-	-	2	-	2	1	-	-	-	-	-	-	-	-	-
CO3: Develop the use cases on Hyperledger. (LOTS: Level 6: Create)	-	-	2	1	2	-	-	-	-	-	-	-	-	-	-
CO4: Analyze the major research challenges and technical gaps existing between theory andpractice in Blockchain (LOTS: Level 5: Evaluate)	-	2	-	1		-	-	-	1	-	-	-	-	-	-
Level of Attainment: PE/CSE/15-T															

Natural Language Processing

General Course Information

Course Code: PE/CSE/16-T Course Credits: 3 Type: Professional Core Contact Hours: 3 hours/week Mode: Lectures (L) Examination Duration: 3 hours	**Course Assessment Methods (internal: 30; external: 70)** Three minor tests each of 20 marks will be conducted. The average of the highest marks obtained by a student in the any of the two minor examinations will be considered. Class Performance will be measured through percentage of lectures attended (04 marks). Assignments, quiz etc. will have weightage of 06 marks For the end semester examination, nine questions are to be set by the examiner. A candidate is required to attempt 5 questions in all. All questions carry equal marks. Question number 1 will be compulsory and based on the entire syllabus. It will contain seven parts of 2 marks each. Question numbers 2 to 9 will be given by setting two questions from each of the four units of the syllabus. A candidate is required to attempt the remaining four questions by selecting one question from each of the four units.

Pre-requisites: Mathematics

About the Course:

To understand the basic Concepts of Natural Language Processing. To demonstrate the problems using NLP Techniques. To apply of basic programming tools for NLP. To analyze the statistical approach in machine Translation.

Course Outcomes:

By the end of the course students will be able to:

CO1:. Explain the approaches to syntax and semantics in NLP. (LOTS: Level 2: Understand)

CO2: Analyze the approaches of generation, dialogue and summarization within NLP.(LOTS:Level 5: Evaluate)

CO3: Illustrate the methods for statistical approaches to machine translation. (LOTS: Level 6: Create)

CO4: Apply Machine learning techniques and models for Machine Translation. (LOTS: Level 3: Apply)

Course Content

Unit I

Introduction: Introduction to the Morphology, Syntax, Semantics by linking the "linguistics view" (computational linguistics) with the "artificial intelligence view" (natural language processing).

Unit II

Morphology: Analysis and generation of language on word level: e.g., problems with compounding and idiomatic phrases, homophonous strings as well as loan words and their processing using e.g., finite state automata as well as semantic networks. Ambiguities in words like "pen" and "pipe", but will also discuss some complex strings.

Unit III

Syntax Analysis: Parsing Natural Language, Treebanks: A Data-Driven Approach to Syntax, Representation of Syntactic Structure, Parsing Algorithms, Models for Ambiguity Resolution in Parsing, Multilingual Issues.

Unit VI

Semantic Analysis: Representing Meaning - Meaning Structure of Language - First Order Predicate Calculus. Representing Linguistically Relevant Concepts – Syntax Driven Semantic Analysis - Semantic Attachments –Syntax Driven Analyzer. Robust Analysis - Lexemes and Their Senses - Internal Structure -Word Sense Disambiguation -Information Retrieval

Text and Reference Books:

- Daniel Jurafsky, James H. Martin “Speech and Language Processing” Second Edition,Prentice Hall, 2008.
- Tanvier Siddiqui: Natural Language Processing and Information Retrieval, U.S. Tiwary
- Allen, James, Natural Language Understanding, Second Edition, Benjamin/Cumming, 1995.
- C. Manning and H. Schutze, “Foundations of Statistical Natural Language Processing”,MIT Press. Cambridge, MA:,1999

CO-PO Articulation Matrix Natural Language Processing Course (PE/CSE/16-T)

List of Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1:. Explain the approaches to syntax and semantics in NLP. (LOTS: Level 2: Understand)	2	2	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2: Analyze the approaches of generation, dialogue and summarization within NLP. (LOTS:Level 5: Evaluate) .	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3: Illustrate the methods for statistical approaches to machine translation. (LOTS: Level 6: Create)	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-
CO4: Apply Machine learning techniques and models for Machine Translation. (LOTS: Level 3: Apply)	-	-	2	-	2	-	-	-	-	-	-	-	-	-	-
Level of attainment PE/CSE/16-T															

Mobile Application Development Lab.

General Course Information

Course Code: PE/CSE/12-P Course Credits: 1 Type: Professional Core Lab. Course Mode: Lab practice and assignments Contact Hours: 2 hours / week	**Course Assessment Methods (internal: 50; external: 50)** The internal and external assessment is based on the level of participation in lab. sessions and the timely submission of lab experiments/assignments, the quality of solutions designed for the assignments, the performance in VIVA- VOCE, the quality of lab. file and ethical practices followed. The internal examination is conducted by the course coordinator. The external examination is conducted by external examiner appointed by the Controller of Examination in association with the internal examiner appointed by the Chairperson of the Department.

Pre-requisites: Java programming, Object-oriented programming, RDBMS and OLTP

About the Course:
This course on Mobile Application Development is a developmental lab. work on Mobile programming. It incorporates creating Applications related to Android Studio framework. The objective of the lab course is to equip the students to solve the practical Mobile problems related to Application development.

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

CO1. **apply** Android programming concepts for calling, display, creation and validation.(LOTS: Level 3:Apply)
CO2. **generate** solutions for content providers and permissive models. (LOTS: Level 6:Create)
CO3. **compare** the visual effects generated by Android and visual studio frameworks. (LOTS: Level 4:Analyse)
CO4. **design** applications for Android Programming by using Android Studio framework. (LOTS: Level6: Create)
CO5. **create** lab record of the solutions for assignment. (LOTS: Level 6: Create)
CO6. **demonstrate** ethical practices, independent enquiry and self-learning to solve unseen problems.(LOTS: Level 3: Apply)

List of experiments/assignments:

1. Create “Hello World” application to display “Hello World” in the middle of the screenin red color with white background.
2. Create sample application with login module. (Check username and password), validateit for login screen or alert the user with a Toast.
3. Create and validate a login application using username as Email ID else login buttonmust remain disabled.
4. Create a Login application and open a browser with any one search engine.
5. Create an application to display “Hello World” string the number of times user inputs a numeric value. (Example. If user enters 5, the next screen should print “Hello World” five times.)
6. Create spinner with strings from the resource folder (res >> value folder). Onchanging spinner value, change image.
7. Create an application to change screen color as per the user choice from a menu.
8. Create a background application that will open activity on specific time.
9. Create an application that will have spinner with list of animation names. On selecting

animation name, that animation should effect on the images displayed below.

10. Create an UI listing the engineering branches. If user selects a branch name, display thenumber of semesters and subjects in each semester.
11. Use content providers and permissions by implementing read phonebook contactswith content providers and display in the list.
12. Create an application to call a phone number entered by the user in the Edit Text box.
13. Create an application that will create database to store username and password.
14. Create an application to insert, update and delete a record from the database.

Note:
The actual experiments/assignments will be designed by the course coordinator. One assignment should be designed to be done in groups of two or three students. The assignments must meet theobjective of the course and the levels of the given course outcomes. The list of assignments and schedule of submission will be prepared by the course coordinator at the beginning of the semester.

CO-PO Articulation Matrix Mobile Application Development Lab. Course (PE/CSE/12-P)

List of Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO1 1	PO1 2	PSO1	PSO2	PSO3
CO1. **Apply** Android programming concepts for calling, display, creation and validation. (LOTS: Level 3: Apply)	2	2	2	_	3	_	_	_	_	_	_	_	3	_	_
CO2. **Generate** solutions for content providers and permissive models. (LOTS: Level 6: Create)	2	2	2	2	3	_	_	_	_	_	_	_	3	_	_
CO3. **Compare** the visual effects generated by Android and visual studio frameworks. (LOTS: Level 4:Analyse)	2	2	2	2	3	_	_	_	_	_	_	_	3	_	_
CO4. **Design** applications for Android Programming by using Android Studioframework. (LOTS: Level 6: Create)	3	3	2	3	3	_	_	_	_	_	_	_	3	_	_
CO5. **Create** lab record of the solutions forassignment. (LOTS: Level 6: Create)	_	_	_	_	_	_	_	_	_	3	_	_	_	_	_
CO6. **Demonstrate** ethical practices, independent enquiry and self-learning to solve unseen problems. (LOTS: Level 3: Apply)	_	_	_	_	_	_	_	3	3	_	_	3	_	_	_
Level of Attainments PE/CSE/12-P															

Multimedia Technologies Lab.

General Course Information

Course Code: PE/CSE/13-P Course Credits: 1 Type: Professional Core Lab. Course Mode: Lab practice andassignments Contact Hours: 2 hours / week	**Course Assessment Methods (internal: 50; external: 50)** The internal and external assessment is based on the level of participation in lab. sessions and the timely submission of lab experiments/assignments, the quality of solutions designed for the assignments, the performance in VIVA- VOCE, the quality of lab. file and ethical practices followed. The internal examination is conducted by the course coordinator. The external examination is conducted by external examiner appointed by the Controller of Examination in association with the internal examiner appointed by the Chairperson of the Department.

Pre-requisites: Basic programming skills and knowledge of computer graphics.

About the Course:
This lab. course on Multimedia technologies involves a rigorous training on Adobe Photoshop, Macromedia Flash and blender. It incorporates solving problems related to animation and modelling framework. The objective of the lab course is to Learn to navigate and use modellingtools that will help students to gain a strong foundation in 3D design software Blender.

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

CO1. **apply** the fundamental principles of different elements of multimedia. (LOTS:Level 3: Apply)
CO2. **use** modern tools for applying state-of-the art multimedia technologies. (LOTS:Level 3: Apply)
CO3. **analyse** various tools for an application. (LOTS: Level 4: Analyse)
CO4. **create** elegant posters, sceneries, animated stories and movie clips. (LOTS: Level6: Create)
CO5. **creating** record of lab experiments. ((LOTS: Level 6: Create)
CO6. **demonstrate** ethical practices, self-learning and team work. (LOTS: Level 3:Apply)

List of experiments/assignments:

Adobe Photoshop

1. Introduction to Photoshop Basics.
2. Design a poster for 2019 elections and show the difference in quality and resolution forPrint and Web.
3. Pick any picture of a magazine cover page and make changes using selection tool.
4. Draw a landscape using multiple Layers.
5. Paint a scenery of a park using different tools of Photoshop.
6. Take image from different Image Sources show variation in resolution.
7. Use effective cropping techniques to design a collage.
8. Design a scenery showing correction of image tonality.
9. Make a poster by adjusting Image Colours.
10. Painting the cover page of your magazine with Special Photoshop Tools.
11. Design a card on the occasion of Diwali using at least 3 different filters.
12. Make your passport size picture with all editing and print multiple copies of the same onA4 size page.

Macromedia Flash

13. Introduction to the layout and tools of Flash.
14. Move a car from left to right of the screen using symbols.

15. Design a movie clip.
16. Using timeline, design the casting of the movie directed by you.
17. Depict a small story using 2 D animation.

Blender

18. Introduction to Blender and its various tools.
19. Create an object using blender and show its motion.
20. Using Selections and Transform make a scenery.
21. Design a character for your game using modelling.
22. Depict the change in Materials, Lights and Rendering in 3 different frames.
23. Using Blender show compositing.

Note:
The actual experiments/assignments will be designed by the course coordinator. One assignment should be designed to be done in groups of two or three students. The assignments must meet the objective of the course and the levels of the given course outcomes. The list of assignments and schedule of submission will be prepared by the course coordinator at the beginning of the semester.

CO-PO Articulation Matrix Multimedia Technologies Lab. Course (PE/CSE/13-P)

List of Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CO1. **Apply** the fundamental principles of different elements of multimedia. (LOTS: Level 3: Apply)	2	1	–	–	–	–	–	–	–	–	–	–	2	–	–
CO2. **Use** modern tools for applying state-of-the art multimedia technologies. (LOTS: Level 3: Apply)	–	–	–	–	3	–	–	–	–	–	–	–	3	–	–
CO3. **Analyse** various tools for an application. (LOTS: Level 4: Analyse)	–	–	–	–	3	–	–	–	–	–	–	–	3	–	–
CO4. **Create** elegant posters, sceneries, animated stories and movie clips. (LOTS: Level 6: Create)	2	2	2	3		–	–	–	–	–	–	–	3	–	–
CO5. **Prepare** record of lab experiments. ((LOTS: Level 6: Create)	–	–	–	–	–	–	–	–	–	3	–	–	–	–	–
CO6. **Demonstrate** ethical practices, self-learning andteam work. (LOTS: Level 3: Apply)	–	–	–	–	–	–	–	3	3	–	–	3	–	–	–
Level of Attainments PE/CSE/13-P															

Digital Image Processing Lab.

General Course Information

Course Code: PE/CSE/14-P Course Credits: 1 Type: Professional Core Lab. Course Mode: Lab practice andassignments Contact Hours: 2 hours / week	**Course Assessment Methods (internal: 50; external: 50)** The internal and external assessment is based on the level of participation in lab. sessions and the timely submission of lab experiments/assignments, the quality of solutions designed for the assignments, the performance in VIVA- VOCE, the quality of lab. file and ethical practices followed. The internal examination is conducted by the course coordinator. The external examination is conducted by external examiner appointed by the Controller of Examination in association with the internal examiner appointed by the Chairperson of the Department.

Pre-requisites: The students are expected to have a knowledge of computer graphics concepts.

About the Course:
This Lab course on Digital Image Processing is a developmental lab. work. It incorporates transformation of images in spatial and frequency domains, compression, restoration and reconstruction of images in SCILAB/MATLAB. The objective of the lab course is to equip the students to solve the practical Image processing problems.

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

CO1. **implement** digital image processing concepts for image compression, restorationand reconstruction in SCILAB/MATLAB.(LOTS: Level 3: Apply)

CO2. **verify** the results of applying image processing problems to images (compression,expansion, multi-resolution processing etc.) (LOTS: Level 4: Analyze)

CO3. **measure** the quality of image after the digital image processing techniques areimplemented to an image. (LOTS: Level 5: Evaluate)

CO4. **devise** solutions for Image Processing tasks problems. (LOTS: Level 6: Create)

CO5. **design** Lab record for the assignments including aim, hardware and softwarerequirements and solutions to the given problems. (LOTS: Level 6: Create)

CO6. **use** ethical practices, independent enquiry, self-learning and team spirit. (LOTS: Level3: Apply).

List of experiments/assignments

1. Two/Three introductory assignments on SCILAB/MATLAB.
2. Two assignments on Point processing and Pixel Operations e.g scan your signature andmake it clean with thresholding.)
3. One/Two assignments on Image flipping.
4. Two assignments on Image Arithmetic such as Addition, subtraction, multiplication anddivision.
5. Create an application to display “Hello World” string the number of times user inputs a numeric value. (Example. If user enters 5, the next screen should print “Hello World” five times.)
6. Two/Three assignments on performing Logical operations on Digital images such asNAND, NOR,EX-OR on these images.
7. Two/Three assignments on calculation and equalization of histogram for an input image.
8. Two/Three assignments on geometric transformation of image such as translation,Scaling, Rotation, Shrinking, Zooming.
9. One/Two assignments on adding noise to the image and apply image restorationtechniques to improve quality of image.
10. Perform low pass and high pass filtering in frequency domain.

Note:
The actual experiments/assignments will be designed by the course coordinator. One assignment should be designed to be done in groups of two or three students. The assignments must meet the objective of the course and the levels of the given course outcomes. The list of assignments and schedule of submission will be prepared by the course coordinator at the beginning of the semester.

CO-PO Articulation Matrix Digital Image Processing Lab. Course (PE/CSE/14-P)

List of Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CO1. **Implement** digital image processing conceptsfor image compression, restoration and reconstruction in SCILAB/MATLAB.(LOTS: Level 3: Apply)	2	2	2	_	3	_	_	_	_	_	_	_	_	_	3
CO2. **Verify** the results of applying image processing problems to images (compression, expansion, multi-resolution processing etc.) (LOTS: Level 4: Analyze)	3	3	2	_	3	_	_	_	_	_	_	_	_	_	3
CO3. **Measure** the quality of image after the digital image processing techniques are implemented toan image. (LOTS: Level 5: Evaluate)	3	3	2	_	3	_	_	_	_	_	_	_	_	_	3
CO4. **Devise** solutions for Image Processing tasks problems.(LOTS: Level 6: Create)	3	3	3	3	3	_	_	_	_	_	_	_	_	_	3
CO5. **Design** Lab record for the assignments including aim, hardware and software requirements and solutions to the given problems. (LOTS: Level 6: Create)	_	_	_	_	_	_	_	_	_	3	_	_	_	_	_
CO6. **Use** ethical practices, independent enquiry, self-learning and team spirit. (LOTS: Level 3: Apply).	_	_	_	_	_	_	_	3	3	_	_	3	_	_	_
Level of Attainments PE/CSE/14-P															

Blockchain Lab

General Course Information

Course Code: PE/CSE/15-P Course Credits: 1 Type: Professional Core Lab. Course Mode: Lab practice and assignments Contact Hours: 2 hours / week	**Course Assessment Methods (internal: 50; external: 50)** The internal and external assessment is based on the level of participation in lab. sessions and the timely submission of lab experiments/assignments, the quality of solutions designed for the assignments, the performance in VIVA-VOCE, the quality of lab. file and ethical practices followed. The internal examination is conducted by the course coordinator. The external examination is conducted by external examiner appointed by the Controller of Examination in association with the internal examiner appointed by the Chairperson of the Department.

Pre-requisites: Discrete Mathematics

About the Course:
This course involves studying the tools such as Python, VS Cod, understand the conceptof Blockchain, demonstrate the Cryptocurrencies.

Course Outcomes:
By the end of the course students will be able to:
CO1. **Understand** Understand the functional or operational aspects of cryptocurrency ecosystem.(LOTS: Level 1: Understand)
CO2. Demonstrate the emerging abstract models for Blockchain Technology. (LOTS: Level 4: Analyze)
CO3. Able to work with Web Wallets, Mobile Wallets, Desktop Wallets, Paper Wallets. (LOTS: Level 3: Apply)
CO4. Apply Blockchain in use cases like Real state, Supply chain, voting, ICO, etc (LOTS: Level 6: Create)

(10 Programs like these)
Detailed Contents:

1. Create a Blockchain
   - 1.1 Create new blocks and add to the chain
     - 1.1.1 Structure of a block: Index, Timestamp, Transaction List, Proof, Previous Block Hash
   - 1.2 Initialize Blockchain
   - 1.3 Adds new transaction
   - 1.4 Hashing a block
   - 1.5 Registering a node to the network
   - 1.6 Validates the chain
   - 1.7 Validates block before submission chain
   - 1.8 Implement Proof of Work Consensus
2. Create a Cryptocurrency
3. Create a Smart Contracts hadcoins_ico , Calculator, simple wallets
4. Supply chain smart contract
5. Voting Smart Contract

CO-PO Articulation Matrix BlockChain Lab Course (PE/CSE/15-P)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1. **Understand** the functional or operational aspects of cryptocurrency ecosystem.(LOTS: Level 1: Understand)	2	2		3		1	–	–	–	–	–	–	–	–	–
CO2. Demonstrate the emerging abstract models for Blockchain Technology. (LOTS: Level 4: Analyze)	1		2		1	–	–	3	1		2		-	-	-
CO3. Able to work with Web Wallets, Mobile Wallets, Desktop Wallets, Paper Wallets. (LOTS: Level 3: Apply)	1	3		2	3	2	–	2	–	3	–	–	-	-	-
CO4. Apply Blockchain in use cases like Real state, Supply chain, voting, ICO, etc (LOTS: Level 6: Create)	3	2	2	2		3	–	2	1	–	–	2	-	-	-
Level of attainment: PE/CSE/15-P															

Natural Language Processing Lab

General Course Information

Course Code: PE/CSE/16-P Course Credits: 1 Type: Professional Core Lab. Course Mode: Lab practice and assignments Contact Hours: 2 hours / week	**Course Assessment Methods (internal: 50; external: 50)** The internal and external assessment is based on the level of participation in lab. sessions and the timely submission of lab experiments/assignments, the quality of solutions designed for the assignments, the performance in VIVA- VOCE, the quality of lab. file and ethical practices followed. The internal examination is conducted by the course coordinator. The external examination is conducted by external examiner appointed by the Controller of Examination in association with the internal examiner appointed by the Chairperson of the Department.

Pre-requisites: Fundamental of computer and Software engineering

About the Course:
This course involves studying algorithms available for the processing of linguistic information and computational, properties of natural languages and knowledge on various morphological, syntactic and semantic NLP tasks.

Course Outcomes:
By the end of the course students will be able to:
CO1. Describe the concepts of morphology, syntax, semantics, discourse & pragmatics of natural language. (LOTS: Level 1: Understand)
CO2. Demonstrate understanding of the relationship between NLP and statistics & machine learning. (LOTS: Level 3: Apply)
CO3. Discover various linguistic and statistical features relevant to the basic NLP task, namely, spelling (LOTS: Level 6: Create)
CO4. correction, morphological analysis, parts-of-speech tagging, parsing and semantic analysis. (LOTS: Level 3: Apply)
CO5. Develop systems for various NLP problems with moderate complexity (LOTS: Level 6: Create)

LIST OF EXERCISES

1. How to tokenize a given text?
2. How to get the sentences of a text document?
3. How to tokenize text with stop words as delimiters?
4. How to remove stop words and punctuations in a text?
5. How to perform stemming?
6. How to lemmatize a given text?
7. How to extract usernames from emails?
8. How to find the most common words in the text excluding stop words?
9. How to do spell correction in a given text?
10. How to classify a text as positive/negative sentiment?
11. How to extract Noun and Verb phrases from a text?
12. How to find the ROOT word of any word in a sentence?
13. Write a Python program to load the iris data from a given csv file into a dataframe andprint the shape of the data, type of the data and first 3 rows.
14. Write a Python NLTK program to find the sets of synonyms and antonyms of a givenword.
15. Write a Python NLTK program to print the first 15 random combine labeled male andlabeled female names from names corpus.

CO-PO Articulation Matrix Natural Language Processing Lab Course (PE/CSE/16-P)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1. Describe the concepts of morphology, syntax, semantics, discourse & pragmatics of natural language. (LOTS: Level 1: Understand)	2		1	3		2		3		2	1	1	_	2	_
CO2. Demonstrate understanding of the relationship between NLP and statistics & machine learning. (LOTS: Level 3: Apply)	3	1	2	1	3	2		1	2	1	_	_	_	3	_
CO3. Discover various linguistic and statistical features relevant to the basic NLP task, namely, spelling(LOTS: Level 6: Create)	3	3	1	_	3	1		3	1	2	_	_	2	3	_
CO4. correction, morphological analysis, parts-of-speech tagging, parsing and semantic analysis. (LOTS: Level 3: Apply)	2	1	_	_	2	_	_	_	_	_	_	_	2	3	2
CO5. Develop systems for various NLP problems with moderate complexity (LOTS: Level 6: Create)		3	_	_	1	_	_	1	2	1			_3	3	2
Level of attainment PE/CSE/16-P															

Major Project 1

General Course Information

Course Code: EEC/CSE/3-P Course Credits: 4 Mode: Self learning under the guidance of faculty members. Contact hours: 8 hours/week	**Course Assessment Method (100)** An internal evaluation is done by a committee of two teachers constituted by the Chairperson of the Department. The criteria for evaluation are given below. 1. Literature review: 20 2. Problem formulation: 20 3. Basic knowledge of the tools: 20 4. Organization and presentation of synopsis: 20 5. Level of Ethics followed: 20

About the major project Part I:

Students start working on their project work in seventh semester. Student do the background research for identifying appropriate problems, methodology and tools for their respective project works to be culminated in eighth semester. They prepare a synopsis of the project work to be carried out. At the end of seventh semester, each student is required to prepare a synopsis in the format provided and present it in front of a committee constituted by the Chairperson of the Department. Students can carry out projects in groups of two. In case of group project, the size of the problem should be significant, and members of the group must specify their individual contribution.

Course Outcomes: After doing Major Project Part 1 students will be able to:

CO1. **evaluate** critically the existing solutions and methodologies through reviewing literature. (LOTS: Level 5: Evaluate)
CO2. **formulate** suitable problems to be addressed. (LOTS: Level 6: Create)
CO3. **identify** tentative modern tools to solve the problem. (LOTS: Level 4: Analyse)
CO4. **organize** and communicate (written and oral) ideas effectively. (LOTS: Level 6:Create)
CO5. **develop** methodologies that meet ethical, societal and legal considerations. (LOTS:Level 6: Create)

CO-PO Articulation Matrix Major Project Part 1 (EEC/CSE/3-P)

List of Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CO1. **Evaluate** critically the existing solutions and Methodologies through reviewing literature. (LOTS: Level 5: Evaluate)	2	3	3	3	–	–	–	–	–	–	–	3	–	–	–
CO2. **Formulate** suitable problems to be addressed.(LOTS: Level6: Create)	2	3	3	3	–	–	–	–	–	–	–	–	–	–	–
CO3. **Identify** tentative modern tools to solve theproblem. (LOTS: Level 4: Analyse)	2	–	2	–	3	–	–	–	–	–	–	2	–	–	–
CO4. **Organize** and communicate (written andoral) ideas effectively. (LOTS: Level 6: Create)	–	–	–	–	–	–	–	–	–	3	3	–	–	–	–
CO5. **Develop** methodologies that meet ethical, societal and legal considerations. (LOTS: Level6: Create)	–	–	–	–	–	3	–	3	3	–	–	3	–	–	–
Level of Attainments EEC/CSE/3-P															

Mini Project using Open-Source Tools

General Course Information

Course Code: EEC/CSE/2-P *Course Credits: 2 Mode: Design and developmentof mini-project in lab. No. of hours per week: -4	**Course Assessment Method (100)** An internal evaluation is done by the course coordinator. Significance and originality of the problem addressed andthe solution provided: 20 Knowledge of the problem domain and the tool used (VIVA-VOCE):25 Report Writing: 20 Judgement of the open-source tools learnt and quality ofthe solution developed: 20 Level of Ethics followed: 15

About the mini project:

Students do a mini project using open source software after sixth semester. They are expectedto learn any opensource software and develop applications that can be completed within 4 to 6 weeks.

After doing mini-projects students will be able to

CO1. **identify** a suitable problem from the environment around. (LOTS: Level 4: Analyse)
CO2. **survey** the design of similar problems (LOTS: Level 5: Evaluate)
CO3. **select** suitable engineering specialization and modern IT tools. (LOTS: Level 3: Apply)
CO4. **address** the problem in an original and innovative manner. (LOTS: Level 6: Create)
CO5. **communicate** orally as well as in written (mini project report) about the application developed. (LOTS: Level 6: Create)
CO6. **engage** in ethical practices, individual and team work, and lifelong learning. (LOTS: Level3: Apply)

CO-PO Articulation Matrix Mini Project using Open-Source Tools Course (EEC/CSE/2-P)

List of Course Outcomes		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CO1.	**Identify** a suitable problem from the environment around. (LOTS: Level 4: Analyse)	2	3	_	2	_	3	2	_	_	_	_	_	_	_	_
CO2.	**Survey** the design of similar problems (LOTS: Level 5: Evaluate)	_	3	2	3	_	_	_	_	_	_	_	_	_	_	_
CO3.	**Select** suitable engineering specialization and modern IT tools. (LOTS: Level 3: Apply)	_	_	_	_	3	_	_	_	_	_	_	_	_	_	_
CO4.	**Address** the problem in an original and innovative manner. (LOTS: Level 6: Create)	3	3	3	3	_	2	_	_	_	_	_	_	_	_	_
CO5.	**Communicate** orally as well as in written (mini project report) about the application developed. (LOTS: Level 6: Create)	_	_	_	_	_	_	_	_	_	3	_	_	_	_	_
CO6.	**Engage** in ethical practices and lifelong learning. (LOTS: Level 3: Apply)	_	_	_	_	_	_	_	3	3	_	_	3	_	_	_
Level of Attainments EEC/CSE/2-P																

Data Mining Techniques

General Course Information

Course Code: PC/CSE/21-T Course Credits: 3 Type: Professional Core Contact Hours: 3 hours/week Mode: Lectures (L) Examination Duration:3 hours	**Course Assessment Methods (internal: 30; external: 70)** Three minor tests each of 20 marks will be conducted. The average of the highest marks obtained by a student in the any of the two minor examinations will be considered. Class Performance will be measured through percentage of lectures attended (04 marks). Assignments, quiz etc. will have weightage of 06 marks For the end semester examination, nine questions are to be set by the examiner. A candidate is required to attempt 5 questions in all. All questions carry equal marks. Question number 1 will be compulsory and based on the entire syllabus. It will contain seven parts of 2 marks each. Question numbers 2 to 9 will be given by setting two questions from each of the four units of the syllabus. A candidate is required to attempt the remaining four questions by selecting one question from each of the four units.

Pre-requisites: Knowledge of database systems, elementary knowledge of statistics and probability.

About the Course:

Today's era is the era of information. Data is growing exponentially day by day. There is a need to process and analyse the data to extract knowledge from it, so that one can use that knowledge for decision making. This course provides introductory concepts of data mining and data warehousing. The course will be taught with a database as well as machine learning perspectives. The objective of the course is to provide a comprehensive understanding of data prep-processing, data mining tasks and evaluation of results obtained out of data mining processes.

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

CO1. **outline** various types of data mining and data warehouse concepts and techniques.(LOTS: Level 1: Remember)
CO2. **explain** characteristics, architecture of a data warehouse, OLAP operations and datamining tasks. (LOTS: Level 2: Understand)
CO3. **apply** various pre-processing and data mining techniques for extracting valuableinformation from data. (LOTS: Level 3: Apply)
CO4. **evaluate** the descriptive and predictive data mining models. (LOTS: Level 5:Evaluate)
CO5. **plan** a data mining process for discovering knowledge from real-world databases.(LOTS: Level 6: Create)

Course Content

Unit I

Introduction to Data Mining: Kind of data to be mined, Data Mining Functionalities, Technologies used in Data Mining, Applications of data Mining, Major Issues in Data Mining.

Data Pre-Processing: Need for preprocessing, Data Objects and Attribute types, Statistical description of data, Data Visualization, Measuring similarity and dissimilarity of data, Data Cleaning, Data Integration, Data Reduction, Data Transformation and Data Discretization.

Unit II

Data Warehouse: Introduction, Data Warehouse and Database Systems, Data Warehouse Architecture, Data Warehouse Models, Data Cube and OLAP, Multidimensional data Model, Concept Hierarchies, OLAP operations, Data Warehouse Implementation

Unit III

Mining Associations and Correlations: Mining Frequent Patterns, Associations and Correlations, Frequent Itemset Mining using Apriori Algorithm, Generating Association Rules from Frequent Item sets. Improving efficiency of Apriori, Pattern Growth Approach for Mining Frequent itemset, Pattern evaluation Methods.

Advanced Pattern Mining: Pattern Mining in Multilevel and Multidimensional Space, Constraint-Based Frequent Pattern Mining.

Unit IV

Classification: Introduction, Classification using Decision Tree Induction, Bayesian Classification Methods, Rule Based Classification, Model Evaluation and Selection, Techniques to Improve Classification Accuracy. Classification by Backpropagation, Support Vector Machines and Lazy Learners.

Cluster Analysis: Introduction, Basic Clustering Methods, Partitioning Methods, Hierarchical Methods, Evaluation of Clustering.

Text and Reference Books:

1. Jiawei Han, Micheline Kamber and Jian Pei, *Data Mining Concepts and Techniques*, MorganKaufmann Publishers, Third Edition, July 2011.
2. Alex Berson, Stephen J. Smith, *Data Warehousing, Data Mining & OLAP*, TataMcGraw Hill, 2004.
3. Pang-Ning Tan, Michael Steinbach and Vipin Kumar, *Introduction to Data Mining*, Pearson Education,2014.
4. K. P. Soman, Shyam Diwakar and V. Ajay, *Insight into Data Mining Theory and Practice*, EasterEconomy Edition, Prentice Hall of India, 2009.
5. G. K. Gupta, *Introduction to Data Mining with Case Studies*, Prentice Hall of India,2006.
6. Daniel T. Larose, *Data Mining Methods and Models*, Wiley, 2006.
7. W. H. Inman, *Building the Data Warehouse*, Wiley India, 2005.

CO-PO Articulation Matrix Data Mining Techniques (PC/CSE/21-T)

List of Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CO1. **Outline** various types of data mining anddata warehouse concepts and techniques. (LOTS: Level1: Remember)	1	_	_	_	_	_	_	_	_	_	_	_	_	_	2
CO2. **Explain** characteristics, architecture of a data warehouse, OLAP operations and data mining tasks.(LOTS: Level 2: Understand)	1	_	_	_	_	_	_	_	_	_	_	_	_	_	3
CO3. **Apply** various pre-processing and data mining techniques for extracting valuable information from data. (LOTS: Level 3: Apply)	2	1	_	_	2	_	_	_	_	_	_	_	_	_	3
CO4. **Evaluate** the descriptive and predictive data mining models. (LOTS: Level 5: Evaluate)	3	2	2	3	-	_	_	_	_	_	_	_	_	_	3
CO5. **Plan** a data mining process for discovering knowledge from real-world databases. (LOTS: Level 6: Create)	3	3	3	3	-	1	_	_	_	_	_	_	_	_	3
Level of Attainments PC/CSE/21-T															

Human Values and Personality Development

General Course Information

Course Code: HSMC/2-T Course Credits: 2 Type: Humanities and Social Sciences Contact Hours: 02 hours/week Mode: Lectures) Examination Duration: 3 hours	**Course Assessment Methods (internal: 30; external: 70)** Three minor examinations (20 marks), Class Performance measured through percentage of lectures attended (4 marks), assignments (6 marks), and the end-semester examination (70 marks). For the end semester examination, nine questions are to be set by the examiner. A candidate is required to attempt 5 questions in all. All questions carry equal marks. Question number 1 will be compulsory and based on the entire syllabus. It will contain seven parts of 2 marks each. Question numbers 2 to 9 will be given by setting two questions from each of the four units of the syllabus. A candidate is required to attempt the remaining four questions by selecting one question from each of the four units.

Pre-requisites: None

About the Course:

This course is designed to develop a holistic perspective based on self-exploration and co- existence in society and nature. The focus is on to understand harmony and being in harmony with the society and the environment around us. The students will nurture a habit of self-reflection and courage to act. This course includes practice sessions to discuss natural acceptance in human being as the innate acceptance for living with responsibility (living in relationship, harmony and co-existence) rather than as arbitrariness in choice based on liking-disliking).

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

CO1: **exhibit** awareness about oneself, one's surroundings and goals in one's life.

CO2: **stay** in harmony with society and nature.
CO3: **develop** healthy and harmonious relationships.
CO4: **work** in groups and develop team spirit.
CO5: **exhibit** leadership qualities.
CO6: **excel** in personal and professional life.

Course Contents

Unit I

Understanding the concept of self. Exploration of self with JOHARI-Window. Self-Esteem, Characteristics of individuals with low and high self-esteem. Self Confidence, strategies of building self-confidence.

Personality: Definition &Types & Traits; Relevance and Importance of nature and nurture in the development ofpersonality.

Unit II

Nature of Socialization; Socialization Process, Contributions to Society and Nation. Importance of discipline andhard work. Ecologically responsibility of Engineers.

Professional Ethics: Competencies in professional values and ethics

Personal and Professional Excellence: Identifying long term choice and goals.

Unit III

Importance of Interpersonal relationships: Role and relationships, Maintaining healthy relationships. Importance andSteps to improve Interpersonal Communication.
Meaning and nature of teams, Internal and external factors affecting team building. Leadership Meaning, Nature and functions. leadership styles in organization. Meaning and nature of stress, causes, effect and management.

Unit IV

Meaning and importance of human rights, Human right awareness.

Harmony in nature, understanding coexistence, harmony at all levels of coexistence, Human being as cause of imbalance in nature, Understanding the concept of happiness and well-being. Role and importance of positive emotions, Gratitude, hope and optimism.

Text and Reference Books:

1. Bates, A. P. and Julian, J.: Sociology - Understanding Social Behaviour.
2. Dressler, David and Cans, Donald: The Study of Human Interaction.
3. Pestonjee, D.M, Pareek, Udai, Agarwal Rita; Studies in Stress And its Management
4. Organizational Behaviour, Davis, K.
5. Hoover, Judhith D. Effective Small Group and Team Communication, 2002, Harcourt College Publishers
6. Dick, McCann &Margerison, Charles: Team Management, 1992 Edition, viva books
7. Pestonjee, D.M.; Stress and Coping: The Indian Experience
8. Clegg, Brian; Instant Stress Management – Bring calm to your life now.

CO-PO Articulation Matrix: Human Values and Personality Development (HSMC/2-T)

Course Outcomes	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1. **exhibit** awareness about oneself, one's surroundings and goals in one's life.	-		-	-	-	-	-	2	-	-	-	3	_	_	_
CO2. **stay** in harmony with society and nature.	-	-	-	-	-	2	3	2	1	-	-	2	_	_	_
CO3. **develop** healthy and harmonious relationships.	-	-	-	-	-	-	-	2	2	2	-	2	_	_	_
CO4. **work** in groups and develop team spirit.	-	-	-	-	-	-	-	-	3	2	-	1	_	_	_
CO5. **exhibit** leadership qualities.	-	-	-	-	-	-	_	-	3	-		-	_	_	_
CO6. **excel** in personal and professional life.	-	-	-	-	-	-	-	-	-	2	-	-	_	_	_
Level of Attainments HSMS/2-T															

Internet of Things

General Course Information

Course Code: PE/CSE/17-T Course Credits: 3 Type: Professional Core Contact Hours: 3 hours/week Mode: Lectures (L) Examination Duration:3 hours	**Course Assessment Methods (internal: 30; external: 70)** Three minor tests each of 20 marks will be conducted. The average of the highest marks obtained by a student in the any of the two minor examinations will be considered. Class Performance will be measured through percentage of lectures attended (04 marks). Assignments, quiz etc. will have weightage of 06 marks For the end semester examination, nine questions are to be set by the examiner. A candidate is required to attempt 5 questions in all. All questions carry equal marks. Question number 1 will be compulsory and based on the entire syllabus. It will contain seven parts of 2 marks each. Question numbers 2 to 9 will be given by setting two questions from each of the four units of the syllabus. A candidate is required to attempt the remaining four questions by selecting one question from each of the four units.

Pre-requisites: Fundamentals of Computer Networks

About the Course:
The field of Internet of Things is growing very fast. The purpose of this course is to impart the knowledge on basic concepts of IoT, its Architecture, various protocols and applications in real world scenarios.

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

CO1. **state** the basic concepts and key technologies of IoT. (LOTS: Level 1: Remember)
CO2. **discuss** the pros and cons of various protocols for IoT. (LOTS: Level 2: Understand)
CO3. **apply** the IOT models for business applications. (LOTS: Level 3: Apply)
CO4. **analyse** applications of IoT in real time scenario. (LOTS: Level 4: Analyse)
CO5. **design** business model scenarios (LOTS: Level 6: Create)

Course Content

Unit I
What is the Internet of Things? : History of IoT, About IoT, Overview and Motivations, Examples of Applications, Internet of Things Definitions and Frameworks : IoT Definitions, IoT Architecture, General Observations, ITU-T Views, Working Definition, IoT Frameworks, Basic Nodal Capabilities, Basics Of Microcontroller, Microprocessor Vs Microcontroller, Types of Sensor, Actuators and their Applications.

Unit II
Identification of IoT Objects and Services, Structural Aspects of the IoT, Environment Characteristics, Traffic Characteristics, Scalability, Interoperability, Security and Privacy, Open Architecture, Key IoT Technologies, Device Intelligence, Communication Capabilities, Mobility Support, Device Power, Sensor Technology, RFID Technology-Introduction, Principleof RFID, Components of an RFID system, Issues, Satellite Technology.

Unit III
IoT Access Technologies: Physical and MAC layers, Topology and Security of IEEE 802.15.4, 802.15.4g, 802.15.4e, 1901.2a, 802.11ah and LoRaWAN, Network Layer: IP versions, Constrained Nodes and Constrained Networks, Optimizing IP for IoT: From 6LoWPAN to 6Lo, Routing over Low Power and Lossy Networks, Application Transport Methods: Supervisory Control and Data Acquisition, Application Layer Protocols: CoAP and MQTT.

Unit IV

Business Models and Business Model Innovation, Value Creation in the Internet of Things, Business Model Scenarios for the Internet of Things. Internet of Things Applications: Smart Metering Advanced Metering Infrastructure, e-Health Body Area Networks, City Automation, Automotive Applications, Home Automation, Smart Cards, Smart Transportation and Smart Shopping.

Text and Reference Books:

1. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton and Jerome Henry, *IoT Fundamentals: Networking Technologies, Protocols and Use Cases for Internet of Things*, Cisco Press,1st Edition, 2017.
2. Olivier Hersent, David Boswarthick, Omar Elloumi , *The Internet of Things – Key applications and Protocols*, Wiley, 2nd Edition, 2012.
3. Dieter Uckelmann, Mark Harrison, Michahelles, Florian (Eds), *Architecting the Internet of Things*, 1st Edition, Springer, 2011.
4. Michael Margolis, Arduino Cookbook, "*Recipes to Begin, Expand, and Enhance Your Projects*", 2nd Edition, O'Reilly Media, 2011.
5. Arshdeep Bahga, Vijay Madisetti, *Internet of Things – A hands-on approach*, 1st Edition, Universities Press, 2015.

CO-PO Articulation Matrix Introduction to Internet of Things Course (PE/CSE/17-T)

List of Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CO1. **State** the basic concepts and key technologies of IoT. (LOTS: Level 1: Remember)	1	_	_	2	_	_	_	_	_	_	_	_	_	2	_
CO2. **Discuss** the pros and cons of various protocols for IoT. (LOTS: Level 2: Understand)	1	_	_	3	_	_	_	_	_	_	_	_	_	3	_
CO3. **Apply** the IOT models for business applications. (LOTS: Level 3: Apply)	2	2	2	3	3	_	_	_	_	_	_	_	2	3	_
CO4. **Analyse** applications of IoT in real time scenario. (LOTS: Level 4: Analyse)	3	3	2	_	3	_	_	_	_	_	_	_	2	3	2
CO5. **Design** business model scenarios (LOTS: Level 6: Create)	3	3	2	_	3	_	_	_	_	_	_	_	_3	3	2
Level of Attainments PE/CSE/17-T															

Network Administration and Management

General Course Information

Course Code: PE/CSE/18-T Course Credits: 3 Type: Professional Core Contact Hours: 3 hours/week Mode: Lectures (L) Examination Duration:3 hours	**Course Assessment Methods (internal: 30; external: 70)** Three minor tests each of 20 marks will be conducted. The average of the highest marks obtained by a student in the any of the two minor examinations will be considered. Class Performance will be measured through percentage of lectures attended (04 marks). Assignments, quiz etc. will have weightage of 06 marks For the end semester examination, nine questions are to be set by the examiner. A candidate is required to attempt 5 questions in all. All questions carry equal marks. Question number 1 will be compulsory and based on the entire syllabus. It will contain seven parts of 2 marks each. Question numbers 2 to 9 will be given by setting two questions from each of the four units of the syllabus. A candidate is required to attempt the remaining four questions by selecting one question from each of the four units.

Pre-requisites: Networking, protocols defined in layered Architecture, programming fundamentals**.**

About the Course:

Network Administration and Management is a Professional Elective course deemed to be necessary during the present era of Information Technology and Computer Science. This course deals with analyzing Network for statistics such as protocols, servers, memory, CPU etc. Network Monitoring and Management deals with different events in various types of platforms for response.

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

CO1. **define** Network Administration and its various components. (LOTS: Level 1: Remember)

CO2. **distinguish** Network Administration and its Management on various platforms. (LOTS: Level 2:Understand)

CO3. **classify** the output for different responses to events by interpreting Network Monitoring statistics.(LOTS: Level 3: Apply)

CO4. **separate** portions of Network for troubleshooting using various tools. (LOTS: Level 4: Analyse)

CO5. **combine** Network Administration, Network Management and Network Monitoring into a one scenario and compute the performance of the integrated environment. (LOTS: Level 6: Create)

Course Content

Unit I

Network Administration: Introduction to Network Administration Approaches, Addressing, Subnetting and Super netting, Fixed Vs Variable Masks, VLAN Principles and Configuration, Routing Concepts: Static and Dynamic Routing, Routing Protocols: RIP, OSPF, BGP. Network Address Translation (NAT), Configuring a Windows Box as a Router, Dial-up configuration and Authentication: PPP, Radius, RAS. Configuring a DNS Server in windows, Configuring Send mail Service, Configuring a Web Server, Configuring a Proxy Server, TCP/IP Troubleshooting: ping, traceroute, if config, netstat, ipconfig.

Unit II

Linux Network Administration: Setting up a file server, setting up samba server, configuring Network services: installing and configuring DHCP server, installing and configuring DNS server, setting up internal NTP server, hosting http content via Apache, sharing resources in a Network.

Unit III

Network management: Management Standards and models, Configuration Management and auto discovery, Fault Management, Fault identification and isolation, Event correlation techniques, SNMPv1, SNMPv2: Structure of Management Information, Standard Management Information Base (MIBs), MIB-II, Network Management Functions: Accounting Management, Performance Management, Network Usage, Metrics, and Quotas, SNMPv3: Protocol, MIB.

Unit IV

Network Monitoring: Network Performance Monitoring, Remote Network Monitoring (RMON1): Statistics Collection, Alarms and Filters, RMON2: Monitoring Network Protocol Traffic, Application-Layer Visibility, Management Tools, Systems and Applications: Test and Monitoring tools, Integrating tools, Development tools, Web-based Enterprise Management.

Text and Reference Books:

1. Mark Burgess, *Principles of Network and System Administration*, 2nd Edition, Wiley publications,2004.
2. Craig Hunt, *TCP/IP Network Administration*, 3rd Edition, O'Reilly Publications, 2002.
3. George Splading, *Windows 2000 Administration*, Tata McGraw-Hill, 2000.
4. Tony Bautts, Terry Dawson, and Gregor N. Purdy, *Linux Network Administrator's Guide,* 3rd Edition,O'Reilly publications, 2005.

CO-PO Articulation Matrix Network Administration and Management Course (PE/CSE/18-T)

List of Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CO1. **Define** Network Administration and its various components. (LOTS: Level 1: Remember)	1	–	–	–	–	–	–	–	–	–	–	–	–	3	–
CO2. **Distinguish** Network Administration and its Management on various platforms. (LOTS: Level2: Understand)	1	–	–	–	–	–	–	–	–	–	–	–	–	3	–
CO3. **Classify** the output for different responses to events by interpreting Network Monitoring statistics. (LOTS: Level 3:Apply)	2	2	2	3	3	–	–	–	–	–	–	–	–	3	–
CO4. **Separate** portions of Network for troubleshooting using various tools. (LOTS: Level 4: Analyse)	2	3	2	2	3	–	–	–	–	–	–	–	–	3	–
CO5. **Combine** Network Administration, Network Management and Network Monitoring into a one scenario and compute the performance of the integrated environment. (LOTS: Level 6: Create)	3	3	2	3	3	–	–	–	–	–	–	–	–	3	–
Level of Attainments: PE/CSE/18-T															

Software Testing and Quality Assurance

General Course Information

Course Code: PE/CSE/19-T Course Credits: 3 Type: Professional Core Contact Hours: 3 hours/week Mode: Lectures (L) Examination Duration:3 hours	**Course Assessment Methods (internal: 30; external: 70)** Three minor tests each of 20 marks will be conducted. The average of the highest marks obtained by a student in the any of the two minor examinations will be considered. Class Performance will be measured through percentage of lectures attended (04 marks). Assignments, quiz etc. will have weightage of 06 marks For the end semester examination, nine questions are to be set by the examiner. A candidate is required to attempt 5 questions in all. All questions carry equal marks. Question number 1 will be compulsory and based on the entire syllabus. It will contain seven parts of 2 marks each. Question numbers 2 to 9 will be given by setting two questions from each of the four units of the syllabus. A candidate is required to attempt the remaining four questions by selecting one question from each of the four units.

Pre-requisites: Software Engineering.

About the Course:
This course introduces students to software testing process and describes the quality assurance process and itsrole in software development. During the course students learns about the testing methods and tools, creating good test cases to improve the quality of software.

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

CO1. **recall** the process of software testing life cycle and quality assurance. (LOTS: Level1: Remember)
CO2. **demonstrate** reusability testing on software applications. (LOTS: Level 2:Understand))
CO3. **apply** software testing tools for predicting the behavior of software applications.(LOTS: Level 3: Apply)
CO4. **identify** the test cases for software applications. (LOTS: Level 4: Analyse)
CO5. **plan** test cases and quality management activities. (LOTS: Level 6: Create)
CO6. **predict** software quality based on quality parameters and quality models. (LOTS:Level 6: Create)

Course Content

Unit I
Introduction to Basic of software testing & Terminology, Software Development & Software Testing Life Cycle- role and activities, Necessity and Objectives of testing; Quality Concepts, Quality Control, McCall's factor model; Different Software Development Model; Object– oriented testing, Web testing, GUI testing; Elements of Software quality assurance; Quality Assurance Activities, Statistical Quality Assurance; Software Reliability, SQA plan , Quality Standards:-IEEE, CMM, ANSI.

Unit II
Testing Concepts, Issues and Techniques, Levels of Testing, Verification and Validation Model ; Techniques of Verification:-Peer Review, Walkthrough, Inspection, FTR ; Unit testing, Integration testing, Function Testing ; System testing, Installation Testing, Usability Testing, Regression testing, ; Performance testing:-Load Testing, Stress Testing, Security testing, Volume testing ; Acceptance testing:-Alpha testing, Beta testing, Gamma testing.

Unit III

Black Box Testing Methods: Equivalence partitioning, Boundary-value analysis, Error guessing, graph-based testing methods, Decision Table Testing; White Box Testing Methods: Statement coverage, Decision coverage, Condition coverage, Path testing, Data flow testing.

Test Planning & Documentation: Development plan and quality plan objectives; Testing Strategy, Test Management, Strategic Management, Operational Test Management, Managing the Test Team, Test Plans, Test Cases, Test Data, Risk Analysis.

Unit IV

Testing Tools, Features of test tool; Guidelines for selecting a tool; Tools and skills of tester; Static testing tools, Dynamic testing tools, Advantages and disadvantages of using tools, Introduction to open source testing tool.

Text and reference books:

1. M. G. Limaye, *Software Testing Principles, Techniques and Tools*, TMH, 2009.
2. Yogesh Singh, *Software Testing*, Cambridge University Press, 2016.
3. Ron Pattorn, *Software Testing*, 2nd edition, Sams, 2005.
4. Roger S. Pressman, Software Engineering- a Practitioners approach, 8th edition,McGraw Hill, 2014
5. Jeff Tian, *Software Quality Engineering: Testing, Quality Assurance and Quantifiable Improvement*,Wiley, 2005.
6. Stephan H. Kan, *Metrics and Models in Software Quality Engineering*, 2nd edition, Addison-Wesley,2009.
7. William E. Perry, *Effective Methods of Software Testing*, 2nd edition, Wiley, 2000.

CO-PO Articulation Matrix Software Testing and Quality Assurance Course (PE/CSE/19-T)

List of Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CO1. **Recall** the process of software testing life cycleand quality assurance. (LOTS: Level 1: Remember)	1	–	–	–	–	–	–	–	–	–	–	–	3	–	–
CO2. **Demonstrate** reusability testing on software applications. (LOTS: Level 2: Understand))	1	–	–	–	–	–	–	–	–	–	–	–	3	–	–
CO3. **Apply** software testing tools for predicting the behavior of software applications. (LOTS: Level3: Apply)	2	2	2	2	3	–	–	–	–	–	–	–	3	–	–
CO4. **Identify** the test cases for software applications. (LOTS: Level 4: Analyse)	2	3	2	3	–	–	–	–	–	–	–	–	3	–	–
CO5. **Plan** test cases and quality management activities. (LOTS: Level 6: Create)	3	3	3	3	3	–	–	–	–	–	–	–	3	–	–
CO6. **Predict** software quality based on quality parameters andquality models. (LOTS: Level6: Create)	3	3	2	3	3	–	–	–	–	–	–	–	3	–	–
Level of Attainments PE/CSE/19-T															

Pattern Recognition

General Course Information

Course Code: PE/CSE/20-T Course Credits: 3 Type: Professional Core Contact Hours: 3 hours/week Mode: Lectures (L) Examination Duration:3 hours	**Course Assessment Methods (internal: 30; external: 70)** Three minor tests each of 20 marks will be conducted. The average of the highest marks obtained by a student in the any of the two minor examinations will be considered. Class Performance will be measured through percentage of lectures attended (04 marks). Assignments, quiz etc. will have weightage of 06 marks For the end semester examination, nine questions are to be set by the examiner. A candidate is required to attempt 5 questions in all. All questions carry equal marks. Question number 1 will be compulsory and based on the entire syllabus. It will contain seven parts of 2 marks each. Question numbers 2 to 9 will be given by setting twoquestions from each of the four units of the syllabus. A candidate is required to attempt the remaining four questions by selecting one question from each of the four units.

Pre-requisites: Basics of Linear Algebra and Statistics, Basics of Probability Theory, Data Structures and Computer Algorithms.

About the Course:

Pattern Recognition is the study of basic concept of pattern recognition, equip with mathematical and statistical techniques used in pattern recognition, develop machine learning algorithms for real world problems.

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

CO1. **understand** the concept of a pattern and the basic approach to the development of pattern recognition and machine intelligence algorithms and applications of PR system. (LOTS:Level 1: Remember)

CO2. Demonstrate the basic methods of feature extraction, feature evaluation, analyze and relate research in the pattern recognition area. (LOTS: Level 2: Understand)

CO3. Apply both supervised and unsupervised classification methods to develop PR system in real-world data. (LOTS: Level 3: Apply)

CO4. Develop pattern recognition techniques to real-world problems such as object detection and recognition and to implement simple pattern classifiers, classifier combinations, and structural pattern recognizers ((LOTS: Level 4:Analyse)

Course Content

Unit I

Introduction to Pattern Recognition. Tree Classifiers Getting our feet wet with real classifiers- Decision Trees: CART, C4.5, ID3 Random Forests-Bayesian Decision Theory Grounding our inquiry- Linear Discriminants Discriminative Classifiers.

Unit II

The Decision Boundary, Separability, Perceptron, Support Vector Machines, Parametric Techniques Generative Methods grounded in Bayesian DecisionTheory

Unit III

Maximum Likelihood Estimation- Bayesian Parameter Estimation. Non-Parametric Techniques-Kernel Density Estimators. Nearest Neighbour Methods - Unsupervised Methods Exploring the Data for Latent Structure - Component Analysis and Dimension Reduction.

Unit IV

The Curse of Dimensionality, Principal Component Analysis, Fisher Linear Discriminant, Locally Linear Embedding, Clustering, K-Means. Expectation Maximization, Mean Shift, Classifier Ensembles, Bagging, Boosting / AdaBoost

Text and Reference Books:

1. Duda, Hart and Stork, Pattern Classification, Second Edition, Wiley, 2001.
2. Bishop Christopher, *Pattern Recognition and Machine Learning*, Springer Verlag, 2006.
3. Pattern Recognition principles: Julus T. Tou and Rafel C. Gonzalez, Addision –Wesley
4. S. Theodoridis, K. Koutroumbas, Pattern Recognition, Academic Press, 1999

CO-PO Articulation Matrix Pattern Recognition Course (PE/CSE/20-T)

List of Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1 **understand** the concept of a pattern and the basic approach to the development of pattern recognition and machine intelligence algorithms and applications of PR system. (LOTS: Level 1: Remember)	1	–	–	1	–	–	–	–	–	–	–	–	–	–	3
CO2 Demonstrate the basic methods of feature extraction, feature evaluation, analyze and relate research in the pattern recognition area. (LOTS: Level 2: Understand)	2	2	2	3	–	–	–	–	–	–	–	–	–	–	3
CO3 Apply both supervised and unsupervised classification methods to develop PR system in real-world data. (LOTS: Level 3: Apply)	2	2	2	2	–	–	–	–	–	–	–	–	–	–	3
CO4Develop pattern recognition techniques to real-world problems such as object detection and recognition and to implement simple pattern classifiers, classifier combinations, and structural pattern recognizers ((LOTS: Level 4:Analyse	3	3	2	3	–	–	–	–	–	–	–	–	–	–	3
Level of Attainments PE/CSE/20-T															

Artificial Neural Network

General Course Information

Course Code: PE/CSE/21-T Course Credits: 3 Type: Professional Core Contact Hours: 3 hours/week Mode: Lectures (L) Examination Duration:3 hours	**Course Assessment Methods (internal: 30; external: 70)** Three minor tests each of 20 marks will be conducted. The average of the highest marks obtained by a student in the any of the two minor examinations will be considered. Class Performance will be measured through percentage of lectures attended (04 marks). Assignments, quiz etc. will have weightage of 06 marks For the end semester examination, nine questions are to be set by the examiner. A candidate is required to attempt 5 questions in all. All questions carry equal marks. Question number 1 will be compulsory and based on the entire syllabus. It will contain seven parts of 2 marks each. Question numbers 2 to 9 will be given by setting twoquestions from each of the four units of the syllabus. A candidate is required to attempt the remaining four questions by selecting one question from each of the four units.

Pre-requisites: Artificial Intelligence

About the Course:
Artificial Neural network is the study of neural networks in engineering, acquire the knowledge of artificial intelligence, and cognitive modeling, implement the concept of types of neural networks and analyze of computation and dynamical systems using neural networks.

Course Outcomes: By the end of the course students will be able to:
CO1. Identify the neural network algorithms. (LOTS:Level 1: Remember)
CO2. **interpret** the results of neural network algorithms. (LOTS: Level 2: Understand) CO3. **apply** a variety of neural network algorithm on the available dataset. (LOTS:Level 3:Apply)
CO4. Implement the neural network algorithms and solve real-world problems. ((LOTS:Level 4: Analyse)
CO5. Perform evaluation of neural network algorithms. (LOTS: Level 5: Evaluate)

Course Content

Unit I

General characteristics of the human brain, Introduction to Biological Neural Networks, Nervestructure and synapse, Basic concepts of Neural Networks, Characteristics of Neural Networks, Terminologies, Applications of the artificial neural networks.

Unit II

Structure of a neural net (topology), Directed graphs, Models of Neuron, Neural Network Architectures, Artificial Neuron, Activation functions, Threshold function, Piecewise linearfunction, Sigmoidal function, Supervised learning,Unsupervised learning, Re-enforcement Learning.

Unit III

Knowledge Representation, Artificial Intelligence, learning rules, Error correction learning, Memory based learning, Hebbian learning, Competitive learning, Boltzmann learning, singlelayer perceptron, Multilayer perceptron, Back propagation, Recurrent networks, Network pruning. Adaptive networks, Supervised Learning Neural Networks, Decision-based neural networks, Hierarchical neural networks,

Unit IV

Multilayer perceptron. Support vector machines, Self-organization maps, Genetic Algorithms,Optimization, Prediction Systems, speech and decision-making.

Text and Reference Books:

1. Tom M. *Mitchell, Machine Learning*, McGraw-Hill, 1997.
2. Bishop Christopher, *Pattern Recognition and Machine Learning*, Springer Verlag, 2006.
3. Trevor Hastie, Robert Tibshirani, Jerome Friedman, *The Elements of Statistical Learning: Data Mining, Inference and Prediction*, Springer, 2nd edition, 2009..J. Han and M. Kamber, Data Mining Concepts and Techniques, 3rd Edition, Elsevier, 2012.
4. S. Rajeshkaran, G. A. Vijayalakshmi Pai, *Neural Networks, Fuzzy Logic and Genetic Algorithm:Synthesis and Applications*, PHI, 2003.

CO-PO Articulation Matrix Artificial Neural Network Course (PE/CSE/21-T)

List of Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1 Identify the neural network algorithms.(LOTS: Level 1: Remember)	1	–	–	1	–	–	–	–	–	–	–	–	–	–	3
CO2 **interpret**the results of neural network algorithms. (LOTS: Level 2: Understand	2	2	2	3	–	–	–	–	–	–	–	–	–	–	3
CO3 **apply** a variety of neural network algorithm on the available dataset. (LOTS: Level 3:Apply)	2	2	2	2	–	–	–	–	–	–	–	–	–	–	3
CO4 Implement the neural network algorithms and solve real-world problems. ((LOTS:Level 4:Analyse)	3	3	2	3	–	–	–	–	–	–	–	–	–	–	3
CO5 Perform evaluation of neural network algorithms. (LOTS: Level 5: Evaluate)	3	3	2	3	–	–	–	–	–	–	–	–	–	–	3
Level of Attainments PE/CSE/21-T															

.NET Using C#

General Course Information:

Course Code: PE/CSE/22-T Course Credits: 3 Type: Professional Core Contact Hours: 3 hours/week Mode: Lectures Examination Duration: 3 hours	**Course Assessment Methods (internal: 30; external: 70)** Three minor tests each of 20 marks will be conducted. The average of the highest marks obtained by a student in the any of the two minor examinations will be considered. Class Performance will be measured through percentage of lectures attended (04 marks). Assignments, quiz etc. will have weightage of 06 marks For the end semester examination, nine questions are to be set by the examiner. A candidate is required to attempt 5 questions in all. All questions carry equal marks. Question number 1 will be compulsory and based on the entire syllabus. It will contain seven parts of 2 marks each. Question numbers 2 to 9 will be given by setting two questions from each of the four units of the syllabus. A candidate is required to attempt the remaining four questions by selecting one question from each of the four units.

Pre-requisites: Object oriented languages

About the Course:
.NET using C# is a core and an essential advanced course for every graduate in Computer Science and Engineering. This course introduces .NET Framework basics with object-oriented technology like CLS, CTS, CLR, Assembly, Type Info, Delegates and Reflector etc., and various operations to be implemented surrounding these features for solving real world problems. It includes ADO.NET framework with its classes for database connectivity.

Course Outcomes: By the end of the course students will be able to:
CO1. define the concepts related to .NET Framework. (LOTS: Level 1: Remember) CO2. explainvarious C# constructs. (LOTS: Level 1: Understand)
CO3. apply .NET framework using C# for solving moderate/complex problems. (LOTS: Level 3:Apply)
CO4. use advanced features of C# like Reflector, and Assembly. (LOTS: Level 3: Apply)CO5. identify logical errors in given .Net using C# programs. (LOTS: Level 3: Analyse)
CO6. Design stand-alone applications in the .NET framework using C#. (LOTS: Level 6: Create)

Course Content

Unit I
.NET Framework: Beginning of NET Technology, Overview of .NET Framework, .NET Framework Class Libraries, NET Programming Languages, NET Namespaces and Type. Architecture of .NET Framework. Common Language Runtime (CLR) – Common Type Specification (CTS), Common Language Specifications (CLS), Assemblies of .NET Base Classes, CLR Debugger.

Unit - II
Evolution of C#: Overview of C#, C# and .NET, Similarities & Differences from JAVA, Structure of C# program. Data Types including Out and Ref, Identifiers, Variables & Constants, Flow Control and Iteration,

Object-Oriented Programming in C# - Encapsulation, Inheritance, and Polymorphism, Object and Classes, Basics of C# Classes,

Unit-III
Creating DLL files, Assemblies of multiple versions. GAC Utility and Strong Name, Arrays and Strings, Boxing and Unboxing, – Exception Handling in C#, Garbage Collection & Its Stages, Files and Streams, Delegates and their usefulness and Events, Attributes, I/O in C# and Windows Applications.

Unit - IV
Architecture of ADO.NET, Database Connection, Connected and Disconnected Environment, Create Connection using ADO.NET Object Model, Connection Class, Command Class, Data Adapter Class, Dataset Class.

Text and Reference Books:

- Benjamin Perkins, Jacob Vibe Hammer and Jon D. Reid, *C# 6 Programming with Visualstudio*, Wroxpublication, 2016.
- Matt Telles, *C# Programming*, Black Book, Coriolis Group, 2001.
- Stephen C. Perry. Atul Kahate, *Essential of .NET and Related Technologies*, PearsonEducation 2009.

CO-PO Articulation Matrix .NET using C# Course (PE/CSE/22-T)

List of Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO 9	PO1 0	PO1 1	PO1 2	PSO1	PSO2	PSO3
Define the concepts related to .NET Framework. (LOTS: Level 1:Remember)	1	_	_	_	_	_	_	_	_	_	_	_	2	_	_
Explain various C# constructs. (LOTS: Level 1: Understand)	1	_	_	_	_	_	_	_	_	_	_	_	3	_	_
Apply .NET framework using C# for solving moderate/complex problems.(LOTS: Level 3: Apply)	2	1	_	_	_	_	_	_	_	_	_	_	3	_	_
Use advanced features of C# like Reflector, and Assembly.(LOTS: Level 3:Apply)	2	2	1		2	_	_	_	_	_	_	_	3	_	_
Identify logical errors in given .Net using C# programs. (LOTS: Level 3:Analyse)	2	2	1		2	_	_	_	_	_	_	_	3	_	_
Design stand-alone applications in the .NET framework usingC#. (LOTS: Level 6: Create)	3	3	2	2	3	_	_	_	_	_	_	_	3	_	_
Level of Attainments PE/CSE/22-T														_	_

Big Data Analytics

General Course Information

Course Code: PE/CSE/23-T Course Credits: 3 Type: Professional Core Contact Hours: 3 hours/week Mode: Lectures (L) Examination Duration:3 hours	**Course Assessment Methods (internal: 30; external: 70)** Three minor tests each of 20 marks will be conducted. The average of the highest marks obtained by a student in the any of the two minor examinations will be considered. Class Performance will be measured through percentage of lectures attended (04 marks). Assignments, quiz etc. will have weightage of 06 marks For the end semester examination, nine questions are to be set by the examiner. A candidate is required to attempt 5 questions in all. All questions carry equal marks. Question number 1 will be compulsory and based on the entire syllabus. It will contain seven parts of 2 marks each. Question numbers 2 to 9 will be given by setting two questions from each of the four units of the syllabus. A candidate is required to attempt the remaining four questions by selecting one question from each of the four units.

Pre-requisites: Basics of statistics and data mining.

About the Course:
This course aims to provide students with the knowledge of current challenges, methodologies and technologies in processing big data. Emphasis will be placed on the students' understanding of the rationales behind the technologies and the students' ability to analyse big data using professional packages and tools.

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

CO1. **recall** the concepts of big data analysis. (LOTS: Level 1: Remember)
CO2. **interpret** the outcomes of big data analysis. (LOTS: Level 2: Understand)
CO3. **apply** technical skills and modern tools for descriptive and predicative modelling.(LOTS: Level 3: Apply)
CO4. **analyse** a framework for visualization of big data analytics for business user.(LOTS: Level 4: Analyse)
CO5. **examine** critically the results of mining to support business decision-making.(LOTS: Level 5: Evaluate)
CO6. **design** schemes for big data analytics for solving big data problems in efficientmanner. (LOTS: Level 6: Create)

Course Content

Unit I

Introduction: Overviews of Big Data, State of the Practice in Analytics, The Data Scientist, Big Data Analytics in Industry Verticals, Data Analytics Lifecycle Challenges of Conventional Systems, Statistical Concepts: Sampling Distributions, Re-Sampling, Statistical Inference, Prediction Error, Regression Modelling, Multivariate Analysis, Bayesian Modelling.

Unit II

Mining Data Streams: Stream Data Model and Architecture, Stream Computing, Sampling Data in a Stream, Filtering Streams, Counting Distinct Elements in a Stream, Estimating Moments, Counting Oneness in a Window, Decaying Window, Real time Analytics, Platform (RTAP) Applications, Case Studies, Real Time Sentiment Analysis, Stock Market Prediction

Unit III

Frequent Itemset and Clustering: Mining Frequent item sets, Market Based Model: Apriori Algorithm, Handling Large Data Sets in Main Memory, Limited Pass Algorithm, Counting Frequent item sets in a Stream, Clustering based Techniques: Hierarchical, K-Means etc., Clustering High Dimensional Data, CLIQUE And PROCLUS, Frequent Pattern based Clustering Methods, Clustering in Non-Euclidean Space, Clustering for Streams and Parallelism.

Unit IV

Frameworks and Visualization: Overview of MapReduce, Hadoop, Hive, MapR, Sharding, NoSQL Databases, S3, HADOOP, Distributed File System (HDFS), Visualizations: Visual Data Analysis Techniques, Interaction Technique and Applications.

Text and Reference Books:

1. Michael Berthold, David J. Hand, *Intelligent Data Analysis*, Springer, 2007.
2. A. Rajaraman, J.D. Ullman, *Mining of Massive Datasets*, Cambridge University Press,2012.
3. Bill Franks, *Taming the Big Data Tidal Wave: Finding Opportunities in HugeData Streams withAdvanced Analytics*, John Wiley & sons, 2012.
4. Glenn J. Myatt, *Making Sense of Data*, John Wiley & Sons, 2007
5. Pete Warden, *Big Data Glossary*, O'Reilly, 2011.

CO-PO Articulation Matrix Big Data Analytics Course (PE/CSE/23-T)

List of Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CO1. **Recall** the concepts of big data analysis. (LOTS: Level 1: Remember)	1	1	–	1	–	–	–	–	–	–	–	–	–	–	2
CO2. **Interpret** the outcomes of big data analysis. (LOTS: Level2: Understand)	2	2	2	2	–	–	–	–	–	–	–	–	–	–	3
CO3. **Apply** technical skills and modern tools for descriptive and predicative modelling. (LOTS: Level 3: Apply)	3	2	2	2	–	–	–	–	–	–	–	–	–	–	3
CO4. **Analyse** a framework for visualization of big data analytics for business user. (LOTS: Level 4: Analyse)	3	2	2	3	–	–	–	–	–	–	–	–	–	–	3
CO5. **Examine** critically the results of mining to support business decision-making. (LOTS: Level5: Evaluate)	3	2	2	3	–	–	–	–	–	–	–	–	–	–	3
CO6. **Design** schemes for big data analytics for solving big data problems in efficient manner. (LOTS: Level 6: Create)	3	2	2	3	–	–	–	–	–	–	–	–	–	–	3
Level of Attainments PE/CSE/23-T															

Web Development

General Course Information

Course Code: PE/CSE/24-T Course Credits: 3 Type: Professional Core Contact Hours: 3 hours/week Mode: Lectures (L) Examination Duration:3 hours	**Course Assessment Methods (internal: 30; external: 70)** Three minor tests each of 20 marks will be conducted. The average of the highest marks obtained by a student in the any of the two minor examinations will be considered. Class Performance will be measured through percentage of lectures attended (04 marks). Assignments, quiz etc. will have weightage of 06 marks For the end semester examination, nine questions are to be set by the examiner. A candidate is required to attempt 5 questions in all. All questions carry equal marks. Question number 1 will be compulsory and based on the entire syllabus. It will contain seven parts of 2 marks each. Question numbers 2 to 9 will be given by setting two questions from each of the four units of the syllabus. A candidate is required to attempt the remaining four questions by selecting one question from each of the four units.

Pre-requisites: knowledge of Computer Basics

About the Course:
Web development is a management of information. Web Development is a core and an essential course for every graduate in Computer Science and Engineering. This course introduces web designing tools like HTML, XML, Java Script and ASP/JSP etc. and various web site will be designed with the help of these tools for solving real world problems. It includes various types ofwebsite. Further, It is more useful for dynamic programming as well.

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

CO 1. **enlist** principles of Information Architecture for Web design. (LOTS: Level1: Remember)

CO 2. **explain** navigational systems, labeling systems, and taxonomies for websites.(LOTS: Level 2:Understand)

CO 3. **apply** basic web designing tools (HTML, XML, ASP/JSP, JQuery, Java Script).(LOTS: Level 3:Apply)

CO 4. **evaluate** critically design of webpages based on various technologies. (LOTS: Level5: Evaluate)

CO 5. **create** a report describing or making recommendations for a website design. (LOTS:Level 6: Create)

Course Content

Unit I

Information Architecture, Role of Information Architect, Collaboration and Communication, Organizing Information, Organizational Challenges, Organizing Web Sites and Intranets, Creating Cohesive Organization Systems Designing, Navigation Systems, Types of Navigation Systems, Integrated Navigation Elements, Remote Navigation Elements, Designing Elegant Navigation Systems, Searching Systems, Designing the Search Interface, Indexing the Right Stuff, What to Search or not to Search, Grouping Content, Conceptual Design, Architecture Blueprints, Architectural Page Mockups, Design Sketches.

Unit – II

Structured Information, Design and Documentation, XML Web 6.0, JDBC, Metadata, Unstructured Information, Techniques for Unstructured Information, HTML Basic Concepts, Good Web Design, Process of Web Publishing, Phases of Web Site Development, Structure of Html Documents, Html

Elements for Designing Pages. Text Level Events, Linking Basics, Linking In Html, Images and Anchors Attributes, Image Maps, Semantic Linking Meta Information, Image Preliminaries, Images, Layout Design, Advanced Layout. Audio Support in Browsers, Video Support, Other Binary Formats. Style Sheets, Positioning With Style Sheets. Basic Interactivity and Html: Forms, Forms Control, Advance HTML and Web Designing.

Unit – III

Alternative Technologies for Designing, The Hypertext Transport Protocol, URLs, HTTP, Browser Requests, Server Responses, Proxies, Content Negotiation, The Common Gateway Interface, The CGI Environment Variables. CGI Output, Forms and CGI, Sending Data to the Server, Form Tags, Decoding Form Input, Architectural Guidelines, Coding Guidelines, Efficiency and Optimization. JSP Basics, Integrating Scripts in JSPs, ASP Objects and Components, JSP: Request and Response Objects, Retrieving the Contents of a HTML form, retrieving a Query String, Cookies, Creating and Reading Cookies.

Unit – IV

XML basics, Relationship between HTML, SGML, and XML, Valid Documents. Ways to use XML, XML for Data Files, Embedding XML into HTML documents, Converting XML to HTML for DISPLAY, Displaying XML using CSS and XSL, Rewriting HTML as XML, Basics of Advance Web Development Tools.

Text and Reference Books:

1. Thomas A Powell, *HTML-The Complete Reference*, Tata McGraw Hill, 2003.
2. Scott Guelich, Shishir Gundavaram, Gunther Birzniek, *CGI Programming with Perl* 2nd edition,O'Reilly, 2000.
3. Doug Tidwell, James Snell, Pavel Kulchenko, *Programming Web Services with SOAP*, O'Reilly, 2009.
4. Young, *XML Step by Step*, 2nd edition, PHI.
5. Paul J. Deitel, Harvey M. Deitel, Abbey Deitel, *Internet & World Wide WebHow to Program*, 5thedition, 2008.

CO-PO Articulation Matrix Web Development Course (PE/CSE/24-T)

List of Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CO1. **Enlist** principles of Information Architecture for Web design. (LOTS: Level 1: Remember)	1	–	–	–	–	–	–	–	–	–	–	–	2	–	–
CO2. **Explain** navigational systems, labeling systems, and taxonomies for websites. (LOTS: Level 2: Understand)	1	–	–	–	–	–	–	–	–	–	–	–	3	–	–
CO3. **Apply** basic web designing tools (HTML, XML, ASP/JSP,JQuery, Java Script). (LOTS: Level 3: Apply)	2	2	2	2	3	3	–	–	–	–	–	–	3	2	–
CO4. **Evaluate** critically design of webpages basedon various technologies. (LOTS: Level 5: Evaluate)	3	3	2	3	3	3	–	–	–	–	–	–	3	2	–
CO5. **Create** a report describing or making recommendations for a website design. (LOTS: Level 6: Create)	–	–	–	3	3	–	–	3	3	3	2	–	3	–	–
Level of Attainments PE/CSE/24-T															

Statistical Computing

General Course Information

Course Code: PE/CSE/25-T Course Credits: 3 Type: Professional Core Contact Hours: 3 hours/week Mode: Lectures (L) Examination Duration:3 hours	**Course Assessment Methods (internal: 30; external: 70)** Three minor tests each of 20 marks will be conducted. The average of the highest marks obtained by a student in the any of the two minor examinations will be considered. Class Performance will be measured through percentage of lectures attended (04 marks). Assignments, quiz etc. will have weightage of 06 marks For the end semester examination, nine questions are to be set by the examiner. A candidate is required to attempt 5 questions in all. All questions carry equal marks. Question number 1 will be compulsory and based on the entire syllabus. It will contain seven parts of 2 marks each. Question numbers 2 to 9 will be given by setting two questions from each of the four units of the syllabus. A candidate is required to attempt the remaining four questions by selecting one question from each of the four units.

Pre-requisites: Basics of probability

About the Course:
It is important to know essentials of statistics to become a successful data analyst or researcher. This course is tailored to introduce the graduating engineering to the fundamentals of statistics so that they can analyze data and draw inference from it.

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

CO1. **define** basic tools of data analysis. (LOTS: Level 1: Remember)
CO2. **explain** the concepts given in descriptive and inferential statistics (LOTS: Level 2:Understand)
CO3. apply statistical concepts to solve real world statistical computing problems. (LOTS:Level 3: Apply)
CO4. **analyse** the trends in data using descriptive statistics. (LOTS: Level 4: Analyse)CO5. **interpret and evaluate** statistical models. (LOTS: Level 5: Evaluate)
CO6. **conclude** the findings of statistical analysis. (LOTS: Level 6:Create)

Course Content

Unit I

Review of Descriptive Statistics and Probability Theory: Scale of measurement and datatypes, Descriptive statistics, Frequency Tables and graphs, Relative frequency tables and graphs, grouping data, histograms and ogive, mean, median, mode, variance and standard deviation of sample data, Sample spaces and events, Axioms, Conditional Probability, Independent event, Bayes Theorem, Binomial Theorem.

Unit II

Random Variable and Distributions: Random variables, type of random variables, Mean (Expectation) and variance of a discrete random variables, Discrete uniform distribution, Bernoulli's distribution, Binomial distribution, Geometric distribution, Poisson's distribution, Mean and variance of a continuous random variable, Continuous uniform distribution: normal distribution, exponential distribution, Central Limit Theorem.

Unit III

Hypothesis testing: determining levels of significance, Types of hypothesis testing errors, Hypothesis testing for population mean for large and small samples; Comparing two population means for large and small independent samples; Comparing two population means for paired samples; Comparing two population proportions, Chi-Square, t test and F test, Analysis of variance (ANOVA).

Unit IV

Statistical Learning and Linear Regression: Definition of statistical learning, estimating a function f, the trade of between prediction accuracy and model comprehensibility, Regression versus Classification problems, Measuring the quality of fit, Bias and Variance trade off, Linear Regression between variables, Estimating the Coefficients, accessing the accuracy of the coefficient estimates, assessing the accuracy of the model, Multiple linear regression, estimating the multiple regression.

Text and Reference Books:

1. Ross Sheldon M., *Introduction to Probability and Statistics for Engineers and Scientists*, 4th edition,Academic Press, 2009.
2. Douglas S. Shafer and Zhang Zhiyi, *Beginning Statistics*, 2012. [Available freely onlineunder Creative Commons by-nc-sa 3.0 license]
3. Brain S. Everitt, *A Handbook of Statistical Analysis Using R*, Second Edition, LLC 2014
4. Roger D. Peng, *R Programming for Data Science*, Lean Publishing, 2015.
5. Michael J. Crawley, *Statistics, An introduction using R*, Second edition, John Wiley,2015
6. Trevor Hastie, Robert Tibshirani, Jerome Friedman, *The Elements of Statistical Learning: DataMining, Inference and Prediction*, Springer, 2nd edition, 2009.

CO-PO Articulation Matrix Statistical Computing Course (PE/CSE/25-T)

List of Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CO1. **Define** basic tools of data analysis. (LOTS: Level 1: Remember)	1	–	–	–	–	–	–	–	–	–	–	–	–	–	3
CO2. **Explain** the concepts given in descriptive and inferential statistics (LOTS: Level 2: Understand)	1	–	–	–	–	–	–	–	–	–	–	–	–	–	3
CO3. **Apply** statistical concepts to solve real world statistical computing problems. (LOTS: Level 3: Apply)	2	2	2	2	3	–	–	–	–	–	–	–	–	–	3
CO4. **Analyse** the trends in data using descriptive statistics. (LOTS: Level 4: Analyse)	2	3	2	3	3	–	–	–	–	–	–	–	–	–	3
CO5. **Interpret and evaluate** statistical models. (LOTS: Level 5: Evaluate)	2	2	2	3	3	–	–	–	–	–	–	–	–	–	3
CO6. **Conclude** the findings of statistical analysis.(LOTS: Level6: Create	2	3	2	3	–	–	–	–	–	–	–	–	–	–	3
Level of Attainments PE/CSE/25-T															

Digital Forensics

General Course Information

Course Code: PE/CSE/26-T Course Credits: 3 Type: Professional Core Contact Hours: 3 hours/week Mode: Lectures (L) Examination Duration:3 hours	**Course Assessment Methods (internal: 30; external: 70)** Three minor tests each of 20 marks will be conducted. The average of the highest marks obtained by a student in the any of the two minor examinations will be considered. Class Performance will be measured through percentage of lectures attended (04 marks). Assignments, quiz etc. will have weightage of 06 marks For the end semester examination, nine questions are to be set by the examiner. A candidate is required to attempt 5 questions in all. All questions carry equal marks. Question number 1 will be compulsory and based on the entire syllabus. It will contain seven parts of 2 marks each. Question numbers 2 to 9 will be given by setting two questions from each of the four units of the syllabus. A candidate is required to attempt the remaining four questions by selecting one question from each of the four units.

Pre-requisites: working knowledge of Windows/Macintosh/Linux, Network security.

About the Course:

The course on Digital Forensics is an inevitable study in this information era. Computer crimesare on a hike by the hackers and cyber criminals. The need to recover the deleted, hidden and corrupted files on Windows/Macintosh/Linux platforms give an opportunity to offer digital forensics automating features. This will give students a chance to study laws of court against computer crimes committed intentionally or inadvertently.

Course outcomes: By the end of the course students will be able to:

- CO1. **determine** the hardware and operating system requirements for digital forensics. (LOTS: Level 1: Remember)
- CO2. **represent** digital forensics by organization of data and metadata in computersystems. (LOTS: Level2: Understand)
- CO3. **analyze** file recovery and hidden file extraction techniques. (LOTS: Level 4: Analyze) CO4. **identify** various types of forensics in the arena of information technology. (LOTS: Level 4:Analyze)
- CO5. **critic** the computer crimes by studying the security Laws and legal Landscape around theworld.(LOTS: Level 5: Evaluate)
- CO6. **integrate** security of computer systems with digital forensics and evaluate its performance. (LOTS:Level 6: create)

Course Content

Unit I

Introduction to Digital Forensics: digital crimes, digital investigation, evidence, extraction, preservation etc.; overview of hardware and operating systems: structure of storage media/devices, Windows/Macintosh/Linux- registry, boot process; disk and file system analysis, data acquisition of physical storage devices.

Unit II

Data recovery: identifying hidden data, recovering deleted files; digital evidence controls: uncovering attacks that evade detection by event viewer, task manager and other windows GUI tools; disk imaging, recovering swap files, temporary and cache files; automating analysis and extending capabilities.

Unit III

Network Forensics: collecting and analyzing network-based evidence, reconstructing web browsing, email activity, intrusion detection, tracking offenders, windows registry changes, etc.; Mobile Network forensics: introduction, investigations, collecting evidences, where to seek digital data for further investigations; Email and database forensics; memory acquisition.

Unit IV

Computer crime and legal issues: intellectual property, privacy issues, criminal justice system for forensic, audit/investigative situations and digital crime scene, investigative procedure/standards for extraction, preservation and deposition of legal evidence in a court oflaw.

Text and Reference Books:

1. Thomas J Holt , Adam M Bossler, Kathryn C Seigfried-Spellar, *Cybercrime and Digital Forensics: AnIntroduction*, Routledge, 2015.
2. Cory Altheide and Harlan Carvey, *Digital Forensics with Open Source Tools,* Elsevier publication, April2011.
3. B. Nelson, A. Phillips, F. Enfinger, C. Steuart, *Guide to Computer Forensics and Investigations* 4thedition, Thomson, 2009.
4. Michael Hale Ligh, Andrew Case, Jamie Levy, AAron Walters, *The Art of Memory Forensics: Detecting Malware and Threats in Windows, Linux, and Mac Memory*, july 2014.

CO-PO Articulation Matrix Digital Forensics Course (PE/CSE/26-T)

List of Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CO1. **Determine** the hardware and operating system requirements for digital forensics. (LOTS: Level 1: Remember)	1	–	–	–	–	–	–	–	–	–	–	–	–	2	–
CO2. **Represent** digital forensics by organization of dataand metadata in computer systems. (LOTS: Level 2: Understand)	1	–	–	–	–	–	–	–	–	–	–	–	–	3	–
CO3. **Analyze** file recovery and hidden file extraction techniques. (LOTS: Level 4: Analyze)	2	2	–	–	3	–	–	–	–	–	–	–	–	3	–
CO4. **Identify** various types of forensics in the arena of information technology. (LOTS: Level 4: Analyze)	2	2	2	2	3	–	–	–	–	–	–	–	–	3	2
CO5. **Critic** the computer crimes by studying the securityLaws and legal Landscape around the world. (LOTS: Level 5: Evaluate)	3	3	3	3	–	3	–	3	–	3	–	–	–	3	–
CO6. Integrate security of computer systems with digital forensics and evaluate its performance. (LOTS: Level 6: create)	3	3	2	3	3	–	–	–	–	–	–	–	–	3	–
Level of Attainments PE/CSE/26-T															

Internet of Things Lab.

General Course Information

Course Code: PE/CSE/17-P Course Credits: 1 Type: Professional Core Lab. Course Mode: Lab practice andassignments Contact Hours: 2 hours / week	**Course Assessment Methods (internal: 50; external: 50)** The internal and external assessment is based on the level of participation in lab. sessions and the timely submission of lab experiments/assignments, the quality of solutions designed for the assignments, the performance in VIVA- VOCE, the quality of lab. file and ethical practices followed. The internal examination is conducted by the course coordinator. The external examination is conducted by external examiner appointed by the Controller of Examination in association with the internal examiner appointed by the Chairperson of the Department.

Pre-requisites: Basic knowledge of C/C++ language, Basics of Electronics.

About the Course:

This course focuses on significant components of Internet of Things. The objective of this labcourse is to make the students familiar with prototype and key components of networking for development of application based on Internet of Things.

Course outcomes: By the end of the lab course students will be able to:

CO1. **solve** the existing problems of traditional sensor networks and wireless communication using the concepts of Internet of Things. (LOTS: Level 3: Apply)
CO2. **analyse** the working of controllers and sensors. (LOTS: Level 4: Analyse)
CO3. **compare** and contrast the existing solutions related to IOT. (LOTS: Level 5:Evaluate)
CO4. **design** solutions for practical assignments by using Internet of Things technologies.(LOTS: Level 6:Create)
CO5. **create** lab reports by presenting the ideas regarding solutions in an effectivemanner. (LOTS: Level6: Create)
CO6. **demonstrate** independent enquiry, team spirit and ethical practices while solvingproblems. (LOTS: Level 3: Apply)

List of experiments/assignments:

1. In order to implement IoT practical assignments one needs the following:
   - Hardware Setup- device capable of storage and network, e.g. Raspberry Pi,Intel Galileo, Intel, Edison, Multiple sensors etc.
   - Software- Wiring Pi (C++ for Raspberry Pi), Wiring x86 (Python for Intel Edison)
   - API to connect hardware to web server
   - Web Interface
2. Two assignments to figure out input and output devices.
3. Two assignments to interface digital and analogue devices with microcontroller unit.
4. Two assignment for calibration of sensors.
5. Two assignments for receiving data from sensors serially.
6. Two assignments to read the values from sensors.
7. Two assignments based on testing of temperature sensor, integrating of temperature sensor with microcontroller, temperature control over internet.

Note:

The actual experiments/assignments will be designed by the course coordinator. One assignment should be designed to be done in groups of two or three students. The assignments must meet the objective of the course and the levels of the given course outcomes. The list of assignments and schedule of submission will be prepared by the course coordinator at the beginning of the semester.

CO-PO Articulation Matrix Internet of Things Lab. Course (PE/CSE/17-P)

List of Course Outcomes		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CO1.	**Solve** the existing problems of traditional sensor networks and wireless communication using the concepts of Internet of Things. (LOTS: Level 3: Apply)	2	2	2	2	3	_	_	_	_	_	_	_	_	3	2
CO2.	**Analyse** the working of controllers and sensors. (LOTS: Level 4: Analyse)	2	2	2	3	3	_	_	_	_	_	_	_	_	3	2
CO3.	**Compare** and contrast the existing solutions related to IOT. (LOTS: Level 5: Evaluate)	3	2	2	3	2	_	_	_	_	_	_	_	_	3	2
CO4.	**Combining** Internet of Things technologies for designing solutions for complex problems. (LOTS: Level 6: Create)	3	3	2	3	3	_	_	_	_	_	_	_	_	3	3
CO5.	**Create** lab reports by presenting the ideas regarding solutions in an effective manner. (LOTS: Level 6: Create)	_	_	_	_	_	_	_	_	_	3	_	_	_	_	_
CO6.	**Demonstrate** independent enquiry, team spirit and ethical practices while solving problems. (LOTS: Level 3: Apply)	_	_	_	_	_	_	_	3	3	_	3	_	_	_	_
Level of Attainments PE/CSE/17-P																

Network Administration and Management Lab.

General Course Information

Course Code: PE/CSE/18-P Course Credits: 1 Type: Professional Core Lab. Course Mode: Lab practice andassignments Contact Hours: 2 hours / week	**Course Assessment Methods (internal: 50; external: 50)** The internal and external assessment is based on the level of participation in lab. sessions and the timely submission of lab experiments/assignments, the quality of solutions designed for the assignments, the performance in VIVA- VOCE, the quality of lab. file and ethical practices followed. The internal examination is conducted by the course coordinator. The external examination is conducted by external examiner appointed by the Controller of Examination in association with the internal examiner appointed by the Chairperson of the Department.

Pre-requisites: knowledge of Computer Networks, System Administration, Unix/Linux Command line.

About the Course:

This lab. course on Network Administration and Management involves configuration of servers for different platforms. It incorporates setting up of ones' machine to be connected to a Network and checking its status frequently for any intrusion. The objective of the lab. course is to equip the students to solve the practical Administration, Management and Monitoring related problems.

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

CO1. **configure** a server to work as a DNS/DHCP/FTP/Web/Mail/Print server (LOTS: Level3: Apply)
CO2. **detect** the trends in attacks through in depth attack analysis. (LOTS: Level 4: Analyse)
CO3. **formulate** solutions for Monitoring assignments by using principles of Networkstatistics. (LOTS:Level 6: Create)
CO4. **plan** solutions for overall security of Computer/Network systems. (LOTS: Level 6:Create)
CO5. **create** file records of solutions of assignments. (LOTS: Level 6: Create)
CO6. **demonstrate** use of ethical practices, self-learning and team spirit. (LOTS: Level 3:Apply)

List of experiments/assignments:

1. Management (creation, modification and deletion of left users) of the users & theirdomain.
2. Setting up the local security policy for the system, software.
3. Maintaining your system in Linux Networking and Setup Linux for firewall and IPfiltering.
4. Configure the kernel for IP Accounting and IP Masquerade.
5. Install sendmail distribution and create sendmail configuration files.
6. Start and stop services from user window and command prompt.
7. Use of event viewer and performance monitor.
8. Management of the IIS and FTP server.
9. Setting up of router in Window 2000 server and Linux server.
10. Use of utilities (a) Ping(b) Tracert (c) netstat(d) net(e) IP configuration (f) Path ping
11. Monitor the Network using performance monitoring tools such as RMON, tcpdump etc.
12. Setting up of a DNS server.
13. Setting up and use "Terminal Client Services".

Note:

The actual experiments/assignments will be designed by the course coordinator. One assignment should be designed to be done in groups of two or three students. The assignments must meet the objective of the course and the levels of the given course outcomes. The list of assignments and schedule of submission will be prepared by the course coordinator at the beginning of the semester.

CO-PO Articulation Matrix Network Administration and Management Lab. Course (PE/CSE/18-P)

List of Course Outcomes		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CO1.	**Configure** a server to work as a DNS/DHCP/FTP/Web/Mail/Print server (LOTS: Level 3:Apply)	1	_	2	_	3	_	_	_	_	_	_	_	_	3	_
CO2.	**Detect** the trends in attacks through in depth attack analysis.(LOTS: Level 4: Analyse)	2	2	2	2	3	_	_	_	_	_	_	_	_	3	_
CO3.	**Formulate** solutions for Monitoring assignments by using principles of Network statistics. (LOTS: Level 6: Create)	3	3	3	3	3	_	_	_	_	_	_	_	_	3	_
CO4.	**Plan** solutions for overall security of Computer/Network systems. (LOTS: Level 6: Create)	3	3	3	3	3	2	_	_	_	_	_	_	_	3	_
CO5.	**Create** file records of solutions of assignments. (LOTS: Level 6: Create)	_	_	_	_	_	_	_	_	_	3	_	_	_	_	_
CO6.	**Demonstrate** use of ethical practices, self- learning and team spirit. (LOTS: Level 3: Apply)	_	_	_	_	_	_	_	3	3	_	_	3	_	_	_
Level of Attainments PE/CSE/18-P																

Software Testing and Quality Assurance Lab.

General Course Information

Course Code: PE/CSE/19-P Course Credits: 1 Type: Professional Core Lab. Course Mode: Lab practice andassignments Contact Hours: 2 hours / week	**Course Assessment Methods (internal: 50; external: 50)** The internal and external assessment is based on the level of participation in lab. sessions and the timely submission of lab experiments/assignments, the quality of solutions designed for the assignments, the performance in VIVA- VOCE, the quality of lab. file and ethical practices followed. The internal examination is conducted by the course coordinator. The external examination is conducted by external examiner appointed by the Controller of Examination in association with the internal examiner appointed by the Chairperson of the Department.

Pre-requisites: Knowledge of Software Engineering along with Programming in C/C++/Java or /MATLAB.

About the Course:
In this lab. Course, students learn to design, generate, minimize, and prioritize test cases of a software application using programming language or with the help of software testing tools. The lab experiments involve designing testing datasets by taking case studies and applying software testing techniques on these datasets. The course has a special focus on understanding and implementation of test results of software testing techniques to improve software quality.

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

CO1. **implement** software testing using testing tools. (LOTS: Level 3: Apply)
CO2. **apply** software testing techniques for the classification of test cases. (LOTS: Level 3: Apply)
CO3. **interpret** the results of various software testing techniques. (LOTS: Level 4: Analyse) CO4. **plan** test case activities. (LOTS: Level 6: Create)
CO5. **prepare** lab reports for software quality testing assignments. (LOTS: Level 6: Create) CO6. **demonstrate** use of ethical practices, self-learning and team spirit. (LOTS: Level 3: Apply)

List of experiments/assignments

1. Write a program to count the number of digits in a number. Its input is any number from interval [0,9999]. Design the boundary value analysis test cases and robustness test cases.
2. Write a program to calculate cyclomatic complexity.
3. Consider a program to perform binary search and generate the test cases using equivalence class testing and decision table based testing.
4. Write a program to determine whether a number is even or odd. Draw the programgraph and DD path graph. Find the independent paths.
5. Consider the program for classification of a triangle. Consider all variables and generate possible program slices. Design at least one test case from every slice.
6. Consider the problem statement of a University Student Registration System. Prepare the software requirement checklist with the details of faults in the given SRS.
7. Write a program to generate, minimize and prioritize test cases using any programming language/Matlab Tool/Software Testing tool.
8. Write the outline of test plan document as per IEEE Std 829-1998.
9. One assignment to be done in groups.

Note:

The actual experiments/assignments will be designed by the course coordinator. One assignment should be designed to be done in groups of two or three students. The assignments must meet the objective of the course and the levels of the given course outcomes. The list of assignments and schedule of submission will be prepared by the course coordinator at the beginning of the semester.

CO-PO Articulation Matrix Software Testing and Quality Assurance Lab. Course (PE/CSE/19-P)

List of Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO1	PSO2	PSO3
CO1. **Implement** software testing using testing tools. (LOTS: Level 3: Apply)	2	2	2	2	3	_	_	_	_	_	_	_	3	_	_
CO2. **Apply** software testing techniques for the classification oftest cases. (LOTS: Level 3: Apply)	2	2	2	2	3	_	_	_	_	_	_	_	3	_	_
CO3. **Interpret** the results of various software testing techniques. (LOTS: Level 4: Analyse)	3	2	3	3		_	_	_	_	_	_	_	3	_	_
CO4. **Plan** test case activities. (LOTS: Level 6: Create)	3	3	3	3	3	_	_	_	_	_	3	_	3	_	_
CO5. **Prepare** lab reports for software quality testing assignments. (LOTS: Level 6: Create)	_	_	_	_	_	_	_	_	_	3	_	_	_	_	_
CO6. **Demonstrate** use of ethical practices, self- learning and team spirit. (LOTS: Level 3: Apply)	_	_	_	_	_	_	_	3	3	_	_	3	_	_	_
Level of Attainments PE/CSE/19-P														_	_

Pattern Recognition (Lab)

General Course Information

Course Code: PE/CSE/20-P Course Credits: 1 Type: Professional Core Lab. Course Mode: Lab practice and assignments Contact Hours: 2 hours / week	**Course Assessment Methods (internal: 50; external: 50)** The internal and external assessment is based on the level of participation in lab. sessions and the timely submission of lab experiments/assignments, the quality of solutions designed for the assignments, the performance in VIVA-VOCE, the quality of lab. file and ethical practices followed. The internal examination is conducted by the course coordinator. The external examination is conducted by external examiner appointed by the Controller of Examination in association with the internal examiner appointed by the Chairperson of the Department.

Pre-requisites: Knowledge of Programming in C/C++/Java or MATLAB.

About the Course:
In this lab. Course, students learn to Pattern recognition i.e generally categorized according tothe type of learning procedure used to generate the output value.

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

CO1. **implement** random variable algorithms. (LOTS: Level 3: Apply)
CO2. **apply** feature representation techniques for the classification of samples. (LOTS: Level 3: Apply)
CO3. **interpret** the results of various data clustering techniques. (LOTS: Level 4: Analyse) CO4. **plan** activities related to learning. (LOTS: Level 6: Create)
CO5. **prepare** lab reports for pattern recognitition assignments. (LOTS: Level 6: Create) CO6. **demonstrate** use of ethical practices, self-learning and team spirit. (LOTS: Level 3: Apply)

List of experiments/assignments

1. Feature Representation
2. Mean and Covariance
3. Linear Perceptron Learning
4. Generation of Random Variables
5. Bayesian Classification
6. MLE: Learning the classifier from data
7. Data Clustering: K-Means, MST-based

One assignment to be done in groups.

Note:

The actual experiments/assignments will be designed by the course coordinator. One assignment should be designed to be done in groups of two or three students. The assignments must meet the objective of the course and the levels of the given course outcomes. The list of assignments and schedule of submission will be prepared by the course coordinator at the beginning of the semester.

CO-PO Articulation Matrix Pattern Recognition Lab. Course (PE/CSE/20-P)

List of CourseOutcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1 **implement** random variable algorithms. (LOTS: Level 3: Apply)	2	2	2	2	3	–	–	–	–	–	–	–	3	–	–
CO2 **apply** feature representation techniques for the classification of samples. (LOTS: Level3: Apply)	2	2	2	2	3	–	–	–	–	–	–	–	3	–	–
CO3 **interpret** the results of various data clustering techniques. (LOTS: Level 4: Analyse)	3	2	3	3		–	–	–	–	–	–	–	3	–	–
CO4 **plan** activities related to learning. (LOTS: Level 6: Create)	3	3	3	3	3	–	–	–	–	–	3	–	3	–	–
CO5 **prepare** lab reports for pattern recognitition assignments. (LOTS: Level 6: Create)	–	–	–	–	–	–	–	–	–	3	–	–	–	–	–
CO6 **demonstrate** use of ethical practices, self-learning and team spirit. (LOTS: Level 3: Apply)	–	–	–	–	–	–	–	3	3	–	–	3	–	–	–
Level of Attainments PE/CSE/20-P														–	–

Artificial Neural Network

General Course Information

Course Code: PE/CSE/21-P Course Credits: 1 Type: Professional Core Lab. Course Mode: Lab practice and assignments Contact Hours: 2 hours / week	**Course Assessment Methods (internal: 50; external: 50)** The internal and external assessment is based on the level of participation in lab. sessions and the timely submission of lab experiments/assignments, the quality of solutions designed for the assignments, the performance in VIVA- VOCE, the quality of lab. file and ethical practices followed. The internal examination is conducted by the course coordinator. The external examination is conducted by external examiner appointed by the Controller of Examination in association with the internal examiner appointed by the Chairperson of the Department.

Pre-requisites: Knowledge of Artificial Intelligence

About the Course:
In this lab. Course, students learn to design, generate, minimize, and prioritize test cases of a software application using programming language or with the help of software testing tools. The lab experiments involve designing testing datasets by taking case studies and applying software testing techniques on these datasets. The course has a special focus on understanding and implementation of test results of software testing techniques to improve software quality.

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

CO1. **implement** different neural network models. (LOTS: Level 3: Apply)CO2. **apply** optimization techniques. (LOTS: Level 3: Apply)
CO3. **interpret** the results of various problems solved through neural network. (LOTS:Level 4: Analyse)
CO4. **plan** pattern storage task activities. (LOTS: Level 6: Create)
CO5. **prepare** lab reports for ANN assignments. (LOTS: Level 6: Create)
CO6. **Demonstrate** use of ethical practices, self-learning and team spirit. (LOTS: Level 3: Apply)

List of experiments/assignments

1. Parallel and distributed processing - I: Interactive activation and competition models
2. Parallel and distributed processing - II: Constraint satisfaction neural network models
3. Perceptron learning
4. Multi layer feed forward neural networks
5. Hopfield model for pattern storage task
6. Hopfield model with stochastic update
7. Competitive learning neural networks for pattern clustering
8. Solution to travelling salesman problem using self organizing maps
9. Solution to optimization problems using Hopfield models
10. Weighted matching problem: Deterministic, stochastic and mean-field annealing of anHopfield model

One assignment to be done in groups.

Note:

The actual experiments/assignments will be designed by the course coordinator. One assignment should be designed to be done in groups of two or three students. The assignments must meet the objective of the course and the levels of the given course outcomes. The list of assignments and schedule of submission will be prepared by the course coordinator at the beginning of the semester.

CO-PO Articulation Matrix Artificial Neural Network Lab. Course (PE/CSE/21-P)

List of Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1 **implement** different neural network models. (LOTS: Level 3: Apply)	2	2	2	2	3	–	–	–	–	–	–	–	3	–	–
CO2 **apply** optimization techniques. (LOTS: Level 3 Apply)	2	2	2	2	3	–	–	–	–	–	–	–	3	–	–
CO3. **interpret** the results of various problems solved through neural network. (LOTS:Level 4: Analyse)	3	2	3	3		–	–	–	–	–	–	–	3	–	–
CO4. **plan** pattern storage task activities. (LOTS: Level 6: Create)	3	3	3	3	3	–	–	–	–	–	3	–	3	–	–
CO5. **prepare** lab reports for ANN assignments. (LOTS: Level 6: Create)	–	–	–	–	–	–	–	–	–	3	–	–	–	–	–
CO6. **Demonstrate** use of ethical practices, self-learning and team spirit. (LOTS: Level 3: Apply)	–	–	–	–	–	–	–	3	3	–	–	3	–	–	–
Level of Attainments PE/CSE/21-P														–	–

.NET using C# Lab.

General Course Information

Course Code: PE/CSE/22-P Course Credits: 1 Type: Professional Core Lab. Course Contact Hours: 2 hours/week Mode: Lab practice and assignments	**Course Assessment Methods (internal: 50; external: 50)** The internal and external assessment is based on the level of participation in lab. sessions and the timely submission of lab experiments/assignments, the quality of solutions designed for the assignments, the performance in VIVA- VOCE, the quality of lab. file and ethical practices followed. The internal examination is conducted by the course coordinator. The external examination is conducted by external examiner appointed by the Controller of Examination in association with the internal examiner appointed by the Chairperson of the Department.

Pre-requisites: Programming knowledge of C++ and HTML basics

About the Course:
This lab course involves implementation of basic and advanced programs of C#. The objective of the lab. course is to train the students to solve the problems related to Object Oriented Technology, ADO.NET Connectivity andWeb Applications using XML.

Course Outcomes: By the end of the lab course a student would be able to:

CO1. **implement** C# programs in .NET framework. (LOTS: Level 3: Apply)
CO2. **apply** ADO.NET for developing database applications. (LOTS: Level 3: Apply)
CO3. **analyse** given programs for their correctness and efficiency for given inputs andexpected outputs. (LOTS: Level 4: Analysis)
CO4. **integrate** HTML code with ASP.NET and HTML code for designing a web pages.(LOTS: Level 6: Create)
CO5. **create** written records for the given assignments with problem definition, design ofsolution and conclusions. (LOTS: Level 6: Create)
CO6. **demonstrate** ethical practices while solving problems individually or in groups(LOTS: Level 3:Apply).

List of experiments/assignments

- Write a console application that obtains four int values from the user and displays the product.
- Write an application that receives the following information from a set of students:Student Id:
- Student Name:
- Course Name:
- Date of Birth:
- The application should also display the information of all the students once thedata is Entered. Implement this using an Array of Structures.
- Database programs with ASP.NET and ADO.NET Create a Login Module which adds Username and Password in the database. Username in the database should be a primary key.
- Create a web application to insert 3 records inside the SQL database table having following fields (DeptId, DeptName, EmpName, Salary). Update the salary for any oneemployee and
- increment it to 15% of the present salary. Perform delete operation on 1 row of the database table.
- Create a web page to display the cricket score from the table event(id, name, score). Refresh thewebsite automatically after every 30 seconds.
- Write a C# Sharp program to extract the Date property and display the DateTime value in the formatted output
- Write a program in C# Sharp to count a total number of alphabets, digits and special characters

in a string.

- Create a web page to display animation using JQuery.
- Create a web page to display hide, show, slide down, slide up and Toggle effects for paragraph tags, using JQuery

Note:
The actual experiments/assignments will be designed by the course coordinator. One assignment should be designed to be done in groups of two or three students. The assignments must meet the objective of the course and the levels of the given course outcomes. The list of assignments and schedule of submission will be prepared by the course coordinator at the beginning of the semester.

CO-PO Articulation Matrix .NET using C# Lab. (PE/CSE/22-P)

List of Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1. **Implement** C# programs in .NET framework. (LOTS: Level 3: Apply)	2	1	-	-	3	_	_	_	_	_	_	_	_	_	2
CO2. **Apply** ADO.NET for developing database applications. (LOTS: Level 3: Apply)	2	2	-	3	3	_	_	_	_	_	_	_	_	_	3
CO3. **Analyse** given programs for their correctness and efficiency for given inputs and expected outputs. (LOTS: Level 4: Analysis)	3	3	-	3	3	_	_	_	_	_	_	_	_	_	3
CO4. **Integrate** HTML code with ASP.NET and HTMLcode for designing web pages. (LOTS: Level 6: Create)	3	3	1	3	3	_	_	_	_	_	_	_	_	_	3
CO5. **Create** written records for the given assignmentswith problem definition, design of solution and conclusions. (LOTS: Level 6: Create)	_	_	_	_	_	_	_	_	_	3	_	_	_	_	_
CO6. **Demonstrate** ethical practices while solving problems individually or in groups (LOTS: Level 3: Apply).	_	_	_	_	_	_	_	3	3	_	_	3	_	_	_
Level of Attainments PE/CSE/22-P															

Big Data Analytics Lab.

General Course Information

Course Code: PE/CSE/23-P Course Credits: 1 Type: Professional Core Lab. Course Mode: Lab practice andassignments Contact Hours: 2 hours / week	**Course Assessment Methods (internal: 50; external: 50)** The internal and external assessment is based on the level of participation in lab. sessions and the timely submission of lab experiments/assignments, the quality of solutions designed for the assignments, the performance in VIVA- VOCE, the quality of lab. file and ethical practices followed. The internal examination is conducted by the course coordinator. The external examination is conducted by external examiner appointed by the Controller of Examination in association with the internal examiner appointed by the Chairperson of the Department.

Pre-requisites: Some basic knowledge and experience of Java (JARS, Array, Classes, Objects,etc.)

About the Course:

This lab course provides an overview of key technology used in manipulating, storing, andanalyzing big data. This incorporates big data analytics and use of Hadoop.

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

CO1. **implement** solutions for big data problem. (LOTS: Level 3: Apply) CO2. **apply** Hadoop ecosystem components. (LOTS: Level 3: Apply) CO3. **analyse** the results of big data algorithms. (LOTS: Level 4: Analyse)

CO4. **build** and maintain reliable, scalable, distributed systems. (LOTS: Level 6: Create)

CO5. **create** lab record of the lab assignments that contains problem definitions, their solutions in big data perspective and the interpretation of the results. (LOTS: Level 6: Create)

CO6. **demonstrate** ethical practices, self-learning and team spirit. (LOTS: Level 3: Apply)

List of experiments/assignments

1. Installing and configuring Hadoop cluster.
2. Manipulating files in HDFS using Hadoop fs commands.
3. Hadoop File Systems: IBM GPFS, MapR-FS, Lustre, Amazon S3 etc.
4. Writing an Inverted Index MapReduce Application.
5. Distributed Cache MapReduce Design Patterns Sorting Joins.
6. Writing a streaming MapReduce job in Hadoop.
7. Big Data and R: Clustering, Simple Linear Regression, Decision Trees, Naïve Bayesian Classification
8. Big Data Interactions: Big Data and Cloud: Big Data and Web Services /SOA:BigData and Internet of Things (IoT)
9. Big Data Case Study: Healthcare Data: Web Click stream Data: Social Media Data [RSS, Tweets]

Note:

The actual experiments/assignments will be designed by the course coordinator. One assignment should be designed to be done in groups of two or three students. The assignments must meet the objective of the course and the levels of the given course outcomes. The list of assignments and schedule of submission will be prepared by the course coordinator at the beginning of the semester.

CO-PO Articulation Matrix Big Data Analytics Lab. Course (PE/CSE/23-P)

List of Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO1	PSO2	PSO3
CO1. **Implement** solutions for big data problem. (LOTS: Level 3:Apply)	2	2	2	2	3	_	_	_	_	_	_	_	_	_	3
CO2. **Apply** Hadoop ecosystem components. (LOTS: Level 3:Apply)	2	2	2	2	3	_	_	_	_	_	_	_	_	_	3
CO3. **Analyse** the results of big data algorithms. (LOTS: Level 4:Analyse)	3	2	2	3	3	_	_	_	_	_	_	_	_	_	3
CO4. **Build** and maintain reliable, scalable, distributed systems.(LOTS: Level 6: Create)	2	3	3	3	3	_	_	_	_	_	_	_	_	_	3
CO5. **Create** lab record of the lab assignments that contains problem definitions, their solutions in bigdata perspective and the interpretation of the results. (LOTS: Level 6: Create)	_	_	_	_	_	_	_	_	_	3	_	_	_	_	_
CO6. **Demonstrate** ethical practices, self-learning andteam spirit.(LOTS: Level 3: Apply)	_	_	_	_	_	_	_	3	3	_	_	3	_	_	_
Level of Attainments PE/CSE/23-P															

Web Development Lab.

General Course Information

Course Code: PE/CSE/24-P Course Credits: 1 Type: Professional Core Lab. Course Mode: Lab practice andassignments Contact Hours: 2 hours / week	**Course Assessment Methods (internal: 50; external: 50)** The internal and external assessment is based on the level of participation in lab. sessions and the timely submission of lab experiments/assignments, the quality of solutions designed for the assignments, the performance in VIVA- VOCE, the quality of lab. file and ethical practices followed. The internal examination is conducted by the course coordinator. The external examination is conducted by external examiner appointed by the Controller of Examination in association with the internal examiner appointed by the Chairperson of the Department.

Pre-requisites: Basic programming skills and knowledge of surfing internet.

About the Course:
This lab. course on web development involves learning web-based programming languages. It incorporates the development of web pages by structuring information provided for the website design. The objective of the lab course is to equip the students to design web pages using modernweb development tools.

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

CO1. **implement** object models for website design using modern tools like HTML,XMLand JAVAscripting etc. (LOTS: Level 3: Apply)
CO2. **analyse** the design of websites. (LOTS: Level 4: Analyse)
CO3. **test** the design of websites. (LOTS: Level 5: Evaluate)
CO4. **design** websites that consider socio-cultural values. (LOTS: Level 6: Create)CO5. **create** a written report for website designed. (LOTS: Level 6: Create)
CO6. **use** ethical practices and socio-cultural values while designing websites. (LOTS: Level3: Apply)

List of experiments/assignments

1. Create a simple webpage using HTML.
2. Designing of registration form with table and use of hyperlink.
3. Design a page with frames to include Images and Videos.
4. Add a cascading style sheet for designing the web page.
5. Use user defined function to get array of values and sort them in ascending order on webpage
6. Design a dynamic web page with validation of form field using JavaScript.
7. Design a catalogue in ASP.
8. Event Handling Validation of registration form.
9. Open a Window from the current window on Mouse Over event.
10. Create a simple application to demonstrate Servlets Request and Response object.
11. Demonstrate Array Objects and Date Object's predefined methods
12. Display calendar for the month and year selected from combo box
13. Create a welcome Cookie (Hit for a page) and display different image and textcontent each time whenthe user hit the page
14. Demonstrate Request and Response object using HTML Form.

15. Database Connection to display all the values in the table.

Note:

The actual experiments/assignments will be designed by the course coordinator. One assignment should be designed to be done in groups of two or three students. The assignments must meet the objective of the course and the levels of the given course outcomes. The list of assignments and schedule of submission will be prepared by the course coordinator at the beginning of the semester.

CO-PO Articulation Matrix Web Development Lab. Course (PE/CSE/24-P)

List of Course Outcomes		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CO1.	**Implement** object models for website design using modern tools like HTML, XMLand JAVA scripting etc. (LOTS: Level 3: Apply)	2	2	2	_	3	_	_	_	_	_	_	_	3	_	_
CO2.	**Analyse** the design of websites. (LOTS: Level 4: Analyse)	3	3	2	2	3	_	_	_	_	_	_	_	3	_	_
CO3.	**Test** the design of websites. (LOTS: Level 5: Evaluate)	2	3	2	2	3	_	_	_	_	_	_	_	3	_	_
CO4.	**Design** websites that consider socio-cultural values. (LOTS:Level 6: Create)	3	3	3	3	3	3	_	_	_	_	_	_	3	_	_
CO5.	**Create** a written report for website designed. (LOTS: Level6: Create)	_	_	_	_	_	_	_	_	_	3	_	_	_	_	_
CO6.	**Use** ethical practices and socio-cultural values while designing websites. (LOTS: Level 3: Apply)	_	_	_	_	_	_	_	3	3	_	_	3	_	_	_
Level of Attainments PE/CSE/24-P																

Statistical Computing Lab.

General Course Information

Course Code: PE/CSE/25-P Course Credits: 1 Type: Professional Core Lab. Course Mode: Lab practice andassignments Contact Hours: 2 hours / week	**Course Assessment Methods (internal: 50; external: 50)** The internal and external assessment is based on the level of participation in lab. sessions and the timely submission of lab experiments/assignments, the quality of solutions designed for the assignments, the performance in VIVA- VOCE, the quality of lab. file and ethical practices followed. The internal examination is conducted by the course coordinator. The external examination is conducted by external examiner appointed by the Controller of Examination in association with the internal examiner appointed by the Chairperson of the Department.

Pre-requisites: Basic Statistics and Programming in Python, R

About the Course:
In this lab. Course, students learn to solve statistical computing problems using R or Python. Thelab experiments involve applying statistical tools for analyzing and inferring information from real world datasets. The course has a special focus on interpreting, evaluating and concluding from the results of statistical analysis.

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

CO1. **implement** statistical tools for drawing inference from data. (LOTS: Level 3: Apply)CO2. **explore** the trends in datasets using descriptive statistics. (LOTS: Level 4: Analyse) CO3. **apply** probability, hypothesis testing and regression for solving research questions. (LOTS: Level 3: Apply)

CO4. **Judge** different problem situations for applying appropriate statistical tests (LOTS:Level 5: Evaluate)

CO5. **create** lab records of assignment by incorporating problem definitions, design ofsolutions, resultsand interpretations. (LOTS: Level 6: Create)

CO6. **demonstrate** use of ethical practices, self-learning and team spirit. (LOTS: Level 3:Apply)

List of experiments/assignments

1. Install R and R studio.
2. Two assignments related to descriptive statistics.
3. Two assignments related to visualizing trends in data.
4. Three assignments related to permutations, combinations and probability.
5. Four assignments on Hypothesis Testing.
6. Two assignments on linear regression.
7. Two assignments on logistic regression.
8. One assignment to be done in groups.

Note:

The actual experiments/assignments will be designed by the course coordinator. One assignment should be designed to be done in groups of two or three students. The assignments must meet the objective of the course and the levels of the given course outcomes. The list of assignments and schedule of submission will be prepared by the course coordinator at the beginning of the semester.

CO-PO Articulation Matrix Statistical Computing Lab. Course (PE/CSE/25-P)

List of Course Outcomes		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CO1.	**Implement** statistical tools for drawing inferencefrom data.(LOTS: Level 3: Apply)	2	2	2	3	3	–	–	–	–	–	–	–	–	–	3
CO2.	**Explore** the trends in datasets using descriptive statistics.(LOTS: Level 4: Analyse)	2	2	2	2	3	–	–	–	–	–	–	–	–	–	3
CO3.	**Apply** probability, hypothesis testing and regression for solving research questions. (LOTS: Level 3: Apply)	2	3	2	3	3	–	–	–	–	–	–	–	–	–	3
CO4.	**Judge** different problem situations for applying appropriate statistical tests (LOTS: Level 5: Evaluate)	3	3	3	3	3	–	–	–	–	–	–	–	–	–	3
CO5.	**Create** lab records of assignment by incorporating problem definitions, design of solutions, results and interpretations. (LOTS: Level 6: Create)	–	–	–	–	–	–	–	–	–	3	–	–	–	–	–
CO6.	**Demonstrate** use of ethical practices, self- learning and team spirit. (LOTS: Level 3: Apply	–	–	–	–	–	–	–	3	3	–	–	3	–	–	–
Level of Attainments PE/CSE/25-P																

Digital Forensics Lab.

General Course Information

Course Code: PE/CSE/26-P Course Credits: 1 Type: Professional Core Lab. Course Mode: Lab practice andassignments Contact Hours: 2 hours / week	**Course Assessment Methods (internal: 50; external: 50)** The internal and external assessment is based on the level of participation in lab. sessions and the timely submission of lab experiments/assignments, the quality of solutions designed for the assignments, the performance in VIVA- VOCE, the quality of lab. file and ethical practices followed. The internal examination is conducted by the course coordinator. The external examination is conducted by external examiner appointed by the Controller of Examination in association with the internal examiner appointed by the Chairperson of the Department.

Pre-requisites: The students are expected to have a knowledge of components of computer system, operating systems like Windows, Macintosh, Linux.

About the Course:
This course on Digital Forensics is a developmental laboratory work. It incorporates file system recovery related to various operating systems. The objective of the lab course is to equip the students to solve the practical digital forensics issues.

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

- CO1. **employ** the digital forensics tools for file system analysis. (LOTS: level 3: Apply)
- CO2. **test** ethical practices while solving the problems at hand. (LOTS: level 4: Analyze)
- CO3. **select** open-source tools for imaging various types of media by wiping a target drive.(LOTS: level 5: evaluate)
- CO4. **develop** solutions for disk imaging and like problems in different hardware conditionsand for various operating systems. (LOTS: level 6: create)
- CO5. **design** Lab record for the assignments including aim, hardware and softwarerequirements and solutions to given problems. (LOTS: Level 6: Create)
- CO6. **demonstrate** independent enquiry, use of ethical practices and self-learning to solveunseen problems. (LOTS: level 2: understand)

List of experiments/assignments:

1. Two assignments on forensically examining Window registry for evidences located init.
2. Two assignments on wiping a target drive and ensure that it is wiped, imagingvarious types of media such as hard drives, USB flash drives, optical drives, ZIP disks.
3. Two assignments on system restore points and how they are valuable in a forensic investigation.
4. Two assignments on open-source tool autopsy for timeline analysis, hash filteringand file system analysis.
5. Two-three assignments on open-source tool Caine for mobile forensics, Network forensics, data recovery.
6. Two-three assignments on Helix3 for incident response and computer forensics.

Note:

The actual experiments/assignments will be designed by the course coordinator. One assignment should be designed to be done in groups of two or three students. The assignments must meet the objective of the course and the levels of the given course outcomes. The list of assignments and schedule of submission will be prepared by the course coordinator at the beginning of the semester.

CO-PO Articulation Matrix Digital Forensics lab. Course (PE/CSE/26-P)

List of Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO1	PSO2	PSO3
CO1. **Employ** the digital forensics tools for file systemanalysis. (LOTS:level 3: Apply)	2	2	_	3	3	_	_	_	_	_	_	_	_	3	_
CO2. **Deploy** forensics techniques/algorithms in solvingproblems related to the arena of Engineering/Information Technology. (LOTS: Level 3: Apply)	2	3	2	2	3	_	_	_	_	_	_	_	_	3	_
CO3. **Select** open source tools for imaging various types of media bywiping a target drive. (LOTS: level 5: evaluate)	2	2	3	3	3	_	_	_	_	_	_	_	_	3	_
CO4. **Develop** solutions for system restore points and like problems in different hardware conditions and for various operating systems.(LOTS: level 6: create)	3	3	3	3	3	_	_	_	_	_	_	_	_	3	_
CO5. **Design** Lab record for the assignments including aim, hardware andsoftware requirements and solutions to given problems. (LOTS: Level 6: Create)	_	_	_	_	_	_	_	_	_	3	_	_	_	_	_
CO6. **Demonstrate** independent enquiry, use of ethical practices and self-learning to solve unseen problems. (LOTS: level 2: understand)	_	_	_	_	_	_	_	3	3	_	_	3	_	_	_
Level of Attainments PE/CSE/26-P															

Major Project II

General Project Information

Course Code: EEC/CSE/4-P Course Credits: 4 Mode: Self learning under the guidance of a faculty member. Contact hours: 12 hours/week	**Course Assessment Methods (Internal evaluation: 50 marks; External Evaluation marks: 50)** Evaluation is done by the internal examiner (project guide) and external examiner appointed by Controller of Examination. The criteria for evaluation are given below. 1. Review of literature related to problem domain: 15 2. Significance and originality of the solution presented: 15 3. Application of software engineering principles and project management: 15 4. Significance and Scope of results: 20 5. Organization and presentation of major project report: 20 6. Level of Ethics and societal issues covered: 15

About the major project II:

Students continue working on their project work and they are required to complete their project work by the end of VIII semester. Students carry out implementation of their respective projects based on the problem identified, methodology and tools suggested in the synopsis prepared during seventh semester. They prepare the final project reports according to the format provided. At the end of eighth semester, each student is required to present his/her project work in front of internal project guide and external examiner appointed by Controller of Examination.

Course Outcomes: After doing major Project students will be able to:

CO1. **review** information critically for solving complex engineering problems. (LOTS: Level 4: Analyse)

CO2. **plan** the project according to principles of project management.(LOTS: Level 6: Create)

CO3. **devise** original solutions to complex engineering problems using modernengineering tools. (LOTS: Level 6: Create)

CO4. **justify** the outcomes of the project work. (LOTS: Level 5: Evaluate)

CO5. **organize** and communicate (written and oral) ideas effectively. (LOTS: Level 6: Create)

CO6. **develop** solutions that meet ethical, societal and legal considerations. (LOTS: Level 6: Create)

CO-PO Articulation Matrix Course (EEC/CSE/4-P)

List of Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1. **Review** information critically for solving complex engineering problems. (LOTS: Level 4: Analyse)	2	2	2	3										
CO2. **Plan** the project according to principles of project management. (LOTS: Level 6: Create)	1	1	1								3	3		
CO3. **Devise** original solutions to complex engineering problems using modern engineering tools. (LOTS: Level 6: Create)	3	2	3	3	3	2								
CO4. **Justify** the outcomes of the project work. (LOTS: Level 5: Evaluate)	3	3	3	3		2								
CO5. **Organize** and communicate (written and oral) ideas effectively.(LOTS: Level 6: Create)										3	3			
CO6. **Develop** solutions that meet ethical, societal and legal considerations. (LOTS: Level 6: Create)								3	3			3		
Level of Attainments EEC/CSE/4-P														

LIST OF OPEN ELECTIVES (OE) COURSES TO BE OFFERED BY CSE BRANCH / DEPARTMENT TO THE STUDENTS OF OTHER BRANCH/ DEPARTMENT

OE-I: List of Open electives (For V semester):

OE/CSE/1-T: Internet & Application
OE/CSE/2-T: Introduction to Software Engineering
OE/CSE/3-T: Fundamental of Computer Networks
OE/CSE/4-T: Fundamentals of Python Programming

OE-II: List of Open electives (For VI semester):

OE/CSE/5-T: Basics of Digital Marketing
OE/CSE/6-T: Cyber Laws and IPR
OE/CSE/7-T: Fundamentals of Information Security
OE/CSE/8-T: Big Data
OE/CSE/9-T: Introduction to Data Science

OE-III: List of Open electives (For VII semester):

OE/CSE/10-T: Basics of Cloud computing
OE/CSE/11-T: Introduction to Software Project Management
OE/CSE/12-T: Cyber security
OE/CSE/13-T: Intelligent Systems
OE/CSE/14-T: Basics of Machine Learning

Internet & Application

General Course Information

Course Code: OE/CSE/1-T Course Credits:3 Type: Open Elective Contact Hours: 3 hours/week Mode: Lectures(L) Examination Duration: 3 hours	**Course Assessment Methods (internal:30; external:70)** Three minor tests each of 20 marks will be conducted. The average of the highest marks obtained by a student in the any of the two minor examinations will be considered. Class Performance will be measured through percentage of lectures attended (04 marks). Assignments, quiz etc. will have weight age of 06 marks. For the end semester examination, nine questions are to beset by the examiner. A candidate is required to attempt 5questions in all. All questions carry equal marks. Question number1will be compulsory and based on the entire syllabus. It will contain even parts of 2 marks each. Question numbers 2 to 9 will be given by setting two questions from each of the four units of the syllabus. A candidate is required to attempt the remaining four questions by selecting one question from each of the four units.

Pre-requisites: Mathematics and Programming language.

About the Course:

This is an introductory course for students covering the clear idea of using the Internet, audio and video conferencing concepts easily, associate the principles of web browser and Web applications and learn concepts of ISDN, ADSL and Intranet.

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

CO1. **Understand** the concept relating to Internet and Web. (LOTS: Level1: Remember)
CO2: Compare different high speed connective device. (LOTS: Level 4: Analyze)
CO3: Analyze the connection of LAN to internet. (LOTS: Level3: Apply)
CO4: Construct an environment for chat, channel and Web Conference. (LOTS: Level 4: Create)
CO5: Describe all concept related to email. (LOTS: Level 2: Understand)

Course Content

Unit I

Overview: Computer Security Concepts, Security Attacks, Security Services, Security Mechanism, A Model for Network Security, Symmetric Ciphers: Symmetric Cipher Model, Substitution Techniques, Transposition Techniques, Steganography, Block Ciphers and the Data Encryption, Euclid's Algorithm, Placement of Encryption Function, Traffic Confidentiality, keydistribution

Unit II

Public Key Crypto System and RSA: Prime Numbers, Fermat's and Euler's Theorems, Principles of Public-Key Cryptography, the RSA Algorithm, Key Management, Diffie- Hellman Key Exchange, Cryptographic Hash Function: Applications, Requirements & Security, SHA-3, Authentication Requirements, Authentication Functions

Unit III

Digital Signatures, Digital Signature Standards, Authentication Application & Electronic MailSecurity: Kerberos, X.509 Authentication Service, Pretty Good Privacy, S/MIME.

Unit IV

IP Security and Web Security: IP Security overview, IP Security Policy, Encapsulating Security Payload, Transport Level Security, Wireless Network Security

Text and Reference books:

- Cryptography and Network Security: Principals & Practice: by William Stallings
- Cryptography and Network Security: Atul kahate

CO-PO Articulation Matrix Software Engineering Course (OE/CSE/1-T):

Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	_	_	_	_	_	_	1	_	_	_	_	_	_
CO2	_	2	2	_	_	_	2	_	_	_	_	_	_	_	_
CO3	_	2	2	_	_	_	2	_	3	_	_	_	_	_	_
CO4	_	2	2	_	_	_	2	_	_	2	_	_	2	_	_
CO5	_	2	2	_	_	_	2	_	_	_	_	_	_	_	_
3-High 2-Medium 1-Low															

Introduction to Software Engineering

General Course Information

Course Code: OE/CSE/2-T Course Credits:3 Type: Open Elective Contact Hours: 3 hours/week Mode: Lectures(L) Examination Duration: 3hours	**Course Assessment Methods (internal:30; external:70)** Three minor tests each of 20 marks will be conducted. The average of the highest marks obtained by a student in the any of the two minor examinations will be considered. Class Performance will be measured through percentage of lectures attended (04 marks).Assignments, quiz etc. will have weight age of 06 marks. For the end semester examination, nine questions are to beset by the examiner. A candidate is required to attempt 5questions in all. All questions carry equal marks. Question number1will be compulsory and based on the entire syllabus. It will contain even parts of 2 marks each. Question numbers 2 to 9 will be given by setting two questions from each of the four units of the syllabus. A candidate is required to attempt the remaining four questions by selecting one question from each of the four units.

Pre-requisites: Fundamental of computer and programming language

About the Course:

This is an introductory course for students specify software requirements, design the software using tools, different testing techniques, planning and scheduling techniques and application of computing-based solutions.

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

CO1. **Understand** the concept relating to Software and Software tool. (LOTS: Level1: Remember)
CO2: Compare different testing techniques. (LOTS: Level 4: Analyze)
CO3: Analyze the planning and scheduling techniques. (LOTS: Level3: Apply)
CO4: Construct an application of computing-based solutions. (LOTS: Level 4: Create)
CO5: Describe all concept related to structured and object-oriented analysis & design. (LOTS:Level 2: Understand)

Course Content

Unit-I

The Product-The Process-Project Management Concepts-Software Projects and Project Metrics-Software Project Planning-Risk Analysis and Management.

Unit-II

Project Scheduling and Tracking-Software Quality Assurance- Software Configuration Management-System Engineering-Analysis Concepts And Principles-Analysis Modeling.

Unit-III

Design Concepts and Principles – Architectural Designs-User Interface Design.

Unit-IV

Component level Design-Software Testing Techniques-Software Testing Strategies- Technical Metrics For Software.

Text and reference books:

- RogerS.Pressman-SoftwareEngineeringAPractitioner'sapproach–5th edition- McGraw Hill.
- IanSommerville– SoftwareEngineering-5th Edition –AddisonWesley

CO-PO Articulation Matrix Software Engineering Course (OE/CSE/2-T)

Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	_	_	_	_	_	_	1	_	_	_	_	_	_
CO2	_	2	2	_	_	_	2	_	_	_	_	_	_	_	_
CO3	_	2	2	_	_	_	2	_	3	_	_	_	_	_	_
CO4	_	2	2	_	_	_	2	_	_	2	_	_	2	_	_
CO5	_	2	2	_	_	_	2	_	_	_	_	_	_	_	_
3-High 2-Medium 1-Low															

Fundamental of Computer Networks

General Course Information

Course Code: OE/CSE/3-T Course Credits:3 Type: Open Elective Contact Hours: 3 hours/week Mode: Lectures(L) ExaminationDuration:3hours	**Course Assessment Methods (internal:30; external:70)** Three minor tests each of 20 marks will be conducted. The average of the highest marks obtained by a student in the any of the two minor examinations will be considered. Class Performance will be measured through percentage of lectures attended (04 marks). Assignments, quiz etc. will have weight age of 06 marks. For the end semester examination, nine questions are to beset by the examiner. A candidate is required to attempt 5questions in all. All questions carry equal marks. Question number1 will be compulsory and based on the entire syllabus. It will contain even parts of 2marks each. Question numbers 2to 9 will be given by setting two questions from each of the four units of the syllabus. A candidate is required to attempt the remaining four questions by selecting one question from each of the four units.

Pre-requisites: Fundamental of Internet

About the Course:

This is an introductory course for students to understand the concept of Computer network, knowledge about networking and internetworking devices, topologies and protocols, moderntechnologies and their application, OSI model and TCP/IP.

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

CO1. **Understand** the concept relating to Computer Networks. (LOTS: Level1: Remember)
CO2: Compare different networking protocols and their hierarchical relationship in the conceptual model (LOTS: Level 4: Analyze)
CO3: Analyze the different network models. (LOTS: Level3: Apply)
CO4: Construct a classless addressing scheme. (LOTS: Level 4: Create)
CO5: Describe how computer networks are organized with the concept of layered approach.(LOTS: Level 2: Understand)

Course Content

Unit-1

Introduction – Network Hardware - Software - Reference Models - OSI and TCP/IP Models-Example Networks: Internet, ATM, Ethernet and Wireless LANs -Physical Layer - Theoretical Basis for Data Communication - Guided Transmission Media.

Unit-II

Wireless Transmission - Communication Satellites - Telephone System: Structure, Local Loop, Trunks and Multiplexing and Switching. Data Link Layer:Design Issues - Error Detection and Correction.

Unit-III

Elementary Data Link Protocols - Sliding Window Protocols - Data Link Layer in the Internet-Medium Access Layer-Channel Allocation Problem –Multiple Access Protocols - Bluetooth.

Unit-IV

Network Layer - Design Issues - Routing Algorithms - Congestion Control Algorithms - IP Protocol - IP Addresses - Internet Control Protocols. Transport Layer - Services - Connection Management - Addressing, Establishing and Releasing a Connection- Simple Transport Protocol-Internet Transport Protocols(ITP)- Network Security: Cryptography.

Text and reference books:

- A.S.Tanenbaum, "Computer Networks", Prentice-Hall of India2008, 4th Edition.
- Stallings, "Data and Computer Communications", Pearson Education 2012,7th Edition.
- B.A.Forouzan, "Data Communications and Networking", Tata McGraw Hill 2007, 4th Edition.
- F.Halsall, "Data Communications, Computer Networks and Open System Pearson Education 2008

CO-PO Articulation Matrix of Fundamental of Computer Networks Course (OE/CSE/3-T)

Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO12	PSO1 3	PSO1 4	PSO15
CO1	2	2	_	_	_	_	_	_	1	_	_	_	_	_	_
CO2	_	2	2	_	_	_	2	_	_	_	_	_	_	_	_
CO3	_	2	2	_	_	_	2	_	3	_	_	_	_	_	_
CO4	_	2	2	_	_	_	2	_	_	2	_	_	2	_	_
CO5	_	2	2	_	_	_	2	_	_	_	_	_	_	_	_
3-High 2-Medium 1-Low															

Fundamentals of Python Programming

General Course Information

Course Code: OE/CSE/4-T Course Credits: 3 Type: Professional Core Contact Hours: 3 hours/week Mode:Lectures (L) Examination Duration: 3 hours	**Course Assessment Methods (internal: 30; external: 70)** Three minor tests each of 20 marks will be conducted. The average of the highest marks obtained by a student in the any of the two minor examinations will be considered. Class Performance will be measured through percentage of lectures attended (04 marks). Assignments, quiz etc. will have weightage of 06 marks For the end semester examination, nine questions are to be set by the examiner. A candidate is required to attempt 5 questions in all. All questions carry equal marks. Question number 1 will be compulsory and based on the entire syllabus. It will contain seven parts of 2 marks each. Question numbers 2 to 9 will be given by setting two questions from each of the four units of the syllabus. A candidate is required to attempt the remaining four questions by selecting one question from each of the four units.

Pre-requisite: Exposure to programming languages

About the Course:
Python is a popular open-source programming language used for both standalone programs and scripting applications in a wide variety of domains. It is free, portable, and powerful and is both relatively easy and remarkably fun to use. In today's era Python has found great applicability in machine learning, data analytics and many other data science applications. This is introductory course and covers most of the basic concepts required for basic python programming. Some of the contents are advanced may be useful for data analytics purpose.

Course Outcomes: By the end of the course students will be able to:
CO1. **outline** various basic programming constructs including operators, character sets, basic data types and control statements. (LOTS: level 1: Understand)
CO2. **explain** Python packages and their functionalities for data analysis. (LOTS: level 2: Understand)
CO3. **solve** problems using python programming. (LOTS: level 3: Apply)
CO4. **analyse** the results of data analysis or machine learning programs (LOTS: level 4: Analyse)
CO5. **evaluate** solutions according to the problem definition. (LOTS: level 5: Evaluate)
CO6. **develop** database applications in Python. (LOTS: level 6: Create)

Course Content

Unit I
Introduction to Python, History of Python, Features of Python, Python Identifiers, Python Character Set, Keywords and Indentation, Comments, Command Line Arguments, Assignment Operator, Operators and Expressions, *print()* Function, *input()* Function, *eval()* Function, Python Data Types: *int, float, complex*, Variables, Mutable vs Immutable variables, Decision Statements: Boolean Type, Boolean Operators, *if* statement, *else* statement, Nested Conditionals Statements, Multi-way Decision Statements (*elif* statement).

Unit II
Loop Control Statements: *While* loop, *range ()* Function, *For* Loop, Nested Loops, Infinite

Loop, *Break* Statement, *Continue* Statement, *Pass* Statement, Introduction to Strings, String Operations: Indexing and Slicing, Lists: Operations on List: Slicing, Inbuilt Functions for Lists, List Processing: Searching and Sorting, Dictionaries: Need of Dictionary, Operations on Directories: Creation, Addition, Retrieving Values, Deletion; Tuples, operations on Tuples, Inbuilt Functions for Tuples, Introduction to Sets, operations on sets.

Unit III

Operations on File: Reading text files, read functions, *read ()*, *readline()* and *readlines()*, writing Text Files, write functions, *write()* and *writelines()*,Manipulating file pointer using seek, Appending to Files.

Python Object Oriented: Overview of OOP, Classes and objects, accessing attributes, Built-In Class Attributes, Methods, Class Inheritance: *super ()*, Method Overriding, Exception Handling, *Try-except-else* clause, Python Standard Exceptions, User-Defined Exceptions

Unit IV

Databases in Python: Create Database Connection, *create, insert, read, update* and *delete* Operation, DML andDDL Operation with Databases.

Python for Data Analysis: *numpy*: Creating arrays, Using arrays and Scalars, Indexing Arrays, Array Transposition, Universal Array Function, Array Processing, Array Input and Output

Text and Reference Books:

- Ashok Namdev Kamthane, *Programming and Problem Solving with Python*, Mc GrawHill Education Publication, 2018.
- John Guttag, *Introduction to Computation and Programming using Python*, Springer,Revised andExpanded version (Referred by MIT), 2013.
- Lutz, M., *Learning Python: Powerful Object-Oriented Programming*. O'Reilly Media,Inc., 2013.
- Michael T Goodrich and Robertto. Thamassia, Micheal S Goldwasser, *Data Structuresand Algorithms in Python*, Wiley, 2016.
- Y. Daniel Liang, *Introduction to Programming Using Python*, Pearson, 2013.
- Reema Thareja, *Python Programming Using Problem Solving Approach* , OxfordPublications, 2017.
- Dr. R. Nageswara Rao, Allen B. Downey, *Core Python Programming , Think Python*,O'Reilly Media,2012.
- Kenneth A. Lambert, *The Fundamentals of Python: First Programs*, Cengage Learning,2011.

CO-PO Articulation Matrix Python Programming Course (OE/CSE/4-T)

Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	_	_	_	_	_	_	_	_	_	_	_	_	_	2
CO2	1	_	_	_	_	_	_	_	_	_	_	_	_	_	3
CO3	3	2		2	_	3	_	_	_	_	_	_	_	_	3
CO4	2	3	2	2	_	_	_	_	_	_	_	_	_	_	3
CO5	2	3	2	2	_	_	_	_	_	_	_	_	_	_	3
CO6	3	3	2	3		3	_	_	_	_	_	_	3		3
3-High 2-Medium 1-Low															

Basics of Digital Marketing

General Course Information

Course Code: OE/CSE/5-T Course Credits: 3 Type: Open Elective Contact Hours: 3 hours/week Mode: Lectures (L) Examination Duration:3 hours	**Course Assessment Methods (internal:30; external:70)** Three minor tests each of 20 marks will be conducted. The average of the highest marks obtained by a student in the any of the two minor examinations will be considered. Class Performance will be measured through percentage of lectures attended (04 marks). Assignments, quiz etc. will have weight age of 06 marks. For the end semester examination, nine questions are to beset by the examiner. A candidate is required to attempt 5questions in all. All questions carry equal marks. Question number1 will be compulsory and based on the entire syllabus. It will contain even parts of 2marks each. Question numbers 2to 9 will be given by setting two questions from each of the four units of the syllabus. A candidate is required to attempt the remaining four questions by selecting one question from each of the four units.

Pre-requisites: Computer Fundamental

About the Course:
To understand digital marketing, important conceptual insights and perspectives to demonstrate the use of tools required for effective digital marketing and analyze the market impact from digital marketing, and apply the tools of digital marketing to get best visibility in market.
Course Outcomes: By the end of the course students will be able to:

CO1. understanding digital marketing along with technical acumen will be an added tool as a problem solver and solution provider. (LOTS: Level 1: Remember)
CO2. demonstrate the use of search engine optimization keyword planner Tools.(LOTS: Level 2: Understand)
CO3. assist and advice the marketer to take right decision. (LOTS: Level 3: Apply)
CO4. apply various social media platform for marketing such as Facebook, Twitter, LinkedIn etc. (LOTS: Level 4: Analyse).
CO5. **assess** real time digital marketing services. (LOTS: Level 5:Evaluate)

Course Content

Unit I

Introduction to Digital Marketing and its Significance Traditional Marketing Vs Digital Marketing Digital Marketing Process. Website Planning and Development: Types of websites Website Planning and Development, Understanding Domain and Webhosting Building Website/Blog using CMS Word Press, Using Word Press Plug-ins

Unit II

Introduction to Search Engine Optimization Keyword Planner Tools on Page SEO Techniques- Indexing and Key Word Placement, On Page SEO Techniques- Content Optimization on Page SEO: Yoast, SEO Plug-in, Off –Page SEO Techniques, Email Marketing- Introduction and Significance, Designing e-mail marketing campaigns using Mail Chimp

Unit III
Building E-mail List and Signup Forms, Email Marketing Strategy and Monitoring Email – Atomization. Pay Per Click Advertising: Introduction Pay Per Click Advertising: Google Ad word, Types of Bidding strategies, Designing and Monitoring search campaigns, Designing and Monitoring Display campaigns

Unit IV
Designing and Monitoring Video campaigns Designing and Monitoring Universal App Campaigns. Google Analytics: Introduction and Significance Google Analytics Interface and Setup Understanding Goals and Conversions. Monitoring Traffic Behavior and preparing Reports Social Media Marketing: Introduction and Significance Facebook Marketing, Types of Various Ad Formats

Text and Reference Books:

- The Art of Digital Marketing: The Definitive Guide to Creating Strategic, Targeted, and Measurable Online Campaigns by Ian Dodson, Wiley; 1st edition (2016)
- Digital Marketing for Dummies by Ryan Deiss and Russ Henneberry, For Dummies.
- Understanding Digital Marketing: Marketing Strategies for Engaging the Digital Generation by Damian Ryan, Kogan Page Publisher.
- Digital Marketing by Seema Gupta, McGraw Hill Education.

CO-PO Articulation Digital Marketing Matrix Course (OE/CSE/5-T)

Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	_	_	_	_	_	_	_	_	_	_	_	_	_
CO2	_	2	2	_	_	_	2	_	_	_	_	_	_	_	_
CO3	_	_	_	1	_	1	_	_	1	_	_	_	_	_	_
CO4	1	_	2	_	2	_	3	_	_	2	_	_	_	_	_
CO5	_	3	2	_	2	_	1	_	_	2	_	_	2	_	_
3-High 2-Medium 1-Low															

Cyber Laws and IPR

General Course Information

Course Code: OE/CSE/6-T Course Credits:3 Type: Open Elective Contact Hours: 3 hours/week Mode: Lectures(L) Examination Duration: 3 hours	**Course Assessment Methods (internal:30; external:70)** Three minor tests each of 20 marks will be conducted. The average of the highest marks obtained by a student in the any of the two minor examinations will be considered. Class Performance will be measured through percentage of lectures attended (04 marks). Assignments, quiz etc. will have weight age of 06 marks. For the end semester examination, nine questions are to beset by the examiner. A candidate is required to attempt 5questions in all. All questions carry equal marks. Question number1will be compulsory and based on the entire syllabus. It will contain even parts of 2marks each. Question numbers 2to 9 will be given by setting two questions from each of the four units of the syllabus. A candidate is required to attempt the remaining four questions by selecting one question from each of the four units.

Pre-requisites: Basic Computer Network

About the Course:
This course involves studying cyber-Investigation that is admissible by the Courtroom, a clear idea on International Law and Regulation of Cyberspace, concept of Intellectual Property Rights and Copyright.

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

CO1. **Understand** the concept relating to E-Governance and E- Commerce. (LOTS: Level1: Remember)
CO2. **Describe** legal issue relating to courtroom practices. (LOTS: Level 2: Understand)
CO3. **Apply** the laws dealing with the cyber-crimes related to Patents and Trade Mark..(LOTS: Level 3: Apply)
CO4. **Use** the concept of Trademark, copyright and IPR. (LOTS: Level3: Apply)
CO5. **Compare** international Laws and Regulation of Cyberspace. (LOTS: Level 4: Analyze)

Course Content

Unit-1

Fundamentals of Cyber Law Introduction on cyber space - Jurisprudence of Cyber Law - Scope of Cyber Law - Cyber law in India with special reference to Information Technology Act, 2000 (as amended) and Information Technology Act, 2008

Unit-II

E- Governance and E – Commerce Electronic Governance - Procedures in India - Essentials & System of Digital Signatures - The Role and Function of Certifying Authorities - Digital contracts - UNCITRAL Model law on Electronic Commerce - Cryptography – Encryption and decryption

Unit-III

Cyber Crimes Investigation Investigation related issues - Issues relating to Jurisdiction - Relevant provisions under Information Technology Act, Evidence Act - Indian PenalCode -

Cyber forensics - Case studies

Unit-IV

Trademark, IPR and Patent laws Definitions and concepts Trademark: Introduction to Trademarks, Functions and types of Trademarks, Madrid Agreements, Trademarks Law Treaty (Geneva), Indian Trademark Act, Registration of Trademarks, IPR infringements - Secrecy and Confidentiality in IPR - Civil and Criminal liabilities in IPR - International Applications and its advantages - Geneva convention on Patent Law - Software and Business Method Patents - Indian Patent Act - Infringement - Defenses

Text and reference books:

- Raman Mittal.(2004).Legal Dimension on Cyber Space, Indian Law Institute, New Delhi
- Anupa P Kumar.(2009).Cyber Law,Volume 1.Create space Independent Publishers
- Vakul Sharma.(2017).Information Technology -Law and Practice.5th Edition, Universal Law Publishing, NewDelhi
- Laws on Cyber Crime: P.K.Singh (2007), Book Enclave Jaipur, Page 131
- Dr. Gupta & Agrawal.(2016). Cyber Laws. Premier Publishing Company
- Seth Kamika.(2013).Computers Internet and New Technology Law
- Cyber law by Nandan kamath, Fifth Edition, Universal law Publication, 01 Jan 2012
- intellectual property by Robert P Merges, 3rd Edition, Aspen Publication, 2003

CO-PO Articulation Mapping with Programme Outcomes (OE/CSE/6-T)

Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO12	PSO1 3	PSO1 4	PSO15
CO1	2	2	–	–	–	–	–	–	–	–	–	–	–	–	–
CO2	–	2	2	–	–	–	2	–	–	–	–	–	–	–	–
CO3	2	2	–	–	–	–	–	–	–	–	–	–	–	–	–
CO4	–	–	–	1	–	1	–	–	1	–	–	–	–	–	–
CO5	–	–	2	–	2	–	–	–	–	2	2	2	2	–	–
3-High 2-Medium 1-Low															

Fundamentals of Information Security

General Course Information

Course Code: OE/CSE/7-T Course Credits:3 Type: Open Elective Contact Hours: 3 hours/week Mode: Lectures(L) Examination Duration: 3 hours	**Course Assessment Methods (internal:30; external:70)** Three minor tests each of 20 marks will be conducted. The average of the highest marks obtained by a student in the any of the two minor examinations will be considered. Class Performance will be measured through percentage of lectures attended (04 marks). Assignments, quiz etc. will have weight age of 06 marks. For the end semester examination, nine questions are to beset by the examiner. A candidate is required to attempt 5questions in all. All questions carry equal marks. Question number1will be compulsory and based on the entire syllabus. It will contain even parts of 2marks each. Question numbers 2to 9 will be given by setting two questions from each of the four units of the syllabus. A candidate is required to attempt theremaining four questions by selecting one question from each of the four units.

Pre-requisites: Fundamental of computer and Software engineering

About the Course:

This course involves studying information security, asset classification in the organization, risk management process, knowledge about emerging technology.

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

CO1. **Understand** the concept relating to basic information security concepts. (LOTS: Level1: Remember)
CO2. **Describe** asset classification. (LOTS: Level 2: Understand)
CO3.**apply** risk analysis and management process.(LOTS: Level 3: Apply)
CO4.**use** the concept of critically assess in access control and privilege management. (LOTS: Level3: Apply)
CO5. **Compare** emerging technologies. (LOTS: Level 4: Analyze)

Course Content

Unit-I

Overview of Information Security What is Information and why should be protect it? - Information Security: Threats, Frauds, Thefts, Malicious Hackers, Malicious Code, Denial of Services Attacks, Social Engineering - Vulnerability – Risk: Risk definition, Types Risk – an introduction Business Requirements Information Security - Definitions Security Policies: Tier1 (Origination Level), Tier2 (Function Level), Tier3 (Application/Device Level), Procedures, Standards, Guidelines

Unit-II

Information Asset Classification Why should we classify information? - Information Asset: Owner, Custodian, User - Information Classification: Secret, Confidential, Private, Public, Declassification, Reclassification, Retention and Disposal of Information Assets, Provide Authorization for Access - Owner Custodian User

Unit-III

Risk Analysis & Risk Management Risk Analysis Process - Asset Definition - Threat Identification - Determine Probability of Occurrence - Determine the Impact of the Threat - Controls Recommended Risk Mitigation - Control Types – Categories - Cost/Benefit Analysis

Unit-IV

Emerging Technologies Introduction to Cloud Computing: Concepts - Fundamentals of Cloud Computing - Types of clouds - Security Design and Architecture -Concerns Internet of Things: Overview of IoT - Key Features of IoT - IoT Architecture - Impact of IoT on Business - Examples of IoT - Advantages and Disadvantages of IoT - IoT Hardware: IoT Sensors, Wearable Electronics, Standard Devices - IoT Software - IoT technology and Protocols - IoT Common Issues - IoT applications Domains - IoT Liability -IoT Security and Threats: Mitigation

Text and reference books:

- CISSP All-in-One Exam Guide by Shon Harris and Fernando Maymi, 7th Edition, McGrawHill Education, 1 June 2016
- Information Security Management handbook, 6th Edition, Harold F Tipton, Micki Krause,Auerbach Publications, 5 April 2012
- The CISSP Prep Guide: Gold Edition by Ronald L. Krutz, Russel Dean Vines, Gold Edition Wiley Publication, 31 Oct 2002
- Certified Information Systems Security Professional, Study Guide by Ed Tittel, Mike Chapple James Michael Stewart, 6th Edition, Sybex Publication, 06 July 2012

CO-PO Articulation Mapping with Programme Outcomes (OE/CSE/7-T)

Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	_	_	_	_	_	_	_	_	_	_	_	_	_
CO2	_	2	2	_	_	_	2	_	_	_	_	_	_	_	_
CO3	_	2	2	_	_	_	2	_	_	_	_	_	_	_	_
CO4	_	2	2	_	_	_	2	_	_	_	_	_	_	_	_
CO5	_	2	2	_	_	_	2	_	_	_	_	_	2	_	_
3-High 2-Medium 1-Low															

Big Data

General Course Information

Course Code: OE/CSE/8-T Course Credits:3 Type: Open Elective Contact Hours: 3 hours/week Mode: Lectures(L) ExaminationDuration:3hours	**Course Assessment Methods (internal:30; external:70)** Three minor tests each of 20 marks will be conducted. The average of the highest marks obtained by a studentin the any of the two minor examinations will be considered. Class Performance will be measured through percentage of lectures attended (04 marks).Assignments, quiz etc. will have weight age of 06 marks. For the end semester examination, nine questions are to beset by the examiner. A candidate is required to attempt 5questions in all. All questions carry equal marks. Question number1will be compulsory and based on the entire syllabus. It will contain even parts of 2marks each. Question numbers 2to 9 will be given by setting two questions from each of the four units of the syllabus. A candidate is required to attempt the remaining four questions by selecting one question from each of the four units.

Pre-requisites: Fundamental of Database and Mobile Computing

About the Course:

This course involves studying basic technologies related to BigData, cloud computing with a view to rapid prototyping of complex applications, big data application, and big data analytics.

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

CO1. **Understand** the concept of Big data and challenges in processing Big data. (LOTS: Level1: Remember)
CO2. **Describe** Hadoop architecture and eco-system. (LOTS: Level 2: Understand)
CO3.**apply** research trends related to Hadoop File System, Map Reduce and Google File System etc.(LOTS: Level 3: Apply)
CO4.**use** the concept of critically assess in access control and privilege management. (LOTS:Level3:Apply)
CO5. **Compare** appropriate techniques and tools to solve actual Big Data problems. (LOTS: Level 4: Analyze)

Course Content

Unit I

Introduction to Big Data and Hadoop: What is Big Data, What are Challenges in processing Big data? What is hadoop, Data Storage and Analysis, Comparison with Other Systems: RDBMS, Grid Computing, Volunteer Computing; A Brief History of Hadoop, Apache Hadoop and the Hadoop Ecosystem.

Unit II

HDFS: Hadoop Distributed File System: Significance of HDFS in Hadoop, Features of HDFS, The Design of HDFS, HDFS Concepts: Blocks, Data replication, Namenodes and Datanodes; Accessing HDFS

Unit III

Map Reduce: Map Reduce Architecture, How map reduce works:Job Submission, Job Initialization, Task Assignment, Task Execution, Progress and Status Updates, Job Completion. Failures, Job Scheduling.

Unit IV

Pig: Introduction to Apache Pig, Map-Reduce vs Pig, Pig Latin, Data Processing Operators. Hive: Hive introduction, Architecture, Comparison with Traditional Databases, HiveQL, Tables. HBase:HBasics, Concepts, HBase Versus RDBMS. ZooKeeper: The ZooKeeper Service. Case Studies: Hadoop and Hive at Facebook, Log Processing at Rackspace.

Text and reference books:

- Big Data Analytics in Cyber Security, Edited by Onur Savas and Julia Deng.
- Tom White, "Hadoop: The Definitive Guide", Second Edition, O'Reilly Yahoo Press.
- Robert D. Schneider, "Hadoop for Dummies", Wiley. 3.
- VigneshPrajapati, "Big Data Analytics with R and Hadoop", Packt Publishing.

CO-PO Articulation Mapping with Programme Outcomes (OE/CSE/8-T)

Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	_	_	_	_	_	_	1	_	_	_	_	_	_
CO2	_	2	2	_	_	_	2	_	_	_	_	_	_	_	_
CO3	_	2	2	_	_	_	2	_	3	_	_	_	_	_	_
CO4	_	2	2	_	_	_	2	_	_	2	_	_	_	_	_
CO5	_	2	2	_	_	_	2	_	_	_	_	_	2	_	_
3-High 2-Medium 1-Low															

Introduction to Data Science

General Course Information

Course Code: OE/CSE/9-T Course Credits: 3 Type: Professional Core Contact Hours: 3 hours/week Mode: Lectures (L) Examination Duration:3 hours	**Course Assessment Methods (internal: 30; external: 70)** Three minor tests each of 20 marks will be conducted. The average of the highest marks obtained by a student in the any of the two minor examinations will be considered. Class Performance will be measured through percentage of lectures attended (04 marks). Assignments, quiz etc. will have weightage of 06 marks For the end semester examination, nine questions are to be set by the examiner. A candidate is required to attempt 5 questions in all. All questions carry equal marks. Question number 1 will be compulsory and based on the entire syllabus. It will contain seven parts of 2 marks each. Question numbers 2 to 9 will be given by setting two questions from each of the four units of the syllabus. A candidate is required to attempt the remaining four questions by selecting one question from each of the four units.

Pre-requisites: Student should have a fundamental understanding of Fundamentals of Programming Languages (C, C++, and Java & Python) and a strong mathematical foundation.

About the Course:
This course involves studying the concept of data science and data science life cycle. Moreover, students learn about the techniques for generating quality data inputs.

Course Outcomes: By the end of the course students will be able to:
CO1. To understand the concept of data science and data science life cycle (LOTS: Level 1: Remember)
CO2. To apply the pre-processing techniques for generating quality data inputs (LOTS: Level 2: Understand)
CO3. To analyse the concept and parameters of exploratory data analytics (LOTS: Level 3: Apply)
CO4. To develop the regression models using data science and analytics process (LOTS: Level 3: Apply)
CO5. To analyse various tools and techniques of data visualization (LOTS: Level 4: Analyse)
CO6. handling data, encoding, tools apply, and types of data visualization (LOTS: Level 6: Create)

Course Content

Unit I
Evolution of Data Science, Introduction to Data Science – Types of Data, Data Science Vs Big Data, Concept of Big Data, Concept of Data Warehousing, Introduction to Data Mining, Role of Data Scientist, Data Science Life Cycle, Data Science Roles – Data Science Project Stages – Data Science Applications in Various Fields – Data Security Issues, thinking in a structured way to solve data science problem statements.

Unit II
Need of Data Pre-processing, Pre-processing of data and data collection, Data Pre-Processing Overview – Data Cleaning – Data Integration and Transformation – Data Reduction – Data Discretization, Data Storage, and management, Data preparation with Sandbox for analytics.

Unit III
Simple and Linear Regression – Visual Model Evaluation – Residual Plot – Distribution Plot – Polynomial Regression and Pipelines – Residual Plot – Distribution Plot – Polynomial Regression and Pipelines – In- sample Evaluation Measures – Prediction and Decision Making

Unit IV

Metrics for Out-of-Sample Evaluation Error – Cross Validation – Overfitting – Under fitting and Model Selection – Ridge Regression Prediction – Grid Search Testing Multiple Parameters
Data handling /Data wrangling using Python Definition.

Text and reference books:

1.G. Strang . Introduction to Linear Algebra, Wellesley-Cambridge Press, Fifth edition, USA, 2016.
2. Bendat, J. S. and A. G. Piersol. Random Data: Analysis and Measurement Procedures. 4th Edition. John Wiley & Sons, Inc., NY, USA, 2010
3. Montgomery, D. C. and G. C. Runger. Applied Statistics and Probability for Engineers. 5th Edition. John Wiley & Sons, Inc., NY, USA, 2011.
4. David G. Luenberger . Optimization by Vector Space Methods, John Wiley & Sons (NY), 1969.
5. Cathy O'Neil and Rachel Schutt . Doing Data Science, O'Reilly Media, 2013.
6.Jojo Moolayil, "Smarter Decisions : The Intersection of IoT and Data Science", PACKT, 2016.
7.Cathy O'Neil and Rachel Schutt , "Doing Data Science", O'Reilly, 2015.
8. David Dietrich, Barry Heller, Beibei Yang, "Data Science and Big data Analytics", EMC 2013

CO-PO Articulation Matrix Foundations of Data Science Course (OE/CSE/9-T)

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1.	1	1	2	1	_	_	_	_	_	_	_	_	_	_	_
CO2.	1	2	_	2	_	_	_	_	_	_	_	_	_	_	_
CO3.	2	1	2	1	_	_	_	_	_	_	_	_	_	_	_
CO4.	1	2	_	2	_	_	_	_	_	_	_	_	_	_	_
CO5.	_	_	2	_	_	_	_	_	_	_	_	_	_	_	_
CO6.	_	2	1	2	_	_	_	_	_	_	-	_	_	_	_
3 –High, 2-Medium, 1-Low															

Basics of Cloud Computing

General Course Information

Course Code: OE/CSE/10-T Course Credits: 3 Type: Open Elective Contact Hours: 3 hours/week Mode: Lectures (L) Examination Duration:3 hours	**Course Assessment Methods (internal: 30; external: 70)** Three minor tests each of 20 marks will be conducted. The average of the highest marks obtained by a student in the any of the two minor examinations will be considered. Class Performance will be measured through percentage of lectures attended (04 marks). Assignments, quiz etc. will have weightage of 06 marks. For the end semester examination, nine questions are to be set by the examiner. A candidate is required to attempt 5 questions in all. All questions carry equal marks. Question number 1 will be compulsory and based on the entire syllabus. It will contain seven parts of 2 marks each. Question numbers 2 to 9 will be given by setting two questions from each of the four units of the syllabus. A candidate is required to attempt the remaining four questions by selecting one question from each of the four units.

Pre-requisites: Basics of Computer Network, Distributed System.

About the Course:

The objective of the course is to give students a comprehensive view of storage and networking infrastructures for highly virtualized cloud ready deployments. To familiarize the students with basics of Cloud Computing and its Applications.

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

CO1. **define** concepts related to cloud computing. (LOTS: Level 1: Remember)
CO2. **express** deployment models for clouds. (LOTS: Level 2: Understand)
CO3. **apply** cloud computing techniques for various applications. (LOTS: Level 3: Apply)
CO4. **analyse** cloud computing services used at various levels. (LOTS: Level 4: Analyse)
CO5. **assess** real time cloud services. (LOTS: Level 5: Evaluate)

Course Content

Unit I

Cloud Computing: Introduction to client server computing, Peer to Peer computing, Distributed computing, collaborative computing and cloud computing, Importance of cloud computing in current era, Characteristics, advantages and disadvantages of cloud computing.

Unit II

Cloud Services: Functioning of cloud computing, Classification of cloud on the basis of services: Software as a Service (SaaS), Platform as a Service (PaaS), and Infrastructure as a Service (Iaas): Definition, characteristics and their benefits.

Unit III

Cloud Architecture: Cloud computing Logical and service architecture, Types of clouds: Private cloud, Public cloud and Hybrid cloud, Comparison of a Private, public and hybrid clouds, migrating to a cloud, seven step model to migrate.

Unit IV

Applications: Business opportunities using cloud, Managing Desktop and devices in cloud, cloud as a type of distributed infrastructure, Application of cloud computing for centralizing. Email communication, collaboration on schedules, calendars. Overview of major cloud service providers - Amazon Ec2, Google App Engine.

Text and Reference Books:

1. Srinivasan, A. Cloud Computing: A Practical Approach for Learning and Implementation. Pearson Education India, 2014.
2. Cloud Computing, A Practical Approach-McGraw-Hill Osborne Media by "Toby Velte, Anthony Velte, Robert Elsenpeter- (2009)".
3. Cloud Computing Bible, Author: "Barrie Sosinsky", Publisher: "Wiley" (2011)
4. Rajkumar Buyya, Christian Vecchiola and S ThamaraiSelvi, *Mastering Cloud Computing*, TataMcGraw Hill Education Pvt. Ltd., 2013.

CO-PO Articulation Matrix Cloud Computing Course (OE/CSE/10-T)

Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	_	_	_	_	_	_	_	_	_	_	_	_	2	_
CO2	1	_	_	_	_	_	_	_	_	_	_	_	_	3	_
CO3	2	2	2	_	2	_	_	_	_	_	_	_	_	3	_
CO4	3	3	2	3	2	_	_	_	_	_	_	_	_	3	_
CO5	3	3	3	3	3	2	_	_	_	_	_	2	_	3	_
3-High 2-Medium 1-Low															

Introduction to Software Project Management

General Course Information

Course Code: OE/CSE/11-T Course Credits: 3 Type: Open Elective Contact Hours: 3 hours/week Mode: Lectures (L) Examination Duration:3 hours	**Course Assessment Methods (internal: 30; external: 70)** Three minor tests each of 20 marks will be conducted. The average of the highest marks obtained by a student in the any of the two minor examinations will be considered. Class Performance will be measured through percentage of lectures attended (04 marks). Assignments, quiz etc. will have weightage of 06 marks For the end semester examination, nine questions are to be set by the examiner. A candidate is required to attempt 5 questions in all. All questions carry equal marks. Question number 1 will be compulsory and based on the entire syllabus. It will contain seven parts of 2 marks each. Question numbers 2 to 9 will be given by setting two questions from each of the four units of the syllabus. A candidate is required to attempt the remaining four questions by selecting one question from each of the four units.

Pre-requisites: Preliminary knowledge of Software Engineering.

About the Course:

The course recognizes basic concepts and issues of software project management; Emphasize successful software projects that support organization's strategic goals, Comprehend software quality issues, and Comprehend software risk issues.

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

CO1. **maintain** software projects and monitor software project. (LOTS: Level 1: Remember)
CO2. **demonstrate** the design and develop project modules and assign resources (LOTS: Level2: Understand)
CO3. **illustrate** Comprehend, assess, and calculate the cost of risk involved in a project management. (LOTS: Level 2: Understand)
CO4. **apply** tools and methods for identifying risk management. (LOTS: Level 3: Apply)
CO5. **analyse** the tools for risk management. (LOTS: Level 4: Analyse)
CO6. **plan** a Case study using SPM tools. (LOTS: Level 6: Create)

Course Content

Unit I

SPM Concepts Definition: components of SPM - challenges and opportunities - tools and techniques - managing human resource and technical resource - costing and pricing of projects -training and development - project management techniques.

Unit II

Software Measurements: Monitoring & measurement of SW development - cost - size andtime metrics - methods and tools for metrics - issues of metrics in multiple projects.

Unit III

Software Quality: Quality in SW development - quality assurance - quality standards and certifications - the process and issues in obtaining certifications - the benefits and implications for the organization and its customers - change management.

Unit IV

Risk Issues and SPM Tools The risk issues in SW development and implementation - identification of risks - resolving and avoiding risks - tools and methods for identifying risk management. Tools Software project management using Primavera & Redmine - case study on SPM tools.

Text & Reference Books

1. Richard H. Thayer, “Software Engineering Project Management”, Second Edition, JohnWiley & Sons, 2001.
2. Royce, Walker, “Software Project Management”, Pearson Education, 2002.
3. Kelker S. A., “Software Project Management”, Prentice Hall, 2003.
4. Kan, Stephen H., “Metrics and Models in Software Quality Engineering”, Addison-WesleyLongman Publishing Co. Inc., 2002.
5. Galin, Daniel, “Software Quality Assurance: From Theory to Implementation”, PearsonEducation India, 2004.
6. Charette, Robert N., “Software Engineering Risk Analysis and Management”, New York:McGraw Hill, 1989.

CO-PO Articulation Matrix Software Project Management Course (OE/CSE/11-T)

Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO11	PO12	PSO1	PSO2	PSO3
CO1	_	_	_	_	3	_	_	_	_	_	_	_	_	_	_
CO2		_	_	_	3	_	_	_	_	_	_	_	_	_	_
CO3	2	_	_	_	1	_	_	_	_	_	_	_	3	_	_
CO4	_	2	_	_	2	_	_	2	_	_	_	_	2	_	_
CO5	_	_	3	2	_	3	_	2	_		2	_	2	_	_
CO6	3	3	_	3	3	_	_	_	_	2	3	2	3	_	_
3-High 2-Medium 1-Low															

Cyber Security

General Course Information

Course Code: OE/CSE/12-T Course Credits: 3 Type: Open Elective Contact Hours: 3 hours/week Mode: Lectures (L) Examination Duration:3 hours	**Course Assessment Methods (internal: 30; external: 70)** Three minor tests each of 20 marks will be conducted. The average of the highest marks obtained by a student in the any of the two minor examinations will be considered. Class Performance will be measured through percentage of lectures attended (04 marks). Assignments, quiz etc. will have weightage of 06 marks For the end semester examination, nine questions are to be set by the examiner. A candidate is required to attempt 5 questions in all. All questions carry equal marks. Question number 1 will be compulsory and based on the entire syllabus. It will contain seven parts of 2 marks each. Question numbers 2 to 9 will be given by setting two questions from each of the four units of the syllabus. A candidate is required to attempt the remaining four questions by selecting one question from each of the four units.

Pre-requisites: Computer Networks
About the Course:

The course has been designed to give students an extensive overview of cyber security issues,tools and techniques that are critical in solving problems in cyber security domains.

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

CO1. **define** the various challenges and constraints in cyber security. (LOTS: Level 1: Remember)
CO2. **discuss** IT ACT (Cyber law) to the given case/problem and analyse it.(LOTS: Level 2: Understand)
CO3. **understand** the need for Computer Cyber forensics. (LOTS: Level 3:Apply)
CO4. **Analyse** the design of Intellectual Property Law. (LOTS: Level 4:Analyse)
CO5. **demonstrate** the network defence tools to provide security of information. (LOTS: Level 5: Evaluate)

Course Content

Unit-I

Introduction to Cyber Security: Overview of Cyber Security, Internet Governance: Challenges and Constraints, Cyber Threats, Cyber Warfare, Cyber Crime, Cyber terrorism, Cyber Espionage, need for a Comprehensive Cyber Security Policy, Need for a Nodal Authority, International convention on Cyberspace.

Unit – II

Introduction to Cybercrime and Laws: Origins of Cybercrime, Classifications of Cybercrimes, information Security, Cybercriminals, Criminals Plan for Attacks, Cybercafe, Botnets, Attack Vector, The Indian IT ACT 2000 and amendments.

Tools and Methods used in Cybercrime: Introduction, Proxy Server and Anonymizers, Password Cracking, Keyloggers and Spyware, Virus and Warms, Trojan and backdoors, DOS and DDOS attack, SQLinjection.

Unit – III

Phishing and Identity Theft: Introduction to Phishing, Methods of Phishing, Phishing Techniques, Phishing Toolkits and Spy Phishing. Identity Theft: PII, Types of Identity Theft, Techniques of ID Theft. Digital Forensics Science, Need for Computer Cyber forensics and Digital Evidence, Digital Forensics Life Cycle.

Introduction to Intellectual Property Law – The Evolutionary Past - The IPR Tool Kit- Para -Legal Tasks in Intellectual Property Law – Ethical obligations in Para Legal Tasks in Intellectual Property Law –types of intellectual property rights.

Unit – IV

Network Defence tools: Firewalls and Packet Filters: Firewall Basics, Packet Filter Vs. Firewall, Packet Characteristic to Filter, Stateless Vs. Stateful Firewalls, Network Address Translation (NAT) and Port Forwarding, Virtual Private Networks, Snort Detection System, Introduction to block chain technology and its applications.

Text and Reference Books:

1. Mike Shema, Anti-Hacker Tool Kit (Indian Edition), McGraw Hill.
2. Nina Godbole and Sunit Belpure, Cyber Security: Understanding Cyber Crimes, ComputerForensics and
Legal Perspectives, Wiley.
3. Marjie T. Britz, Computer Forensics and Cyber Crime: An Introduction, Pearson Education
4. Chwan-Hwa (John) Wu,J. David Irwin, Introduction to Computer Networks and Cybersecurity, CRC Press
5. Bill Nelson, Amelia Phillips, Christopher Steuart, Guide to Computer Forensics andInvestigations, CengageLearning
6. Debirag E.Bouchoux, Intellectual Property, Cengage Learning.

CO-PO Articulation Matrix Cyber Security Course (OE/CSE/12-T)

Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	_	_	_	_	_	_	_	_	_	_	_	_	2	_
CO2	1	_	_	_	_	_	_	_	_	_	_	_	_	3	_
CO3	2	2	2	_	2	_	_	_	_	_	_	_	_	3	_
CO4	3	3	2	3	2	_	_	_	_	_	_	_	_	3	_
CO5	3	3	3	3	3	2	_	_	_	_	_	2	_	3	_

Intelligent Systems

General Course Information

Course Code: OE/CSE/13-T Course Credits: 3 Type: Open Elective Contact Hours: 3 hours/week Mode: Lectures (L) Examination Duration:3 hours	**Course Assessment Methods (internal: 30; external: 70)** Three minor tests each of 20 marks will be conducted. The average of the highest marks obtained by a student in the any of the two minor examinations will be considered. Class Performance will be measured through percentage of lectures attended (04 marks). Assignments, quiz etc. will have weightage of 06 marks For the end semester examination, nine questions are to be set by the examiner. A candidate is required to attempt 5 questions in all. All questions carry equal marks. Question number 1 will be compulsory and based on the entire syllabus. It will contain seven parts of 2 marks each. Question numbers 2 to 9 will be given by setting two questions from each of the four units of the syllabus. A candidate is required to attempt the remaining four questions by selecting one question from each of the four units.

Pre-requisites: Basic knowledge of Algorithms and probability.

About the Course:

To introduce to the field of Artificial Intelligence (AI) with emphasis on its use to solve real world problems for which solutions are difficult to express using the traditional algorithmic approach and to explore the essential theory behind methodologies for developing systems that demonstrate intelligent behaviour including dealing with uncertainty, learning from experience and following problem solving strategies found in nature.

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

CO1. **outline** the concepts of neural networks and fuzzy logic. (LOTS: Level 1: Remember)
CO2. **illustrate** the concepts of artificial intelligence in state space search. (LOTS: Level 2: Understand)
CO3. **apply** search and knowledge representation techniques to solve AI problems. (LOTS: Level 3: Apply)
CO4. **compare** strengths and weaknesses of AI algorithms (LOTS: Level 4: Analyse).
CO5. **understand** and use the concepts of reasoning in artificial intelligence. (LOTS: Level 6: Create)

Course Content

Unit – I

Biological foundations to intelligent systems: Artificial neural networks, Back-Propagation networks, Radial basis function networks, and recurrent networks. Fuzzy logic, knowledge Representation and inference mechanism, genetic algorithm, and fuzzy neural networks.

Unit – II

Search Methods: Basic concepts of graph and tree search. Three simple search methods: breadth-first search, depth-first search, iterative deepening search. Heuristic search methods: best-first search, admissible evaluation functions, hill-climbing search. Optimization and searchsuch as stochastic annealing and genetic algorithm.

Unit – III

Knowledge representation and logical inference Issues in knowledge representation. Structured representation, such as frames, and scripts, semantic networks and conceptual graphs. Formal logic and logical inference. Knowledge-based systems structures, its basic components. Ideas ofBlackboard architectures.

Unit – IV

Reasoning under uncertainty and Learning Techniques on uncertainty reasoning such as Bayesian reasoning, Certainty factors and Dempster-Shafer Theory of Evidential reasoning, A study of different learning and evolutionary algorithms, such as statistical learning and induction learning. Recent trends in Fuzzy logic, Knowledge Representation

Text and Reference Books:

1. Luger G.F. and Stubblefield W.A., Artificial Intelligence: Structures and strategies forComplex Problem Solving. Addison Wesley.
2. Russell S. and Norvig P., Artificial Intelligence: A Modern Approach. Prentice-Hall

CO-PO Articulation Intelligent Systems Matrix Course (OE/CSE/13-T)

Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	3	3	1	3	1	3	2	3	3	1	2	_	_	_
CO2	2	3	2	1	3	1	3	2	3	3	1	2	_	_	_
CO3	3	3	3	1	3	3	3	2	3	3	1	3	_	_	_
CO4	2	2	2	2	_	_	_	_	_	_	_	_	_	_	3
CO5	4	3	2	1	3	3	3	2	3	3	1	3	_	_	_

Basics of Machine Learning

General Course Information

Course Code: OE/CSE/14-T CourseCredits:3 Type: Professional/ Programme Elective Contact Hours: 3 Mode: Lectures (L) ExaminationDuration:3hours	**Course Assessment Methods (internal: 30; external: 70)** Three minor examinations (20 marks), Class Performance measured through percentage of lectures attended (4marks), assignments (6marks), and the end-semester examination (70marks). For the end semester examination, nine questions are to beset by the examiner. A candidate is required to attempt 5 questions in all. All questions carry equal marks. Question number1 will be compulsory and based on the entire syllabus. It will contain even parts of 2 marks each. Question numbers 2 to 9 will be given by setting two questions from each of the four units of the syllabus. A candidate is required to attempt the remaining four questions by selecting one question from each of the four units.

Pre-requisites: Basics of Linear Algebra and Statistics, Basics of Probability Theory, Data Structures and Computer Algorithms.

About the Course:

The course introduces some of the key machine learning algorithms and the theory that form the backbone of these algorithms. The examples of such algorithms are classification algorithms for learning patterns from data, clustering algorithms for grouping objects based on similarity, neural network algorithms for pattern recognition, genetic algorithms for searching large and complex search spaces etc.

Course Outcomes: By the end of the course students will be able to:
CO1. **outline** the concepts and working of different machine learning algorithms. (LOTS: Level1: Remember)
CO2. **Interpret** the results of machine learning algorithms. (LOTS: Level 2: Understand)
CO3. **Apply** machine learning concepts and algorithms to given problems. (LOTS: Level 3: Apply)
CO4. **Analyse** the performance of machine learning algorithms. ((LOTS: Level 4: Analyze)
CO5. **Compare and contrast** different machine learning algorithms. (LOTS: Level5: Evaluate)
CO6. **Design** machine learning algorithms for optimization, pattern recognition and search problems. (LOTS: Level 6: Create)

Course Content

Unit-I

Introduction: Well posed learning problems, designing a learning system, Issues in machine learning, the concept learning task, Concept learning as search, Version spaces and candidate elimination algorithm, Remarks on version spaces and candidate-eliminations, Inductive bias.

Unit- II

Supervised Learning: Introduction to linear regression, estimating the coefficients, Accessing the accuracy of the coefficient estimates, Accessing the accuracy of the regression model, Multiple

linear regression, Logistic regression, basic decision tree learning (ID3) algorithm, Inductive bias in decision tree learning, Issues in decision tree learning.

Unit-III

Unsupervised Learning: About clustering, type of data in clustering analysis, DB SCAN density-based clustering method, Performance analysis of clustering algorithms,

Artificial Neural networks: Neural Network representations, Appropriate problems for neural network learning, Perceptron, perceptron training rule, Multilayer Networks and back propagation algorithm.

Unit-IV

Bayesian Learning: Bayes theorem, Bayes theorem and concept learning, Maximum likelihood and least-squared error hypotheses.

Text and Reference Books:

1. TomM. Mitchell, Machine Learning, McGraw-Hill, 1997.
2. Bishop Christopher, Pattern Recognition and Machine Learning, Springer Verlag, 2006.
3. Trevor Hastie, Robert Tibshirani, Jerome Friedman, The Elements of Statistical Learning: Data Mining, Inference and Prediction, Springer, 2nd edition, 2009.
4. J.Hanand M.Kamber, Data Mining Concepts and Techniques, 3rdEdition, Elsevier, 2012.
5. S. Rajeshkaran, G.A.VijayalakshmiPai, Neural Networks, Fuzzy Logic and Genetic Algorithm: Synthesis and Applications, PHI, 2003.

CO-PO Articulation Matrix Machine Learning Course (OE/CSE/14-T)

Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	_	_	1	_	_	_	_	_	_	_	_	_	_	3
CO2	2	2	2	3	_	_	_	_	_	_	_	_	_	_	3
CO3	2	2	2	2	_	_	_	_	_	_	_	_	_	_	3
CO4	3	3	2	3	_	_	_	_	_	_	_	_	_	_	3
CO5	3	3	2	3	_	_	_	_	_	_	_	_	_	_	3
CO6	3	3	2	3	_	_	_	_	_	_	_	_	_	_	3
3-High 2-Medium 1-Low															

List of Common Courses:

BSC

Course Code	Definition / Category
BSC	Basics Science Courses
ESC	Engineering Science Courses
HSMC	Humanities and Social Sciences Including Management Courses
MC	Mandatory Courses
PC	Program Courses
PE	Program Core
OE	Open Elective Courses
EEC	Employability Enhancement Courses (Project Work/ Summer Training/ Industrial Training/ Practical Training/ Internship/ Seminar, etc.)

#	Course Title	Course Code (T)	Course Code(P)	Credit
1.	Physic	BSC/1-T(i-vii)	BSC/1-P	
2.	Chemistry	BSC/2-T	BSC/2-P	
3.	Mathematics-I	BSC/3-T		
4.	Mathematics-II	BSC/4-T		
5.	Mathematics-I (CSE/IT)	BSC/5-T		
6.	Mathematics-II (CSE/IT)	BSC/6-T		
7.	Mathematics-III	BSC/7-T		
8.	Introduction to Food Biotechnology	BSC/8-T	BSC/8-P	

ESC

#	Course Title	Course Code (T)	Course Code(P)	Credit
1.	Basics Electrical Engineering	ESC/1-T	ESC/1-P	
2.	Engineering Graphics and Design Lab	-	ESC/2-P	
3.	Programming for Problem Solving	ESC/3-T	ESC/3-P	
4.	Workshop/ Manufacturing Practices	ESC/4-T	ESC/4-P	
5.	Analog Electronics Circuit	ESC/5-T		
6.	Engineering Properties of Food	ESC/6-T		
7.	Civil Engineering Mats Testing Evaluation-I Lab	-	ESC/7-P	
8.	Civil Engineering Mats Testing Evaluation-II Lab	-	ESC/8-P	
9.	Engineering Mechanics	ESC/9-T		
10.	Workshop Technology-II Lab		ESC/10-P	
11.	Basics of Machine Drawing		ESC/11-P	

HSMC

#	Course Title	Course Code (T)	Course Code(P)	Credit
1.	English	HSMC/1-T	HSMC/1-P	
2.	Human Values & Personality Development	HSMC/2-T		
3.	Fundamentals of Management for Engineers	HSMC/3-T		
4.	Economics for Engineers	HSMC/4-T		
5.	Industrial Physiology	HSMC/5-T		

MC

#	Course Title	Course Code (T)	Course Code(P)	Credit
1.	Induction Training	MC/1		
2.	Environmental Sciences	MC/2-T		
3.	Indian Constitution	MC/3-T		
4.	Essence of Indian Traditional Knowledge	MC/4-T		
5.	Technical Presentation		MC/5-P	
6.	Entrepreneurship	MC/6-T		
7.	Disaster Preparedness & Planning Management	MC/7-T		
8.	General Proficiency		MC/8-P	