Proposed for the academic years 2020-2024

FACULTY OF ENGINEERING

Scheme of Instruction & Examination

(AICTE Model Curriculum)

and

Syllabi

of

Four Year Degree Program of

Bachelor of Engineering (B.E)

COMPUTER SCIENCE AND ENGINEERING

Issued by

Dean, Faculty of Engineering

Osmania University, Hyderabad – 500 007

18/11/2021

Vision and Mission of Osmania University

Vision	The Vision of the University is to generate and disseminate knowledge through a harmonious blend of ancient and modern wisdom, and to serve the society by developing in students heightened intellectual, cultural, ethical, and humane sensitivities; to foster a scientific temper, and to promote professional and technological expertise. Central to this vision is a commitment to regional and national development in consonance with our culture, heritage, and environment.
Mission	• To achieve excellence in teaching and research. • To generate, disseminate and preserve knowledge. • To meet the challenges of a complex, and modern society through informed social outreach. • To empower through knowledge and information. • To develop a responsible and productive citizenry. • To develop, enhance, and improve the quality of human resources. • To cultivate resolute moral and ethical values. • To meet contemporary regional and national needs and anticipate future social and economic development. • To preserve and promote cultural heritage, humanistic and spiritual values.

Program Outcomes

PO1: Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2: Problem analysis: Identify, formulate, research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences
PO3: Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4: Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5: Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
PO6: The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO7: Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO8: Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9: Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10: Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO11: Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO 12: Life-long learning: Recognise the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Proposed for the academic years 2020-2024

SCHEME OF INSTRUCTION & EXAMINATION

B.E (Computer Science and Engineering)

SEMESTER-I

S. No.	Course Code	Course Title	Scheme of Instruction				Scheme of Examination			Credits
			L	T	P / D	Contact Hrs / Wk	CIE	SEE	Duration in Hrs	
Theory Courses										
1.	**Three Week Induction Program**									
2.	MC 802 CE	Environmental Sciences	2	-	-	2	30	70	3	-
3.	MC 803 PY	Essence of Indian Traditional Knowledge	2	-	-	2	30	70	3	-
4.	BS 201 MT	Mathematics-I	3	1	-	4	30	70	3	4
5.	BS 204 CH	Chemistry	3	1	-	4	30	70	3	4
6.	ES 302 CS	Programming for Problem Solving	3	-	-	3	30	70	3	3
Practical / Laboratory Courses										
7.	BS 252CH	Chemistry Lab	-	-	3	3	25	50	3	1.5
8.	ES 351 CS	Programming for Problem Solving Lab	-	-	2	2	25	50	3	1
9.	ES 352 ME	Workshop Practice	-	-	2x3	6	50	50	3	3
Total			**13**	**02**	**11**	**26**	**250**	**500**		**16.5**

BS: Basic Science ES: Engineering Science MC: Mandatory Course

L: Lecture T: Tutorial P: Practical D: Drawing

CIE: Continuous Internal Evaluation SEE: Semester End Evaluation

SCHEME OF INSTRUCTION & EXAMINATION

B.E (Computer Science and Engineering)

SEMESTER-II

S. No.	Course Code	Course Title	Scheme of Instruction				Scheme of Examination			Credits
			L	T	P / D	Contact Hrs / Wk	CIE	SEE	Duration in Hrs	
Theory Courses										
1	MC 801 PO	Indian Constitution	2	-	-	2	30	70	3	-
2	HS 101 EG	English	2	-	-	2	30	70	3	2
3	BS 202 PH	Physics	3	1	-	4	30	70	3	4
4	BS 203MT	Mathematics-II	3	1	-	4	30	70	3	4
5	ES 301 EE	Basic Electrical Engineering	3	1	-	4	30	70	3	4
Practical / Laboratory Courses										
6	HS 151EG	English Lab	-	-	2	2	25	50	3	1
7	BS 251PH	Physics Lab	-	-	3	3	25	50	3	1.5
8	ES 353 CE	Engineering Graphics		-	3x2	6	50	50	3	3
9	ES 354 EE	Basic Electrical Engineering Lab	-	-	2	2	25	50	3	1
Total			**13**	**03**	**13**	**29**	**275**	**550**		**20.5**

ENVIRONMENTAL SCIENCES

MC 802CE

Instruction: 2 periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits : 0

Objectives:

1. To create awareness and impart basic knowledge about the environment and its allied problems.
2. To know the functions of ecosystems, social and environment related issues and their preventive measures
3. To understand importance of biological diversity, different pollutions and their impact on environment

Outcomes: Student will be able to:

1. Adopt environmental ethics to attain sustainable development
2. Develop an attitude of concern for the environment
3. Conservation of natural resources and biological diversity
4. Creating awareness of Green technologies for nation's security
5. Imparts awareness for environmental laws and regulations

UNIT – I

The Multidisciplinary Nature of Environmental Studies: Definition, scope and importance, need for public awareness.

***Natural Resources*:** Water Resources – Use and over utilization of surface and ground water, flood, drought, conflicts over water, Dams: Benefits and Problems. Food Resources –World Food Problems, effects of modern agriculture, fertilizer-pesticides problems, water logging, salinity, Forest Resources – Use and over exploitation, deforestation & its effect on tribal people.Land Resources –Land Degradation, environmental effect of mining, man induced landslides, soil erosion and desertification. Energy Resources –Growing energy needs, Renewable and Non-renewable energy resources.

UNIT – II

Ecosystems: Concept of an ecosystem, Structure and function of an ecosystem, Producers, consumers and decomposers, Energy flow in ecosystem, food chains, ecological pyramids, ecological succession, types of ecosystems (marine, pond, river, forest, grassland, desert)

UNIT – III

Biodiversity: Levels of Biodiversity, Bio-geographical classification of India, Value of biodiversity, Threats to biodiversity, endangered and endemic species of India, Conservation of biodiversity, global and national efforts.

UNIT – IV

Environmental Pollution: Definition, Causes, effects and control measures of air pollution, water pollution, soil pollution, noise pollution, thermal pollution, solid waste management.

Environment Protection Act: Air, water, forest and wildlife Acts, issues in the enforcement of environmental legislation

UNIT – V

Social Issues and the Environment: Watershed management and environmental ethics. Climate change, global warming, acid rain, ozone layer depletion.

Environmental Disaster Management: Types of disasters, impact of disasters on environment, infrastructure, and development. Basic principles of disaster mitigation, disaster management, and methodology. Disaster management cycle and disaster management in India.

Field Work:Visit to a local area to document environmental issues- agricultural area/ pond/lake/terrestrial ecosystem.Visit to a local polluted area- market/slum area/Industrial area/traffic area.

Suggested Readings:

1	De Anil Kumar, "*Environmental Chemistry",* New Age Publisher International Pvt Ltd, New Delhi , 2016
2	E.P. Odum, '*Fundamentals of Ecology',* W.B. Sunders Co., USA.,1971
3	M.N. Rao and A.K. Datta, "*Waste Water Treatment",* Oxford and IBK Publications, New Delhi, 2009.
4	Benny Joseph, "*Environmental Studies",* Tata McGraw Hill, New Delhi, 2009
5	V.K. Sharma, "*Disaster Management",* National Centre for Disaster Management, IIPE, New Delhi, 1999

ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE

MC 803 PY

Instruction: 2 periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits : 0

Objectives:

1. To get a knowledge in Indian Culture
2. To Know Indian Languages and Literature and the fine arts in India
3. To explore the Science and Scientists of Medieval and Modern India

Outcomes: Student will be able to:

1. Understand philosophy of Indian culture
2. Distinguish the Indian languages and literature.
3. Learn the philosophy of ancient, medieval and modern India.
4. Acquire the information about the fine arts in India
5. Know the contribution of scientists of different eras.

UNIT – I
Introduction to Culture: Culture, civilization, culture and heritage, general characteristics of culture, importance of culture in human literature, Indian Culture, Ancient India, Medieval India, Modern India
UNIT – II
Indian Languages, Culture and Literature: Indian Languages and Literature-I: the role of Sanskrit, significance of scriptures to current society, Indian philosophies, other Sanskrit literature, literature of south India. ***Indian Languages and Literature-II***: Northern Indian languages & literature
UNIT – III
Religion and Philosophy: Religion and Philosophy in ancient India, Religion and Philosophy in Medieval India, Religious Reform Movements in Modern India (selected movements only)
UNIT – IV
***Fine Arts in India (Art, Technology& Engineering*)**: Indian Painting, Indian handicrafts, Music, divisions of Indian classic music, modern Indian music, Dance and Drama, Indian Architecture (ancient, medieval and modern), Science and Technology in India, development of science in ancient, medieval and modern India.
UNIT – V
Education System in India: Education in ancient, medieval and modern India, aims of education, subjects, languages, Science and Scientists of Ancient India, Science and Scientists of Medieval India, Scientists of Modern India

Suggested Readings:

1	Kapil Kapoor, "*Text and Interpretation*: *The India Tradition*", D. K. Print world, 2005
2	Gopala Krishnan , "*Science in Samskrit*", Samskrita Bharti Publisher, New Delhi, 2017
3	NCERT, "*Position paper on Arts, Music, Dance and Theatre*" NCERT, New Delhi, 2010.
4	S. Narain, "*Examinations in Ancient India*", Arya Book Depot, New Delhi, 1993
5	Satya Prakash, "*Founders of Sciences in Ancient India*", Vijay Kumar Publisher, New Delhi, 1989
6	M. Hiriyanna, "*Essentials of Indian Philosophy*", Motilal Banarsidass Publishers, New Delhi, 2005

MATHEMATICS-I

BS 201 MT

Instruction: 3+1 periods per week *Duration of SEE: 3 hours*

CIE: 30 marks *SEE: 70 marks*

Credits : 4

Objectives:

1.To introduce the concepts of sequences, series and their properties
2.To introduce the concepts of functions of several variables and multiple integrals
3.To study vector differential and integral calculus

Outcomes: Student will be able to:

1.Find the nature of sequences and series
2.Apply this knowledge to solve the curriculum problems
3.Evaluate multiple integrals

UNIT – I

Sequences and Series: Sequences, Series, General properties of series, Series of positive terms, Comparison tests, tests of Convergence D'Alembert's ratio test, Cauchy's n^{th} root test, Raabe's test, Logarithmic test, Alternating series, Series of positive and negative terms, Absolute convergence and Conditional convergence.

UNIT – II

Calculus of one Variable: Rolle's theorem, Lagrange's, Cauchy's mean value theorems, Taylor's series, Curvature, Radius of curvature, Circle of curvature, Envelope of a family of curves, Evolutes and Involutes.

UNIT – III

Multivariable Calculus (Differentiation): Functions of two variables, Limits and continuity, Partial derivatives, Total differential and differentiability, Derivatives of composite and implicit functions (Chain rule), Change of variables, Jacobian, Higher order partial derivatives, Taylor's series of functions of two variables, Maximum and minimum values of functions of two variables, Lagrange's method of undetermined multipliers.

UNIT – IV

***Multivariable Calculus* (*Integration*):** Double integrals, Change of order of integration, Change of Variables from Cartesian to plane polar coordinates, Triple integrals

UNIT – V

Vector Calculus: Scalar and vector fields, Gradient of a scalar field, Directional derivative, Divergence and Curl of a vector field, Line, Surface and Volume integrals, Green's theorem in a plane, Gauss's divergence theorem, Stoke's theorem (without proofs) and their verification.

Suggested Readings:

1	R.K. Jain & S.R.K Iyengar, "*Advanced Engineering Mathematics"*, Alpha Science International Limited, 2014.
2	Erwin Kreyszig, "*Advanced Engineering Mathematics"*, John Wiley, 9th Edition, 2012.
3	B.S. Grewal, "*Higher Engineering Mathematics"*, Khanna Publishers, 43rd Edition, 2014.
4	G.B. Thomas, Maurice Weir and Joel Hass, "*Thomas' Calculus"*, Pearson Education, 12th Edition,2010.
5	B.V. Ramana, "*Higher Engineering Mathematics*", Tata Mc Graw Hill Education, 23rd reprint, 2017.

CHEMISTRY

BS 204 CH

Instruction: 3+1 periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits : 4

Objectives:

1. Correlate the properties of materials with their internal structure and use for Engineering applications
2. Apply the principles of electrochemistry in storage of electrical energy in batteries.
3. Gains knowledge about the causes of corrosion and its prevention.
4.Attains knowledge about the hard water and treatment of water for drinking purpose.
5.Exposed to qualitative and quantitative parameters of chemical fuels and aware of eco-friendly materials and processes.

Outcomes: Student will be able to:

1.Apply concept of electrode potential in identifying feasibility of electrochemical reaction; illustrate electro analytical techniques and working of batteries.
2. Identify the mechanism of corrosion of materials on basis of electrochemical approach and devise corrosion control methods.
3. Estimate the physical & chemical parameters of quality of water and explain the process of water treatment
4.Analyze the influence of chemical structure on properties of materials and their choice in engineering applications.
5. Classify chemical fuels and grade them through qualitative analysis and relate the concept of green c chemistry to modify engineering processes and materials.

UNIT – I

***Electrochemistry*:** Electrochemical cells, Electrolytic and Galvanic cells-notation, cell reaction and cell potentials. Types of electrodes, Calomel Quinhydrone and Glass electrodes. Determination of pH of a solution by using Quinhydrone electrode. Thermodynamics of emf of cells, Nernst equation and its derivation. Applications of Nernst equation to electrode potential and emf of cells. Numerical problems.

Battery Chemistry: Primary batteries: Zn - Carbon battery. Secondary batteries: Pb-Acid battery and Li-Ion battery, Applications. Flow batteries (Fuel cells): Methanol-Oxygen fuel cells, Construction, Applications.

UNIT – II

Water Chemistry: Hardness of Water-Types and units of hardness, estimation of temporary and permanent hardness of water by EDTA method. Alkalinity of water and its determination. Water softening by Ion exchange and Reverse Osmosis methods. Numerical problems. Specifications of potable water. Sterilization by Chlorination.

Break Point Chlorination.

Corrosion: Causes and its effects. Types of Corrosion-Dry or Chemical corrosion and Wet or Electrochemical corrosion and their mechanism. Electrochemical corrosion – Waterline and Pitting Corrosion. Factors influencing rate of corrosion.

Corrosion control methods: Cathodic protection methods - Sacrificial anodic and impressed current methods.

Surface coating methods: Hot Dipping-Galvanizing.

UNIT – III

Engineering Materials: Polymers: Basics of terms polymers: Monomer and its functionality, Polymers and degree of polymerization. Classification of polymers - Thermoplastics & Thermosetting resins.

Types of Polymerization-Addition, Condensation, Co-Polymerization. Mechanism of free radical polymerization. Preparation, Properties & Uses of the following polymers: Plastics - PVC and Bakelite, Fibres - Nylon 6:6, and Kevlar, Elastomers - Buna-S, Butyl and Silicone Rubbers.

Conducting polymers: Introduction, Classification and Mechanism of conduction in Poly-acetylene, Applications of conducting polymers.

Biodegradable polymers: Introduction preparation, properties and applications of polylactic acid.

UNIT – IV

Chemical Fuels: Classification of fuels: Introduction, definition and classification of chemical fuels-Primary and secondary fuels. Solid, liquid and gaseous fuels. Requirements of a good fuel. Calorific Value – HCV and LCV. Theoretical calculations of calorific value by Dulong's formula – Numerical problems.

Solid Fuels: Coal and its Ranking. Analysis of coal - Proximate and Ultimate analysis.

Liquid Fuels: Fractionation of Petroleum. Composition and uses of Gasoline, Diesel and Kerosene. Cracking & its Significance- Catalytic cracking by moving bed method, Knocking. Fuel rating – Octane and Cetane numbers.

Gaseous Fuels: LPG, CNG -Composition and Uses.

Combustion: Ignition temperature of a fuel, calculation of air quantities by weight and volume required for combustion of a fuel- Numerical problems.

UNIT – V

Green Chemistry: Concept, Principles of green chemistry – Atom Economy, Catalysis. and examples of clean technology.

Biodiesel: Sources, Concept of Transesterification and carbon neutrality, Properties and significance

Composites: Introduction to composites, composition and characteristic properties of composites.

Classification of composites based on matrix, reinforcement and ply. Applications of composites.

Suggested Readings:

1	B.R. Puri, L.R. Sharma, Madan S. Pathania , "*Principles of Physical Chemistry*", S.N. Chand & Co. New Delhi,1987
2	P C Jain and M Jain ,"*Engineering Chemistry*", Dhanpat Rai & Sons , 15th Edition, New Delhi, 2004
3	J C Kuriacose and J Rajaram ,"*Chemistry in Engineering and Technology* ", Tata Mc Graw Hill, New Delhi, 2010
4	O G Palanna, "*Engineering Chemistry*", Tata Mc Graw Hill, New Delhi, 2009
5	S S Dara and SS Umare, "*Engineering Chemistry*", S.N. Chand & Co. New Delhi, 2004
6	Sashi Chawla, "*Engineering Chemistry*", Dhanpat Rai & Sons, New Delhi, 2017
7	Prasanta Rath, "*Engineering Chemistry*", Cengage Learning India Pvt. Ltd, 2015

PROGRAMMING FOR PROBLEM SOLVING

ES 302 CS

Instruction: 3periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits: 3

Objectives:

1.To introduce the concepts of Computing environment, number systems, flowcharts and algorithms
2.To familiarize the basic constructs of C language – data types, operators and expressions
3.To understand modular and structured programming constructs in C
4.To learn the usage of structured data types and memory management using pointers
5.To learn the concepts of data handling using pointers

Outcomes: Student will be able to:

1. Formulate simple algorithms and translate the algorithms to programs using C language.
2. Implement conditional branching, and iteration and arrays.
3.Apply the function concepts to implement searching and sorting algorithms
4. Analyse the usage of structures and pointer variables.

UNIT – I
Introduction to Programming: Introduction to components of a computer system (disks, memory, processor, where a program is stored and executed, operating system, compilers etc.). Idea of Algorithm: steps to solve logical and numerical problems. ***Representation of Algorithm***: Flowchart / Pseudocode with examples. From algorithms to programs; source code, variables (with data types) variables and memory locations, Syntax and Logical Errors in compilation, object and executable code.
UNIT – II
Control Structures: Arithmetic expressions and precedence, Conditional Branching and Loops, Writing and evaluation of conditionals and consequent branching. ***Arrays:*** Arrays (1-D, 2-D), Character arrays and Strings.
UNIT – III
Basic Algorithms: Searching, Basic Sorting Algorithms (Bubble and Selection), Finding roots of Equations. ***Functions:*** Functions (including using built in libraries), Parameter passing in functions, call by value. Passing arrays to functions: idea of call by reference
UNIT – IV
Recursion: Recursion, Example programs, such as Finding Factorial, Fibonacci series ***Structure***: Structures, Defining structures and Array of Structures
UNIT – V
Pointers : Idea of pointers, Defining pointers, Use of Pointers in self-referential structures, notion of linked list (no implementation), Introduction to File Handling.

Suggested Readings:

1	Byron Gottfried, "*Theory and practice of Programming with C"*, Schaum's Outline McGraw-Hill, 1996
2	A.K. Sharma, "*Computer Fundamentals and Programming in C*", Universities Press, 2nd Edition, 2018.
3	E. Balaguruswamy, "*Programming in ANSI C*", Tata McGraw-Hill Education, 2008
4	Brian W. Kernighan and Dennis M. Ritchie,"*The C Programming Language*", Prentice Hall of India,1988.

CHEMISTRY LAB

ES 252 CH

Instruction:3 periods per week *Duration of SEE: 3 hours*
CIE: 25 marks *SEE: 50 marks*
Credits: 1.5

Objectives:

1.Conduct experiments, take measurements and analyse the data though hands-on experience in order to demonstrate understanding of the theoretical concepts of quantitative Analysis while working in small group.
2.Interpret the electro analytical principles with experimental results graphically
3.Demonstrate writing skills through clear laboratory reports

Outcomes: Student will be able to:

1.Apply the principles of Colourimetry and Electrochemistry in quantitative estimations.
2.Estimate the rate constants of reactions from concentration of reactants/ products as a function of time.
3. Synthesize small drug molecules.

List of Experiments:

1. Introduction to Chemical Analysis.
2. Techniques of Weighing. Volumetric Analysis:
3. Preparation of Standard Mohr's salt solution, Standardization of $KMnO_4$ and estimation ferrous ion.
4. Estimation Iron(II) by Dichromatometry
5. Water Analysis:
6. Preparation of Standard Magnesium sulphate solution, standardization of EDTA and Estimation of Total Hardness.
7. Preparation of Standard Sodium Carbonate Solution, Standardization of HCL and Estimation of Carbonate and Bicarbonate Alkalinity.
   Conductometry: Estimation of HCL
8. Estimation of CH_3COOH and mixture of Acids
   Potentiometry
9. Estimation of HCL
10. Estimation of Iron
    pH Metry:
11. Estimation of HCL
    Colorimetry:
12. Verification of Beer-Lambert's law and estimation of Manganese.
    Chemical Kinetics:
13. Determination of rate constant of acid catalysed hydrolysis of methyl acetate.
14. Drug Synthesis Preparation of spirin

Note: Minimum ten experiments should be conducted in the semester

Suggested Readings:

1	B.D. Khosla, A. Gulati and V. Garg , "*Senior Practical Physical Chemistry*", R. Chand & Co., Delhi, 2011.
2	K. K. Sharma and D.S. Sharma , "*An Introduction to Practical Chemistry*", Vikas publishers, New Delhi, 1982.

WORKSHOP PRACTICE

ES 352 ME

Instruction:6 periods per week *Duration of SEE: 3 hours*
CIE: 25 marks *SEE: 50 marks*
Credits: 3

Objectives:

1.Identify and use marking out tools, hand tools, measuring equipment and to work to prescribed tolerances.
2.To provide hands on experience about use of different engineering materials, tools, equipments and processes those are common in the engineering field.
3.To gain a good basic working knowledge required for the production of various engineering products.
4.To Study different hand operated power tools, uses and their demonstration.
5.Adopt safety practices while working with various tools

Outcomes: Student will be able to:

1. Demonstrate an understanding of and comply with workshop safety regulations.
2. Identify and apply suitable tools for different trades of Engineering processes including drilling, material removing, measuring, chiseling.
3. Study and practice on machine tools and their operations
4.Undertake jobs connected with Engineering Workshop trades including fitting, carpentry, sheet metal, house wiring, welding, smithy and foundry.
5.Apply basic electrical engineering knowledge for house wiring practice

List of Experiments:

A. TRADE FOR EXERCISES:

1. Carpentry
2. Fitting
3. House wiring
4. Sheet metal working
5. Smithy
6. Welding
7. Plumbing

B. TRADES FOR DEMONSTRATION AND EXPOSURE:

1. Machining (Lathe & Drilling)
2. Injection moulding
3. Mould making and casting
4. Basic Electronics lab instruments

C. PRESENTATIONS AND VIDEO LECTURES

1. Manufacturing Methods
2. Rapid Prototyping
3. Glass Cutting
4. 3D printing
5. CNC LATHE

D. IT WORKSHOP: Computer hardware, identification of parts, Disassembly, Assembly of computer to working condition, operating system installation.

Note: At least two exercises from each trade.

Suggested Readings:

1	Venugopal, K, "*Workshop Manual*", Anuradha Publications, Kumbakonam, TN, 2012
2	K.C. John, "*Mechanical Workshop*" 2nd Edn., PHI, 2010.
3	Hajra Choudary, "*Elements of Workshop Technology*" Vol. 1, Asian Publishers, Edn., 1993.
4	G.S. Sawhney, "*Mechanical Experiments and Workshop Practice*", I.K. International Publishing House, New Delhi, 2009.

PROGRAMMING FOR PROBLEM SOLVING LAB

ES 351 CS

Instruction:2 periods per week *Duration of SEE: 3 hours*
CIE: 25 marks *SEE: 50 marks*
Credits: 1

Objectives:

1. Understand the fundamentals of programming in C Language
2. Write, compile and debug programs in C
3. Formulate solution to problems and implement in C.
4. Effectively choose programming components to solve computing problems

Outcomes: Student will be able to:

1.Choose appropriate data type for implementing programs in C language
2.Design and implement modular programs involving input output operations, decision making and looping constructs.
3.Implement search and sort operations on arrays.
4.Apply the concept of pointers for implementing programs on dynamic memory management and string handling.
5.Design and implement programs to store data in structures and files.

List of Experiments:

1. Finding maximum and minimum of given set of numbers, finding roots of quadratic equation.
2. Sin x and Cos x values using series expansion.
3. Conversion of binary to decimal, octal, hexadecimal and vice versa.
4. Generating Pascal triangle, pyramid of numbers.
5. Recursion: factorial, Fibonacci, GCD.
6. Matrix addition and multiplication using arrays, linear search and binary search using recursive and non-recursive procedures.
7. Bubble sort and selection sort.
8. Programs on pointers: pointer to arrays, pointer to functions.
9. Functions for string manipulations.
10. Programs on structures and unions.
11. Finding the number of characters, words and lines of given text file.
12. File handling programs

Suggested Readings:

1	Byron Gottfried, "*Theory and practice of Programming with C"*, Schaum's Outline McGraw-Hill, 1996
2	A.K. Sharma, "*Computer Fundamentals and Programming in C*", Universities Press, 2nd Edition, 2018.
3	E. Balaguruswamy, "*Programming in ANSI C*", Tata McGraw-Hill Education, 2008
4	Brian W. Kernighan and Dennis M. Ritchie,"*The C Programming Language*", Prentice Hall of India,1988.

INDIAN CONSTITUTION

MC 801 PO

Instruction: 2 periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits: 0

Objectives:

1. To create awareness among students about the Indian Constitution.
2.To acquaint the working conditions of union, state, local levels, their powers and functions
3. To create consciousness in the students on democratic values and principles articulated in the constitution.
4.To expose the students on the relations between federal and provincial units.
5.To divulge the students about the statutory institutions.

Outcomes: Student will be able to:

1. Know the background of the present constitution of India
2.Understand the working of the union, state and local levels
3.Gain consciousness on the fundamental rights and duties
4.Be able to understand the functioning and distribution of financial resources between the centre and states
5.Be exposed to the reality of hierarchical Indian social structure and the ways the grievances of the deprived sections can be addressed to raise human dignity in a democratic way.

UNIT – I
Evolution of the Indian Constitution: 1909 Act, 1919 Act and 1935 Act. Constituent Assembly: Composition and Functions; Fundamental features of the Indian Constitution
UNIT – II
Union Government: Executive-President, Prime Minister, Council of Minister ***State Government***: Executive: Governor, Chief Minister, Council of Minister ***Local Government***: Panchayat Raj Institutions, Urban Government
UNIT – III
Rights and Duties: Fundamental Rights, Directive principles, Fundamental Duties
UNIT – IV
Relation between Federal and Provincial units: Union-State relations, Administrative, legislative and Financial, Inter State council, NITI Ayog, Finance Commission of India.
UNIT – V
Statutory Institutions: Elections-Election Commission of India, National Human Rights Commission, National Commission for Women.

Suggested Readings:

1	Durga Das Basu, "*Introduction to the Constitution of India*", Lexis Nexis Butterworths Wadhwa Nagpur, 2008
2	Subhash Kashyap, "*Our Parliament*", National Book Trust, India, 2004.
3	Peu Ghosh, "*Indian Government and Politics*", Prentice Hall of India, New Delhi,2012.

ENGLISH

HS 101 EG

Instruction: 2 periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits: 2

Objectives:

1.Using authentic material for language learning
2.Exposing them to a variety of content-rich texts
3.Strengthening their grammar and vocabulary
4.Improving their reading and comprehension skills
5.Honing their writing skills
6.Encouraging them to think creatively and critically

Outcomes: Student will be able to:

1.Read, understand, and interpret a variety of written texts
2.Use appropriate vocabulary and correct grammar
3. Undertake guided and extended writing with confidence

UNIT – I
Reading: RK Narayan, "A Horse and Two Goats"***Vocabulary***: Word formation—Prefixes, Suffixes, Root Words ***Grammar:*** Articles, Prepositions, Determiners
UNIT – II
Reading: Rudyard Kipling, "If" ***Vocabulary***: Word formation—Compounding and Blending, Contractions ***Grammar***: Transitions, Connectives ***Writing***: Paragraph Writing
UNIT – III
Reading: Martin Luther King Jr., "I Have a dream" ***Vocabulary***: Synonyms, Antonyms, One Word Substitutes ***Grammar***: Voice ***Writing:*** Letter Writing
UNIT – IV
Reading: Robert Frost, "Road Not Taken" ***Vocabulary***: Homophones, Homonyms, Homographs ***Grammar***: Narration (Direct-Indirect Speech) ***Writing:*** Report Writing
UNIT – V
Reading: George Orwell, "The Sporting Spirit" (Excerpt) ***Vocabulary***: Inclusive Language, Euphemisms ***Grammar***: Tense ***Writing:*** SOP

Suggested Readings:

1	Board of Editors," *Language and Life: A Skills Approach*", Orient Black Swan, 2018.
2	Sudharshana, NP and C Savitha," *English for Engineers*", Cambridge University Press, 2018
3	Kumar, Sanjay and Pushp Lata," *English Language and Communication Skills for Engineers*", Oxford University Press, 2018

PHYSICS

BS 202 PH

Instruction: 3+1 periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits: 4

Objectives:

1. Aware of limits of classical free electron free theory and to apply band theory of solids
2.Acquire knowledge on various properties of semiconductors.
3. Grasp the intricacies in semiconductor-optical interaction

Outcomes: Student will be able to:

1.Distinguish materials based on band theory of solids.
2.Classify semiconductors on the basis doping and to estimate conductivity and learn transport phenomenon in semiconductors.
3.Appreciate use of optical absorption by semiconductors.

UNIT – I
Crystallography: Introduction, Types of crystal systems, Bravais lattices, Lattiee planes and Miller Indices (Cubic system), Inter planar spacing (Cubic system), Bragg's law, Powder diffraction method. ***Crystal Defects***: Classification of point defects, Concentration of Schottky defects in metals and ionic crystals, Concentration of Frankel defects, Line defects, Screw and Edge dislocations, Burger's vector.
UNIT – II
Band Theory of Solids & Semiconductors: Classical free electron theory (qualitative), Kronig Penney model (qualitative treatment), Energy band formation in solids, Intrinsic and Extrinsic semiconductors, Concept of a hole, Carrier concentration and conductivity in intrinsic semiconductors, Formation of P-N junction diode and its I – V characteristics, Thermistor and its characteristics, Hall effect and its applications. ***Dielectric Materials:*** Dielectrics, Types of polarizations, Electronic, Ionic, Orientational and Space charge polarizations, Expression for Electronic polarizability, Frequency and temperature dependence of dielectric polarizations, Determination of dielectric constant by capacitance Bridge method, Ferro electricity, Barium titanate, Applications of Ferroelectrics.
UNIT – III
Wave Mechanics: Matter waves –de-Broglie wavelength, properties of wave function, Physical significance, Schrodinger time dependent and time in-dependent wave equation. Particle in a 1-D box. ***Electromagnetic Theory***: Basic laws of electricity and magnetism, Maxwell's equations in integral and differential forms, Conduction and displacement current, Relation between D, E and P – Electromagnetic waves: Equation of plane wave in free space, Poynting theorem.
UNIT – IV
Magnetic Materials: Classification of magnetic materials: dia, para, ferro, antiferro and ferrimagnetic materials, Weiss molecular field theory of ferromagnetism, Magnetic domains, Hysteresis curve, soft and hard magnetic materials, Ferrites: Applications of ferrites. ***Superconductivity:*** Introduction, General properties of super conductors, Meissner effect, Type I and Type II superconductors, BCS theory (qualitative), Introduction to High T_c superconductors, Applications of superconductors
UNIT – V
Lasers: Characteristics of Lasers, spontaneous and stimulated emission of radiation, Einstein's Coefficients, population inversion, Ruby Laser, Helium Neon Laser, Semi-Conductor Laser

	and applications of lasers. ***Fiber Optics:*** Introduction, Propagation of light through an optical fiber, Acceptance angle, Numerical aperture (NA), Types of Optical fibers and Refractive index profiles, Fiber drawing process (double Crucible Method), Losses in optical fibers, applications of optical fibers.

Suggested Readings:

1	B.K. Pandey and S. Chaturvedi," *Engineering Physics*", Cengage Learning, 2012
2	A.K. Bhandhopadhya, "*Nano Materials*", New Age International, 1st Edition, 2007
3	M.S. Avadhanulu and P.G. Kshirusagar," *Engineering Physics*", S. Chand & Co. 1st Edition,1992
4	C.M. Srivastava and C. Srinivasan , "*Science of Engineering Materials*", New Age International, 2001
5	R.K Gaur and S.L Gupta, "*Engineering Physics*", McGraw-Hill Education (India) Pvt Limited, 1992
6	Sanjay D Jain and Girish G Sahasrabudhe, "Engineering Physics", Orient Black swan Pvt Limited, 2016

MATHEMATICS-II

BS 203 MT

Instruction: 3+1 periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits: 4

Objectives:

1.To study matrix algebra and its use in solving system of linear equations and in solving eigen value problems
2. To provide an overview of ordinary differential equations
3. To study special functions like Legendre and Beta Gamma functions
4.To learn Laplace Transforms and its properties

Outcomes: Student will be able to:

1.Solve system of linear equations and eigen value problems
2.Solve certain first order and higher order differential equations
3.Solve basic problems of Beta Gamma and Legender's Function
4.Apply Laplace Transforms; solve ordinary Differential Equations by using it

UNIT – I

Matrices: Rank of a matrix, Echelon form, System of linear equations, Linearly dependence and independence of vectors, Linear transformation, Orthogonal transformation, Eigen values, Eigenvectors, Properties of eigen values, Cayley - Hamilton theorem, Quadratic forms, Reduction of quadratic form to canonical form by orthogonal transformation, Nature of quadratic forms.

UNIT – II

Differential Equations of First Order: Exact differential equations, Integrating factors, Linear differential equations, Bernoulli's, Riccati's and Clairaut's differential equations, Orthogonal trajectories of a given family of curves.

UNIT – III

Differential Equations of Higher Orders: Solutions of second and higher order linear homogeneous equations with constants coefficients, Method of reduction of order for the linear homogeneous second order differential equations with variable coefficients, Solutions of non-homogeneous linear differential equations, Method of variation of parameters, solution of Euler-Cauchy equation.

UNIT – IV

Special Function: Gamma Functions, Beta Functions, Relation Between Beta and Gamma Function, Error Functions. Power Series Method, Lengender's Differential Equations and Legender's Polynomial $P_n(x)$, Rodrigue's Formula (without proof).

UNIT – V

Laplace Transforms: Laplace Transforms, Inverse Laplace Transforms, Properties of Laplace Transforms and inverse Laplace Transforms, Convolution Theorem (without proof). Solution of ordinary Differential Equations using Laplace Transforms.

Suggested Readings:

1	R.K. Jain & S.R.K. lyengar, "*Advanced Engineering Mathematics"*, Narosa Publications, 4th Edition, 2014.
2	Erwin Kreyszig, "*Advanced Engineering Mathematics"*, John Wiley, 9th Edition, 2012
3	Dr.B.S. Grewal*, "Higher Engineering Mathematics"*, Khanna Publications, 43rd Edition, 2014
4	B.V. Ramana, "*Higher Engineering Mathematics"*, Tata Mc Graw Hill, 2008
5	N. Bali and M. Goyal," *A text book of Engineering Mathematics"*, Laxmi Publications, 7th Edition, 2010
6	H.K. Dass, Er. Rajnish Varma, "*Higher Engineering Mathematics"*, S. Chand and Company Ltd, 3rd Edition, 2008

BASIC ELECTRICAL ENGINEERING

ES 301 EE

Instruction: 3+1 periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits: 4

Objectives:

1. To provide an understanding of basics in Electrical circuits.
2. To provide an overview of ordinary differential equations

Outcomes: Student will be able to:

1. To analyse Electrical circuits to compute and measure the parameters of Electrical Energy
2.To comprehend the working principles of Electrical DC Machines
3. To Identify and test various Electrical switchgear, single phase transformers and assess the ratings needed in given application
4.To comprehend the working principles of electrical AC machines

UNIT – I
DC Circuits: Electrical circuit elements (R, L and C), voltage and current sources, Kirchoff current and voltage laws, analysis of simple circuits with dc excitation. Superposition, Thevenin and Norton Theorems.
UNIT – II
AC Circuits: Representation of sinusoidal waveforms, peak and rms values, phasor representation, real power, reactive power, apparent power, power factor. Analysis of single-phase ac circuits consisting of R, L, C, and RL, RC, RLC combinations (series only). Three phase balanced circuits, voltage and current relations in star and delta connections.
UNIT – III
Transformers and 3-ph Induction Motors: Transformers: Electromagnetic induction, Faradays laws, statically induced emf, Lenz law, BH characteristics, ideal and practical transformer, losses and efficiency, Auto-transformer and three-phase transformer connections. ***Three Phase Induction motor:*** Generation of rotating magnetic fields, Construction and working of a three-phase induction motor, squirrel cage IM, slip-ring IM, Applications
UNIT – IV
Single-phase induction motor and DC Machines: Single-phase induction motor: Construction and principle of operation, Capacitor start & capacitor run motor, applications. ***DC Generators***: Dynamically induced emf, Flemming's Right hand and Left hand rules, Construction and principle of operation of DC generator, EMF equation, Types of DC Generators, OCC characteristics, applications. ***DC Motors:*** principle of operation of DC Motor, Types of DC motors, applications
UNIT – V
Electrical Installations: Components of LT Switchgear: Switch Fuse Unit (SFU), MCB, ELCB, MCCB, Types of Wires and Cables, Earthing. Types of Batteries, Important Characteristics for Batteries. Elementary calculations for energy consumption, power factor improvement and battery backup.

Suggested Readings:

1	N. K. De, "*Basic Electrical Engineering*", Universities Press, 2015.
2	J.B. Gupta, "*Fundamentals of Electrical Engineering and Electronics*" S.K. Kataria & Sons Publications, 2002
3	J.B. Gupta, "*Utilization of Electric Power and Electric Traction*" S.K. Kataria & Sons Publications, 2010
4	Abhijit Chakrabarti, Sudipta Nath, Chandan Kumar Chanda, "*Basic Electrical Engineering*" Tata McGraw Hill, Publications, 2009
5	Hughes, "*Electrical Technology*", 7th Edition, Addison Welsey Longman Inc., 1995

ENGLISH LAB

HS 151 EG

Instruction:2 periods per week *Duration of SEE: 3 hours*
CIE: 25 marks *SEE: 50 marks*
Credits: 1

Objectives:

1. Giving them sufficient practice in listening with comprehension
2. Providing them ample opportunities to improve their public speaking skills
3. Training them in the use of correct pronunciation, stress, and intonation
4. Sensitizing them to the use of verbal and non-verbal communication appropriate to the context
5. Encouraging them to learn the art of conversation to suit formal and informal situations
6.Preparing them to make formal presentations and face interviews

Outcomes: Student will be able to:

1.Listen, understand, and interpret formal and informal spoken language
2. Speak English with acceptable pronunciation, stress, and intonation
3.Present themselves with confidence in formal situations
4. Participate in individual and group activities with relative ease

List of Experiments:

1. Listening for Comprehension
2. Pronunciation, Intonation, Stress, and Rhythm
3. Conversation Skills
4. Introducing Oneself and Others
5. Asking for and Giving Information
6. Making Requests and Responding to them Appropriately
7. Giving Instructions and Responding to them Appropriately
8. Making Formal Announcements and Emceeing
9. Group Discussions
10. JAM
11. Role Play
12. Debate
13. Public Speaking Skills and Body Language
14. Interviews
15. Formal Presentations

Suggested Readings:

1	Board of Editors, "*Language and Life: A Skills Approach*", Orient Black Swan, 2018
2	T. Balasubramanian, "*Textbook of English Phonetics for Indian Students*", Macmillan publishers, 1981
3	CIEFL Exercises in Spoken English. Parts. I-III. Oxford University Press
4	Pillai, Radhakrishna G, "*Spoken English For You - Level II*", 8th Edition, Emerald Publishers, 2014
5	Sethi, J and PV Dhamija, "*A Course in Phonetics and Spoken English*", 2nd Edition, Prentice Hall India Learning Private Limited, 1999

PHYSICS LAB

BS 251 PH

Instruction:3 periods per week *Duration of SEE: 3 hours*
CIE: 25 marks *SEE: 50 marks*
Credits: 1.5

Objectives:

1. Make precise measurements using basic physical principles and acquire skills to handle the instruments
2. Relates the theoretical Knowledge to the behavior of Practical Physical world
3.Analyse errors in the experimental data
4.Plot graphs between various physical parameters

Outcomes: Student will be able to:

1.Conduct experiments, take measurements independently
2. Write appropriate laboratory reports
3.Compute and compare the experimental results and draw relevant conclusions
4.Use the graphical representation of data and estimate results from graphs

List of Experiments:

1. To determine the Dielectric constant and Phase transition temperature of Lead Zirconium Titanate (PZT).
2. To draw the I - V Characteristics of P-N Junction diode and to evaluate the resistance.
3. To find the values of Electrical conductivity and energy gap of Ge crystal.
4. Determination of rigidity of modulus of Torsion pendulum.
5. Determination of carrier concentration, Mobility and Hall Coefficient of Ge crystal using Hall Effect Experiment.
6. To determine the constants of A, B and α using Thermistor characteristics.
7. To draw the curve between the magnetizing field and the intensity of magnetization of the specimen (soft iron rod) and to find out
   i) Coercivity ii) Retentivity and iii) Hysteresis loss.
8. To draw the I - V Characteristics of a solar cell and to calculate the
   i) Fill factor Efficiency and ii) Series resistance.
9. To Determine the Numerical Aperture (NA) of Optical fiber.
10. To determine the wave length of the given Laser source.

Note: Minimum eight experiments should be conducted in the semester

Suggested Readings:

1	N.K. De, "*Basic Electrical Engineering*", Universities Press, 2015
2	J.B. Gupta, "*Fundamentals of Electrical Engineering and Electronics*" S.K. Kataria & Sons Publications, 2002
3	J.B. Gupta, "*Utilization of Electric Power and Electric Traction*" S.K. Kataria & Sons Publications, 2010

BASIC ELECTRICAL ENGINEERING LAB

ES 354 EE

Instruction:2 periods per week *Duration of SEE: 3 hours*
CIE: 25 marks *SEE: 50 marks*
Credits: 1

Objectives:

1. To impart the practical knowledge on testing of DC and AC Machines.
2. To learn the usage of common electrical measuring instruments

Outcomes: Student will be able to:

1.Get an exposure to common electrical components and their ratings
2. Analyse the performance of DC and AC Machines
3.Comprehend the usage of common electrical measuring instruments
4. Test the basic characteristics of transformers and electrical machines

List of Experiments:

Dem1. Basic safety precautions. Introduction and use of measuring instruments – voltmeter, ammeter, multi-meter, oscilloscope. Real-life resistors, capacitors and inductors.

Exp 1. Verification of KVL and KCL, superposition theorem (with DC excitation)

Exp 2 Verification of Thevinens and Nortons theorems (with DC excitation)

Exp 3. Sinusoidal steady state response of R-L, and R-C circuits – impedance calculation and verification. Observation of phase differences between current and voltage. Power factor calculation

Exp 4. Transformers: Observation of the no-load current waveform on an oscilloscope (nonsinusoidal wave-shape due to B-H curve nonlinearity should be shown along with a discussion about harmonics).

Exp 5. Loading of a transformer: measurement of primary and secondary voltages and currents, and power.

Exp 6. Three-phase transformers: Star and Delta connections. Voltage and Current relationships (line-line voltage, phase-to-neutral voltage, line and phase currents).

Exp 7. Measurement of phase voltage/current, line voltage/current and power in a balanced three-phase circuit connected in star and delta.

Dem2. Demonstration of cut-out sections of machines: dc machine (commutator-brush arrangement), induction machine (squirrel cage rotor), synchronous machine (field winging - slip ring arrangement) and single-phase induction machine.

Exp 8. OCC characteristics of DC Generator

Exp 9. Synchronous speed of two and four-pole, three-phase induction motors. Direction reversal by change of phase-sequence of connections.

Exp 10. Power factor improvement of Induction Motor using static capacitors

Exp 11. Load Test of DC Motor

Note - 1:

(i) List of Experiments and Demonstrations suggested above are already available in the

	Laboratory of the electrical department. No need to purchase any extra equipment except Demonstration2 equipments
iii)	Procurement of Demonstration 2 equipments can be done during the course work of that semester. It can be included in the laboratory.

Suggested Readings:

1	J.B. Gupta, "*Fundamentals of Electrical Engineering and Electronics*" ,S.K. Kataria & Sons Publications, 2002.
2	J.B. Gupta, "*Utilization of Electric Power and Electric Traction*" S.K. Kataria & Sons Publications, 2010
3	Abhijit Chakrabarti, Sudipta Nath, Chandan Kumar Chanda, "*Basic Electrical Engineering*", Tata McGraw Hill, Publications, 2009
4	Hughes, "*Electrical Technology*", 7th Edition, Addison Wesley Longman Inc., 1995

ENGINEERING GRAPHICS

ES 353 CE

Instruction:6 periods per week *Duration of SEE: 3 hours*
CIE: 50 marks *SEE: 50 marks*
Credits: 3

Objectives:

1.To prepare you to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
2. To prepare you to use the techniques, skills, modern engineering tools to use for Engineering practice.

Outcomes: Student will be able to:

1. Introduction to engineering design and its place in society
2. Exposure to the visual aspects of engineering design
3. Exposure to engineering graphics standards
4. Exposure to solid modelling
5. Exposure to computer-aided geometric design
6. Exposure to creating working drawings
7. Exposure to engineering communication

S.No	Description	Lectures	Drawing
1	Principles of Engineering Graphics and their significance, usage of drawing instruments	1	
2	Conic Sections – I, Construction of ellipse, parabola and hyperbola given focus and eccentricity.	1	2
3	Conic Sections – II, Construction of ellipse (given major and minor axis), parabola (given bas and height), rectangular hyperbola	-	2
4	Cycloids (cycloid & epicycloid)	1	2
5	Involutes (involute of triangle, square & circle)	-	2
6	Scales (plain & diagonal scales)	1	2+2
7	Introduction to AutoCAD –Basic commands and simple drawings	-	2+2
8	Orthographic Projection , Projection of points situated in different quadrants	1	2
9	Projections of straight lines-I Lines parallel to both the reference planes, lines perpendicular or inclined to one reference plane	1	2
10	Projections of straight lines-II Lines parallel to both the reference planes	1	2
11	Projections of planes-I Perpendicular planes	1	2
12	Projections of planes-II Oblique planes	-	2
13	Projections of solids – I Polyhydra and solids revolution, projections of solids in simple position	1	2
14	Projections of solids – II	1	2

	Polyhydra and solids when the axes inclined to one or both the reference planes.		
15	Section of solids – I When the sectional plane is parallel or perpendicular to one reference plane	1	2
16	Section of solids – II When the sectional plane is inclined to one reference plane	-	2
17	Development of surfaces – I Prisms and Cylinders	1	2
18	Development of surfaces – II Pyramids and Cones	-	2
19	Intersection of surfaces – I Intersection of cylinder and cylinder	1	2
20	Intersection of surfaces – I Intersection of cylinder and cones	-	2
21	Isometric projection – I- planes and simple solids	1	2
22	Isometric projection – I – Combination of two or three solids	-	2
23	Conversion of Isometric Views to Orthographic Views	1	2
24	Floor plans of 2 or 3 rooms including windows, doors, and fixtures such as WC, bath, sink, shower, etc.	1	2

Suggested Readings:

1	Bhatt N.D., Panchal V.M. & Ingle P.R.,"*Engineering Drawing"*, Charotar Publishing House, 2014
2	Shah, M.B. & Rana B.C., " *Engineering Drawing and Computer Graphics"*, Pearson Education, 2008
3	S.N Lal, " *Engineering Drawing with Introduction to Auto CAD"*, Cengage Learning India Pvt Ltd, New Delhi, 2018
4	Agarwar B. & Agrawal C. M., "*Engineering Graphics*", TMH Publication, 2012
5	Narayana, K.L. & P Kannaiah," *Text book on Engineering Drawing*", Scitech Publishers, 2008
6	(Corresponding set of) CAD Software Theory and User Manuals

NOTE:

1. At least 20 sheets must be covered.
2. Sheet number 1 to 6 (Graph sheets / drawing sheets)
3. Sheet number 7 to 24 (AutoCAD drawings.

BE(CSE) SEMESTER-III, IV with Effect from AY(21-22)

CSE: SEMESTER – III

S. No.	Course Code	Course Title	Scheme of Instruction				Scheme of Examination			Credits
			L	T	P/D	Contact Hrs/Wk	CIE	SEE	Duration in Hrs	
TheoryCourses										
1	HS 103 ME	Operations Research	3	-	-	3	30	70	3	3
2	ES 306 EC	Basic Electronics	3	-	-	4	30	70	3	3
3	ES 303 EC	Digital Electronics	3	1	-	4	30	70	3	3
4	PC 301 CS	Data Structures and Algorithms	3	1	-	4	30	70	3	3
5	PC 302 CS	Discrete Mathematics	3	1	-	4	30	70	3	3
6	PC 303 CS	OOP using JAVA	3	1	-	4	30	70	3	3
Practical/ LaboratoryCourses										
7	PC 351 CS	Data Structures and Algorithms Lab	-	-	2	2	25	50	3	1
8	PC 352 CS	Advanced Computer Skills Lab	-	-	2	2	25	50	3	1
9	ES 351 EC	Basic Electronics Lab	-	-	2	2	25	50	3	1
10	PC 353 CS	OOP using JAVA Lab	-	-	2	2	25	50	3	1
Total			**18**	**4**	**08**	**30**	**280**	**620**		**22**

CSE: SEMESTER – IV

S. No.	Course Code	Course Title	Scheme of Instruction				Scheme of Examination			Credits
			L	T	P/D	Contact Hrs/Wk	CIE	SEE	Duration in Hrs	
Theory Courses										
1	HS 104 EG	Effective Technical Communication in English	3	-	-	3	30	70	3	3
2	HS 105 CM	Finance and Accounting	3	1	-	4	30	70	3	3
3	BS 207 MT	Mathematics – III (Probability & Statistics)	3	-	-	3	30	70	3	3
4	ES 305 EC	Signals and Systems	3	-	-	3	30	70	3	3
5	PC 401 CS	Operating Systems	3	-	-	3	30	70	3	3
6	PC 402 CS	Computer Organization	3	1	-	4	30	70	3	3
7	PC 403 CS	Database Management Systems	3	1	-	4	30	70	3	3
Practical/ Laboratory Courses										
8	PC 451 CS	Computer Organization Lab	-	-	2	2	25	50	3	1
9	PC 452 CS	Operating Systems Lab	-	-	2	2	25	50	3	1
10	PC 453 CS	Database Management Systems Lab	-	-	2	2	25	50	3	1
Total			**21**	**3**	**06**	**30**	**285**	**640**		**24**

HS 103 ME **OPERATIONS RESEARCH**

Instruction: 3 periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits: 3

Objectives:

1. Use variables for formulating complex mathematical models in management science, industrial engineering and transportation models.
2. Use the basic methodology for the solution of linear programming problems
3. Understand the mathematical tools that are needed to solve optimization problems like Transportation models and Assignment models
4. Understand the replacement models with change in money value considering with time and without time.
5. Model a system as a queuing model and compute important performance measures

Outcomes: Student will be able to:

1. Prepare the students to have the knowledge of Linear Programming Problem in Operations
2. Research at the end students would be able to understand the concept and develop the models for different applications.
3. Make students understand the concept Replacement models at the end students would able to explain various features and applications of replacement models in real time scenario.
4. Prepare the students to understand theory of Game in operations research at the end students would able to explain application of Game theory in decision making for a conflict

UNIT – I

Introduction: Definition and Scope of Operations Research.

Linear Programming: Introduction, Formulation of linear programming problems, graphical method of solving LP problem, simplex method, maximization and minimization, Degeneracy in LPP, Unbounded and, Infeasible solutions.

UNIT – II

Duality: Definition, Relationship between primal and dual solutions, Economic Interpretation, Post optimal of sensitivity analysis, Dual Simplex Method..

UNIT – III

Transportation Models: Finding an initial feasible solution - North West corner method, least cost method, Vogel's Approximation method, Finding the optimal solution, optimal solution by stepping stone and MODI methods, Special cases in Transportation problems - Unbalanced Transportation problem.

Assignment Problems: Hungarian method of Assignment problem, Maximization in Assignment problem, unbalanced problem, problems with restrictions, travelling salesman problems.

UNIT – IV

Replacement Models: Introduction, replacement of items that deteriorate ignoring change in money value, replacement of items that deteriorate considering change in money value with time, replacement of items that fail suddenly - Individual replacement policy, Group replacement policy.

Game Theory: Introduction, 2 person zero sum games, Maximin - Minimax principle, Principle of Dominance, Solution for mixed strategy problems, Graphical method for 2 x n and m x 2 games.

UNIT – V

Sequencing Models: Introduction, General assumptions, processing n jobs through 2 machines, processing 'n' jobs through m machines, Processing 2 jobs through m machines

Queuing Theory: Introduction, single channel - Poisson arrivals - exponential service times with infinite population & finite population, Multi channel - poison arrivals - Exponential service times with infinite population.

Introduction to Optimization Techniques: Single objective & Multi objective optimization Techniques like G.A, NSGA, P.Q.O & MPSO Techniques.

Suggested Readings:

1	Hamdy, A. Taha, "Operations Research-An Introduction", Sixth Edition, Prentice Hall of India Pvt. Ltd.,1997
2	S.D. Sharma, Operations Research, Kedarnath, Ramnath & Co., Meerut,2009
3	J.B. Gupta, "Utilization of Electric Power and Electric Traction" S.K. Kataria & Sons Publications, 2010 Hrvey M. Wagner, Principles of Operations Research, Second Edition, Prentice Hall of India Ltd., 1980.
4	V.K. Kapoor, Operations Research, S. Chand Publishers, New Delhi,2004
5	R. Paneer Selvam, Operations Research, Second Edition, PHI Learning Pvt. Ltd., New Delhi,2008.

ES 306 EC **BASIC ELECTRONICS**

Instruction: 3+1 *periods per week* *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits: 3

Course Objectives

1. To understand the characteristics of diodes and transistor configurations
2. To understand the design concepts of biasing of BJT and FET
3. To understand the design concepts of feedback amplifiers and oscillators
4. To study the design concepts of OP Amp and data converters

Course Outcomes

The student will be able to:

1. Study and analyse the rectifiers and regulator circuits.
2. Study and analyse the performance of BJTs, FETs on the basis of their operation and working.
3. Ability to analyse & design oscillator circuits.
4. Ability to analyse different logic gates & multi-vibrator circuits.
5. Ability to analyse different data acquisition systems

UNIT – I
PN Junction Diode: Characteristics, Half wave rectifier, Full wave rectifier, filters, ripple, regulation, TIF and efficiency, Zener diode and Zener diode regulators. CRT construction and CRO applications.
UNIT – II
Transistors: BJT construction and working, modes of operation, configurations of BJT (CB, CE, CC), small signal h-parameter model of CE, CE amplifier analysis. Construction and working of JFET, V-I characteristics of JFET.
UNIT – III
Feedback concepts: Types of negative feedback – modification of gain, bandwidth, input and output impedances, applications. **Oscillators:** RC Phase shift, Wein bridge, LC and crystal Oscillators (Qualitative treatment only).
UNIT – IV
Operational Amplifier: OP-AMP Block diagram, Ideal OP-AMP, DC and AC Characteristics, Inverting and Non-Inverting Amplifiers, Adder/Subtractor, Integrator, Differentiator. **Logic gate circuits -** Introduction to Digital systems- AND, NAND, NOR, XOR gates, Binary half adder, full adder.
UNIT – V
Data Acquisition Systems: Construction and Operation of transducers- Strain guage LVDT, Thermo couple, Instrumentation systems. **Data Converters**: R-2R Ladder DAC, Successive approximation and Flash ADC.

Suggested Readings:

1	Robert Boylestad L. and Louis Nashelsky, Electronic Devices and Circuit Theory, PHI,2007.
2	Helfrick Dand DavidCooper,ModernElectronicInstrumentationandMeasurementsTechniques, 1st Edition, Prentice Hall of India, 2006.
3	Salivahanan, Suresh Kumar and Vallavaraj, Electronic Devices and Circuits, 2nd Edition, Tata McGraw-Hill,2010.

ES 303 EC **DIGITAL ELECTRONICS**

Instruction: 3+ 1 periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits: 3

Course Objectives

1. To learn the principles of digital hardware and support given by it to the software.
2. To explain the operation and design of combinational and arithmetic logic circuits.
3. To design hardware for real world problems.

Course Outcomes

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

1. Understand the deign process of digital hardware, use Boolean algebra to minimize the logical expressions and optimize the implementation of logical functions.
2. Understand the number representation and design combinational circuits like adders, MUXetc.
3. Design Combinational circuits using PLDS and write VHDL code for basic gates and combinational circuits.
4. Analyse sequential circuits using flip-flops and design registers, counters.
6. Represent a sequential circuit using Finite State machine and apply state minimization techniques to design a FSM

UNIT – I
Design Concepts: Digital Hardware, Design process, Design of digital hardware. Introduction to logic circuits – Variables and functions, Logic gates and networks. Boolean algebra, Synthesis using gates, Design examples. Optimized implementation of logic functions using K-Map and Quine-McCluskey Tabular method
UNIT – II
Number Representation: Addition and Subtraction of signed and unsigned numbers.Combinational circuit building blocks: Half adder, Full adder, Multiplexers. Decoders. Encoders. Code converters, BCD to 7-segment converter, Arithmetic comparator circuits.
UNIT – III
Design of combinational circuits using Programmable Logic Devices (PLDs): General structure of a Programmable Array Logic (PAL), Programmable Logic Arrays(PLAs), Structure of CPLDs and FPGAs, 2- input and 3-input lookup tables (LUTs).Introduction to Verilog HDL: Verilog code for basic logic gates, adders, decoders.
UNIT – IV
Sequential Circuits: Basic Latch, Gated SR Latch, gated D Latch, Master-Slave edge triggered flip-flops, T Flip-flop, JK Flip-flop, Excitation tables. Registers, Counters, Verilog code for flip-flops
UNIT – V
Synchronous Sequential Circuits: Basic Design Steps, Finite State machine(FSM) representation using Moore and Mealy state models, State minimization, Design of FSM for Sequence Generation and Detection, Algorithmic State Machine charts.

Suggested Readings:

1	Moris Mano and Michael D CIletti, Digital Design, Pearson, fourth Edition,2008.
2	ZviKohavi, Switching and Finite Automata Theory, 3rd ed., Cambridge University Press-New Delhi, 2011.
3	Samir Palnitkar, "Verilog HDL A Guide to Digital Design and Synthesis," 2nd Edition, Pearson Education,2006.

Course Code	Course Title						Core/Elective
PC301CS	**DATA STRUCTURES AND ALGORITHMS**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
-	L	T	D	P	**30**	**70**	**3**
	3	1	-	-			

Objectives:

1. To develop proficiency in the specification, representation, and implementation of abstract data types and data structures.
2. To discuss the linear and non-linear data structures and their applications
3. To introduce the creation, insertion and deletion operations on binary search trees and balanced binary search trees.
4. To introduce various internal sorting, searching techniques and their time complexities

Outcomes:

After completing this course, the student will be able to:

1. Understand the importance of abstract data type and implementing the concepts of data structure using abstract data type.
2. Evaluate an algorithm by using algorithmic performance and measures.
3. Distinguish between linear and non-linear data structures and their representations in the memory using array and linked list.
4. Apply the suitable data structure for a real world problem and think critically for improvement in solutions.
5. Determine the suitability of the standard algorithms: Searching, Sorting and Traversals

UNIT – I
Algorithms: Introduction, Algorithm Specifications, Recursive Algorithms, Performance Analysis of an algorithm- Time and Space Complexity, Asymptotic Notations. **Arrays:** Arrays - ADT, Polynomials, Sparse matrices, Strings-ADT, PatternMatching.
UNIT – II
Stacks and Queues: Stacks, Stacks using Arrays, Stacks using dynamic arrays, Evaluation of Expressions – Evaluating Postfix Expression, Infix to Postfix. **Queues:** Queues ADT, operations, Circular Queues, Applications
UNIT – III
Linked Lists: Singly Linked Lists and Chains, Linked Stacks and Queues, Polynomials, Operations for Circularly linked lists, Equivalence Classes, Sparse matrices, Doubly Linked Lists. **Hashing:** Static Hashing, Hash Tables, Hash Functions, Overflow Handling, Theoretical Evaluation of Overflow Techniques
UNIT – IV
Trees: Introduction, Binary Trees, Binary Tree Traversals, Heaps, Binary Search trees (BST) : Definition, Searching an element, Insertion into a BST, Deletion from a BST. **Efficient Binary Search Trees:** AVL Trees: Definition, Searching an element, Insertion into a AVL

UNIT – V
Graphs: Graph Abstract Data Type, Elementary Graph operations (DFS and BFS), Minimum Cost Spanning Trees (Prim's and Kruskal's Algorithms). **Sorting and Searching:** Insertion sort, Quick sort, Best computing time for Sorting, Merge sort, Heap sort, shell sort, Sorting on Several Keys, List and Table Sorts, Summary of Internal Sorting, Linear and Binary Search algorithms.

Suggested Books:

1. Horowitz E, Sahni S and Susan Anderson-Freed, Fundamentals of Data structures in C, 2nd Edition (2008), Universities Press

Reference Books:

1. Mark A Weiss, Data Structures and Algorithm Analysis In C, Second Edition (2002), Pearson
2. Kushwaha D. S and Misra A.K, Data structures A Programming Approach with C, Second Edition (2014), PHl.
3. Gilberg R. F and Forouzan B. A, Data structures: A Pseudocode Approach with C, Second Edition (2007), Cengage Leaming
4. Tanenbaum A. M , Langsam Y. Augenstein M. J, Data Structures using C, Second Edition (2008), Pearson.
5. Thomas H. Cormen, Charles E. Leiserson, Ronald L Rivest, Clifford Stein, Introduction to Algorithms, Third Edition (2009), MIT Press
6. Yedidyah Langsam , Moshe J. Augenstein ,Aaron M. Tenenbaum, Data Structures Using C and C++ , Second Edition (2009), PHI

Proposed for the academic years 2020-2024

DISCRETE MATHEMATICS

PC 302 CS

Instruction: 3 +1 periods per week *Duration of SEE: 3 hours*

CIE: 30 marks *SEE: 70 marks*

Credits: 3

Objectives:

3. To explain with examples, the basic terminology of functions, relations, and sets.
4. To perform the operations associated with sets, functions, and relations.
5. To relate practical examples to the appropriate set, function, or relation model, and interpret the associated operations and terminology in context.
4. To describe the importance and limitations of predicate logic.
5. To relate the ideas of mathematical induction to recursion and recursively defined structures.
6. To use Graph Theory for solving problems.

Outcomes:

After completing this course, the student will be able to:
5. Illustrate by examples the basic terminology of functions, relations, and sets and demonstrate knowledge of their associated operations.
6. Understand basics of counting, apply permutations and combinations to handle different types of objects.
7. Describe and use recursively-defined relationships to solve problems using generating functions.
8. Analyse semi group, monoid group and abelian group with suitable examples and appreciate group theory applications in computer arithmetic.
9. Demonstrate in practical applications the use of basic counting principles of permutations, combinations, inclusion/exclusion principle and the pigeon hole methodology.

UNIT – I
Mathematical Logic: Statements and notations, Connectives, Well-formed formulas, Truth Tables, tautology, equivalence implication, Normal forms, Quantifiers, universal quantifiers. Predicates: Predicative logic, Free & Bound variables, Rules of inference, Consistency, proof of contradiction, Automatic Theorem Proving
UNIT – II
Relations: Properties of Binary Relations, equivalence, transitive closure, compatibility and partial ordering relations, Lattices, Hasse diagram. Functions: Inverse Function Composition of functions, recursive Functions, Lattice and its Properties, Algebraic structures: Algebraic systems Examples and general properties, Semi groups and monads, groups sub groups' homomorphism, Isomorphism.
UNIT – III
Elementary Combinatorics: Basis of counting, Combinations & Permutations, with repetitions, Constrained repetitions, Binomial Coefficients, Binomial Multinomial theorems, the principles of Inclusion – Exclusion. Pigeon hole principles and its application.
UNIT – IV
Recurrence Relation: Generating Functions, Function of Sequences Calculating Coefficient of generating function, Recurrence relations, Solving recurrence relation by substitution and Generating

funds. Characteristics solution of in homogeneous Recurrence Relation.
UNIT – V
Graph Theory: Representation of Graph, DFS, BFS, Spanning Trees, planar Graphs. Graph Theory and Applications, Basic Concepts Isomorphism and Sub graphs, Multi graphs and Euler circuits, Hamiltonian graphs, Chromatic Numbers.

Suggested Readings:

1. Elements of Discrete Mathematics- A Computer Oriented Approach- C L Liu, D P Mohapatra. Third Edition, Tata McGrawHill.
7. Discrete Mathematics for Computer Scientists & Mathematicians, J.L. Mott, A. Kandel, T.P. Baker, PHI.
8. Discrete Mathematics and its Applications, Kenneth H. Rosen, Fifth Edition.TMH.
9. Discrete Mathematical Structures Theory and Application-Malik & Sen,Cengage.
10. Discrete Mathematics with Applications, Thomas Koshy,Elsevier
11. Logic and Discrete Mathematics, Grass Man & Trembley, Pearson Education

OOP using JAVA PC303CS

Instruction: 3 +1 periods per week *Duration of SEE: 3 hours*

CIE: 30 marks *SEE: 70 marks*

Credits: 3

Objectives:

1. To understand fundamentals of object-oriented programming in Java which includes defining classes, invoking methods, difference between applet and application programs, using class libraries
2. To create Java application programs using sound OOP practices such as interfaces, exception handling, multi threading.
3. To understand fundamentals of object-oriented programming in Java which includes defining classes, invoking methods, difference between applet and application programs, using class libraries
4. Use Collection framework, AWT and event handling to solve real world problems.
5. Exploring Swing, and implementing Servlets.

Outcomes:

1. Achieve proficiency in object-oriented concepts and also learns to incorporate the same into the Java programming language.
2. Create Java application programs using sound OOP practices e.g. Inheritance, interfaces and proper program structuring by using packages, access control specifiers.
3. Understand and Implement the concepts of Exception Handling in JAVA.
4. Develop the ability to solve real-world problems through software development in high-level programming language using Large APIs of Java as well as the Java standard class library.
5. Understand File, Streams, Input and Output Handling injava.
6. Create graphical user interface and Applets in java as well as apply the knowledge of Event Handling.

UNIT – I

Object Oriented Programming: Principles, Benefits of Object Oriented Programming.

Introduction to Java: Java buzzwords, bytecode. Java Programming Fundamentals: Applet and Application program using simple java program, data types, variables, arrays, operators, expressions, control statements, type conversion and casting, concepts of classes, objects, constructors, methods, access control, this keyword, garbage collection, overloading methods and constructors, introducing

access control, static, final, nested and inner classes, exploring string class, using command-linear arguments.

Inheritance: Inheritance concept, types of inheritance, Member access rules, use of super and final. Polymorphism - dynamic binding, method overriding, abstract classes and methods.

UNIT – II

Interfaces: Defining an interface, implementing interfaces, extending interface.

Packages: Defining, Creating and Accessing a Package, importing packages

Exception handling: Benefits of exception handling, classification, checked exceptions and unchecked exceptions, usage of try, catch, throw, throws and finally, rethrowing exceptions, built in exceptions, creating own exception sub classes

Multithreading: Java Thread Model, The Main Thread, creating a Thread, creating multiple threads, using is Alive() and join(), thread priorities, synchronization, inter thread communication,deadlock

UNIT – III

Collections: Overview of Java Collection frame work, commonly used Collection classes – Array List, Linked List, Hash Set, Tree Set, Collection Interfaces – Collection, List, Set. Accessing Collection via iterator, working with Map. Legacy classes and interfaces – Vector, Hashtable, Stack, Dictionary, Enumeration interface.

Other Utility classes: String Tokenizer, Date, Calendar, Gregorian Calendar, ScannerJava Input/Output: exploring java.io, Java I/O classes and interfaces, File, Stream classes, byte stream, character stream, serialization.

UNIT – IV

GUI Programming with java: The AWT class hierarchy, MVC architecture. Applet Revisited: Basics, architecture and skeleton, simple applet program.

Event Handling: Delegation Event Model, Event Classes, Source of Events, Event Listener Interfaces. Handling mouse and keyboard events, Adapter classes.

Database Programming using JDBC: Introduction to JDBC, JDBC Drivers & Architecture, CURD operation Using JDBC, Connecting to non-conventional Databases.

UNIT – V

Exploring Swing: JLabel, ImageIcon, JTextField, the Swing buttons, JTabbedpane, JScrollPane, JList, JComboBox.

Servlet: Life cycle, using tomcat, simple servlet, servlet API, javax.servlet package, reading servlet parameters, javax.servlet.http package, handling HTTP requests and responses

Suggested Readings:

1. Herbert Scheldt, "The Complete Reference Java, 7th Edition, Tata McGraw Hill,2006.
2. James M Slack, Programming and Problem Solving with JAVA, Thomson Learning,2002.
3. C Thomas Wu, An Introduction to Object Oriented Programming with Java 5th Edition, McGraw Hill Publishing,2010.
4. H. M. Dietel and P. J. Dietel, Java How to Program, Sixth Edition, Pearson Education /PHI.

Course Code	Course Title						Core/Elective
PC351CS	**DATA STRUCTURES AND ALGORITHMS LAB**						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
-	L	T	D	P	**25**	50	1
	-	-	-	2			

Objectives:

1. To develop skills to design and analyse simple linear and nonlinear data structures, such as stacks, queues and lists and their applications.
2. To gain programming skills to implement sorting and searching algorithms
3. To Strengthen the ability to identify and apply the suitable data structures for the given real world problem
4. To Gain knowledge in practical applications of data structures

Outcomes:

After completing this course, the student will be able to:

1. Implement various data structures using arrays, linked lists
2. Develop ADT necessary for solving problems based on Stacks and Queues
3. Implement binary trees, general tree structures, advanced search trees, heaps, graphs.
4. Implement hash functions and handle collisions
5. Implement various kinds of sorting techniques and apply appropriate techniques for solving a given problem

List of Experiments (Using C programming Language):

1. Implementation of Stacks and Queues using Arrays.
2. Implementation of Circular Queue.
3. Implementation of Infix to Postfix Conversion, Postfix ExpressionEvaluation.
4. Implementation of Singly Linked List
5. Implementation of Doubly Linked List.
6. Implementation of Circular Linked List.
7. Implementation of Stacks, Queues using Linked Lists.
8. Implementation of Binary Search and Hashing
9. Implementation of Operations on Binary Tree (Delete Entire Tree, Copy Entire Tree, Mirror Image, Level Order, Search for a Node etc.)
10. Implementation of Tree Traversals on Binary Trees.
11. Implementation of Binary Search Tree. (Insertion, Deletion and Search operations)
12. Implementation of operations on AVL Trees.
13. Implementation of Traversal on Graphs.
14. Implementation of Prims and Kruskals Algorithm.
15. Implementation of Selection, Merge, Quick, Heap, and InsertionSort.

ADVANCED COMPUTER SKILLS LAB

PC352CS

Instruction: 2 periods per week | Duration of SEE: 3 hours

CIE: 25 marks | SEE: 50 marks

Objectives:

1. To learn programming of python with a focus of basic structure
2. To gain programming skills of python using function and OOP concept
3. To gain practical knowledge of MATLAB toolkit along with operations in matrices and plotting 2D graph

Outcomes:

After completing this course, the student will be able to:
1. Implement basic syntax in Python
2. Analyze and implement different kinds of OOP concept in real world problems.
3. Implement MATLAB operations and graphic functions.

List of Programming Exercises:

1. Python Variables, Executing Python from the Command Line, Editing Python Files, Python Reserved Words.
2. Comments, Strings and Numeric Data Types, Simple Input and Output
3. Control Flow and Syntax, Indenting, if Statement, Relational Operators, Logical Operators, Bit Wise Operators, while Loop, break and continue, for Loop, Lists, Tuples, Sets, Dictionaries
4. Functions: Passing parameters to a Function, Variable Number of Arguments, Scope, Passing Functions to a Function, Mapping Functions in a Dictionary, Lambda, Modules, Standard Modules
5. OOP concepts: Classes, File Organization, Special Methods, Inheritance, Polymorphism, Special Characters, Character Classes, Quantifiers, Dot Character, Greedy Matches, Matching at Beginning or End, Match Objects, Compiling Regular Expressions
6. MATLAB Menus, Toolbars, Computing with MATLAB, Script Files and the Editor/Debugger, MATLAB help System
7. MATLAB controls: Relational Logical Variables. Conditional Statements: if – else – elseif, switch, Loops: for – while –break, continue. User-Defined Functions.
8. Arrays, Matrices and Matrix Operations Debugging MATLAB Programs. Working with Data Files, and Graphing Functions: XY Plots –Sub-plots

Suggested Readings:

1. Mark Summerfield," Programming in Python A Complete introduction to the Python Language", Addison-Wesley Professional,2009.

2. Martin C. Brown," PYTHON: The Complete Reference", McGraw-Hill,2001.

3. W.J. Palm III, Introduction to MATLAB 7 for Engineers, McGraw-Hill International Edition,2005.

4. Wesley J Chun," Core Python Applications Programming", Prentice Hall,2012

5. Hordeski, Michael F, HVAC Control in the New Millennium, Fairmont press, 2001

6. Bela G. Liptak, Process Control-Instrument Engineers Handbook, Chilton book co.

BASIC ELECTRONICS LAB

ES 351 EC

Instruction: 2 periods per week — *Duration of SEE: 3 hours*
CIE: 25 marks — *SEE: 50 marks*
Credits: 1

Objectives:

1.To understand the characteristics of diodes and transistorconfigurations
2.To understand the design concepts of biasing of BJT andFET
3.To understand the design concepts of feedback amplifiers andoscillators
4.To study the design concepts of OP Amp and dataconverters

Outcomes:

1.After completing this course, the student will be able to:
2.Ability to design diode circuits & understand the application of Zenerdiode.
3.Ability to analyse characteristics of BJTs &FETs.
4.Ability to understand the different oscillatorcircuits.
5.Ability to understand operation of HWR & FWR circuits with & withoutfilters.
6.Ability tom design Analog-to-Digital converters & Digital-to-Analogconverters.

List of Experiments:

1	CRO-Applications, Measurements of R, L and C using LCR meter, Colour code method and solderingpractice.
2	Characteristics of Semiconductors diode (Ge, Si andZener)
3	Static Characteristics of BJT-CommonEmitter
4	Static Characteristics of BJT-CommonBase
5	Static Characteristics ofFET
6	RC-Phase ShiftOscillator
7	Hartley and ColpittsOscillators
8	Common EmitterAmplifier
9	AstableMultivibrator
10	Full-wave rectifier with and without filters usingBJT
11	Operational AmplifierApplications
12	Strain GaugeMeasurement
13	Analog-to-Digital and Digital to AnalogConverters

SuggestedReading:

1	MaheshwariandAnand,*LaboratoryExperimentsandPSPICESimulationsinAnalogElectronics,* 1st edition, Prentice Hall of India, 2006.
2	David Bell A., *Laboratory Manual for Electronic Devices and Circuits,* Prentice Hall of India,2001.

OOP using JAVA Lab

PC 353 CS

Instruction: 2 periods per week *Duration of SEE: 3 hours*
CIE: 25 marks *SEE: 50 marks*
Credits: 1

Objectives:

The objectives of the course are to impart knowledge of:
1. To build software development skills using java programming for real world applications.
2. To implement frontend and backend of an application
3. To implement classical problems using java programming.

Outcomes:

After the completion of the course, the student will be able to:
1. Develop Java applications using the concepts of Inheritance, interfaces, packages, access control specifiers.
2. Implement the concepts of Exception Handling in java Applications.
3. Read and write data using different Java I/O streams.
4. Create graphical user interfaces and Applets by applying the knowledge of Event Handling.
5. Create robust applications using Java standard class libraries and retrieve data from a database with JDBC.
6. Ability to solve real-world problems by designing user friendly GUI with befitting backend through the APIs of Java.

List of Experiments:

1. Write a Java program to illustrate the concept of class with method overloading
2. Write a Java Program that reads a line of integers, and then displays each integer, and the sum of all the integers (Use String Tokenizer class of java.util)
3. Write a Java program to illustrate the concept of Single level and Multi level Inheritance.
4. Write a Java program to demonstrate the Interfaces & Abstract Classes.
5. Write a Java program to implement the concept of exception handling.

6. Write a Java program to illustrate the concept of threading using Thread Class and runnable Interface.
7. Write a Java program to illustrate the concept of Thread synchronization.
8. Write a Java program that correctly implements producer consumer problem using the concept of inter thread communication.
9. Write a Java program to illustrate collection classes like Array List, LinkedList, Tree map and Hash map.
10. Write a Java program to illustrate Legacy classes like Vector, Hash table, Dictionary & Enumeration interface.
11. Write a Java program to implement iteration over Collection using Iterator interface and List Iterator interface
12. Write a Java program that reads a file name from the user, and then displays information about whether the file exists, whether the file is readable, whether the file is writable, the type of file and the length of the file in bytes.
13. Write a Java program to illustrate the concept of I/O Streams
14. Write a Java program to implement serialization concept
15. Write a Java applet program to implement Colour and Graphics class
16. Write a Java applet program for handling mouse & key events
17. Write a Java applet program to implement Adapter classes
18. Write a Java program that works as a simple calculator. Use a grid layout to arrange buttons for the digits and for the +, -, *, % operations. Add a text field to display the result.
19. Write an example for JDBC prepared statement with ResultSet
20. Write a Java Program to get primary key value (auto-generated keys) from inserted queries using JDBC
21. Write a Java Program to create a simple JList
22. Write a Java Program to create a simple checkbox using JCheckBox
23. Write a Java Program to create a checkbox and Item Listener toit.
24. 1. Write Servlet application to print current date &time 2. Html & Servlet Communication 3. Auto refresh a page 4. Demonstrate session tracking 5. Select record from database 6. Application for login page 7. Insert record into database 8. Count the visits on webpage 9. Insert teacher record in Database

BE(CSE) SEMESTER- IV with Effect from AY(21-22)

CSE: SEMESTER – IV

S. No.	Course Code	Course Title	Scheme of Instruction				Scheme of Examination			Credits
			L	T	P/D	Contact Hrs/Wk	CIE	SEE	Duration in Hrs	
Theory Courses										
1	HS 104 EG	Effective Technical Communication in English	3	-	-	3	30	70	3	3
2	HS 105 CM	Finance and Accounting	3	1	-	4	30	70	3	3
3	BS 207 MT	Mathematics – III (Probability & Statistics)	3	-	-	3	30	70	3	3
4	ES 305 EC	Signals and Systems	3	-	-	3	30	70	3	3
5	PC 401 CS	Operating Systems	3	-	-	3	30	70	3	3
6	PC 402 CS	Computer Organization	3	1	-	4	30	70	3	3
7	PC 403 CS	Database Management Systems	3	1	-	4	30	70	3	3
Practical/ Laboratory Courses										
8	PC 451 CS	Computer Organization Lab	-	-	2	2	25	50	3	1
9	PC 452 CS	Operating Systems Lab	-	-	2	2	25	50	3	1
10	PC 453 CS	Database Management Systems Lab	-	-	2	2	25	50	3	1
Total			**21**	**3**	**06**	**30**	**285**	**640**		**24**

ELECTIVE TECHNICAL COMMUNICATION IN ENGLISH

HS 104 EG

Instruction: 3 periods per week *Duration of SEE: 3 hours*

CIE: 30 marks *SEE: 70 marks*

Credits: 3

Objectives:

1.	Features of technical communication
2.	Types of professional correspondence
3.	Techniques of report writing
4.	Basics of manual writing
5.	Aspects of data transfer and presentations

Outcomes:

On successful completion of the course, the students would be able to	
1.	Handle technical communication effectively
2.	Use different types of professional correspondence
3.	Use various techniques of report writing
4.	Acquire adequate skills of manual writing

Enhance their skills of information transfer and presentations

UNIT – I
Definition and Features of Technical communication: Definition and features of technical communication (precision, relevance, format, style, use of visual aids), Differences between general writing and technical writing, Types of technical communication (oral and written)
UNIT – II
Technical Writing-I (Official correspondence): Emails, IOM, Business letters, Business proposals
UNIT – III
Technical writing-II (Reports): Project report, Feasibility report, Progress report, Evaluation report.
UNIT – IV
Technical writing- III (Manuals): Types of manuals, User manual, Product manual, Operations manual.
UNIT – V
Information Transfer and Presentations: Non-verbal (bar diagram, flow chart, pie chart, tree diagram) to verbal (writing), Verbal (written) to non-verbal, Important aspects of oral and visual presentations.

Suggested Readings:

1. Raman, Meenakshi & Sharma, Sangeeta. (2015). Technical communication: Principles and Practice, 3rd Edition, New Delhi
2. Rizvi, Ashraf, M. (2017). Effective Technical Communication (2nd ed.). New Delhi, Tata McGraw Hill Education *Security.*

3. Sharma, R. C., & Mohan, Krishna. (2017). Business Correspondence and Report Writing: A Practical Approach to Business & Technical Communication (4th ed.). New Delhi, Tata McGraw Hill Education.

4. Tyagi, Kavita &Misra, Padma. (2011). Advanced Technical Communication. New Delhi, PHI Learning.

5. Jungk, Dale. (2004). Applied Writing for Technicians. New York, McGraw-Hill Higher Education

FINANCE AND ACCOUNTING

HS 105 CM

Instruction: 3 +1 periods per week *Duration of SEE: 3 hours*

CIE: 30 marks *SEE: 70 marks*

Credits: 3

Objectives:

1.To provide basic understanding of Financial and Accounting aspects of a business unit
2. To provide understanding of the accounting aspects of business
3. To provide understanding of financial statements
4. To provide the understanding of financial system
5. To provide inputs necessary to evaluate the viability of projects
6. To provide the skills necessary to analyse the financial statements

Outcomes:

After successful completion of the course the students will be able to
1. Evaluate the financial performance of the business unit.
2. Take decisions on selection of projects.
3. Take decisions on procurement offinances.
4. Analyse the liquidity, solvency and profitability of the business unit.
5. Evaluate the overall financial functioning of an enterprise.

UNIT – I
Basics of Accounting: Financial Accounting–Definition- Accounting Cycle – Journal - Ledger and Trial Balance-Cash Book-Bank Reconciliation Statement (including Problems)
UNIT – II
Final Accounts: Trading Account-Concept of Gross Profit- Profit and Loss Account-Concept of Net Profit- Balance Sheet (including problems with minor adjustments)
UNIT – III
Financial System and Markets: Financial System-Components-Role-Considerations of the investors and issuers- Role of Financial Intermediaries. Financial Markets-Players- Regulators and instruments - Money Markets Credit Market- Capital Market (Basics only)
UNIT – IV
Basics of Capital Budgeting techniques: Time Value of money- Compounding- Discounting- Future Value of single and multiple flows- Present Value of single and multiple Flows- Present Value of annuities- Financial Appraisal of Projects– Payback Period, ARR- NPV, Benefit Cost Ratio, IRR (simple ratios).
UNIT – V
Financial statement Analysis: Financial Statement Analysis- Importance-Users-Ratio Analysis-liquidity, solvency, turnover and profitability ratios.

Suggested Readings:

1. Satyanarayana. S.V. and Satish. D., Finance and Accounting for Engineering, PearsonEducation
2. Rajasekharan, Financial Accounting, Pearson Education
3. Sharma. S.K. and Rachan Sareen, Financial Management, Sultan Chand
4. Jonathan Berk, Fundamentals of Corporate Finance, Pearson Education
5. Sharan, Fundamentals of Financial Management, Pearson Education

B.E Mathematics syllabus for affiliated engineering colleges of
Osmania University
(w.e.f: academic year 2019-2020)
For Branches: CSE, IT, EEE & EIE

BS 207MT	**Mathematics-III: Probability and Statistics**	**2L:IT:OP**	**3 credits**

Course objectives :

- To provide the knowledge of probability distributions , tests of significance, correlation and regression.

Course Outcomes :

At the end of the course students will be able to

- apply various probability distributions to solve practical problems, to estimate unknown parameters of populations and apply the tests of hypotheses
- perform a regression analysis and to compute and interpret the coefficient of correlation

Unit-I : Introduction of Probability, Conditional probability, Theorem of Total probability, Baye's Theorem and its applications, Random variables, Types of random variables, Probability mass function and Probability density function, Mathematical expectations.

Unit-II: Discrete probability distributions: Binomial and Poisson distributions, Mean, variance, moment generating function and evaluation of statistical parameters for these distributions, Moments, skewness and Kurtosis.

Unit-III: Continuous probability distributions, Uniform, Exponentian and Normal distributions, Mean, variance, moment generating function and evaluation of statistical parameters for these distributions

Unit-IV: Curve fitting by the method of least squares : fitting of straight lines, second degree parabolas and more general curves, Correlation, regression and Rank correlation. Test of significance: Large sample test for single proportion, difference of proportions, single mean, difference of means, and difference of standard deviations.

Unit-V : Test for single mean, difference of means and correlation coefficients, test for ratio of variances , Chi-square test for goodness of fit and independence of attributes.

Text / References:

1. Advanced Engineering Mathematics, R.K.Jain & Iyengar, Narosa Publications.
2. B.S. Grewal, “Higher Engineering Mathematics”, Khanna Publishers, 2000.
3. Engineering Mathematics, P.Sivaramakrishna Das & C.Vijaya Kumar, Pearson India Education Services Pvt.Ltd.
4. N.P. Bali and M. Goyal, “A text book of Engineering Mathematics”, Laxmi Publications, 2010.
5. Fundamentals of Mathematical Statistics, S.C.Gupta & V.K.Kapoor, S.Chand Pub.
6. P. G. Hoel, S. C. Port and C. J. Stone, “Introduction to Probability Theory”, Universal Book Stall, 2003.
7. W. Feller, “An Introduction to Probability Theory and its Applications”, Vol. 1, Wiley, 1968.

SIGNALS AND SYSTEMS

ES305EC

Instruction: 3 periods per week *Duration of SEE: 3 hours*

CIE: 30 marks *SEE: 70 marks*

Credits: 3

Objectives:

1. To explain signals and systems representations/classifications and also describe the time and frequency domain analysis of continuous time signals with Fourier series, Fourier transforms and Laplace transforms.
2. To understand Sampling theorem, with time and frequency domain analysis of discrete time signals with DTFS, DTFT and Z-Transform.
3. To present the concepts of convolution and correlation integrals and also understand the properties in the context of signals/systems and lay down the foundation for advanced courses.

Outcomes:

1. Define and differentiate types of signals and systems in continuous and discrete time
2. Apply the properties of Fourier transform for continuous time signals
3. Relate Laplace transforms to solve differential equations and to determine the response of the Continuous Time Linear Time Invariant Systems to known inputs
4. Apply Z-transforms for discrete time signals to solve Difference equations
5. Obtain Linear Convolution and Correlation of discrete time signals with graphical representation

UNIT – I
Some useful operations on signals: Time shifting, Time scaling, Time inversion. Signal models: Impulse function, Unit step function, Exponential function, Even and odd signals. Systems: Linear and Non-linear systems, Constant parameter and time varying parameter systems, Static and dynamic systems, Causal and Non-causal systems, Lumped Parameter and distributed parameter systems, Continuous-time and discrete- time systems, Analog and digital systems.
UNIT – II
Fourier series: Signals and Vectors, Signal Comparison: correlation, Signal representation by orthogonal signal set, Trigonometric Fourier Series, Exponential Fourier Series, LTI system response to periodic inputs.
UNIT – III
Continuous-Time Signal Analysis: Fourier Transform: Aperiodic signal representation by Fourier integral, Fourier Transform of some useful functions, Properties of Fourier Transform, Signal transmission through LTI Systems, ideal and practical filters, Signal energy. Laplace transform: Definition, some properties of Laplace transform, solution of differential equations using Laplace transform.
UNIT – IV
Discrete-time signals and systems: Introduction, some useful discrete-time signal models, Sampling continuous-time sinusoids and aliasing, Useful signal operations, examples of discrete-time systems. Fourier analysis of discrete-time signals, periodic signal representation of discrete-time Fourier series, aperiodic signal representation by Fourier integral.

UNIT – V
Discrete-time signal analysis: Z-Transform, some properties of Z-Transform, Solution to Linear difference equations using Z-Transform, System realization. Relation between Laplace transform and Z-Transform. DTFT: Definition, Properties of DTFT, comparison of continuous-time signal analysis with discrete-time signal analysis.

Suggested Readings:

1. B. P. Lathi, Linear Systems and Signals, Oxford University Press, 2nd Edition,2009
2. Alan V O P Penheim, A. S. Wlisky, Signals and Systems, 2nd Edition, PrenticeHall
3. Rodger E. Ziemer, William H Trenter, D. Ronald Fannin, Signals and Systems, 4th Edition, Pearson 1998.
4. Douglas K. Linder, Introduction to Signals and Systems, McGraw Hill,1999
5. P. Ramakrishna Rao, Signals and Systems,TMH

OPERATING SYSTEMS

PC 401 CS

Instruction: 3 periods per week *Duration of SEE: 3 hours*

CIE: 30 marks *SEE: 70 marks*

Credits: 3

Objectives:

1. To learn the fundamentals of Operating Systems.
2. To learn the mechanisms of OS to handle processes and threads and their communication.
3. To learn the mechanisms involved in memory management in contemporary OS.
4. To gain knowledge on distributed operating system concepts that includes architecture, Mutual exclusion algorithms, deadlock detection.
5. To know the components and management aspects of concurrency management.

Outcomes:

Student will be able to	
1.	Identify System calls and evaluate process scheduling criteria of OS.
2.	Develop procedures for process synchronization of an OS.
3.	Demonstrate the concepts of memory management and of disk management.
4.	Solve issues related to file system interface and implementation, I/O systems.
5.	Describe System model for deadlock, Methods for handling deadlocks.

UNIT – I
Introduction: Concept of Operating Systems, Generations of Operating systems, Types of Operating Systems, OS Services, System Calls, Structure of an OS - Layered, Monolithic, Microkernel Operating Systems, Concept of Virtual Machine.
UNIT – II
Processes: Definition, Process Relationship, Different states of a Process, Process State transitions, Process Control Block (PCB), Context switching **Thread:** Definition, Various states, Benefits of threads, Types of threads, Concept of multithreads, **Process Scheduling:** Foundation and Scheduling objectives, Types of Schedulers, Scheduling Criteria, Scheduling algorithms, multiprocessor scheduling.
UNIT – III
Process Synchronization: Inter-process Communication: Critical Section, Race Conditions, Mutual Exclusion, Peterson‘s Solution, classical problems of synchronization: The Bounded buffer problem, Producer\Consumer Problem, reader‘s & writer problem, Dinning philosopher‘s problem. Semaphores, Event Counters, Monitors, Message Passing, **Deadlocks:** Definition, Necessary and sufficient conditions for Deadlock, Methods for Handling: Deadlocks: Deadlock prevention, Deadlock Avoidance: Banker‘s algorithm, Deadlock detection and Recovery.
UNIT – IV
Memory Management: Basic concept, Logical and Physical address map, Memory allocation: Contiguous Memory allocation, fragmentation, and Compaction; Paging: Principle of operation – Page allocation – Hardware support for paging, structure of page table, Protection and sharing, Disadvantages of paging.

Virtual Memory: Basics of Virtual Memory – Hardware and control structures – Locality of reference, Page fault, Working Set, Dirty page/Dirty bit – Demand paging, Page Replacement algorithms, Trashing.
UNIT – V
I/O Hardware: I/O devices, Device controllers, Direct memory access Principles of I/O Software: Goals of Interrupt handlers, Device drivers, Device independent I/O software, **File Management:** Concept of File, Access methods, File types, File operation, Directory structure, File System structure, Allocation methods, Free-space management, directory implementation, efficiency, and performance. **Secondary-Storage Structure:** Disk structure, Disk scheduling algorithms, Disk Management, RAID structure.

Suggested Readings:

1. Avi Silberschatz, Peter Galvin, Greg Gagne, *Operating System Concepts Essentials*, 9th Edition, Wiley Asia Student Edition, 2017.
2. William Stallings, *Operating Systems: Internals and Design Principles*, 5th Edition, Prentice Hall of India, 2016.
3. Maurice Bach, *Design of the Unix Operating Systems*, 8th Edition, Prentice-Hall of India, 2009.
4. Daniel P. Bovet, Marco Cesati, *Understanding the Linux Kernel*, 3rd Edition, , O'Reilly and Associates.

COMPUTER ORGANIZATION

PC 402 CS

Instruction: 3+1 periods per week *Duration of SEE: 3 hours*

CIE: 30 marks *SEE: 70 marks*

Credits: 3

Objectives:

1. To provide in depth knowledge to the students about the design and organization of a digital computer, operation of various functional units, instruction set design and factors that influence the performance of a computer.
2. To enable the students with the understanding of basic computer architecture with instruction set and programming of 8085 in particular.
3. To learn the functionality and interfacing of various peripheral devices.

Outcomes:

After the completion of the course, the student will be able to:
1. To understand the architecture of modern computer, Bus structures.
2. Analyze the Different memories and evaluate the mapping techniques.
3. Discuss the architecture, the instruction set and addressing modes of 8085 processor.
4. Analyze Stacks, Subroutine, Interrupts of 8085, different PPI techniques, the uses of interfaces 8259, RS 232C, USART (8251), and DMA controller. Design the applications of interfacing circuit's 8254/8253timer, A/D and D/A converter, Keyboard/Display controller.

UNIT – I
Basic Structure of Computers: Computer Types, Functional Units, Basic Operational Concepts, Bus Structures, Performance, Multiprocessors and Multicomputers, Historical perspective. Input/output Organization: Accessing I/O devices, Interrupts, Processor examples, Direct memory access, parallel interface and serial interface.
UNIT – II
The Memory System: Basic concepts, Semiconductor RAM memories, Read-Only memories, Speed, Size and Cost, Cache memories, Performance considerations, Virtual Memories, Memory management requirements, Secondary Storage.
UNIT – III
8085 Architecture: Introduction to microprocessors and microcontrollers, 8085 Processor Architecture, Internal operations, Instructions and timings. Programming the 8085 - Introduction to 8085 instructions, Addressing modes and Programming techniques with Additional instructions.
UNIT – IV
Stacks and subroutines, interfacing peripherals - Basic interfacing concepts, interfacing output displays, Interfacing input keyboards. Interrupts - 8085 Interrupts, Programmable Interrupt Controller (8259A). Direct Memory Access (DMA) - DMA Controller (Intel 8257), Interfacing 8085 with Digital to Analog and Analog to Digital converters.

UNIT – V
Programmable peripheral interface (Intel 8255A), Programmable communication interface (Intel 8251), Programmable. Interval timer (Intel 8253 and 8254), Programmable Keyboard /Display controller (Intel 8279). Serial and parallel bus standards RS 232 C, IEEE 488.

Suggested Readings:

1. Carl Hamacher, Zvonko Vranesic, SafwatZaky, Computer Organization, 5th Edition, McGraw Hill, 2002.
2. Ramesh S Gaonkar, Microprocessor Architecture, Programming, and Applications with the 8085, 5/E Prentice Hall,2002.
3. Pal Chouduri, Computer Organization and Design, Prentice Hall of India,1994.
4. M. M. Mano, Computer System Architecture, 3rd Edition, PrenticeHall.

Database Management Systems

PC403CS

Instruction: 3+1 periods per week *Duration of SEE: 3 hours*

CIE: 30 marks *SEE: 70 marks*

Credits: 3

Objectives:

1. To get familiar with fundamental concepts of database management which includes database design, database languages, and database-system implementation.
2. To get familiar with data storage techniques and indexing.
3. To impart knowledge in transaction Management, concurrency control techniques and recovery techniques.
4. To master the basics of SQL and construct queries using SQL.
5. To become familiar with database storage structures and access techniques

Outcomes:

1. DeveloptheknowledgeoffundamentalconceptsofdatabasemanagementandDesigningadatabase using ER modeling approach.
2. Implement storage of data, indexing, and hashing.
3. Apply the knowledge about transaction management, concurrency control and recovery of database systems.
4. Ability to design entity relationship model and convert entity relationship diagrams into RDBMS and formulate SQL queries on the data

Apply normalization for the development of application software

UNIT – I
Introduction to Database: File System Organization: Sequential - Pointer - Indexed – Direct. Purpose of Database System - Database Characteristics - Users of Database System - Advantages of DBMS Approach - Schemas and Instances - Three Schema Architecture and Data Independence - The Database System Environment - Relational Algebra
UNIT – II
Logical Database Design: Relational DBMS - Codd's Rule - Entity-Relationship model - Extended ER Normalization - Functional Dependencies - Anomaly - 1NF to 5NF - Domain Key Normal Form – Denormalization.
UNIT – III
Indexing: Types of Single Level Ordered Indexes - Multilevel Indexes - Dynamic Multilevel Indexes. **Transaction Processing and Concurrency Control**: Transaction Concepts - ACID Properties - Transaction States - Concurrency Control Problems - Serializability - Recoverability - Pessimistic and Optimistic Concurrency Control Schemes.

UNIT – IV

Introduction to the Relational Model – Integrity Constraint Over relations – Enforcing Integrity constraints– Querying relational data – Logical data base Design – Introduction to views – Destroying /altering Tables and Views.

Relational Algebra – Selection and projection set operations – renaming – Joins – Division – Examples of Algebra overviews – Relational calculus – Tuple relational Calculus – Domain relational calculus – Expressive Power of Algebra and calculus

UNIT – V

Form of Basic SQL Query – Examples of Basic SQL Queries – Introduction to Nested Queries – Correlated Nested Queries Set – Comparison Operators – Aggregative Operators – NULL values – Comparison using Null values – Logical connectivity's – AND, OR and NOT – Impact on SQL Constructs – Outer Joins – Disallowing NULL values – Complex Integrity Constraints in SQL Triggers and Active Data bases.

Advanced Topics: Overview: Parallel Database - Multimedia Database - Mobile Database - Web Database - Multidimensional Database. Data Warehouse - OLTP Vs OLAP - NoSQL Database.

Suggested Readings:

1. Abraham Silberchatz, Henry F Korth and Sudarshan S, "Database System Concepts", Tata McGraw- Hill, New Delhi,2010.
2. RamezElmasri and Shamkant B Navathe, "Fundamentals of Database Systems", Addison Wesley, USA,2010.
3. Raghu Ramakrishnan and Johannes Gehrke, "Database Management Systems", Tata McGraw-Hill, New Delhi,2008.
4. Gupta G K, "Database Management System", Tata McGraw-Hill, New Delhi,2011.
5. Atul Kahate, "Introduction to Database Management Systems", Pearson Education, New Delhi,2009

Practical / Laboratory Courses

Computer Organization Lab

PC 451 CS

Instruction: 2 periods per week *Duration of SEE: 3 hours*

CIE: 25 marks *SEE: 50 marks*

Credits: 1

Objectives:

The objectives of the course are to impart knowledge of:
1. To become familiar with the architecture and Instruction set of Intel 8085microprocessor.
2. To provide practical hands on experience with Assembly Language Programming.
3. Tofamiliarizethestudentswithinterfacingofvariousperipheraldeviceswith8085microprocessors.

Outcomes:

After the completion of the course, the student will be able to:
1. Interpret the principles of Assembly Language Programming, instruction set in developing microprocessor based applications.
2. Develop Applications such as: 8-bit Addition, Multiplication, Division, array operations, swapping, negative and positive numbers.
3. Analyse the interfaces like serial ports, digital-to-analog Converters and analog-to-digital converters etc.
4. Build interfaces of Input-output and other units like stepper motor with8085. Analyse the function of traffic light controller.

List of Programs:

1.	Tutorials on 8085Programming.
2.	Interfacing and programming of 8255. (E.g. traffic light controller).
3.	Interfacing and programming of 8254.
4.	Interfacing and programming of 8279.
5.	A/D and D/A converter interface.
6.	Stepper motor interface.
7.	Display interface

Note: Adequate number of programs covering all the instructions of 8085 instruction set should be done on the 8085 microprocessor trainer kit.

OPERATING SYSMTES LAB

PC 452 CS

Instruction: 3 periods per week *Duration of SEE: 3 hours*

CIE: 25 marks *SEE: 50 marks*

Credits: 1

Objectives:

1.	Learn different types of CPU scheduling algorithms.
2.	Demonstrate the usage of semaphores for solving synchronization problem.
3.	Understand memory management techniques and different types of fragmentation.
4.	That occur in them and various page replacement policies.
5.	Understand Banker‘s algorithm used for deadlock avoidance.
6.	Learn various disk scheduling algorithms.

Outcomes:

Student will be able to
• Evaluate the performance of different types of CPU scheduling algorithms.
• Implement producer-consumer problem, reader-writers problem, Dining philosopher’s problem.
• Simulate Banker’s algorithm for deadlock avoidance.
• Implement paging replacement and disk scheduling techniques.
• Use different system calls for writing application programs.

I. CASE STUDY
Perform a case study by installing and exploring various types of operating systems on a physical or logical (virtual) machine.
II. List of Experiments (preferred programming language is C)
1. Write a C programs to implement UNIX system calls and file management 2. Write C programs to demonstrate various process related concepts. 3. Write C programs to demonstrate various thread related concepts. 4. Write C programs to simulate CPU scheduling algorithms: FCFS, SJF, Round Robin 5. Write C programs to simulate Intra & Inter-Process Communication (IPC) techniques: Pipes, Messages Queues, Shared Memory. 6. Write C programs to simulate solutions to Classical Process Synchronization Problems: Dining Philosophers, Producer-Consumer, Readers-Writers 7. Write a C program to simulate Bankers Algorithm for Deadlock Avoidance. 8. Write C programs to simulate Page Replacement Algorithms: FIFO, LRU 9. Write C programs to simulate implementation of Disk Scheduling Algorithms: FCFS, SSTF.

Software Required:

StarUML/Umbrello, NetBeans/Eclipse IDE, XAMPP/MEAN stack, JUnit, JMeter, Selenium, Bugzilla

Database Management Systems Lab

PC 453 CS

Instruction: 2 periods per week *Duration of SEE: 3 hours*
CIE: 25 marks *SEE: 50 marks*
Credits: 1

Objectives:

The objectives of the course are to impart knowledge of:
1. To practice various DDL commands in SQL
2. To write simple and Complex queries in SQL
3. To familiarize PL/SQL

Outcomes:

After the completion of the course, the student will be able to:
10. Design and implement a database schema for a given problem
11. Develop the query statements with the help of structured query language.
12. Populate and query a database using SQL and PL/SQL
13. Develop multi-user database application

Design GUI using forms and implement database connectivity:

List of Programs
1. Creation of database (exercising the commands for creation)
2. Simple condition query creation using SQL Plus
3. Complex condition query creation using SQL Plus
4. Usage of Triggers and Stored Procedures.
5. Creation of Forms for student Information, library information, Pay roll etc.
6. Writing PL/SQL procedures for data validation
7. Generation using SQL reports
8. Creating Password and Security features for applications.
9. Usage of File locking table locking, facilities in applications.
10. Creation of small full pledged database application spreading over to 3sessions.

Suggested Readings:

1. Nilesh Shah, Database System Using Oracle, PHI,2007.
2. Rick F Vander Lans, Introduction to SQL, Fourth edition, PearsonEducation,2007.
3. Benjamin Rosenzweig, Elena Silvestrova, Oracle PL/SQL by Example, Third edition, Pearson Education, 2004.
4. Albert Lulushi, Oracle Forms Developer's Handbook, Pearson Education,2006.

CSE: SEMESTER -V

S. No.	Course Code	Course Title	Scheme of Instruction				Scheme of Examination			Credits
			L	T	D/P	Contact Hrs/Wk	CIE	SEE	Duration in Hrs	
Theory Courses										
1	PC 501 CS	Software Engineering	3	1	-	4	30	70	3	3
2	PC 502 CS	Programming Languages	3	1	-	4	30	70	3	3
3	PC 503 CS	Automata Languages & Computation	3	1	-	4	30	70	3	3
4	PE-I	Professional Elective-I	3	-	-	3	30	70	3	3
5	PE-II	Professional Elective-II	3	-	-	3	30	70	3	3
6	PE-III	Professional Elective-III	3	-	-	3	30	70	3	3
Practical/Laboratory Courses										
7	PC 551 CS	Software Engineering Lab	-	-	2	2	25	50	3	1
8	PC 552 CS	Programming Languages Lab	-	-	2	2	25	50	3	1
9	PW 533 CS	Mini Project	-	-	4	4	25	50	3	2
Total			**18**	**03**	**08**	**29**	**255**	**570**		**22**

Profession Elective – I	
Course Code	**Course Title**
PE 511 CS	Artificial Intelligence
PE 512 CS	Advanced Computer Architecture
PE 513 CS	Network Security
PE 514 CS	Foundations of Cryptography

Profession Elective – II	
Course Code	**Course Title**
PE 531 CS	Web Technologies
PE 532 CS	Embedded Systems
PE 533 CS	Graph Theory
PE 534 CS	Data Analytics

Profession Elective – III	
Course Code	**Course Title**
PE 521 CS	Block Chain Technologies
PE 522 CS	Information Retrieval Systems
PE 523 CS	Soft Computing
PE 524 CS	Computer Graphics

SOFTWARE ENGINEERING

PC 501 CS

Instruction: 3+1 periods per week | Duration of SEE: 3 hours

CIE: 30 marks | SEE: 70 marks

Credits: 3

Objectives:

1. To introduce the basic concepts of software development processes from defining a product to shipping and maintaining.
2. To impart knowledge on various phases, methodologies, and practices of software development.
3. To understand the importance of testing in software development, study various testing strategies along with its relationship with software quality and metrics.

Outcomes:

Student will be able to

1. Acquired working knowledge of alternative approaches and techniques for each phase of software development
2. Judge an appropriate process model(s) assessing software project attributes and analyze necessary requirements for project development eventually composing SRS
3. Acquire skills necessary as an independent or as part of a team for architecting a complete software project by identifying solutions for recurring problems exerting knowledge on patterns
4. Concede product quality through testing techniques employing appropriate metrics by understanding the practical challenges associated with the development of a significant software system

UNIT – I

Introduction to Software Engineering: A generic view of Process: Software Engineering, Process Framework, CMM Process Patterns, Process Assessment.

Process Models: Prescriptive Models, Waterfall Model, Incremental Process Models, Evolutionary Process Models, Specialized Process Models, The Unified Models, Personal and Team Process Models, Process Technology, Product and Process.

An Agile view of Process: Introduction to Agility and Agile Process, Agile Process Models.

UNIT – II

Software Engineering Principles: SE Principles, Communication Principles, Planning Principles, Modeling Principles, Construction Principles, Deployment.

System Engineering: Computer-based Systems, The System Engineering Hierarchy, Business Process Engineering, Product Engineering, System Modeling.

Requirements Engineering: A Bridge to Design and Construction, Requirements Engineering Tasks, Initiating Requirements Engineering Process, Eliciting Requirements, Developing Use-Cases, Building the Analysis Model, Negotiating Requirements, Validating Requirements.

UNIT – III

Building the Analysis Model: Requirements Analysis Modeling Approaches, Data Modeling Concepts, Object-Oriented Analysis, Scenario-based Modeling, Flow-oriented Modeling, Class-based Modeling, Creating a Behavioral Model.

Design Engineering: Design within the context of SE, Design Process and Design Quality, Design Concepts, The Design Model, Pattern-based Software Design.

UNIT – IV
Creating an Architectural Design: Software Architecture, Data Design, Architectural Styles and Patterns, Architectural Design. **Modeling Component-Level Design:** Definition of Component, Designing Class-based Components, Conducting Component-level Design, Object Constraint Language, Designing Conventional Components. **Performing User Interface Design:** The Golden Rules, User Interface Analysis and Design, Interface Analysis, Interface Design Steps, Design Evaluation.
UNIT – V
Testing: Strategies: A Strategic Approach to Conventional Software Testing, Test Strategies for O-O Software. **Tactics:** Software Testing Fundamentals, Black-box and White-box Testing, Basis Path Testing, Control Structure Testing, O-O Testing Methods. **Debugging:** Debugging Techniques, The Art of Debugging. **Product Metrics:** A Framework for Product Metrics, Metrics for each phase of software development. **Software Quality:** Definition, **Quality Assurance:** Basic Elements, Formal Approaches, Statistical Software Quality Assurance, Software Reliability, ISO9000 Quality Standards, SQA Plan.

Suggested Readings:

1. Roger S. Pressman, *Software Engineering: A Practitioner's Approach*, 7th Edition, McGraw Hill, 2009
2. Ali Behforooz and Frederick J. Hudson, *Software Engineering Fundamentals*, Oxford University Press, 1996
3. PankajJalote, *An Integrated Approach to Software Engineering*, 3rd Edition, Narosa Publishing House, 2008

Course Code	Course Title						Core/Elective
PC 502 CS	**Programming Languages**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**3**	**1**	**-**	**-**	**30**	**70**	**3**

Course Objectives

- To briefly describe various programming paradigms.
- To provide conceptual understanding of High level language design and implementation.
- To introduce the power of scripting languages.
- To provide an introduction to formalisms for specifying syntax and semantics of programming languages.
- To provide an exposure to core concepts and principles in contemporary programming languages.
- To analyse and optimize the complexity of the programming languages.

Course Outcomes

After completing this course, the student will be able to:

1. Ability to express syntax and semantics in formal notation.
2. Ability to apply suitable programming paradigm for the application.
3. Gain Knowledge and comparison of the features programming languages
4. program in different language paradigms and evaluate their relative benefits.
5. Identify and describe semantic issues associated with variable binding, scoping rules, parameter passing, and exception handling.
6. Understand the design issues of object-oriented and functional languages.

UNIT- I

Preliminary Concepts: Reasons for studying, concepts of programming languages, Programming domains, Language Evaluation Criteria, influences on Language design, Language categories, Programming Paradigms – Imperative, Object Oriented, functional Programming, Logic Programming. Programming Language Implementation – Compilation and Virtual Machines, programming environments. Syntax and Semantics: general Problem of describing Syntax and Semantics, formal methods of describing syntax - BNF, EBNF for common programming languages features, parse trees, ambiguous grammars, attribute grammars, denotational semantics and axiomatic semantics for common programming language features.

UNIT- II

Data types: Introduction, primitive, character, user defined, array, associative, record, union, pointer and reference types, design and implementation uses related to these types. Names, Variable, concept of binding, type checking, strong typing, type compatibility, named constants, variable initialization. Expressions and Statements: Arithmetic relational and Boolean expressions, Short circuit evaluation mixed mode assignment, Assignment Statements, Control Structures – Statement Level, Compound Statements, Selection, Iteration, Unconditional Statements, guarded commands.

UNIT-III

Subprograms Blocks and Fundamentals of sub-programs: Scope and lifetime of variable, static and dynamic scope, Design issues of subprograms and operations, local referencing environments, parameter passing methods, overloaded sub-programs, generic sub-programs, parameters that are subprogram names, design issues for functions user defined overloaded operators, co routines.

UNIT- IV

Abstract types: Data Abstractions and encapsulation, introductions to data abstraction, design issues, language examples, C++ parameterized ADT, object oriented programming in small talk, C++, Java, C#, Ada 95 Concurrency: Subprogram level concurrency, semaphores, monitors, massage passing, Java threads, C# threads. Exception handling: Exceptions, exception Propagation, Exception handler in Ada, C++ and Java. Logic Programming Language: Introduction and overview of logic programming, basic elements of prolog, application of logic programming.

UNIT- V

Functional Programming Languages: Introduction, fundamentals of FPL, LISP, ML, Haskell, application of Functional Programming Languages and comparison of functional and imperative Languages. Scripting Language: Pragmatics, Key Concepts, Case Study: Python – Values and Types, Variables, Storage and Control, Bindings and Scope, Procedural Abstraction, Data Abstraction, Separate Compilation, Module Library.

Suggested Readings:

1. Concepts of Programming Languages Robert W. Sebesta 8/e, Pearson Education,2008.
2. Programming Language Design Concepts, D. A. Watt, Wiley dreamtech, rp-2007
3. Programming Languages, 2nd Edition, A.B. Tucker, R.E. Noonan, TMH.
4. Programming Languages, K. C. Louden, 2nd Edition, Thomson, 2003.
5. LISP, Patric Henry Winston and Paul Horn, Pearson Education.
6. Programming in Prolog, W.F. Clocksin, & C.S. Mellish, 5th Edition, Springer.
7. Programming Python, M. Lutz, 3rd Edition, O'reilly, SPD, rp-2007.
8. Core Python Programming, Chun, II Edition, Pearson Education, 2007.
9. Guide to Programming with Python, Michael Dawson, Thomson, 2008

AUTOMATA LANGUAGES & COMPUTATION

PC503CS

Instruction: 3+1 periods per week | Duration of SEE: 3 hours

CIE: 30 marks | SEE: 70 marks

Credits: 3

Objectives:

1. Develop a formal notation for strings, languages, and machines.
2. Design finite automata to accept a set of strings of a language.
3. Prove that a given language is regular and apply the closure properties of languages.
4. Design context free grammars to generate strings from a context free language and Convert them into normal forms.
5. Prove equivalence of languages accepted by Push down Automata and languages generated by context free grammars.
6. Identify the hierarchy of formal languages, grammars, and machines.
7. Distinguish between computability and non-computability and Decidability and undecidability.

Outcomes:

Student will be able to

1. Write a formal notation for strings, languages, and machines.
2. Design finite automata to accept a set of strings of a language.
3. For a given language determine whether the given language is regular or not.
4. Design context free grammars to generate strings of context free languages.
5. Determine equivalence of languages accepted by Pushdown Automata and languages generated by context free grammars.
6. Write the hierarchy of formal languages, grammars, and machines.
7. Distinguish between computability and non-computability and Decidability and undecidability.

UNIT – I

Introduction: Finite state automata, Non-deterministic finite state automata, FA with €-transitions, Regular expressions, Applications of FA, Properties of regular sets, Pumping Lemma, Closure properties, Myhill-Nerode Theorem, Minimization of FA.

UNIT – II

Context Free Grammars and Languages: Derivations, Parse-trees, Ambiguity in Grammars and Languages. Pushdown Automata–Definitions, The languages of PDA, Equivalence of PDAs and CFGs, Deterministic Pushdown Automata**.**

UNIT – III

Properties of CFLs: Normal forms for CFGs, Pumping Lemma, Closure properties, Deterministic Context Free Languages, Decision properties.

UNIT – IV

Turing Machines: Introduction, Computational Languages and Functions, Techniques for construction of Turing machines. Modifications of TM, TM as enumerator, Restricted TM.

UNIT – V

Undecidability: Recursive and Recursively enumerable languages, UTM and undecidable problem, Rice Theorem, Post‘s correspondence problem. Chomsky‘s Hierarchy–Regular grammars, Unrestricted grammar, CSL, Relationship between classes of languages.

Suggested Readings:

1. John E. Hopcroft, Rajeev Motwani and Jeffrey D. Ullman, *Introduction to Automata Theory, Languages, and Computation*, 3rd Edition, Pearson Education Asia,2007.
2. John Martin, *Introduction to Languages and The Theory of Computation*, 3rd Edition,Tata McGraw Hill,2013.

PROFESSIONAL ELECTIVE - I

ARTIFICIAL INTELLIGENCE

PE511CS

Instruction: 3 periods per week | Duration of SEE: 3 hours

CIE: 30 marks | SEE: 70 marks

Credits: 3

Objectives:

1. Understand the importance of the field of AI by discussing its history and various applications.
2. Learn about one of the basic applications of A.I, search state formulations.
3. Learn methods of expressing knowledge by a machine with appropriate reasoning and different mathematics involved behind it.
4. Learn how to reason when an agent has only uncertain information about its task.
5. Know various supervised and unsupervised learning algorithms.

Outcomes:

Student will be able to
1. Formalize a problem in the language/framework of different AI methods.
2. Illustrate basic principles of AI in solutions that require problem solving, search, inference.
3. Represent natural language/English using Predicate Logic to build knowledge through various representation mechanisms.
4. Demonstrate understanding of steps involved in building of intelligent agents, expert systems, Bayesian networks.
5. Differentiate between learning paradigms to be applied for an application.

UNIT – I
Problem Solving & Search: Introduction- What is intelligence? Foundations of artificial intelligence (AI). History of AI, Structure of Agents. **Problem Solving -** Formulating problems, problem types, states and operators, state space. **Search Strategies. -** Informed Search Strategies- Best first search, A* algorithm, heuristic functions, Iterative deepening A*. **Adversarial Search/ Game playing -** Perfect decision game, imperfect decision game, evaluation function, alpha-beta pruning.
UNIT – II
Knowledge, Reasoning & Planning: Reasoning - Knowledge based agent, Propositional Logic, Inference, Predicate logic (first order logic), Resolution **Structured Knowledge Representation –** Frames, Semantic Nets **Planning -** A Simple Planning Agent, Form Problem Solving to Planning, Basic representation of plans, partial order planning, hierarchical planning.
UNIT – III
Expert Systems, Reasoning with Uncertainty: Expert System and Applications: Introduction, Phases in Building Expert Systems, Expert System Architecture, Applications. **Uncertainty -** Basic probability, Bayes rule, Belief networks, Inference in Bayesian Networks**,** Fuzzy sets, and fuzzy logic: Fuzzy logic system architecture, membership

function.
Decision Making- Utility theory, utility functions.

UNIT – IV

Learning: Machine-Learning Paradigms: Introduction, Machine Learning Systems, Supervised and Unsupervised Learning, Inductive Learning, Learning Decision Trees
Artificial Neural Networks: Introduction, Artificial Neural Networks, Single-Layer Feed-Forward Networks, Multi-Layer Feed-Forward Networks
Reinforcement learning – Learning from rewards, Passive and Active reinforcement learning, Applications.

UNIT – V

Communicating & Perceiving: Introduction to NLP- Progress & applications of NLP, Components of NLP, Grammars, Parsing
Automatic Speech Recognition (ASR) – Speech Processing, Ex: DRAGON, HARPY, **Machine Vision –** Applications, Basic Principles of Vision, Machine vision techniques: Low, Middle and High-level vision
AI Today & Tomorrow - Achievements, ubiquitous AI.

Suggested Readings:

1. Stuart Russell and Peter Norvig. *Artificial Intelligence – A Modern Approach*, 3rd Edition, Pearson Education Press, 2009.
2. Kevin Knight, Elaine Rich, B. Nair, *Artificial Intelligence*, 3rd Edition, McGraw Hill, 2008.
3. Nils J. Nilsson, *The Quest for Artificial Intelligence*, Cambridge University Press, 2009.

ADVANCED COMPUTER ARCHITECTURE

PE512CS

Instruction: 3 periods per week | Duration of SEE: 3 hours

CIE: 30 marks | SEE: 70 marks

Credits: 3

Objectives:

An overview of computer architecture, which stresses the underlying design principles and the impact of these principles on computer performance. General topics include design methodology, processor design, control design, memory organization, system organization, and parallel processing.

Outcomes:

Student will be able to
1. Know the classes of computers, and new trends and developments in computer architecture
2. Understand pipelining, instruction set architectures, memory addressing.
3. Understand the performance metrics of microprocessors, memory, networks, and disks.
4. Understand the performance and efficiency in advanced multiple-issue processors.
5. Understand symmetric shared-memory architectures and their performance.

UNIT – I
I**ntroduction** - What is computer architecture? Software-hardware interface. Performance and Power. Performance metrics. Performance measurement. Benchmark programs.
UNIT – II
Instructions- Instruction Set. Operations. Operands and addressing modes. Role of compilers and system software. Understanding implementation of function calls and returns, array references, pointers.
UNIT – III
Computer Arithmetic- Signed integers. Floating point. Rounding and accuracy. Addition and Subtraction. Multiplication. Division **Processor -** Data path elements. Data path control.
UNIT – IV
Pipelining - Speedup. Pipeline hazards. Stalling. Forwarding. Branch prediction. Exceptions. Speculation. Multiple issue. **Dynamic scheduling;** Cache memory- Locality of reference. Cache organization and access. Multilevel caches. Performance. Cache coherence.
UNIT – V
Virtual Memory- Hardware support for address translation, page fault handling. Translation look aside buffer, Hardware-software interface. **Input/Output-** Hard disk. Flash memory. I/O interfacing. Memory mapped I/O. Interrupt driven I/O. Direct memory access. Redundant arrays of inexpensive disks; Introduction to Multi-core architecture, Multi-processors. Clusters.

Suggested Readings:

1. David A. Patterson and John L. Hennessy, Computer Organization and Design: The Hardware and Software Interface, Morgan Kaufmann Publishers, 4th Edition.(2009).
2. John L. Hennessy and David A. Patterson, Computer Architecture: A Quantitative Approach, Morgan Kaufmann Publishers (2007).

NETWORK SECURITY

PE513CS

Instruction: 3 periods per week | Duration of SEE: 3 hours

CIE: 30 marks | SEE: 70 marks

Credits: 3

Objectives:

1 To learn legal and technical issues in building secure information systems
2 To provide an understanding of network security
3 To expose the students to security standards and practices

Outcomes:

Student will be able to
1 Describe the steps in Security Systems development life cycle(SecSDLC)
2 Understand the common threats and attack to information systems
3 Understand the legal and ethical issues of information technology
4 Identify security needs using risk management and choose the appropriate risk control strategy based on business needs

UNIT – I
Introduction: Attributes of Security, Integrity, Authenticity, Non-repudiation, Confidentiality Authorization, Anonymity, Types of Attacks, DoS, IP Spoofing, Replay, Man-in-the-Middle attacks General Threats to Computer Network, Worms, Viruses, -Trojans
UNIT – II
Secret Key Cryptography: DES, Triple DES, AES, Key distribution, Attacks **Public Key Cryptography:** RSA, ECC, Key Exchange (Diffie-Hellman), Java Cryptography Extensions, Attacks
UNIT – III
Integrity, Authentication and Non-Repudiation: Hash Function (MD5, SHA5), Message Authentication Code (MAC), Digital Signature (RSA, DSA Signatures), Biometric Authentication.
UNIT – IV
PKI Interface: Digital Certificates, Certifying Authorities, POP Key Interface, System Security using Firewalls and VPN's. **Smart Cards:** Application Security using Smart Cards, Zero Knowledge Protocols and their use in Smart Cards, Attacks on Smart Cards
UNIT – V
Applications: Kerberos, Web Security Protocols (SSL), IPSec, Electronic Payments, E-cash, Secure Electronic Transaction (SET), Micro Payments, Case Studies of Enterprise Security (.NET and J2EE)

Suggested Readings:

1.	William Stallings, *Cryptography and Network Security*, 4th Edition. Pearson,. 2009.
2.	Behrouz A Forouzan, *Cryptography and Network Security*, TMH, 2009
3.	Joseph Migga Kizza, *A Guide to Computer Network Security*, Springer, 2010
4.	Dario Cataiano, *Contemporary Cryptology*, Springer, 2010.

FOUNDATIONS OF CRYPTOGRAPHY

PE514CS

Instruction: 3 periods per week — Duration of SEE: 3 hours

CIE: 30 marks — SEE: 70 marks

Credits: 3

Objectives:

1.	Discuss fundamentals of IoT and its applications and requisite infrastructure.
2.	Describe Internet principles and communication technologies relevant to IoT.
3.	Discuss hardware and software aspects of designing an IoT system.
4.	Describe concepts of cloud computing and Data Analytics.
5.	Discuss business models and manufacturing strategies of IoT products.

Outcomes:

Student will be able to
1. Understand the various applications of IoT and other enabling technologies.
2. Understand pipelining, instruction set architectures, memory addressing.
3. Comprehend various protocols and communication technologies used in IoT.
4. Design simple IoT systems with requisite hardware and C programming software.
5. Understand the relevance of cloud computing and data analytics to IoT.
6. Comprehend the business model of IoT from developing a prototype to launching a product.

UNIT – I
Security Concepts: Introduction, The need for security, Security approaches, Principles of security, Types of Security attacks, Security services, Security Mechanisms, A model for Network Security Cryptography Concepts and Techniques: Introduction, plain text and cipher text, substitution techniques, transposition techniques, encryption and decryption, symmetric and asymmetric key cryptography, steganography, key range and key size, possible types of attacks.
UNIT – II
Symmetric key Ciphers: Block Cipher principles, DES, AES, Blowfish, RC5, IDEA, Block cipher operation, Stream ciphers, RC4. Asymmetric key Ciphers: Principles of public key cryptosystems, RSA algorithm, Diffie-Hellman Key Exchange.
UNIT – III
Cryptographic Hash Functions: Message Authentication, Secure Hash Algorithm (SHA-512), Message authentication codes: Authentication requirements, HMAC, CMAC, Digital signatures. Key Management and Distribution: Symmetric Key Distribution Using Symmetric & Asymmetric Encryption, Distribution of Public Keys, Kerberos, X.509 Authentication Service.
UNIT – IV
Transport-level Security: Web security considerations, Secure Socket Layer and Transport Layer Security, HTTPS, Secure Shell (SSH) Wireless Network Security: Wireless Security, Mobile Device Security, IEEE 802.11 Wireless LAN, IEEE 802.11i Wireless LAN Security
UNIT – V
E-Mail Security: Good Privacy, S/MIME IP Security: IP Security overview, IP Security architecture, Authentication Header, encapsulating security payload, Combining security associations.

Suggested Readings:

1. Cryptography and Network Security – Principles and Practice: William Stallings, Pearson Education, 6th Edition.
2. Cryptography and Network Security: AtulKahate, Mc Graw Hill, 3rd Edition.

PROFESSIONAL ELECTIVE - II

WEB TECHNOLOGIES

PE531CS

Instruction: 3 periods per week — Duration of SEE: 3 hours

CIE: 30 marks — SEE: 70 marks

Credits: 3

Objectives:

1.	Learn various client-side technologies for developing web-based applications.
2.	Learn the concepts of JavaScript and Angular JS for adding rich GUI.
3.	To Know about XML applications with DTD and Schema.
4.	To familiarize the concepts about Servlets and JSPs in dynamic web applications.
5.	To learn how to establish database connectivity in web applications.

Outcomes:

Student will be able to	
1.	Understand the concepts of HTML and CSS.
2.	Acquire the knowledge to build AJAX based applications using JavaScript.
3.	Understand and apply the concepts of servlet framework.
4.	Implement JSP to build interactive web applications.
5.	Acquire the knowledge of database connectivity in web applications.

UNIT – I

A Brief Introduction to Internet, The World Wide Web, Web Browsers, Web Servers, Uniform Resource Locators, MIME, HTTP

HTML5: Evolution of HTML and XHTML, Basic Syntax, Document Structure, Links, Images, Multimedia, Lists, Tables, Creating Forms. Cascading Style sheets.

UNIT – II

JavaScript: Overview, Object Orientation and JavaScript, Syntactic Characteristics, Primitives, Operators, Expressions, Input and Output, Control Statements, Objects Creation and modification, Arrays, Functions, Constructors, Pattern Matching. Manipulating DOM, HTML DOM Events, Basics of AJAX with example.

UNIT – III

XML: Introduction to XML, Syntax, XML document structure, Document Type Definition, Name spaces, XML Schemas, display in raw XML documents, Displaying XML documents with CSS, XPath Basics, XSLT, XML Processors.

J2EE: Exploring Enterprise architecture styles, Features of EE platform, Web servers and application servers.

Database programming with JDBC: JDBC Drivers, Exploring JDBC Processes with the java‘s Package.

UNIT – IV

Servlets Technology: Exploring the Features of Java Servlet, Exploring the Servlet API, Explaining the Servlet Life Cycle, creating a Sample Servlet, Working with ServletConfig and ServletContext Objects, Implementing Servlet Collaboration, Exploring the Session Tracking Mechanisms.

UNIT – V
JSP Technology: Advantages of JSP over Java Servlet, Architecture of a JSP Page, Life Cycle of a JSP Page, Working with JSP Basic Tags and Implicit Objects, Working with Action Tags in JSP, Exploring EL, Exploring the Elements of Tag Extensions, Tag Extension API, Working with Simple Tag Handlers, Accessing Database from Servlet and JSP.

Suggested Readings:

1. Robert W.Sebesta: *Programming the World Wide Web*, 4th Edition, Pearson Education, 2009.
2. Java Server Programming Java EE7 (J2EE 1.7): Black Book, (2014), Dreamtech Press
3. Porter Scobey, PawanLingras: *Web Programming and Internet Technologies an E-Commerce Approach*, 2nd Edition, Jones & Bartlett Learning, 2009.
4. Bryan Basham, Kathy Sierra, Bert Bates: Headfirst Servlets & JSP, 2nd edition, OREILLY, 2008.

EMBEDDED SYSTEMS

PE532CS

Instruction: 3 periods per week | Duration of SEE: 3 hours

CIE: 30 marks | SEE: 70 marks

Credits: 3

Objectives:

1. To provide an overview of Design Principles of Embedded System.
2. Understand the fundamentals of Microcontroller based systems, basic hardware components, selection methods and attributes of an embedded system.
3. To introduce and discuss Interfacing of various real-world devices with 8051 microcontrollers.
4. Comprehend the real time operating system used for the embedded system.
5. To expose students to the recent trends in embedded system design.

Outcomes:

Student will be able to
1. Demonstrate the role of individual components involved in a typical embedded system.
2. Describe the architectural features and instructions of Intel 8051 Microcontroller.
3. Apply the knowledge gained for Programming ARM for different applications.
4. Expected to visualize the role of Real time Operating Systems in Embedded Systems.
5. Interpret the basic hardware components and their selection method based on the characteristics and attributes of an embedded system.

UNIT – I
Embedded Computing: Introduction, Complex Systems and Microprocessor; Embedded System Design Process, Design Examples. **The 8051 Microcontrollers**: Introduction, 8051 Micro Controller Hardware, Input/Output Ports and Circuits, External Memory, Counter and Timers, Serial data Input/Output, interrupts.
UNIT – II
Basic Assembly Language Programming Concepts: Assembly Language Programming Process, Programming Tools and Techniques, Programming the 8051, Data Transfer and Logical Instructions. Arithmetic Operations, Decimal Arithmetic, Jump and Call Instructions, Further Details on Interrupts.
UNIT – III
Interfacing real world devices with 8051 microcontrollers: Analog to Digital converters (ADC) & Digital to Analog Converter (DAC) basics. ADC, DAC and Temperature Sensor interfacing with 8051 microcontrollers. LCD and Matrix Keyboard interfacing with 8051microcontroller.
UNIT – IV
Introduction to Real-Time Operating Systems: Tasks and Task States, Tasks and Data, Semaphores, Shared Data, Message Queues, Mailboxes and Pipes, Timer Functions, Events, Memory Management, Interrupt Routines in an RTOS Environment.

UNIT – V
Embedded Software Development Tools: Host and Target machines, Linker/Locators for Embedded Software, Getting Embedded Software into the Target System. **Debugging Techniques:** Testing on Host Machine, Using Laboratory Tools, An Example System.

Suggested Readings:

1. Wayne Wolf, Computers as Components-Principles of Embedded Computer System Design, Morgan Kaufmann publishers, Third edition, 2012.
2. Mohamed Ali Mazidi, Janice GillispieMazidi, RolinMcKinlay, *the 8051 Microcontroller and Embedded Systems: Using Assembly and C*, 2nd Edition, Pearson education, 2011.
3. Raj Kamal, Embedded Systems: Architecture, Programming and Design, 3rd Edition, McGraw Hill Education (India), 2014.

GRAPH THEORY

PE533CS

Instruction: 3 periods per week | Duration of SEE: 3 hours

CIE: 30 marks | SEE: 70 marks

Credits: 3

Objectives:

1.	To comprehend graphs as modelling and analysis tool.
2.	To introduce various data structures with graph theory.
3.	To learn a variety of different problems in graph theory.
4.	To understand and analyse various graphs.

Outcomes:

Student will be able to	
1.	Write mathematical definitions involving basic graphs.
2.	Differentiate the potential use of directed and undirected graphs.
3.	Develop algorithms based on diverse applications of graphs in different domains.
4.	Validate and critically assess a mathematical proof related with graphs.

UNIT – I
BASICS OF GRAPHS AND TREES: Graphs – Introduction – Isomorphism – Sub Graphs – Walks, Paths, Circuits – Connectedness– Components – Euler Graphs – Hamiltonian paths and circuits – Trees – Properties of Trees– Distance and Centers in Tree – Rooted and Binary Trees.
UNIT – II
TREES, CONNECTIVITY & PLANARITY: Spanning Trees – Fundamental Circuits – Spanning Trees in a Weighted Graph – Cut Sets – Properties of Cut Set – All Cut Sets – Fundamental Circuits and Cut Sets – Connectivity and Separability – Combinational and Geometric Graphs – Planer Graphs – Different Representation of a Planer Graph.
UNIT – III
COLOURING AND DIRECTED GRAPH: Chromatic Number – Chromatic Partitioning – Chromatic Polynomial – Edge Coloring & Vertex Coloring –Vizing‘s Theorem – Directed Graphs – Types of Directed Graphs – Digraphs and Binary Relations – Directed Paths and Connectedness – Euler Graphs.
UNIT – IV
MATCHINGS & COVERS: Matchings– Matchings& Coverings in Bipartite Graphs – Perfect Matching – Maximum Matching – Hall‘s Theorem & Consequences– Min – Max Theorems – Independent Sets & Edge Covers – Cuts & Connectivity.
UNIT – V
PLANAR GRAPHS: Plane & Planar graphs – Dual Graphs – Euler Formula – Kuratowski‘s Theorem – The five-color theorem and four-color conjecture.

Suggested Readings:

1. Douglas B. West, *Introduction to Graph Theory*, 2nd Edition, Prentice Hall of India,2015.
2. Narsingh Deo, *Graph Theory: With Application to Engineering and Computer Science*, 2nd Edition, Prentice Hall of India, 2003.
3. F. Harry, *Graph Theory*, Narosa Publications, 2001.
4. Rosen K.H., —Discrete Mathematics and Its Applications, McGraw Hill, 2007.

DATA ANALYTICS

PE534CS

Instruction: 3 periods per week | Duration of SEE: 3 hours

CIE: 30 marks | SEE: 70 marks

Credits: 3

Objectives:

1. Overview of Data and Data analytics on huge datasets.
2. Prepare Qualitative Data to perform different strategies of analytics.
3. Explore Data Analysis using R Software.
4. Able to realistically assess the application of data analytics technologies for different usage scenarios.

Outcomes:

Student will be able to
1. Demonstrate proficiency with statistical analysis of data.
2. Develop the ability to build and assess data-based models.
3. Execute statistical analyses with professional statistical software.
4. Demonstrate skill in data management.
5. Apply data science concepts and methods to solve problems in real-world contexts and will communicate these solutions effectively.

UNIT – I
Getting to Know Your Data - Data Objects and Attribute Types - Attribute, Nominal Attributes, Binary Attributes, Ordinal Attributes, Numeric Attributes, Discrete versus Continuous Attributes. Basic Measuring Data Similarity and Dissimilarity - Data Matrix versus Dissimilarity Matrix, Proximity Measures for Nominal Attributes, Proximity Measures for Binary Attributes, Dissimilarity of Numeric Data: Minkowski Distance, Proximity Measures for Ordinal Attributes, Dissimilarity for Attributes of Mixed Types, Cosine Similarity.
UNIT – II
Introduction to Data Analytics - Big Data and Data Science, Small Data, A Short Taxonomy of Data Analytics, Examples of Data Use, Breast Cancer in Wisconsin, Polish Company Insolvency Data, A Little History on Methodologies for Data Analytics. **Descriptive Statistics** - Scale Types, Descriptive Univariate Analysis, Univariate Frequencies, Contents, Univariate Data Visualization, Univariate Statistics, Common Univariate Probability Distributions, Descriptive Bivariate Analysis, Two Quantitative Attributes, Two Qualitative Attributes, at Least one of them Nominal, Two Ordinal Attributes.
UNIT – III
Descriptive Multivariate Analysis - Multivariate Frequencies, Multivariate Data Visualization, Multivariate Statistics, Location Multivariate Statistics, Dispersion Multivariate Statistics. **Data Quality and Preprocessing** - Data Quality, Missing Values, Redundant Data, Inconsistent Data, Noisy Data, Outliers, Converting to a Different Scale Type, Converting Nominal to Relative, Converting Ordinal to Relative or Absolute, Converting Relative or Absolute to Ordinal or Nominal, Converting to a Different Scale.

UNIT – IV
Data Analytics Lifecycle Overview - Key Roles for a Successful Analytics Project, Background and Overview of Data Analytics Lifecycle - Discovery, Data Preparation, Model Planning, Model Building, Communicate Results, Operationalize and Case Study. **Data Analytics Methods using R -** Introduction to R, R Graphical User Interfaces, Data Import and Export, Attribute and Data Types, Descriptive Statistics, Exploratory Data Analysis, Visualization Before Analysis, Dirty Data Visualizing a Single Variable Examining Multiple Variables, Data Exploration Versus Presentation.
UNIT – V
Data Visualization Basics - Key Points Supported with Data, Evolution of a Graph, Common Representation Methods, How to Clean Up a Graphic, Additional Considerations. **Applications of Data Analytics on Text & Web:** Working with Texts, Data Acquisition, Feature Extraction, Tokenization, Stemming, Conversion to Structured Data, Trends, Sentiment Analysis, Web Mining, & Recommender Systems.

Suggested Readings:

1. Data Mining: Concepts and Techniques Second Edition – Jiawei Han and Micheline Kamber – Morgan KaufMan Publisher, 2011.
2. A General Introduction to Data Analytics, Joao Mendes Moreira,Andre C.P.L.F.de Carvalho, Tomas Horvath, Wiley Publications., 2018.
3. David Dietrich, Barry Hiller, “Data Science & Big Data Analytics”, EMC education services, Wiley publications, 2012.

PROFESSIONAL ELECTIVE - III

BLACK CHAIN TECHNOLOGY

PE521CS

Instruction: 3 periods per week | Duration of SEE: 3 hours

CIE: 30 marks | SEE: 70 marks

Credits: 3

Objectives:

1.	Understand how block chain systems (mainly Bitcoin and Ethereum) work.
2.	To securely interact with them.
3.	Design, build, and deploy smart contracts and distributed applications.
4.	Integrate ideas from block chain technology into their own projects.

Outcomes:

Student will be able to	
1.	Explain design principles of Bitcoin and Ethereum.
2.	Explain Nakamoto consensus.
3.	Explain the Simplified Payment Verification protocol.
4.	List and describe differences between proof-of-work and proof-of-stake consensus.
5.	Interact with a block chain system by sending and reading transactions.
6.	Design, build, and deploy a distributed application.
7.	Evaluate security, privacy, and efficiency of a given block chain system.

UNIT – I
Basics: Distributed Database, Two General Problem, Byzantine General problem and Fault Tolerance, Hadoop Distributed File System, Distributed Hash Table, ASIC resistance, Turing Complete. **Cryptography: Hash function, Digital Signature -** ECDSA, Memory Hard Algorithm, Zero Knowledge Proof.
UNIT – II
Blockchain: Introduction, Advantage over conventional distributed database, Block chain Network, Mining Mechanism, Distributed Consensus, Merkle Patricia Tree, Gas Limit, Transactions and Fee, Anonymity, Reward, Chain Policy, Life of Block chain application, Soft & Hard Fork, Private and Public block chain.
UNIT – III
Distributed Consensus: Nakamoto consensus, Proof of Work, Proof of Stake, Proof of Burn, Difficulty Level, Sybil Attack, Energy utilization and alternate.
UNIT – IV
Cryptocurrency: History, Distributed Ledger, Bitcoin protocols - Mining strategy and rewards, Ethereum - Construction, DAO, Smart Contract, GHOST, Vulnerability, Attacks, Sidechain, Name coin
UNIT – V
Cryptocurrency Regulation: Stakeholders, Roots of Bit coin, Legal Aspects-Crypto currency Exchange, Black Market and Global Economy. **Applications:** Internet of Things, Medical Record Management System, Domain Name Service, and future of Block chain.

Case study: Naive Blockchain construction, Memory Hard algorithm - Hashcash implementation, Direct Acyclic Graph, Play with Go-Ethereum, Smart Contract Construction, Toy application using Blockchain, Mining puzzles

Suggested Readings:

1. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller and Steven Goldfeder, Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction, Princeton University Press, 2016.
2. Satoshi Nakamoto, Bitcoin: A Peer-to-Peer Electronic Cash System.
3. DR. Gavin Wood, "ETHEREUM: A Secure Decentralized Transaction Ledger," Yellow paper.2014.
4. Nicola Atzei, Massimo Bartoletti, and TizianaCimoli, A survey of attacks on Ethereum smart contracts.

INFORMATION RETRIEVAL SYSTEMS

PE522CS

Instruction: 3 periods per week | Duration of SEE: 3 hours

CIE: 30 marks | SEE: 70 marks

Credits: 3

Objectives:

1. To understand indexing and querying in information retrieval systems.
2. To learn the different models for information retrieval.
3. To expose the students to text classification and clustering.
4. To learn about web searching.

Outcomes:

Student will be able to
1. Understand the algorithms and techniques for information retrieval (document indexing and retrieval, query processing).
2. Quantitatively evaluate information retrieval systems.
3. Classify and cluster documents.
4. Understand the practical aspects of information retrieval such as those in web search engines.

UNIT – I
Introduction to Information Retrieval Systems: Definition of Information Retrieval System, Objectives of Information Retrieval Systems, Functional Overview, Relationship to Database Management Systems, Digital Libraries and Data Warehouses. **Boolean Retrieval:** An example information, building an inverted index, processing Boolean queries, the extended Boolean model versus ranked retrieval. **The term vocabulary and postings list:** Document delineation and character sequence decoding, determining the vocabulary of terms, Faster postings list intersection via skip pointers, Positional postings, and Phrase queries. **Dictionaries and tolerant retrieval:** Search structures for dictionaries, Wildcard queries, spelling correction.
UNIT – II
Index construction: Hardware basics, blocked sort-based indexing, Single-pass in-memory indexing, Distributed indexing, Dynamic indexing, Other types of indexes. **Index compression:** Statistical properties of terms in information retrieval, Dictionary compression, Postings file compression. **Cataloging and Indexing:** History and Objectives of Indexing, Indexing Process, Automatic Indexing, Information Extraction. **Scoring, term weighting and the vector space model:** Parametric and zone indexes, Term frequency and weighting, the vector space model for scoring, and Variant tf-idf functions.
UNIT – III
Evaluation in information retrieval: Information retrieval system evaluation, Standard test collections, Evaluation of unranked retrieval sets, Evaluation of ranked retrieval results, Assessing relevance. **Relevance feedback and query expansion:** Relevance feedback and pseudo relevance feedback, Global methods for query reformulation.

Probabilistic information retrieval: Basic probability theory, The Probability Ranking Principle, The Binary Independence Model.
Language models for information retrieval: Language models, The query likelihood model**.**

UNIT – IV

Text classification and Naive Bayes: The text classification problem, Naive Bayes text classification, The Bernoulli model, Properties of Naive Bayes, and Feature selection.
Vector space classification: Document representations and measures of relatedness in vector spaces, Rocchio classification, k- nearest neighbor, Linear versus nonlinear classifiers.
Flat clustering: Clustering in information retrieval, Problem statement, Evaluation of clustering, k-means. Hierarchical clustering: Hierarchical agglomerative clustering, Single- link and complete-link clustering, Group-average agglomerative clustering, Centroid clustering, Divisive clustering.

UNIT – V

Matrix decompositions and Latent semantic indexing: Linear algebra review, Term-document matrices and singular value decompositions, Low-rank approximations, Latent semantic indexing.
Web search basics: Background and history, Web characteristics, Advertising as the economic model, The search user experience, Index size and estimation, Near-duplicates, and shingling.
Web crawling and Indexes: Overview, Crawling, Distributing indexes, Connectivity servers.
Link analysis: The Web as a graph, Page Rank, Hubs and Authorities.

Suggested Readings:

1. Christopher D. Manning, Prabhakar Raghavan, Hinrich Schütze, An Introduction to Information Retrieval, Cambridge University Press, Cambridge, England,2008.
2. David A. Grossman, Ophir Frieder, Information Retrieval–Algorithms and Heuristics, Springer, 2nd Edition (Distributed by Universities Press),2004.
3. Gerald J Kowalski, Mark T Maybury. Information Storage and Retrieval Systems, Springer,2000.
4. Soumen Chakrabarti, Mining the Web: Discovering Knowledge from Hypertext Data, Morgan- Kaufmann Publishers,2002.

SOFT COMPUTING

PE523CS

Instruction: 3 periods per week | Duration of SEE: 3 hours

CIE: 30 marks | SEE: 70 marks

Credits: 3

Objectives:

1.	Classify the various soft computing frame works.
2.	Be familiar with the design of neural networks, fuzzy logic, and fuzzy systems.
3.	Learn mathematical background for optimized genetic programming.

Outcomes:

Student will be able to	
1.	Learn about soft computing techniques and their applications.
2.	Learn about fuzzy logic, various fuzzy systems, and their functions.
3.	Use fuzzy rules and reasoning to develop decision making and expert system.
4.	Choose and design suitable neural network for real time problems.
5.	Understand the genetic algorithm concepts and their applications.

UNIT – I

Introduction to Soft Computing: Soft computing constituents, characteristics of neuro-computing and soft computing, difference between hard computing and soft computing, some applications of soft computing techniques, concepts of learning and adaptation.

UNIT – II

Fuzzy logic: Introduction to classical/crisp sets and fuzzy sets, classical/crisp relations and fuzzy relations, tolerance and equivalence relations, non-iterative fuzzy sets.

Membership functions: fuzzification, methods of membership value assignments, defuzzification, lambda cuts for fuzzy sets and fuzzy relations, defuzzification methods.

UNIT – III

Fuzzy arithmetic and fuzzy measures: Fuzzy rule base and approximate reasoning, truth values and tables in fuzzy logic, fuzzy propositions, formation of rules, decomposition and aggregation of rules, fuzzy reasoning, fuzzy inference systems, fuzzy decision making, fuzzy logic control systems, fuzzy expert systems.

UNIT – IV

Introduction Neural Network: Fundamental concept, evolution of neural networks, models of artificial neural networks, important technologies, applications, McCulloch, Pitts Neuron, linear separability, Hebb network.

Supervised learning network: Perception networks, adaptive linear neuron, multiple adaptive linear neurons, back propagation network, radial basis function network.

Unsupervised learning networks: Kohonenself-organizing feature maps, learning vector quantization, counter propagation networks, adaptive resonance theory network.

UNIT – V

Genetic Algorithm: Difference between traditional algorithms and GA, genetic algorithm and search space, general genetic algorithm, operators, generational cycle, in genetic algorithm, stopping condition for genetic algorithm flow, constraints in genetic algorithm, schema theorem, classification of genetic algorithm, genetic programming, multilevel optimization.

Suggested Readings:

1. J.S.R.Jang, C.T.Sun and E.Mizutani, “Neuro-Fuzzy and Soft Computing”, Pearson Education 2004.
2. S.N.Sivanandam, S.N.Deepa “Principles of Soft Computing” Second Edition, Wiley Publication.
3. Timothy J.Ross, “Fuzzy Logic with Engineering Applications”, McGraw-Hill,1997.
4. Davis E.Goldberg, “Genetic Algorithms: Search, Optimization and Machine Learning”, Addison Wesley, N.Y.
5. S.Rajasekaran and G.A.VijayalakshmiPai “Neural Networks, Fuzzy Logic and Genetic Algorithms” PHI Learning.

COMPUTER GRAPHICS

PE524CS

Instruction: 3 periods per week | Duration of SEE: 3 hours

CIE: 30 marks | SEE: 70 marks

Credits: 3

Objectives:

1. To introduce the concept of synthetic camera model, programmable pipeline and OpenGL API.
2. To study different interaction modes and data structures that store 2-D and 3-D geometric objects.
3. To understand different transformations in 2-D and 3-D.
4. To study different rasterization and rendering algorithms.

Outcomes:

Student will be able to
1. Describe the steps in graphics programming pipeline.
2. Write interactive graphics applications using OpenGL geometric primitives.
3. Apply affine transformations for viewing and projections.
4. Create realistic images of 3-d objects that involve lighting shading aspects.

UNIT – I
Graphics Systems and Models: Graphics system, Images, Physical and Synthetic, Imaging system, Synthetic camera model, Programming interface, Graphics architectures, Programmable pipelines. **Graphics Programming:** Programming two-dimensional applications, OpenGL API, Primitives and attributes, Color, Viewing and Control functions.
UNIT – II
Input and Interaction: Input devices, Display lists & modeling, Programming event-driven input, Picking, building interactive models, Animating interactive programs, Logic operations. **Geometric Objects:** Three-dimensional primitives, Coordinate systems and frames, Frames in OpenGL, Modeling colored cube.
UNIT – III
Transformations: Affine transformations, Transformations in homogeneous coordinates, Concatenation of transformations, OpenGL transformation matrices. **Viewing:** Classical and Computer views, Viewing with a computer, Positioning of camera, Simple projections, Projections in OpenGL, Hidden surface removal, Parallel-projection matrices, Perspective-projection matrices.
UNIT – IV
Lighting and Shading: Light sources, The Phong lighting model, Computational vectors, Polygonal shading, Light sources in OpenGL, Specification of matrices in OpenGL, Global illumination. **From Vertices to Frames:** Basic implementation strategies, Line-segment clipping, Polygon clipping, Clipping in three dimensions, Rasterization, Anti-aliasing.

UNIT – V
Modeling & Hierarchy: Hierarchal models, Trees and traversal, Use of tree data structure, Animation, Graphical objects, Scene graphs, Simple scene graph API, Open Scene graph, Other tree structures.

Suggested Readings:

1. Edward Angel, Interactive Computer Graphics: A Top-Down Approach Using OpenGL, Pearson Education, 5th edition, 2009.
2. Francis S Hill Jr., Stephen M Kelley, Computer Graphics using OpenGL, Prentice-Hall Inc., 3rd Edition, 2007.
3. Jim X. Chen, Foundations of 3D Graphics Programming using JOGL and Java3D, Springer Verlag, 2006.
4. Hearn Donald, Pauline M Baker, Computer Graphics, 2nd edition, 1995.

PRACTICAL/ LABORATORY COURSES

SOFTWARE ENGINEERING LAB

PC551CS

Instruction: 3 periods per week | Duration of SEE: 3 hours

CIE: 25 marks | SEE: 50 marks

Credits: 1

Objectives:

1. To understand the software engineering methodologies for project development.
2. To gain knowledge about open-source tools for Computer Aided Software Engineering (CASE).
3. To develop test plans and test cases to perform various testing.

Outcomes:

Student will be able to
1. Analyze and design software requirements in an efficient manner.
2. Use open-source case tools to develop software.
3. Implement the design, debug and test the code.

I. FORWARD ENGINEERING

Students have to form a team with a batch size of two or three and take up a **case study- based project** to analyze, plan, design UML models and create a prototypical model (identifying deliverables) by coding the developed designs and finally documenting considering any one example of the following domains: -

1. Academics (Course Registration System, Student marks analyzing system)
2. Health Care (Expert system to prescribe medicines for given symptoms, Remote Diagnostics, Patient/Hospital Management System)
3. Finance (Banking: ATM/NetBanking, UPI:PayTM/Phone Pay, Stocks:Zerodha)
4. E-Commerce (various online shopping portals like FlipKart/Amazon/Myntra)
5. Logistics (Postal/Courier:IndiaPost/DTDC/UPS/FedEx, Freight:Maersk)
6. Hospitality (Tourism Management:Telangana Tourism/Incredible India, Event Management: MeraEvents/BookMyShow/Explara/EventBrite)
7. Social Networking (LinkedIn, FaceBook, Shaadi.com, BharatMatrimony, Tinder)
8. Customer Support (Banking Ombudsman,Indian Consumer Complaints Forum)
9. Booking/Ticketing(Food:Zomato/Swiggy/BigBasket/Grofers/JioMart, Hotel:OYO/Trivago or Travel: {Cars:Uber/OLA/Zoom, Railways:IRCTC, Buses:OnlineTSRTC/RedBus/AbhiBus, Flights:MakeMyTrip/Goibibo, Ships:Lakport})

II. REVERSE ENGINEERING

Students have to refer any project repository: GitLab/GitHub, execute the code in order to observe its functionalities/features/requirements and by the help of any tool derive the designs from the code for understanding the relationships among various subsystems/classes/components and if the tool partially generates models then identify by associating elements to judge/mark the appropriate relationships.

III. TESTING
Prepare Test Plan and develop Test Case Hierarchy to monitor or uncover/report errors using manual/automated testing tools

Software Required:

1. StarUML/Umbrello, NetBeans/Eclipse IDE, XAMPP/MEAN stack, JUnit, JMeter, Selenium, Bugzilla

Course Code	Course Title						Core / Elective
PC 552 CS	**Programming Languages Lab**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	-	-	-	**2**	**25**	**50**	**1**

Course Objectives

- To introduce the various programming paradigms.
- To understand the evolution of programming languages.
- To introduce the techniques involved in design and implementation ofprogramming languages.
- To introduce the notations to describe the syntax and semantics of programminglanguages.

Course Outcomes

After completing this course, the student will be able to

- Express syntax and semantics in formal notation.
- Identify and apply a suitable programming paradigm for a given computing application
- Compare the features of various programming languages.
- Understand the programming paradigms of modern programming languages.
- Program in different language paradigms and evaluate their relativebenefits

LISP Programming

1. Programming in LISP usingSet
   Operations
   Property List
2. Implementation of LISP interpreter with basic functions.
3. Evaluation of Expression using Cons,CDR,CAR, Length, Append, Min, Max,
   Assoc, Sqrt, expt, Setf,Equal,cond and let built in functions.
4. Write a function using predicates and conditional statement.
5. Program to find even or odd, Palindrome, Fibonacci number, factorial and power of a number etcusing file editing loading and compiling.
6. Demonstrate the application of Anonymous functions and higher order functions
7. Program to demonstrate MAPCAR, reduce, Remove, remove if, count_if, apply, lambda expression

Prolog Programming

1. Programs for Logical Interface examples
2. Program for Symbolic Computation and List manipulation
3. Program to find the factorial of a number using Recursion
4. Program to compute n^{th} Fibonacci term
5. Program to find GCD of two numbers
6. Program to obtain the product of the elements of the list
7. Program to demonstrate Goal, Rule and Relation on a Family database
8. Program to search the database for demonstrating backtracking using Cut, Fail and not

MINI PROJECT

PC533CS

Instruction: 4 periods per week
hours CIE: 25 marks
Credits: 2

Duration of SEE: 3
EE: 50 marks

Objectives:

1.	To enhance practical and professional skills.
2.	To familiarize tools and techniques of systematic literature survey and documentation.
3.	To expose the students to industry practices and teamwork.
4.	To encourage students to work with innovative and entrepreneurial ideas.

Outcomes:

Student will be able to	
1.	Demonstrate the ability to synthesize and apply the knowledge and skills acquired in the academic program to the real-world problems.
2.	Evaluate different solutions based on economic and technical feasibility.
3.	Effectively plan a project and confidently perform all aspects of project management.
4.	Demonstrate effective coding, written, presentation and oral communication skills.

I. CASE STUDY

The students are required to carry out mini projects in any of the areas such as Data Structures, Microprocessors and Interfacing, Database Management Systems, Operating Systems, Design and Analysis of Algorithms, Software Engineering, Data Communications, Web Programming & Services, Computer Networks, Compiler Construction, and Object- Oriented System Development.

Problems Statements are suggested to be taken from Smart India Hackathon (SIH) Portal invited from the Ministries / PSUs / MNCs / NGOs to be worked out through.

The project could be classified as hardware, software, modeling, simulation etc. The project should involve one or many elements of techniques such as analysis, design, and synthesis.

The department will appoint a project coordinator who will coordinate the following:

1. Grouping of students (maximum of 3 students in a group)
2. Allotment of projects and project guides.
3. All projects allotment is to be completed by the 4th week of the semester so that the students get sufficient time for completion of the project.
4. Disseminate guidelines given by monitoring committee comprising of senior faculty members to the students and their guides.

Sessional marks are to be awarded by the monitoring committee.

Common norms will be established for the final presentation and documentation of the project report by the respective departments.

Students are required to submit a presentation and report on the mini project at the end of the semester.

CSE: SEMESTER - VI

S. No	Course Code	Course Title	Scheme of Instruction				Scheme of Examination			Credits
			L	T	D/P	Contact Hrs/Wk	CIE	SEE	Duration in Hrs/Wk	
Theory Courses										
1	PC 601 CS	Compiler Design	3	1	-	4	30	70	3	3
2	PC 602 CS	Computer Networks	3	1	-	4	30	70	3	3
3	PC 603 CS	Design and Analysis of Algorithms	3	1	-	3	30	70	3	3
4	PE –IV	Professional Elective –IV	3	-	-	3	30	70	3	3
5	PE –V	Professional Elective –V	3	-	-	3	30	70	3	3
6	OE-I	Open Elective-I	3	-	-	-	30	70	3	3
Practical/Laboratory Courses										
7	PC 651 CS	Compiler Design Lab	-	-	2	2	25	50	3	1
8	PC 652 CS	Computer Networks Lab	-	-	2	2	25	50	3	1
9	PC 653 CS	Design and Analysis of Algorithms Lab	-	-	2	2	25	50	3	1
10	SI 671 CS	Summer Internship*	-	-	-	-	-	-	-	-
Total			**18**	**3**	**6**	**27**	**255**	**570**		**21**

Open Elective- I		
Sl.No	**Code**	**Name of Subject**
1	**OE601 EE**	Electrical Energy Conservation and Safety (Not for EEE & EIE Students)
2	**OE602 EE**	Reliability Engineering (Not for EEE & EIE Students)
3	**OE611 AE**	Automobile Engineering (Not for Auto. Engg. students)
4	**OE611 ME**	Entrepreneurship (Not for Mech Engg& Prod. Engg. students)
5	**OE601 EG**	Soft Skills & Interpersonal Skills
6	**OE602 MB**	Human Resource Development and Organizational Behaviour
7	**OE601 LW**	Cyber Law and Ethics
8	**OE601 CS**	Operating Systems (Not for CSE Students)
9	**OE602 CS**	OOP using Java (Not for CSE Students)
10	**OE601 IT**	Database Systems (Not for IT Students)
11	**OE602 IT**	Data Structures (Not for IT Students)
12	**OE601 CE**	Disaster Mitigation (Not for Civil Engg. Students)

COMPILER DESIGN

PC 601 CS

Instruction: 3L+1T periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits: 3

Objectives:

➢ To understand and list the different stages in the process of compilation.
➢ Identify different methods of lexical analysis
➢ Design top-down and bottom-up parsers
➢ Identify synthesized and inherited attributes
➢ Develop syntax directed translation schemes
➢ Develop algorithms to generate code for a target machine

Outcomes:

Upon completion of the course, the students will be able to:
1. For a given grammar specification, develop the lexical analyzer.
2. For a given parser specification, design top-down and bottom-up parsers.
3. Develop syntax directed translation schemes.
4. Develop algorithms to generate code for target machine.

UNIT-I
Introduction: The Structure of a Compiler, Phases of Compilation, The Translation Process, Major Data Structures in a Compiler, Bootstrapping and Porting. **Lexical Analysis (Scanner)**: The Role of the Lexical Analyzer, Input Buffering, Specification of Tokens, Recognition of Tokens, The Lexical Analyzer Generator Lex.
UNIT-II
Syntax Analysis (Parser): The Role of the Parser, Syntax Error Handling and Recovery, Top-Down Parsing, Bottom-Up Parsing, Simple LR Parsing, More Powerful LR Parsing, Using Ambiguous Grammars, Parser Generator Yaac.
UNIT-III
Syntax-Directed Translation: Syntax-Directed Definitions, Evaluation Orders for SDD's Applications of Syntax-Directed Translation. **Symbol Table:** Structure, Operations, Implementation and Management.
UNIT-IV
Intermediate Code Generation: Variants of Syntax Trees, Three-Address Code, Types and Declarations, Translation of Expressions, Type Checking, Control Flow, Backpatching, Switch-statements, Intermediate Code for Procedures. **Run-time environment**: Storage Organization, Stack Allocation of Space, Access to Nonlocal Data on the Stack, Parameter passing, Heap Management and Garbage Collection.
UNIT-V
Code Generation: Issues in the Design of a Code Generator, The Target Language, Addresses in the Target Code, Basic Blocks and Flow graphs, Optimization of Basic Blocks, Peephole Optimization, Register Allocation and Assignment. **Machine-Independent Optimizations:** The Principal Sources of Optimizations, Introduction to Data-Flow Analysis.

Suggested Readings:

1. Alfred V. Aho, Monica S. Lam, Ravi Sethi, & Jeffrey D. Ullman , *Compilers :Principles, Techniques and Tools*, 2nd Edition, Pearson Education, 2006.
2. Kenneth C. Louden**,** *Compiler Construction: Principles and Practice*, *Thomson Learning Inc., 1997.*
3. P.Trembley and P.S.Sorenson, ***The Theory and Practice of Compiler Writing***, TMH-1985.

COMPUTER NETWORKS

PC 602 CS

Instruction: 3L+1T periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits: 3

Objectives:

1. To develop an understanding of communication in modern network architectures from a design and performance perspective.
2. To understand Data Transmission standards and MAC protocols.
3. To introduce the protocols functionalities in Network Layer and Transport Layer.
4. To understand DNS and supportive application protocols.
5. To provide basic concepts of Cryptography.

Outcomes:

After completing this course, the student will be able to:
1. Explain the functions of the different layer of the OSI and TCP/IP Protocol.
2. Understand wide-area networks (WANs), local area networks (LANs) and Wireless LANs (WLANs) describe the function of each block.
3. Illustrate network layer and transport layer protocols. For a given problem related TCP/IP protocol developed the network programming.
4. Configure DNS , EMAIL, SNMP, Bluetooth, Firewalls using open source available software and tools.
5. Identify the types of encryption techniques.

UNIT - I
Data communication Components: Representation of data communication, flow of Networks,Layered architecture, OSI and TCP/IP model, Transmission Media. (William stalling). **Techniques for Bandwidth utilization:** Line configuration, Multiplexing - Frequency division, Time division and Wave division, Asynchronous and Synchronous transmission , XDSL , Introduction to Wired and Wireless LAN
UNIT - II
Data Link Layer and Medium Access Sub Layer: Error Detection and Error Correction - Fundamentals, Block coding, Hamming Distance, CRC. **Flow Control and Error control protocols:** Stop and Wait, Go back – N ARQ, Selective Repeat ARQ, Sliding Window, Piggybacking. **Multiple access protocols:** Pure ALOHA, Slotted ALOHA, CSMA/CD,CDMA/CA
UNIT - III
Network Layer: Switching techniques (Circuit and Packet) concept. **Logical addressing**: IPV4(Header), IPV6(Header), NAT , Sub-Netting concepts. **Inter-Networking:**Tunnelling , Fragmentation , congestion control (Leaky Bucket and Token Bucket algorithm), Internet control protocols: ARP, RARP, BOOTP and DHCP.**Network Routing Algorithms:** Delivery, Forwarding and Unicast Routing protocol, Gateway protocols.
UNIT - IV
Transport Layer: Process to Process Communication, Elements of transport protocol, **Internet Transport Protocols**: UDP, TCP.**Congestion and Quality of Service**, QoS improving techniques.
UNIT - V

Application Layer: Domain Name Space (DNS), EMAIL, SNMP, Bluetooth.**Basic concepts of Cryptography:** Network Security Attacks, firewalls, symmetric encryption, Data encryption Standards, public key Encryption (RSA), Hash function, Message authentication, Digital Signature.

Suggested Readings:

1. Data Communication and Networking, 4th Edition, Behrouz A. Forouzan, McGrawHill.
2. Data and Computer Communication, 8th Edition, William Stallings, Pearson Prentice Hall India.
3. W. Richard Stevens, Unix Network Programming, Prentice Hall / Pearson Education, 2009

DESIGN AND ANALYSIS OF ALGORITHMS

PC 603 CS

Instruction: 3L+1T periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits: 3

Prerequisite:

1. Problem Solving Skills
2. Data Structures
3. Discrete Structures

Objectives:

1. Analyze the asymptotic performance of algorithms
2. Write rigorous correctness proofs for algorithms
3. Demonstrate a familiarity with major algorithms and data structures.
4. Apply important algorithmic design paradigms and methods of analysis
5. Synthesize efficient algorithms in common engineering design situations.

Outcomes:

1. Ability to analyze the performance of algorithms.
2. Ability to choose appropriate algorithm design techniques for solving problems.
3. Ability to understand how the choice of data structures and the algorithm design methods impact the performance of programs

UNIT-I
Introduction: Algorithm definition, and specification, asymptotic analysis – best, average, and worst-case behavior; Performance measurements of Algorithms, Time and Space complexities, Analysis of recursive algorithms. **Basic Data Structures:** Disjoint set operations, union and find algorithms, Dictionaries, Graphs, Trees.
UNIT-II
Divide and Conquer: General method, Control abstraction, Merge sort, Quick Sort – Worst, Best and average case. Binary search. **Brute Force:** Computing an– String Matching – Closest-Pair and Convex-Hull Problems - Exhaustive Search – Travelling Salesman Problem – Knapsack Problem – Assignment problem. **Greedy method:** General method, applications- Knapsack problem, Job sequencing with deadlines, Minimum cost spanning trees, Single source shortest path problem.
UNIT-III
Dynamic Programming: General Method, applications- All pairs shortest path problem, Optimal binary search trees, 0/1 knapsack problem, Reliability design, Traveling sales person problem. **Backtracking:** General method, Recursive backtracking algorithm, Iterative backtracking method. 8-Queen problem, Hamiltonian Cycle, 0/1 Knapsack Problem. **Branch and Bound:** Control abstractions for Least Cost Search, Bounding, FIFO branch and bound, LC branch and bound, 0/1 Knapsack problem – LC branch and bound and FIFO branch and bound solution, Traveling sales person problem.
UNIT-IV
Graph Algorithms: Graph Traversals DFS, BFS, Transitive Closure, Directed Acyclic Graphs - Topological Ordering, Network Flow algorithms. **Tries:** Standard Tries, Compressed Tries, Suffix Tries, Search Engine Indexing. **External Searching and B-Trees:** (a, b) Trees, B-Trees
UNIT-V

Computational Complexity: Non Deterministic algorithms, The classes: P, NP, NP Complete, NP Hard, Satisfiability problem, Proofs for NP Complete Problems: Clique, Vertex Cover. **Parallel Algorithms:** Introduction, models for parallel computing, computing with complete binary tree.

Suggested Readings:

1. E. Horowitz, S. Sahni, Fundamentals of Computer Algorithms.
2. Alfred V. Aho, John E. Hopcroft and Jeffrey D. Ullman, "Data Structures and Algorithms", Pearson Education, Reprint 2006.
3. M T Goodrich, Roberto Tamassia, Algorithm Design, John Wiley, 2002.
4. Thomas H.Cormen, Charles E.Leiserson, Ronald L. Rivest and Clifford Stein, "Introduction to Algorithms", Third Edition, PHI Learning Private Limited, 2012.

COMPILER DESIGN LAB

PC 651 CS

Instruction: 2P periods per week *Duration of SEE: 3 hours*
CIE: 25 marks *SEE: 50 marks*
Credits: 1

Objectives:

1. To learn usage of tools LEX, YAAC
2. To develop a code generator
3. To implement different code optimization schemes

Outcomes:

1. Generate scanner and parser from formal specification.
2. Generate top down and bottom up parsing tables using Predictive parsing, SLR and LR Parsing techniques.
3. Apply the knowledge of YACC to syntax directed translations for generating intermediate code – 3 address code.
4. Build a code generator using different intermediate codes and optimize the target code.

List of Experiments to be performed:

1. Sample programs using LEX.
2. Scanner Generation using LEX.
3. Elimination of Left Recursion in a grammar.
4. Left Factoring a grammar.
5. Top down parsers.
6. Bottom up parsers.
7. Parser Generation using YACC.
8. Intermediate Code Generation.
9. Target Code Generation.
10. Code optimization.

COMPUTER NETWORKS LAB

PC 652 CS

Instruction: 2P periods per week *Duration of SEE: 3 hours*
CIE: 25 marks *SEE: 50 marks*
Credits: 1

Prerequisite:

1. Data Communications

Objectives:

1. Learn to communicate between two desktop computers.
2. Learn to implement the different protocols
3. Be familiar with socket programming.
4. Be familiar with the various routing algorithms
5. Be familiar with simulation tools.
6. To use simulation tools to analyze the performance of various network protocols

Outcomes:

1. Implement various protocols using TCP and UDP.
2. Program using sockets.
3. Use simulation tools to analyze the performance of various network protocols.
4. Implement and Analyze various routing algorithms.

List of Experiments:

1. Running and using services/commands like tcpdump, netstat, ifconfig, nslookup, FTP, TELNET and traceroute. Capture ping and trace route PDUs using a network protocol analyzer and examine.
2. Configuration of router, switch . (using real devices or simulators)
3. Socket programming using UDP and TCP (e.g., simple DNS, data & time client/server, echo client/server, iterative & concurrent servers)
4. Network packet analysis using tools like Wireshark, tcpdump, etc.
5. Network simulation using tools like Cisco Packet Tracer, NetSim, OMNeT++, NS2, NS3, etc.
6. Study of Network simulator (NS) and Simulation of Congestion Control Algorithms using NS. Performance evaluation of Routing protocols using Simulation tools.
7. Programming using raw sockets
8. Programming using RPC
Note: The Instructor may add/delete/modify/tune experiments, wherever he/she feels in a justified manner.

Laboratory requirement for students:

Hardware:
1. Standalone desktops
Software:
1. C / C++ / Java / Python / Equivalent Compiler
2. Network simulator like NS2/NS3/OPNET/ CISCO Packet Tracer / Equivalent

DESIGN AND ANALYSIS OF ALGORITHMS LAB

PC 653 CS

Instruction: 2 periods per week *Duration of SEE: 3 hours*
CIE: 25 marks *SEE: 50 marks*
Credits: 1

Prerequisite:

1. 1. Problem Solving Skills
2. 2. Data Structures
3. 3. Discrete Structures

Objectives:

1. To learn the importance of designing an algorithm in an effective way by considering space and time complexity
2. To learn graph search algorithms.
3. To study network flow and linear programming problems
4. To learn the dynamic programming design techniques.
5. To develop recursive backtracking algorithms.

Outcomes:

After completing this course, the student will be able to:
1. Design an algorithm in a effective manner
2. Apply iterative and recursive algorithms.
3. Design iterative and recursive algorithms.
4. Implement optimization algorithms for specific applications.
5. Design optimization algorithms for specific applications.

List of Experiments:

1. Sort a given set of elements using the Quicksort method and determine the time required to sort the elements. Repeat the experiment for different values of n, the number of elements in the list to be sorted and plot a graph of the time taken versus n. The elements can be read from a file or can be generated using the random number generator.
2. Implement Merge Sort algorithm to sort a given set of elements and determine the time required to sort the elements. Repeat the experiment for different values of n, the number of elements in the list to be sorted and plot a graph of the time taken versus n. The elements can be read from a file or can be generated using the random number generator.
3. Obtain the Topological ordering of vertices in a given digraph and Compute the transitive closure of a given directed graph using Warshall's algorithm.
4. Implement 0/1 Knapsack problem using Dynamic Programming.
5. From a given vertex in a weighted connected graph, find shortest paths to other vertices using Dijkstra's algorithm.
6. Find Minimum Cost Spanning Tree of a given undirected graph using Kruskal's algorithm.
7. Print all the nodes reachable from a given starting node in a digraph using BFS method and Check whether a given graph is connected or not using DFS method.
8. Find a subset of a given set S = {sl, s2,.....,sn} of n positive integers whose sum is equal to a given positive integer d. For example, if S= {1, 2, 5, 6, 8} and d = 9 there are two solutions {1, 2, 6} and {1, 8}.A suitable message is to be displayed if the given problem instance doesn't have a solution

9. Implement any scheme to find the optimal solution for the Traveling Salesperson problem and then solve the same problem instance using any approximation algorithm and determine the error in the approximation.
10. Find Minimum Cost Spanning Tree of a given undirected graph using Prim's algorithm.
11. Implement All-Pairs Shortest Paths Problem using Floyd's algorithm.
12. Implement N Queen's problem using Back Tracking.

SUMMER INTERNSHIP

SI 671 CS

Instruction: 2P periods per week *Duration of SEE: 3 hours*
CIE: 50 marks *SEE: ----*
*Credits: 2**

Objectives:

To prepare the students
1. To give an experience to the students in solving real life practical problems with all its constraints.
2. To give an opportunity to integrate different aspects of learning with reference to real life problems.
3. To enhance the confidence of the students while communicating with industry engineers and give an opportunity for useful interaction with them and familiarize with work culture and ethics of the industry.

Outcomes:

On successful completion of this course student will be
1. Able to design/develop a small and simple product in hardware or software.
2. Able to complete the task or realize a pre-specified target, with limited scope, rather than taking up a complex task and leave it.
3. Able to learn to find alternate viable solutions for a given problem and evaluate these alternatives with reference to pre-specified criteria.
4. Able to implement the selected solution and document the same.

Summer Internship:

Summer internship is introduced as part of the curricula for encouraging students to work on problems of interest to industries. A batch of two or three students will be attached to a person from an Industry / R & D Organization / National Laboratory for a period of 4 weeks. This will be during the summer vacation following the completion of the VI semester course. One faculty member will act as an internal guide for each batch to monitor the progress and interacts with the Industry guide.
After the completion of the project, students will submit a brief technical report on the project executed and present the work through a seminar talk to be organized by the department. Award of sessional marks are based on the performance of the student at the work place and awarded by industry guide and internal guide (25 Marks) followed by presentation before the committee constituted by the department (25 Marks). One faculty member will coordinate the overall activity of Summer Internship.
***Note:** * Students have to undergo summer internship of 4 weeks duration at the end of semester VI and credits will be awarded after evaluation in VII semester.*

ADVANCED OPERATING SYSTEMS

PE 641 CS

Instruction: 3L periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits: 3

Prerequisite:

1. Operating Systems

Objectives:

1. To study, learn, and understand the main concepts of advanced operating systems (parallel processing systems, distributed systems, real time systems, network operating systems, and open source operating systems);
2. To learn hardware and software features that support these systems.

Outcomes:

Upon completion of the course, the students will be able to:
1. Understand the design approaches of advanced operating systems
2. Analyse the design issues of distributed operating systems.
3. Evaluate design issues of multiprocessor operating systems.
4. Identify the requirements of database operating systems.
5. Formulate the solutions to schedule the real time applications

UNIT-I
Architecture of Distributed Systems: Types, Distributed Operating System, Issues in Distributed Operating Systems, Theoretical Foundations: Global Clock, Lamport's Logical Clock, Vector Clocks, Global State, and Termination Detection.
UNIT-II
Distributed Mutual Exclusion: Classification, requirement, performance, non-token based algorithms, Lamport's algorithm, the Richart-Agarwala algorithm, token-based algorithm-Suzuki Kasami's broadcast algorithm, Singhal's heuristic algorithm. **Deadlock Detection:** Resource vs Communication deadlock, A graph- theoretic model, prevention, avoidance, detection, control organization, centralized deadlock-detection algorithm, the completely centralized algorithm, the HO-Ramamoorthy algorithm. Distributed deadlock detection algorithm - path - pushing, edge-chasing, hierarchical deadlock detection algorithm, menace-muntz and Ho-Ramamoorthy algorithm. Agreement Protocols: The system model, the Byzantine agreement, and the consensus problem.
UNIT-III
Distributed File System: Mechanisms, Design Issues, ***Case Studies:*** *Sun NFS, Sprite File System, DOMAIN, Coda File System.* **Distributed Shared Memory:** Algorithms for Implementing DSM, Memory Coherence, Coherence Protocols, Design Issues, ***Case Studies:*** *IVY, Mirage, Clouds.* **Distributed Scheduling:** Issues in Load Distribution, Components of Algorithm, Stability Load Distributing Algorithm, Performance.
UNIT-IV
Failure Recovery: Backward, Forward Error Recovery in Concurrent Systems, Consistent Set of Checkpoints, Synchronous and Asynchronous Checkpointing and Recovery. **Fault Tolerance:** Commit Protocols, Non-Blocking Commit Protocols, Voting Protocols. **Protection and Security:** Access Matrix, Private Key, Public key, and Kerberos System.

UNIT-V
Multiprocessor Operating Systems: Motivation, Basic Multiprocessor System Architecture, Interconnection Networks for Multiprocessor Systems, Caching, Hypercube Architecture. Threads, Process Synchronization, Processor Scheduling, and Memory Management. **Database Operating System:** Concurrence Control, Distributed Databases, and Concurrency Control Algorithms.

Suggested Readings:

1. Singhal M, Shivaratri N.G, Advanced Concepts in Operating Systems, McGraw-Hill Intl., 1994.
2. Pradeep K Sinha, Distributed Operating Systems Concepts and Design, PHI, First Edition, 2002.
3. Andrew S. Tanenbaum, Distributed Operating Systems, Pearson Education India, First Edition, 2011.
4.

CLOUD COMPUTING

PE 622 CS

Instruction: 3L periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits: 3

Objectives:

1. To understand the concept of cloud computing.
2. To understand the various issues in cloud computing.
3. To familiarize themselves with the lead players in cloud.
4. To appreciate the emergence of cloud as the next generation computing paradigm.

Outcomes:

1. Articulate the main concepts, key technologies, strengths and limitations of cloud computing. Identify the architecture, infrastructure and delivery models of cloud computing.
2. Explain the core issues of cloud computing such as security, privacy and interoperability.
3. illustrate the use of various cloud services available online

UNIT-I
INTRODUCTION - Historical Development - Cloud Computing Architecture – The Cloud Reference Model – Cloud Characteristics – Cloud Deployment Models: Public, Private, Community, Hybrid Clouds - Cloud Delivery Models: IaaS, PaaS, SaaS.
UNIT-II
CLOUD COMPUTING MECHANISM: Cloud Infrastructure Mechanism: Cloud Storage, Cloud Usage Monitor, Resource Replication – Specialized Cloud Mechanism: Load Balancer, SLA Monitor, Hypervisor, Resource Cluster, Multi Device Broker,
UNIT-III
STATE MANAGEMENT DATABASE – Cloud Management Mechanism: Remote Administration System, Resource Management System, SLA Management System, State Management Database – Cloud Management Mechanism: Remote Administration System, Resource Management System, SLA Management System,.
UNIT-IV
SECURITY IN THE CLOUD: Basic Terms and Concepts – Threat Agents – Cloud Security Threats – Cloud Security Mechanism: Encryption, Hashing, Digital Signature, Public Key Infrastructure, Identity and Access Management. Data Security :Application Security –Virtual Machine Security .
UNIT-V
CASE STUDIES :Google App Engine(GAE) – GAE Architecture – Functional Modules of GAE – Amazon Web Services(AWS) – GAE Applications – Cloud Software Environments – Eucalyptus – Open Nebula – Open Stack

Suggested Readings:

1. Thomas Erl, ZaighamMahood, Ricardo Puttini, ―Cloud Computing, Concept, Technology and Architecture‖, Prentice Hall, 2013.
2. Toby Velte, Anthony Velte, Robert C. Elsenpeter, ―Cloud Computing, A Practical Approach‖, Tata McGraw-Hill Edition, 2010.
3. Rittinghouse, John W., and James F. Ransome, "Cloud Computing: Implementation, Management, And Security", CRC Press, 2017.

NATURAL LANGUAGE PROCESSING

PE 623 CS

Instruction: 3L periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits: 3

Objectives:

1. Teach students the leading trends and systems in natural language processing.
2. Make them understand the concepts of morphology, syntax and semantics of the language and that they are able to give the appropriate examples that will illustrate the above mentioned concepts.
3. Teach them to recognize the significance of pragmatics for natural language understanding.
4. Enable students to be capable to describe the application based on natural language processing and to show the points of syntactic and semantic processing.

Outcomes:

Student will be able to
1. To tag a given text with basic Language features
2. To design an innovative application using NLP components
3. To implement a rule based system to tackle morphology/syntax of a language
4. To design a tag set to be used for statistical processing for real-time applications
5. To compare and contrast the use of different statistical approaches for different types of NLP applications.
6. Perform various language phonetic analysis

UNIT I
Introduction of NLP: Origins and challenges of NLP, Language Modeling: Grammar-based LM, Statistical LM – Regular Expressions, Automata , Morphology and Finite State Transducers,Tokenization, stemming, Normalization, Detecting and Correcting Spelling Errors, Minimum Edit Distance.
UNIT II
WORD LEVEL ANALYSIS: N-grams, Evaluating N-grams, Smoothing,Word Classes, Part-of-Speech Tagging, Rule-based, Stochastic and Transformation-based tagging, Issues in PoS tagging – Entropy, Hidden Markov and Maximum Entropy models, ; Named Entities
UNIT-III
SYNTACTIC ANALYSIS: Context free rules and trees – The noun Phrase – Co-ordination – Verb phrase – context free grammars – Parsing with context free grammars, Shallow parsing – Probabilistic CFG , Dependency Grammar , Semantic Analysis: Meaning Representation-Lexical Semantics- Ambiguity-Word Sense Disambiguation. Discourse Processing: cohesion-Reference Resolution- Discourse Coherence and Structure.
UNIT_IV
Speech Fundamentals: Phonetics – speech sounds and phonetic transcription – articulatory phonetics – phonological categories and pronunciation variation – acoustic phonetics and signals – phonetic resources – articulatory and gestural phonology
UNIT-V
Speech synthesis – text normalization – phonetic analysis – prosodic analysis – diphone waveform synthesis – unit selection waveform synthesis – evaluation

Suggested Readings:

1. Daniel Jurafsky, James H. Martin—Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech, Pearson Publication, 2014.
2. Steven Bird, Ewan Klein and Edward Loper, —Natural Language Processing with Python, First Edition, OReilly Media, 2009.

MACHINE LEARNING

PE 624 CS

Instruction: 3L periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits: 3

Objectives:

1. To learn the concept of how to learn patterns and concepts from data correlation.
2. To design and analyze various machine learning algorithms and techniques with a modern outlook focusing on recent advances.
3. Explore supervised and unsupervised learning paradigms of machine learning.
4. To explore Deep learning technique and various feature extraction strategies.

Outcome:

Upon completion of the course, the students will be able to:
1. Extract features that can be used for a particular machine learning approach in various applications.
2. To compare and contrast pros and cons of various machine learning techniques and to get an insight of when to apply a particular machine learning approach.
3. To mathematically analyze various machine learning approaches and paradigms.

UNIT-I
Supervised Learning (Regression/Classification) - Basic methods: Distance-based methods, Nearest-Neighbours, Decision Trees, Naive Bayes, Linear models: Linear Regression, Logistic Regression, Generalized Linear Models, Support Vector Machines, Nonlinearity and Kernel Methods, Beyond Binary.Classification: Multi-class/Structured Outputs, Ranking.
UNIT-II
Unsupervised Learning - Clustering: K-means/Kernel K-means, Dimensionality Reduction: PCA and kernel PCA, Matrix Factorization and Matrix Completion, Generative Models (mixture models and latent factor models)
UNIT-III
Evaluating Machine Learning algorithms and Model Selection, Introduction to Statistical Learning Theory, Ensemble Methods (Boosting, Bagging, Random Forests)
UNIT-IV
Sparse Modelling and Estimation, Modelling Sequence/Time-Series Data, Deep Learning and Feature Representation Learning
UNIT-V
Scalable Machine Learning (Online and Distributed Learning) A selection from some other advanced topics, e.g., Semi-supervised Learning, Active Learning, Reinforcement Learning, Inference in Graphical Models, Introduction to Bayesian Learning and Inference. Recent trends in various learning techniques of machine learning and classification methods for IOT applications. Various models for IOT applications.

Suggested Readings:

1. Kevin Murphy, Machine Learning: A Probabilistic Perspective, MIT Press, 2012
2. Trevor Hastie, Robert Tibshirani, Jerome H. Friedman, The Elements of Statistical Learning, Springer 2009 (freely available online)
3. Christopher Bishop, Pattern Recognition and Machine Learning, Springer, 2007.

IMAGE PROCESSING

PE 531 CS

Instruction: 3L periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits: 3

Prerequisite:

1. Data Structures
2. Discrete Mathematics

Objectives:

1. To introduce basics of visual perception, sampling, quantization and representation of digital images
2. To introduce spatial domain and frequency domain filtering techniques necessary for image processing operations.
3. To learn advanced image analysis techniques such as image restoration, image compression, image segmentation
4. To learn techniques of multi resolution methods, wavelets and morphological processing.
5. To understand the applications of image processing.

Outcomes:

1. Understand the basic image enhancement techniques in spatial & frequency domains.
2. Understand the basics of multi-resolution techniques.
3. Understand the basics of segmentation methods.
4. Apply this concept for image handling in various fields.
5. Knowledge about Morphological operations.

UNIT-I
Fundamentals of Image Processing: Introduction, examples, fundamental steps, components, elements of visual perception, light and electromagnetic spectrum, image sensing and acquisition, image sampling and quantization, basic relationships between pixels. **Intensity Transformations And Spatial Filtering**: Background, some basic intensity transformation functions, histogram processing, fundamentals of spatial filtering, smoothing spatial filters, sharpening spatial filters, combining spatial enhancement methods.
UNIT-II
Filtering In The Frequency Domain: Background, preliminary concepts, sampling and Fourier transform of sampled functions, discrete Fourier transform (DFT) of one variable, extension to functions of two variables, some properties of the 2-D discrete Fourier transform, basics of filtering in the frequency domain, image smoothing, image sharpening, homo- morphic filtering.
UNIT –III
Image Restoration: Noise models, restoration in the presence of noise only-spatial filtering, periodic noise reduction by frequency domain filtering, linear degradation, position-invariant degradation, estimating the degradation function, inverse filtering, minimum mean square error filtering, constrained least squares filtering, geometric mean filter.
UNIT - IV
Wavelets And Multi Resolution Processing: Background, multi-resolution expansions, wavelet transforms in one dimension, the fast wavelet transform, wavelet transforms in two dimensions, wavelet packets. Image Compression: Fundamentals, image compression models, elements of information theory, error free compression, lossy compression, image compression standards.

UNIT-V
Image Segmentation: Fundamentals, point, line and edge detection, thresholding, region-based segmentation, segmentation using morphological watersheds, the use of motion in segmentation. **Morphological Image Processing**: Preliminaries, erosion and dilation, opening and closing, the Hit-or-Miss transformation, some basic morphological algorithms, some basic gray-scale morphological algorithms.

Suggested Readings:

1. Rafael C. Gonzalez and Richard E. Woods, *Digital Image Processing*, PHI Learning Pvt. Limited, 3rd Edition, 2008.
2. Rafael C.Gonzalez, Richard E.Woods and Steven L.Eddins, *Digital Image Processing Using MATLAB*, 2nd Edition, McGraw Hill, 2010.
3. AL. Bovik, *The Essential Guide to Image processing,* 2nd Edition, Elsevier, 2009.
4. Anil K.Jain, "Fundamentals of Digital Image Processing", PHI, 2006.
5. William K. Pratt, *Digital Image Processing*, John Wiley & Sons, Inc., 3rd Edition, 2001

HUMAN COMPUTER INTERACTION

PE 632 CS

Instruction: 3L periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits: 3

Objectives:

1. Learn the foundations of Human Computer Interaction
2. Be familiar with the design technologies for individuals and persons with disabilities
3. Be aware of mobile human computer interaction
4. Learn the guidelines for human interface

Outcomes:

1. Understand the structure of models and theories of Human Computer Interaction and Vision
2. Design an interactive Web interface on the basis of model studied

UNIT- I
Human: I/O Channels – Memory- Reasoning and Problem Solving; Interaction: Models – Frameworks –Ergonomics- styles – elements – interactivity- paradigms. Interactive Design Basics – process-scenarios-navigation-screen design –iteration and prototyping
UNIT- II
HCI in software process – usability engineering – prototyping in practice – design rationale Design rules – principles, standards, guidelines, rules, Evaluation techniques- Universal design
UNIT-III
Cognitive models – Socio-Organizational issues and stake holder requirements Communication and collaboration models – Hypertext, Multimedia and WWW
UNIT- IV
Mobile Ecosystem: platforms, Application frameworks –Types of mobile applications: Widgets, applications, Games - Mobile information architecture, Mobile 2.0, Mobile Design: elements of mobile design, tools,
UNIT- V
Design of Web interfaces – Drag and Drop, Direct selection, Contextual tools, Overlays, inlays and virtual pages, process flow, case studies,Recent trends: Speech recognition and translation, multimodal system

Suggested Readings:

1. Alan Dix, Janet Finlay, Gregory Abowd, Russel Beale," Human Computer Interaction", 3rd Edition, Pearson Education 2004
2. Brain Fling, "Mobile Design and Development" First edition Orielly Media Inc. 2009
3. Bill Scott and Theresa Neil, "Designing Web Interfaces", First edition, Orielly 2009

DIGITAL FORENSICS

PE 633 CS

Instruction: 3L periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits: 3

Objectives:

➢ To understand the basic digital forensics and techniques for conducting the forensic examination on different digital devices.
➢ To understand how to examine digital evidences such as the data acquisition, identification analysis.

Outcomes:

After completing this course, the student will be able to:
➢ Apply forensic analysis tools to recover important evidence for identifying computer crime.
➢ Be well-trained as next-generation computer crime investigators.

UNIT -I
Computer forensics fundamentals, Benefits of forensics, computer crimes, computer forensics evidence and courts, legal concerns and private issues.
UNIT- II
Understanding Computing Investigations – Procedure for corporate High-Tech investigations, understanding data recovery work station and software, conducting and investigations.
UNIT-III
Data acquisition- understanding storage formats and digital evidence, determining the best acquisition method, acquisition tools, validating data acquisitions, performing RAID data acquisitions, remote network acquisition tools, other forensics acquisitions tools.
UNIT-IV
Processing crimes and incident scenes, securing a computer incident or crime, seizing digital evidence at scene, storing digital evidence, obtaining digital hash, reviewing case.
UNIT-V
Current computer forensics tools- software, hardware tools, validating and testing forensic software, addressing data-hiding techniques, performing remote acquisitions, E-Mail investigations- investigating email crime and violations, understanding E-Mail servers, specialized E-Mail forensics tool.

Suggested Readings:

1. Warren G. Kruse II and Jay G. Heiser, "Computer Forensics: Incident Response Essentials", Addison Wesley, 2002.
2. Nelson, B, Phillips, A, Enfinger, F, Stuart, C., "Guide to Computer Forensics and Investigations, 2nd ed., Thomson Course Technology, 2006.
3. Vacca, J, Computer Forensics, Computer Crime Scene Investigation, 2nd Edition, Charles River Media, 2005.

INTERNET OF THINGS

PE 634 CS

Instruction: 3L periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits: 3

Prerequisite:

1. C
2. Operating Systems
3. Computer Networks
4. Web Technology

Objectives:

Students understanding will be enhanced by:
1. Exploration towards the integration of the physical and logical worlds
2. Exposure in understanding how IoT devices are designed & developed

Outcomes:

After completing this course, the student will be able to:
➢ Able to understand the application areas of IOT
➢ Able to realize the revolution of Internet in Mobile Devices, Cloud & Sensor Networks
➢ Able to understand building blocks of Internet of Things and characteristics

UNIT I
Introduction & Concepts: Introduction to Internet of Things (IoT), Physical Design of IoT, Logical Design of IoT, IoT Enabling Technologies, IoT Levels
UNIT II
Architecture of IoT, Taxonomy, Sensors and Actuators, Preprocessing, Communication, Middleware, Applications of IoT
UNIT III
Introduction to ARDUINO: Getting Started with ARDUINO products, Built-In Examples **ARDUINO IoT Cloud:** ARDUINO IoT Cloud Components.
UNIT IV
Developing Internet of Things & Logical Design using Python: Introduction, IoT Design Methodology. **Basics of Python:** Python Data Types & Data Structures, Control Flow, Functions, Modules, Packages, File Handling, Date/ Time Operations, Classes.
UNIT V
IoT Physical Devices & Endpoints: What is an IOT Device, Exemplary Device, Board, Linux on Raspberry Pi, Interfaces, and Programming & IOT Devices.

Suggested Reading

1. Adrian McEwen, “Designing the Internet of Things”, Wiley Publishers, 2013.

SEMANTIC WEB

PE711CM

Instruction: 3 periods per week *Duration of SEE: 3 hours*

CIE: 30 marks *SEE: 70marks*

Credits: 3

Objectives:

Outcomes: Student will be able to:

1 Understand the concept structure of the semantic web technology and how this technology revolutionizes the World Wide Web.
2 Understand the concepts of Web Science, semantics of knowledge and resource, ontology.
3 Describe logic semantics and inference with OWL.
4 Use ontology engineering approaches in semantic applications
5 Learn Web graph processing for various applications such as search engine, community detection
6 Program web applications and graph processing techniques using Python

UNIT – I
The Future of the Internet: Introduction, Syntactic Web, Semantic Web, Working of Semantic Web, What is not a Semantic Web, Side Effects. **Descriptive Logic:** Introduction, Definition of the basic formalism, Reasoning algorithms, Language extensions
UNIT – II
Structured Web Documents in XML: Introduction, XML, Structuring, Namespaces, Addressing and querying XML document, Processing **Describing Web Resources**: RDF, Introduction, RDF: Basic Ideas, RDF: XML-Based Syntax , RDF serialization, RDF Schema: Basic Ideas, RDF Schema: The Language , RDF and RDF Schema in RDF Schema
UNIT – III
OWL: Introduction, Requirements for Web Ontology Description Languages, Header Information, Versioning and Annotation Properties, Properties, Classes, Individuals, Data types **SPARQL**: SPARQL simple Graph Patterns, Complex Graph Patterns, Group Patterns, Queries with Data Values, Filters, OWL Formal Semantics.
UNIT – IV
Semantic Web Services: Introduction, Web Service Essentials, OWL-S Service Ontology, OWL-S Example. **Methods for Ontology Development:** Introduction, Uschold and King Ontology Development Method, Toronto Virtual Enterprise Method, Methontology, KACTUS Project Ontology Development Method, Lexicon-Based Ontology Development Method, Simplified Methods.
UNIT – V
Ontology Sources: Introduction, Metadata, Upper Ontologies **Software Agents:** Introduction, Agent Forms, Agent Architecture, Agents in the Semantic Web Context.**Applications:** Introduction, Horizontal Information Products, Open academia, Bibster, Data Integration, Skill

Finding, Think Tank Portal, e-learning, Web Services.

Suggested Readings:

1	Michael C. Daconta, Leo J. Obrst, and Kevin T. Smith, "The Semantic Web: A Guide to the Future of XML, Web Services, and Knowledge Management", Fourth Edition, Wiley Publishing, 2003.
2	John Davies, Rudi Studer, and Paul Warren John, "Semantic Web Technologies: Trends and Research in Ontology-based Systems", Wiley and Son's, 2006.
3	John Davies, Dieter Fensel and Frank Van Harmelen, "Towards the Semantic Web: Ontology- Driven Knowledge Management", John Wiley and Sons, 2003.
4	Karin K Brietman, Marco Antonio Casanova, Walter Truszkowski, "*Semantic Web – Concepts*", Technologies and Applications. Springer 2007.
5	Grigoris Antoniou, Frank van Harmelen, "*A Semantic Web Primer*", PHI 2008.
6	Liyang Yu, "*Semantic Web and Semantic Web Services*", CRC 2007

CYBER SECURITY

OE 603 IT

Instruction: 3 periods per week *Duration of SEE: 3 hours*

*CIE: 30 *marks* *SEE: 70 marks*

Credits: 3

Objectives:

1. To familiarize various types of cyber-attacks and cyber-crimes
2. To give an overview of the cyber laws
3. To study the defensive techniques against these attacks

Outcomes:

Student will be able to
1. Understand different types of cyber-attacks
2. Understand the types of cybercrimes and cyber laws
3. To protect them self and ultimately the entire Internet community from such attacks

UNIT – I
Introduction to Cyber Security: Basic Cyber Security Concepts, layers of security, Vulnerability, threat, Harmful acts, Internet Governance –Challenges and Constraints, Computer Criminals, CIA Triad, Assets and Threat, motive of attackers, active attacks, passive attacks, Software attacks, hardware attacks, Spectrum of attacks, Taxonomy of various attacks, IP spoofing, Methods of defense, Security Models, risk management, Cyber Threats-Cyber Warfare, Cyber Crime, Cyber terrorism, Cyber Espionage, etc., Comprehensive Cyber Security Policy.
UNIT – II
Basic Data Privacy Concepts: Fundamental Concepts, Data Privacy Attacks, Data linking and profiling, privacy policies and their specifications, privacy policy languages, privacy in different domains-medical, financial.
UNIT – III
Logical Design: Blue print for security. Security Policy, standards and Practices, Design of Security Architecture. ***Physical Design:*** Security Technology, Physical Design of Security SDLC Firewalls, Dialup Protection, Intrusion Detection Systems, Scanning and analysis tools, and Content filters.
UNIT – IV
Cryptography: The basic elements of cryptography: symmetric (Symmetric Key-DES, IDEA, and AES), and public key cryptography (Public Key Encryptions-RSA).
UNIT – V
Message digest (MD-5, SHA), and digital signatures. ***SSL and SET:*** SSL and SET protocols, Internet transactions using both SSL and SET.

Suggested Readings:

1. Michael E. Whitman and Herbert J. Mattord, "*Principles of Information Security*", Thomson, 2003.
2. William Stallings, "*Cryptography and Network Security*", Pearson Education, 2000.
3. Nina Godbole, "*Information System Security*", John Wiley & Sons, 2008.

OPEN ELECTIVES - I

ELECTRICAL ENERGY CONSERVATION AND SAFETY

OE 601 EE

Instruction: 3 periods per week *Duration of SEE: 3 hours*

CIE: 30 marks *SEE: 70 marks*

Credits: 3

Objectives:

1. To understandthe concepts ofbasicenergyand variousformsofenergy.
2. To understandthe energymanagementand needof energyaudit.
3. To understandtheenergyefficiencytechnologies.

Outcomes:

At theend ofthe course studentswillbe ableto
1. Understandthecurrentenergyscenario and importanceofenergyconservation.
2. Understandtheconcepts ofenergy management.
3. Understandthemethods ofimprovingenergyefficiencyin differentelectricalsystems.
4. Understandtheconcepts ofdifferentenergyefficientdevices.Explain the basic concepts related to Infrastructure Projects.

UNIT – I

EnergyScenario:CommercialandNon-commercial energy,primaryenergy resources,commercialenergy production,finalenergyconsumption,energyneedsofgrowingeconomy,longterm energyscenario,energy pricing,energysectorreforms,energyandenvironment,energysecurity,energyconservationanditsimportance, restructuring oftheenergy supply sector, energy strategy for the future,airpollution, climatechange.Energy Conservation Act-2001 anditsfeatures.

UNIT – II

BasicsofEnergyanditsvariousforms:Electricity tariff,loadmanagementandmaximumdemandcontrol, powerfactorimprovement,selection&locationof capacitors,Thermal Basics-fuels,thermalenergycontentsof fuel,temperature&pressure,heatcapacity, sensibleandlatentheat,evaporation,condensation,steam,moistair and humidity&heattransfer, units andconversion.

UNIT – III

EnergyEfficiencyinElectricalSystems:Electricalsystem:Electricitybilling,electricalloadmanagementand maximum demandcontrol,powerfactorimprovementanditsbenefit,selectionandlocationofcapacitors, performanceassessmentofPFcapacitors,distribution and transformerlosses.Electricmotors: Types, losses in inductionmotors,motorefficiency,factorsaffecting motorperformance,rewinding andmotorreplacement issues, energysavingopportunitieswithenergyefficientmotors.

UNIT – IV

EnergyEfficientTechnologies inElectricalSystems:Maximum demandcontrollers,automaticpowerfactor controllers,energy efficientmotors,softstarterswithenergy saver,variable speeddrives,energy efficient transformers,electronicballast,occupancysensors,energyefficientlightingcontrols,energysavingpotentialof

eachtechnology.
UNIT – V
Electrical Safety: Physiological effects of Electricity, Important Susceptibility parameters, Distribution of Electric Power, Macro shock hazards, Micro Shock hazards, Electrical - Safety codes and Standards, Basic Approaches to protection against shock, Protection: Power distribution, Protection: Equipment Design, Electrical Safety Analyzers, Testing the Electrical System. Test of Electric Appliances.

Suggested Readings:

1.	Guide books forNationalCertification ExaminationforEnergyManager/EnergyAuditors Book-1, GeneralAspects (availableonline).
2.	Guide books forNationalCertification ExaminationforEnergyManager/EnergyAuditors Book-3, ElectricalUtilities (available online).
3.	S. C. Tripathy,*UtilizationofElectricalEnergy and Conservation*,McGraw Hill,1991.
4.	Success storiesofEnergyConservationbyBEE, New Delhi(www.bee-india.org).

RELIABILITYENGINEERING

OE 602 EE

Instruction: 3 periods per week *Duration of SEE: 3 hours*

CIE: 30 marks *SEE: 70 marks*

Credits: 3

Objectives:

1. Description of the design aspects of different types spillways.
2. Knowledge regarding the design of energy dissipation arrangements.
3. Awareness about urban storm drainage and concepts of dam safety.

Outcomes:

At theend ofthe course studentswillbe ableto
1. Understandthemeaningofdiscrete and continuousrandomvariablesandtheirsignificance,causesof failuresofasystem.
2. Acquire the knowledge ofdifferentdistribution functions andtheirapplications.
3. Able to developreliabilityblockdiagrams and evaluation of reliabilityofdifferentsystems.

UNIT-I
Discreteandcontinuousrandom variables.Probabilitydensity functionandCumulativedistributionfunction. Meanand variance. Binomial, Poisson, Exponentialand WeibulIdistributions.
UNIT-II
Failureandcauses of failure.Failure rateandfailuredensity.Reliabilityfunctionand MTTF.Bathtubcurvefor differentsystems. Parametric methodsforabove distributions. Non-Parametricmethods fromfielddata.
UNIT-III
Reliability block diagram.Seriesandparallelsystems.Network reduction technique,Examples.Evaluation of failurerate,MTTFandreliability,ActiveandStandbyRedundancy,routofnconfiguration.Non-series–parallel systems. Path basedand cutsetmethods.
UNIT - IV
Availability,MTTRand MTBF, MarkovmodelsandStatetransitionmatrices. Reliability modelsforsingle component.twocomponents, Load sharingand standbysystems. Reliabilityand availabilitymodelsoftwo-unit parallelsystemswith repairand standbysystems with repair.
UNIT – V
RepairableSystems.maintainability.Preventivemaintenance,Evaluation ofreliabilityandJ1TTF.Overhauling andreplacement.Optimummaintenancepolicy.Markovmodelofapowerplant with identicalunitsandnon- identicalunits. Capacityoutage probabilitytable. Frequencyoffailuresand

Cumulative frequency.

Suggested Readings:

1.	CharlesE. Ebeling, *Reliabilityand MaintainabilityEngineering*, McGraw HillInternationalEdition, 1997.
2.	Balaguruswamy, *ReliabilityEngineering*, Tata McGraw HillPublishingCompanyLtd, 1984.
3.	R.N. Allan, *ReliabilityEvaluationofEngineeringSystems*, Pitman Publishing, 1996.
4.	Endrenyi, *ReliabilityModelingin Electric PowerSystems,*JohnWiley&Sons, 1978.

AUTOMOBILE ENGINEERING

OE 611 AE

Instruction: 3 periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits: 3

Objectives:

1. Understand the Working of Fuel, Ignition, and cooling Systems
2. Understand the Working of Lubrication and Electrical Systems.
3. Understand the Working of transmission, Suspension, Steering and Braking Systems
4. To provide broad introduction to Alternative Energy Sources, Euro norms and Bharat Norms

Outcomes:

1. Generalize the different types of automobiles and engine components
2. Differentiate the Fuel system and electrical system
3. Describe and differentiate the Transmission Systems
4. To identify different components and working of Steering, Brakes and Suspension systems
5. Adapt techniques, skills and modern engineering tools necessary to control the pollution

UNIT – I
***Vehicle Structure and Engines*:** Types of Automobiles, Vehicle Construction, Chassis, Frame and Body , Components of Engine , Cooling and Lubrication systems in Engine, Turbo Chargers, Engine Emission Control by 3 Way Catalytic Controller, Electronic Engine Management System.
UNIT – II
Engine Auxiliary Systems:Carburettor working principle, Electronic fuel injection system, single-point and Multi-Point Injection Systems, Electrical systems, Battery, generator, Starting Motor and Lighting and Ignition.
UNIT – III
Transmission Systems-Clutch: *Types* and Construction, Gear Boxes-Manual and Automatic, , Over Drives, Transfer Box Fluid flywheel Torque convertors, Propeller shaft – Slip Joint – Universal Joints, Differential and Rear Axle, Hotchkiss Drive and Torque Tube Drive.
UNIT – IV
Steering, Brakes and Suspension:Wheels and Tires – Wheel Alignment Parameters, Steering Geometry and Types of steering gear box, Power Steering, Types of Front Axle – Suspension systems. Braking Systems, Types and Construction, Antilock Braking System.
UNIT – V
Alternative Energy Sources*:* Use of Natural Gas, LPG, Biodiesel, Gasohol and Hydrogen in Automobiles, Electric and Hybrid Vehicles, Fuel Cells. Euro and Bharat Norms. Recent trends.

Suggested Reading:

1	Crouse & Anglin, 'Automotive Mechanics' Tata McGraw Hill, Publishing Co., Ltd., New Delhi, Tenth edition - 2004.
2	Kirpal Singh, "Automobile Engineering", Vol I & II Standard Publishers, Delhi.
3	Joseph Heitner, 'Automotive Mechanics', Affiliated East West Pvt., Ltd
4	C.P. Nakra, "Basic Automobile Engineering", Dhanpat Rai Publishing Co.(P) Ltd., New Delhi, 2003

ENTREPRENEURSHIP

OE611ME

Instruction: 3 periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits: 3

Objectives:

1. To motivate students to take up entrepreneurship infuture
2. To learn nuances of starting an enterprise & projectmanagement
3. To understand the design principles of solar energy systems, their utilization and performance evaluation
4. To understand the behavioural aspects of entrepreneurs and timemanagement

Outcomes:

At the end of the course, the students will be able to
1. Understand Indian Industrial Environment, Entrepreneurship and Economic growth, Small and Large Scale Industries, Types and forms ofenterprises.
2. Identify the characteristics of entrepreneurs, Emergence of first generation entrepreneurs, Conception and evaluation of ideas and theirsources.
3. Practice the principles of project formulation, Analysis of market demand, Financial and profitability analysis and Technicalanalysis.
4. Apply the concepts of Project Management during construction phase, project organization, project planning and control using CPM, PERTtechniques
5. UnderstandtheBehaviouralaspectsofentrepreneurs,TimeManagement,Variousapproachesofti me management, their strengths and weakness. The urgency addiction and time management matrix.

Unit-I
Indian Industrial Environment-competence, Opportunities and Challenges. Entrepreneurship and Economic growth. Small Scale Industry in India, Objectives, Linkage among small, medium and heavy industries. Types of enterprises.
Unit-II:
Identification and characteristics of entrepreneurs. Emergence of First generation entrepreneurs, environmental influence and women entrepreneurs. Conception and evaluation of ideas and their sources. Choice of Technology - Collaborative interaction for Technology development.
Unit-III
Project formulation, Analysis of market demand, Financial and profitability analysis and Technical analysis, project financing in India.
Unit-IV
Project Management during construction phase, project organization, project planning and

control using CPM, PERT techniques. Human aspects of project management. Assessment of tax burden.
Unit-V
Behavioural aspects of entrepreneurs: Personality - determinants, attributes and models. Leadership concepts and models. Values and attitudes. Motivation aspects. Change behaviour. Time Management: Various approaches of time management, their strengths and weaknesses. The urgency addiction and time managementmatrix.

Suggested Readings:

1. Vasant Desai, *"Dynamics of Entrepreneurial Development and Management",* Himalaya Publishing House,1997
2. Prasanna Chandra, *"Project-Planning, Analysis, Selection, Implementation and Review",* Tata McGraw-Hill Publishing Company Ltd. 1995.
3. Stephen R. Covey and A. Roger Merrill, *"First Things First",* Simon and Schuster Publication, 1994.
4. G.S. Sudha, *"Organizational Behaviour",*1996.
5. Robert D. Hisrich, Michael P. Peters, *"Entrepreneurship",* Tata Me Graw Hill Publishing Company Ltd., 5^{lh} Ed.,2005.

SOFT SKILLS AND INTERPERSONAL SKILLS

OE 601 EG

Instruction: 3 periods per week *Duration of SEE: 3 hours*

CIE: 30 marks *SEE: 70 marks*

Credits: 3

Objectives:

1. Learn conversational skills
2. Learn reading strategies
3. Learn time management
4. Learn stress management
5. Learn career planning

Outcomes:

Student will be able to
1. Express conversational skills
2. Specify reading strategies
3. Perform time management
4. Perform stress management
5. Explore career planning

UNIT – I
Conversation skills, Listening dialogues from TV/radio/Ted talk/Podcast Group discussion Interview skills, Making presentation Listening to Lectures and News Programmes, Listening to Talk show Watching videos on interesting events on Youtube,
UNIT – II
Reading different genres of tests ranging from newspapers to philosophical treatises Readingstrategies – graphic organizers, Readingstrategies – summarizing Readingstrategies – interpretation, Reports Cover letter, Resume,
UNIT – III
Writingfor publications, Letters, Memos, Emails and blogs Civil Service (Language related), Verbal ability Motivation, Self image

Goal setting, Managing changes
UNIT – IV
Time management, Stress management Leadership traits Team work Career and life planning.
UNIT – V
Multiple intelligences Emotional intelligence Spiritual quotient (ethics) Interculturalcommunication Creative and critical thinking Learning styles and strategies

Suggested Readings:

1. Business English Certificate Materials, Cambridge University Press.
2. Graded Examinations in Spoken English and Spoken English for Work downloadable materials from Trinity College, London.
3. International English Language Testing System Practice Tests, Cambridge University Press.
4. Interactive Multimedia Programs on Managing Time and Stress.
5. Personality Development (CD-ROM), Times Multimedia, Mumbai.
6. Robert M Sherfield and et al. "Developing Soft Skills" 4th edition, New Delhi: Pearson Education, 2009.

Web Sources:

1. http://www.slideshare.net/rohitjsh/presentation-on-group-discussion
2. http://www.washington.edu/doit/TeamN/present_tips.html
3. http://www.oxforddictionaries.com/words/writing-job-applications
4. http://www.kent.ac.uk/careers/cv/coveringletters.htm
5. http://www.mindtools.com/pages/article/newCDV_34.htm

HUMAN RESOURCE DEVELOPMENT AND ORGANIZATIONAL BEHAVIOR

OE 602MB

Instruction: 3 periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits: 3

Objectives:

1. Understand management process and functions
2. Comprehend decision making and negotiations
3. Learn psychological contract
4. Study the models of organization behaviour
5. Managing stress and counseling

Outcomes:

Student will be able to
1. Explain various facets of management
2. Elaborate on ways of making decision
3. Elucidate different motivation content theories
4. Describe approaches to leadership
5. Suggest methods for stress management and counseling

UNIT – I
Management Process and Functions, Scientific and Modern Management, 3D Model of Managerial Behavior - MBO - MBWA - Line and Staff - The Peter's Principle - Parkinson's Law - Approaches to Organization Structure-Management - Classical, Human Relations, Systems and Contingency Approaches, Hawthorne's Experiments - Human Engineering.
UNIT – II
Decision Making and Negotiations: Approaches to Decision making - Rational, Behavioral, Practical, and Personal Approaches - Open and Closed Models of Decision Making, Types and steps in planning, Authority, Responsibility, Centralization, Decentralization and Recentralization, Bureaucracy.
UNIT – III
Psychological contract - Personality Traits, Big 5 personality traits, MBTI inventory, the Process of Perception - Perceptual distortions and errors, Kelly's personal construct Theory, Motivation-Content Theories: Maslow, Alderfer, Herzberg, McCleland. Process Theories: Vroom, Potter and Lawler, Equity Theory - Goal Theory - Attribution Theory.
UNIT – IV
Models of Organization Behavior - Autocratic, Custodial, Supportive, Collegial and System Models, Transactional Analysis, Johari Window. Group Dynamics: Typology of Groups - Conflicts in groups - The nature, of conflict - Reactions to conflict - A model of conflict. Trait and Behavioral Approaches to Leadership, Managerial Grid, Path-Goal Theory, Vroom's Decision Tree Approach to Leadership - Hersey and Blanchard Model.

UNIT – V
Organization Design, Organization culture and organization climate, Stress Management and Counseling, Management of change and organization development. Communication - Emerging aspects of OB.

Suggested Readings:

1. Harold Koontz and Heinz Weihrich, *Essentials of Management*, 9th Edition, McGraw Hill Education, 2015.
2. Curtis W. Cook and Phillip L. Hunsaker, *Management and Organizational Behavior,* 3rd Edition, McGraw-Hill, 2010.

CYBER LAW AND ETHICS

OE 601 LW

Instruction: 3 periods per week *Duration of SEE: 3 hours*

CIE: 30 marks *SEE: 70 marks*

Credits: 3

Objectives:

1. To familiarize various Cyber laws and IT Acts
2. To give cyber security regulations and forensics
3. To study the risk managements and code of ethics

Outcomes:

Student will be able to
1. Understand the various Cyber laws and IT Acts
2. Learn the cyber security regulations and forensics
3. Analyse the risks and assessment of implications and code of ethics

UNIT – I
Cyber laws and rights in today's digital age: IT Act, Intellectual Property Issues connected with use and management of Digital Data The similar Acts of other countries ***Information Warfare****:* Nature of information warfare, including computer crime and information terrorism; Threats to information resources, including military and economic espionage, communications eavesdropping, computer break-ins, denial-of-service, destruction and modification of data, distortion and fabrication of information, forgery, control and disruption of information How, electronic bombs, and sops and perception management.
UNIT – II
Cyberspace and the Law & Cyber Forensics*:* Introduction, Cyber Security Regulations, Roles of International Law. The INDIAN Cyberspace, National Cyber Security Policy. Introduction, Historical background of Cyber forensics, Digital Forensics Science, The Need for Computer Forensics, Cyber Forensics and Digital evidence, Forensics Analysis of Email, Digital Forensics Lifecycle, Forensics Investigation, Challenges in Computer Forensics, Special Techniques for Forensics Auditing
UNIT – III
Legal, Ethical, and Professional Issues in Information Security Ethical Component in Information System, Codes of Ethics, Certification Security Analysis: Risk Management, Identifying and assessing risk, and Controlling Risk.
UNIT – IV
Cyber Security: Organizational Implications: Introduction, cost of cybercrimes and IPR issues, web threats for organizations, security and privacy implications, social media marketing.
UNIT – V
Security risks and perils for organizations, social computing and the associated challenges for organizations. Cybercrime and Cyber terrorism: Introduction, intellectual property in the cyberspace, the ethical dimension of cybercrimes the psychology, mindset and skills of hackers and other cyber criminals.

Suggested Readings:

1. Nina GodboleandSunitBelpure, Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives, Wiley 2017
2. B. B. Gupta, D. P. Agrawal, Haoxiang Wang, Computer and Cyber Security: Principles, Algorithm, Applications, and Perspectives, CRC Press, 2018.

OPERATING SYSTEMS

OE 601 CS

Instruction: 3 periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits: 3

Objectives:

1. To understand CPU, Memory, File andDevicemanagement
2. To learn about concurrency control, protectionandsecurity
3. To gain knowledge of Linux and Windows NTinternals

Outcomes:

Student will be able to
1. Explain the components and functions ofoperatingsystems
2. Analyze various Schedulingalgorithms
3. Apply the principles ofconcurrency
4. Compare and contrast various memorymanagementschemes
5. Perform administrative tasks on Linux WindowsSystems

UNIT-I
Introduction to Operating Systems: OS structure and strategies, Process concepts, Threads, Inter process communication. CPU scheduling algorithms, Process synchronization, Critical section problem, Semaphores, Monitors.
UNIT-II
Memory management, Swapping, Contiguous allocation, Paging, Static and Dynamic partitions, Demand paging, Page replacement algorithms, Thrashing, Segmentation, Segmentation with paging. File system interface: File concepts, Access methods and protection. File system implementation: File system structure, Allocation methods, Directory implementation.
UNIT-III
Deadlocks: Necessary conditions, Resource allocation graph, Methods for handling deadlocks, Prevention, Avoidance, Detection and Recovery. Protection: Goals, Domain of protection, Access matrix. Security: Authentication, Threat monitoring,Encryption.
UNIT-IV
Device Management: Disk scheduling methods, Disk management, Device drivers and interfaces, CPU-Device interactions, I/O optimization.
UNIT-V
Case Studies:The Linux System–Design principles, Kernel modules, Process management, Scheduling, Memory management, File systems, Input and Output, Inter process communication Windows NT – General Architecture, The NT kernel, The NT executive.

Suggested Readings:

1.	Abraham Silberschatz, Peter B Galvin, Operating System Concepts, Addison Wesley,2006
2.	William Stallings, Operating Systems-Internals and Design Principles, 5th edition, PHI, 2005
3.	Andrew S Tanenbaum, Modern Operating Systems, 4th edition, Pearson,2016

OOP USING JAVA

OE 602 CS

Instruction: 3 periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits: 3

Objectives:

1. To introduce fundamental object oriented concepts of Java programming Language such as classes, inheritance, packages andinterfaces
2. To introduce concepts of exception handling and multi-threading
3. To use various classes and interfaces in java collection framework and utility classes To understand the concepts of GUI programming using AWT controls
4. To introduce Java I/O streams and serialization

Outcomes:

Student will be able to
1. develop java applications using OO concepts and packages write multi threaded programs with synchronization
2. implement real world applications using java collection frame work and I/O classes
3. write Event driven GUI programs usingAWT/Swing

UNIT – I
Object Oriented System Development*:* understanding object oriented development, understanding object oriented concepts, benefits of object oriented development. ***Java Programming Fundamentals****:* Introduction, overview of Java, data types, variables and arrays, operators, control statements.
UNIT – II
Java Programming OO concepts*:* classes, methods, inheritance, packages and interfaces. Exceptional Handling, Multithreaded Programming
UNIT – III
I/O Basics, Reading Console Input and Output, Reading and Writing Files, Print Writer Class, String Handling Exploring Java.Lang, Collections Overview, Collection Interfaces, Collection Classes, Iterators, Random Access Interface, Maps, Comparators, Arrays, Legacy Classes and Interfaces, String Tokenizer
UNIT – IV
Introducing AWT working With Graphics*:* AWT Classes, Working with Graphics. ***Event Handling****:* Two Event Handling Mechanisms, The Delegation Event Model, Event Classes, Source of Events, Event Listener Interfaces. **AWT Controls**: Control Fundamentals, Labels, Using Buttons, Applying Check Boxes, CheckboxGroup, Choice Controls, Using Lists, Managing Scroll Bars, Using TextField, Using TextArea, Understanding Layout Managers, Menu bars and Menus, Dialog Boxes, FileDialog,Handling events by Extending AWT

Components, Exploring the controls, Menus and Layout Managers.
UNIT – V
Java I/O Classes and Interfaces, Files, Stream and Byte Classes, Character Streams, Serialization.

Suggested Readings:

1. Herbert Schildt, *The Complete Reference JAVA*, Tata McGraw Hill, 7thEdition,2005
2. James M Slack, Programming and Problem Solving with JAVA, Thomson learning, 2002
3. C.Thomas Wu, An Introduction to Object-Oriented Programming with Java, Tata McGraw Hill, 5thEdition,2005.

DATABASE SYSTEMS

OE 601 IT

Instruction: 3 periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits: 3

Objectives:

1. To understand the basic concept of DBMS
2. To learn to design, develop and query the database
3. To learn database administration and transaction processing

Outcomes:

Student will be able to
1. Apply the basic concept of DBMS
2. Design, develop and query the database
3. Develop database administration and transaction processing methods

UNIT – I
Data and Data Management: Role of Data and Databases ***Database and Database Management System:*** Key Database concepts-Basic Database Models-Database Components ***Data Modeling***: Database Design-Relational Database Models- Relationships-Comparing Data Models
UNIT – II
SQL language: SQL features- command basics-SELECT Fundamentals-Operators and Functions-DDL Commands-DML Commands. ***Data Access and Manipulation:*** SELECT statement Advanced Syntax-Joins and Sub Queries. ***SQL Procedures:*** SQL procedures and Functions-Triggers
UNIT – III
Designing a Database: Designing Relational Tables-Comparing Relational Designs-Normalizing Data. ***Implementing a Database:*** Physical Design and Implementation- Adjusting Design to the Real World-Implementing Database Objects.
UNIT – IV
Improving Data Access: Performance Rollbacks-Using Indexes and Views-Using Programmable objects. ***Database Administration:***Need for Administration-Administration Responsibilities-Management Task.

UNIT – V
Transactions and Locking: Transaction Basics-Managing Concurrency control-SQL server transaction management. ***Database Access and Security:*** Database Connections-Managing Access Control-Protecting data.

Suggested Readings:

1. Mark L. Gillenson, Paulraj Ponniah., "*Introduction to Database Management*", John Wiley & Sons Ltd, 2008.
2. Lee Chao, *"Database Development and Management"*, Auerbach Publications, 2006.
3. Rob Coronel, *"Database Systems: Design, Implementation & Management"* Thomson Course Technology, 2000.

DATA STRUCTURES

OE 602IT

Instruction: 3 periods per week *Duration of SEE: 3 hours*

*CIE: 30 *marks* *SEE: 70 marks*

Credits: 3

Objectives:

1. To develop proficiency in the specification, representation, and implementation of abstract data types and data structures.
2. To discuss the linear and non-linear data structures and their applications.
3. To introduce the creation, insertion and deletion operations on binary search trees and balanced binary search trees.
4. To introduce various internal sorting, searching techniques and their time complexities

Outcomes:

Student will be able to
1. Implement linear, non-linear data structures and balanced binary trees
2. Understand the basic data structures arrays and linked lists.
3. Analyse time complexity of both iterative and recursive functions.
4. Define ADT necessary for solving problems based on Stacks and Queues.
5. Develop solutions using binary trees, advanced search trees, tries and graphs.
6. Use hash functions and handle collisions.

UNIT – I
Performance and Complexity Analysis: Space complexity, Time complexity, Asymptotic notation (big-Oh), complexity analysis examples. ***Linear list-array representation:*** vector representation, multiple lists single array. ***Linear list-linked representation:*** singly linked lists, circular lists, doubly linked lists, Applications (polynomial arithmetic). ***Arrays and matrices:*** row and column major representations, special matrices, sparse matrices.
UNIT – II
Stacks: Array representation, linked representation, applications (recursive calls, infix to postfix, postfix evaluation). ***Queues:*** Array representation, linked representation. ***Skip lists and Hashing:*** skip lists representation, hash table representation, application- text compression.
UNIT – III
Trees: Definitions and properties, representation of binary trees, operations, binary tree traversal. ***Binary Search Trees:*** Definitions, and Operations on binary search trees. ***Balanced Search Trees:*** AVL trees, and B-trees.
UNIT – IV
Graphs: Definitions and properties, representation, graph search methods (Depth First Search and Breadth First Search) ***Application of Graphs:*** shortest path algorithm (Dijkstra), minimum spanning tree(Prim's and Kruskal's algorithms).
UNIT – V
Sorting and Complexity Analysis: Selection sort, Insertion sort, Quick sort, Merge sort, Closest

pair of points, and Heap sort.

Suggested Readings:

1. Sartaj Sahni, "*Data Structures--Algorithms and Applications in C++*" 2nd Edition, Universities Press (India) Pvt. Ltd., 2005.
2. Mark Allen Weiss, "*Data Structures and Problem Solving using C++"* Pearson Education International, 2003.
3. Michael T. Goodrich, Roberto Tamassia, David M. Mount "*Data Structures and Algorithms in C++*", John Wiley & Sons, 2010.

DISASTER MITIGATION

OE 601 CE

Instruction: 3 periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits: 3

Objectives:

1.	To impart knowledge of the basic principles of disaster management.
2.	To give knowledge of the various types of disasters.
3.	To understand the disaster management cycle and framework.
4.	To become aware of the disaster management systems in India.
5.	To become aware of the applications of the latest technologies in disaster management

Outcomes:

After completing this course, the student will be able to	
1.	Define and explain the terms and concepts related to disaster management.
2.	Describe the various categories of disasters and their specific characteristics.
3.	Explain the pre-disaster, during disaster and post-disaster measures and framework
4.	Describe the disaster management acts and frameworks specific to India
5.	List and explain the various technological applications to aid disaster management.

UNIT-I

Introduction: Understanding the Concepts and definitions of Disaster, Hazard, Vulnerability, Risk, and Capacity – Disaster and Development, and disaster management.

UNIT-II

Disasters:Geological Disasters (earthquakes, landslides, tsunami, mining); Hydro-Meteorological Disasters (floods, cyclones, lightning, thunder-storms, hail storms, avalanches, droughts, cold and heat waves) Biological Disasters (epidemics, pest attacks, forest fire); Technological Disasters (chemical, industrial, radiological, nuclear) and Manmade Disasters (building collapse, rural and urban fire, road and rail accidents, nuclear, radiological, chemicals and biological disasters) Global Disaster Trends – Emerging Risks of Disasters – Climate Change and Urban Disasters.

UNIT-III

Disaster Management Cycle and Framework:Disaster Management Cycle – Paradigm Shift in Disaster Management Pre-Disaster – Risk Assessment and Analysis, Risk Mapping, zonation and Microzonation, Prevention and Mitigation of Disasters, Early Warning System; Preparedness, Capacity Development; Awareness.

During Disaster – Evacuation – Disaster Communication – Search and Rescue – Emergency Operation Centre – Incident Command System – Relief and Rehabilitation.

Post-disaster – Damage and Needs Assessment, Restoration of Critical Infrastructure – Early

Recovery – Reconstruction and Redevelopment; IDNDR.
UNIT-IV
Disaster Management in India:Disaster Profile of India – Mega Disasters of India and Lessons Learnt Disaster Management Act 2005 – Institutional and Financial Mechanism National Policy on Disaster Management, National Guidelines and Plans on Disaster Management; Role of Government (local, state and national),Non-Government and Inter Governmental Agencies.
UNIT-V
***Applications of Science and Technology for Disaster Management*:** Geo-informatics in Disaster Management (RS, GIS, GPS and RS) Disaster Communication System (Early Warning and Its Dissemination) Land Use Planning and Development Regulations Disaster Safe Designs and Constructions Structural and Non-Structural Mitigation of Disasters S&T Institutions for Disaster Management in India.

Suggested Reading:

1.	Rajib, S and Krishna Murthy, R. R, *Disaster Management Global Challenges and Local Solutions"* CRC Press, 2009.
2.	Navele, P & Raja, C. K, *Earth and Atmospheric Disasters Management, Natural and Manmade. B. S. Publications.2009*
3.	Battacharya, T., *Disaster Science and Management*. Tata McGraw hill Company, 2017
4.	Manual on natural disaster management in India, M C Gupta, NIDM, New Delhi
5.	*An overview on natural & man-made disasters and their reduction*, R K Bhandani, CSIR, New Delhi
6.	Encyclopedia of disaster management, Vol I, II and IIIL Disaster management policy and administration, S L Goyal, Deep & Deep, New Delhi, 2006
7.	Disasters in India Studies of grim reality, Anu Kapur& others, 2005, 283 pages, Rawat Publishers, Jaipur
8.	*Disaster Management Act 2005*, Publisher by Govt. of India
9.	*Publications of National Disaster Management Authority (NDMA) on Various Templates and Guidelines for Disaster Management*
10.	National Disaster Management Policy, 2009, Govt. of India
11.	Jagbirsingh, Disaster management–Future challenges and opportunities, I.K. International publishing house, 1st edition, 2007.
12.	Coppala P Damon, Introduction to International Disaster management, Butterworth-Heinemann, 2015.

SCHEME OF INSTRUCTION
BE (COMPUTER SCIENCE AND ENGINEERING)
SEMESTER - VII

S. No.	Course Code	Course Title	Scheme of Instruction				Scheme of Examination			Credits
			L	T	P/D	Contact Hrs/Wk	CIE	SEE	Duration in Hrs	
Theory Courses										
1	PC 701 CS	Information Security	3	-	-	4	30	70	3	3
2	PC 702 CS	Data Mining	3	1	-	4	30	70	3	3
3	PC 703 CS	Distributed Systems	3	1	-	3	30	70	3	3
4	OE-II	Open Elective -II	3	-	-	3	30	70	3	3
Practical/ Laboratory Courses										
5	PC 751 CS	Distributed Systems Lab	-	-	2	3	25	50	3	1
6	PC 752 CS	Data Mining Lab	-	-	2	3	25	50	3	1
7	PW 751 CS	Project Work – I	-	-	6	6	50	-	-	3
8	SI 752 CS	Summer Internship	`	-	-	-	50	-	-	2
Total			**12**	**02**	**10**	**24**	**270**	**380**		**19**

INFORMATION SECURITY

PC 703 CS

Instruction: 3 periods per week *Duration of SEE: 3 hours*

CIE: 30 marks *SEE: 70 marks*

Credits: 3

Objectives:

1. To learn legal and technical issues in building secure information systems
2. To provide an understanding of network security
3. To expose the students to security standards and practices.

Outcomes:

Student will be able to
1. Describe the steps in Security Systems development life cycle
2. The common threats and attack to information systems and the legal and ethical issues of information technology
3. Identify security needs using risk management and choose the appropriate risk control strategy based on business needs.
4. Use ethical hacking tools to study attack patterns and cryptography and secure communication Protocols.

UNIT – I
Introduction: History, Critical Characteristics of Information, NSTISSC Security Model, Components of an Information System, Securing the Components, Balancing Security and Access, The SDLC, The Security SDLC. Need for Security: Business Needs, Threats, Attacks, and Secure Software Development.
UNIT – II
Legal, Ethical and Professional Issues: Law and ethics in Information Security, Relevant U.S. Laws, International Laws and Legal Bodies, Ethics and Information Security. **Risk Management**: Overview, Risk Identification, Risk Assessment, Risk Control Strategies, selecting a Risk Control Strategy, Quantitative versus Qualitative Risk Control Practices, Risk Management Discussion Points, Recommended Risk Control Practices.
UNIT – III
Planning for Security: Security policy, Standards and Practices, Security Blue Print, Security Education, Continuity strategies. **Security Technology:** Firewalls and VPNs: Physical Design, Firewalls, Protecting Remote connections
UNIT – IV
Security Technology: Intrusion Detection, Access Control, and other Security Tools: Intrusion Detection and Prevention Systems-Scanning, and Analysis Tools- Access Control Devices. **Cryptography:** Foundations of Cryptology, Cipher methods, Cryptographic Algorithms, Cryptographic Tools, Protocols for Secure Communications, Attacks on Cryptosystems

UNIT – V
Implementing Information Security: Information security project management, Technical topics of implementation, Non-Technical Aspects of implementation, Security Certification and Accreditation. **Security and Personnel:** Positioning and staffing security function, Employment Policies and Practices, and Internal Control Strategies. **Information Security Maintenance:** Security management models, Maintenance model, and Digital Forensics.

Suggested Readings:

6.	Michael E Whitman and Herbert J Mattord, *Principles of Information Security*, Cengage Learning, 2011.
7.	Thomas R Peltier, Justin Peltier, John Blackley, *Information Security Fundamentals*, Auerbach Publications, 2010
8.	Detmar W Straub, Seymour Goodman, Richard L Baskerville, Information *Security, Policy, Processes, and Practices,* PHI, 2008.
9.	Mark Merkow and Jim Breithaupt*, Information Security Principle and Practices*, Pearson Education, 2007.

DATA MINING

PC 702 CS

Instruction: 3 periods per week *Duration of SEE: 3 hours*

CIE: 30 marks *SEE: 70 marks*

Credits: 3

Objectives:

1. To introduce the basic concepts of data Mining and its applications
2. To understand different data mining like classification, clustering and Frequent Pattern mining
3. To introduce current trends in data mining

Outcomes:

Student will be able to
1. Organize and Prepare the data needed for data mining using pre preprocessing techniques
2. Implement the appropriate data mining methods like classification, clustering or Frequent Pattern mining on a given data set
3. Define and apply metrics to measure the performance of various data mining algorithms

UNIT – I
Introduction: Why Data Mining? What is Data Mining? What kinds of data can be mined? What kinds of patterns can be mined? Which technologies are used? Which kinds of applications are Targeted? Major issues in Data Mining. Getting to know your data: Data objects and attributed types. Basic statistical descriptions of data. Data visualization, Measuring data similarity and dissimilarity.
UNIT – II
Mining frequent patterns, Associations and correlations: Basic concepts and methods, Frequent Item set Mining Methods, Pattern evaluation methods.
UNIT – III
Classification: Basic concepts, Decision tree induction, Bayes classification methods, Advance methods, Bayesian Belief Network, Classification by back propagation, Support vector machine.
UNIT – IV
Cluster Analysis: Concepts and Methods: Cluster Analysis, Partitioning Methods, Hierarchical Methods, Density-Based Methods, Grid-Based Methods, Evaluation of clustering.
UNIT – V
Data Mining Trends and Research Frontiers: Mining Complex Data Types, Other Methodologies of Data Mining, Data Mining Applications, Data Mining and Society, Data Mining trends.

Suggested Readings:

1.	Jiawei Han, Micheline Kamber, Jin Pei, Data Mining: Concepts & Techniques, 3rd Edition., Morgon Koffman ,2011
2.	Vikram Pudi, P. Radha Krishna, *Data Mining*, Oxford University Press, 1st Edition, 2009
3.	Ning Tan, Michael Steinbach, Vipin Kumar, *Introduction to Data Mining,* Pearson Education, 2008.

DISTRIBUTED SYSTEMS

PC 703 CS

Instruction: 3 periods per week *Duration of SEE: 3 hours*

CIE: 30 marks *SEE: 70 marks*

Credits: 3

Objectives:

1.	To acquire an understanding of the issues in distributed systems
2.	To study architectures and working of distributed file systems
3.	To expose the students to distributed transaction management, security issues and replication

Outcomes:

Student will be able to	
1.	Describe the problems and challenges associated with distributed systems.
2.	Implement small scale distributed systems.
3.	Design trade-offs in large-scale distributed systems

UNIT – I

Introduction: Goals and Types of Distributed Systems.

Architectures: Architectural Styles, System Architectures, Architectures versus Middleware, and Self-Management in Distributed Systems.

Processes: Threads, Virtualization, Clients, Servers, and Code Migration.
Communication: Fundamentals, Remote Procedure Call, Message-Oriented Communication, Stream- Oriented Communication, and Multicast Communication.

UNIT – II

Naming: Names, Identifiers and Addresses, Flat Naming, Structured Naming, and Attribute-Based Naming. **Synchronization:** Clock Synchronization, Logical Clocks, Mutual Exclusion, Global Positioning of Nodes, and Election Algorithms.

Consistency and Replication: Introduction, Data-Centric Consistency Models, Client-Centric Consistency Models, Replica Management, and Consistency Protocols.

UNIT – III

Data Mining Trends and Research Frontiers: Mining Complex Data Types, Other Methodologies of Data Mining, Data Mining Applications, Data Mining and Society, Data Mining trends.

UNIT – IV

Distributed File Systems: Architecture, Processes, Communication, Naming, Synchronization, Consistency and Replication, Fault Tolerance, and Security.

Distributed Web-Based Systems: Architecture, Processes, Communication, Naming, Synchronization, Consistency and Replication, Fault Tolerance, and Security.

UNIT – V

Distributed File Systems: Architecture, Processes, Communication, Naming, Synchronization, Consistency and Replication, Fault Tolerance, and Security.

Distributed Web-Based Systems: Architecture, Processes, Communication, Naming,

Synchronization, Consistency and Replication, Fault Tolerance, and Security.

Distributed Coordination-Based Systems: Introduction to Coordination Models, Architecture, Processes, Communication, Naming, Synchronization, Consistency and Replication, Fault Tolerance, and Security.

Map-Reduce: Example, Scaling, programming model, Apache Hadoop, Amazon Elastic Map Reduce,Mapreduce.net, Pig and Hive.

Suggested Readings:

1	Andrew S. Tanenbaum and Maarten Van Steen, *Distributed Systems*, PHI 2nd Edition, 2009.
2	R. Hill, L. Hirsch, P. Lake, S. Moshiri, *Guide to Cloud Computing*, Principles and Practice,Springer, 2013.
3	R. Buyya, J. Borberg, A. Goscinski, *Cloud Computing-Principles and Paradigms*, Wiley, 2013.

DISTRIBUTED SYSTEMS LAB

PC 752 CS

Instruction: 2 periods per week *Duration of SEE: 3 hours*
CIE: 25 marks *SEE: 50 marks*
Credits: 1

Objectives:

1.	To implement client and server programs using sockets
2.	To learn about working of NFS
3.	To use Map, reduce model for distributed processing

Outcomes: Student will be able to:

1.	Write programs that communicate data between two hosts
2.	Configure NFS
3.	Use distributed data processing frameworks and mobile application tool kits

List of Experiments to be performed:

List of Experiments:

1. Implementation FTP Client
2. Implementation of Name Server
3. Implementation of Chat Server
4. Understanding of working of NFS (Includes exercises on Configuration of NFS)
5. Implementation of Bulletin Board.
6. Implement a word count application which counts the number of occurrences of each word a large collection of documents Using Map Reduce model.
7. Develop an application (small game-like scrabble, Tic-tac-Toe) using Android SDK.

DATA MINING LAB

PC 753 CS

Instruction: 2 periods per week *Duration of SEE: 3 hours*
CIE: 25 marks *SEE: 50 marks*
Credits: 1

Objectives:

1.	To introduce the basic concepts of data Mining and its applications
2.	To understand different data mining like classification, clustering and Frequent Pattern mining
3.	To introduce current trends in data mining

Outcomes: Student will be able to:

1.	Organize and Prepare the data needed for data mining using prepreprocessing techniques
2.	Implement the appropriate data mining methods like classification, clustering or Frequent Pattern mining on a given data set
3.	Define and apply metrics to measure the performance of various data mining algorithms

List of Experiments to be performed

List of Experiments:

1. Implement the following Multidimensional Data Models
    a. Star Schema
    b. Snowflake Schema
    c. Fact Constellation
2. Implement Apriori algorithm to generate frequent item sets.
3. Implement the following clustering algorithms
    a. K-means
    b. K-medians
4. Implement the following classification algorithms
    a. Decision Tree Induction
    b. KNN
5. Perform data preprocessing using WEKA
6. Perform discretization using WEKA
7. Classification of algorithms using WEKA
8. Apriori algorithm using WEKA
9. Perform data transformations using an ETL Tool
10. A small case study involving all stages of KDD (Datasets are available online like UCI Repository etc.)

PROJECT WORK – I

PW 761 CS

Instruction: 4 periods per week *Duration of SEE: -*
CIE: 50 marks *SEE: -*
Credits: 2

Objectives:

1 To enhance practical and professional skills
2 To familiarize tools and techniques of systematic literature survey and documentation
3 To expose the students to industry practices and team work.
4 To encourage students to work with innovative and entrepreneurial ideas

Outcomes: Student will be able to:

1 Demonstrate the ability to synthesize and apply the knowledge and skills acquired in the academic program to the real-world problems.
2 Evaluate different solutions based on economic and technical feasibility
3 Effectively plan a project and confidently perform all aspects of project management
4 Demonstrate effective written and oral communication skills

The department can initiate the project allotment procedure at the end of VI semester and finalize it in the first two weeks of VII semester.

The department will appoint a project coordinator who will coordinate the following:

Collection of project topics/ descriptions from faculty members (Problems can also be invited from the industries)

- Grouping of students (max 3 in a group)
- Allotment of project guides

The aim of project work is to develop solutions to realistic problems applying the knowledge and skills obtained in different courses, new technologies and current industry practices. This requires students to understand current problems in their domain and methodologies to solve these problems. To get awareness on current problems and solution techniques, the first 4 weeks of VII semester will be spent on special lectures by faculty members, research scholars, post graduate students of the department and invited lectures by engineers from industries and R&D institutions. After completion of these seminars each group has to formalize the project proposal based on their own ideas or as suggested by the project guide.

Seminar schedule will be prepared by the coordinator for all the students from the 5th week to the last week of the semester which should be strictly adhered to.

Each group will be required to:

1. Submit a one-page synopsis before the seminar for display on notice board.
2. Give a 30 minutes' presentation followed by 10 minutes' discussion.
3. Submit a technical write-up on the talk.

At least two teachers will be associated with the Project Seminar to evaluate students for the award of sessional marks which will be on the basis of performance in all the 3 items stated above.

The seminar presentation should include the following components of the project:

- Problem definition and specification
- Literature survey
- Broad knowledge of available techniques to solve a particular problem.
- Planning of the work, preparation of bar (activity) charts
- Presentation- oral and written.

SUMMER INTERNSHIP

SI 671 CS

Instruction:- *Duration of SEE: -*
CIE: 50 marks *SEE: -*
Credits: 2

Objectives:

To give an experience to the students in solving real life practical problems with all its constraints.
To give an opportunity to integrate different aspects of learning with reference to real life problems.
To enhance the confidence of the students while communicating with industry engineers and give an opportunity for useful interaction with them and familiarize with work culture and ethics of the idustry.

Outcomes: Student will be able to:

1. Able to design/develop a small and simple product in hardware or software.
2. Able to complete the task or realize a pre-specified target, with limited scope, rather than taking up a complex task and leave it.
3. Able to learn to find alternate viable solutions for a given problem and evaluate these alternatives with reference to pre-specified criteria.
4. Able to implement the selected solution and document the same.

Summer Internship

Summer Internship is introduced as part of the curricula for encouraging students to work on problems of interest to industries. A batch of two or three students will be attached to a person from an Industry / R & D Organization / National Laboratory for a period of 4 weeks. This will be during the summer vacation following the completion of the VI semester course. One faculty member will act as an internal guide for each batch to monitor the progress and interacts with the Industry guide.

After the completion of the project, students will submit a brief technical report on the project executed and present the work through a seminar talk to be organized by the department. Award of sessional marks are based on the performance of the student at the work place and awarded by industry guide and internal guide (25 Marks) followed by presentation before the committee constituted by the department (25 Marks). One faculty member will coordinate the overall activity of Summer Internship.

***Note: *** *Students have to undergo summer internship of 4 weeks duration at the end of semester*

VI and credits will be awarded after evaluation in VII semester.

Open Elective – II		
1	OE603 EE	Non-Conventional Energy Sources (Not for EEE & EIE Students)
2	OE604 EE	Transducers and Sensors (Not for EEE & EIE Students)
3	OE621 AE	Automotive maintenance (Not for Auto. Engg. students)
4	OE621 ME	Industrial Robotics (Not for Mech Engg& Prod. Engg. students)
5	OE602 CE	Green Building Technologies (Not for Civil Engg. Students)
6	OE602 CS	Data Science Using R (Not for CSE Students)
7	OE 603 IT	Cyber Security (Not for IT Students)

Open Electives– II

NON-CONVENTIONAL ENERGY SOURCES

OE 603 EE

Instruction: 3 periods per week *Duration of SEE: 3 hours*
*CIE: 30 *marks* *SEE: 70 marks*
Credits: 3

Objectives:

1. Toimparttheknowledge ofbasicsofdifferentnon-conventionaltypesofpowergeneration&powerplants
2. To helptheminunderstandingtheneedandroleofNon-Conventional Energysources particularlywhentheconventionalsourcesarescarcein nature

Outcomes:

Student will be able to
1. Understandthedifferentnonconventionalsourcesandthepowergenerationtechniquestogenerate electricalpower.
2. UnderstandtheSolarenergypowerdevelopmentanddifferentapplications.
3. Understanddifferentwindenergypowergenerationtechniquesandapplications.
4. Designa prescribedengineeringsub-system.
5. Recognizetheneedandabilityto engagein lifelonglearningforfurtherdevelopmentsin thisfield.

UNIT – I
ReviewofConventionalandNon-Conventionalenergysources -Needfornon-conventionalenergysources. Typesof Non-conventionalenergysources-Fuel Cells- Principleof operationwithspecial referenceto H_2O_2Cell-ClassificationandBlockdiagram offuelcellsystems - Ionexchangemembranecell-Molten carbonatecells-Solidoxideelectrolytecells-Regenerativesystem-Regenerative FuelCell-Advantages anddisadvantagesofFuelCells-Polarization-ConversionefficiencyandApplicationsofFuelCells.
UNIT – II
Solarenergy-Solarradiationand itsmeasurements-SolarEnergycollectors-SolarEnergystoragesystems-SolarPond-ApplicationofSolarPond-Applicationsofsolarenergy.
UNIT – III
Windenergy-Principlesofwindenergyconversion systems-Natureofwind-PowerintheWind-Basic components ofWECS-ClassificationofWECS-Siteselectionconsiderations -Advantagesand disadvantages ofWECS-Windenergycollectors-Windelectricgeneratingandcontrolsystems-ApplicationsofWindenergy-Environmentalaspects.
UNIT – IV
EnergyfromtheOceans-OceanThermalElectricConversion (OTEC)methods-Principlesoftidalpower generation-Advantages andlimitationsoftidalpowergeneration-Oceanwaves-Waveenergyconversion devices-Advantagesanddisadvantages ofwaveenergy-Geo-ThermalEnergy-TypesofGeo-Thermal EnergySystems-ApplicationsofGeo-ThermalEnergy.

UNIT – V
EnergyfromBiomass-Biomassconversiontechnologies/processes-Photosynthesis -Photosynthetic efficiency-Biogas generation-SelectionofsiteforBiogasplant-Classification ofBiogas plants-Details ofcommonlyusedBiogasplantsinIndia-Advantagesanddisadvantages ofBiogasgeneration-Thermal gasificationofbiomass-Biomassgasifiers.

Suggested Readings:

1. RaiG.D,*Non-ConventionalSourcesofEnergy,*KhandalaPublishers,NewDelhi,1999.
2. M.M.El-Wakil,Power*PlantTechnology.*McGrawHill,1984.

TRANSDUCERS AND SENSORS

OE 604 EE

Instruction: 3 periods per week *Duration of SEE: 3 hours*

*CIE: 30 *marks* *SEE: 70 marks*

Credits: 3

Objectives:

1. To expose the students to various sensors and transducers for measuring mechanical quantities.
2. To understand the specifications of sensors and transducers.
3. To learn the basic conditioning circuits for various sensors and transducers.
4. To introduce advances in sensor technology.

Outcomes:

Student will be able to
4. Familiar with the basics of measurement system and its input, output configuration of measurement system.
5. Familiar with both static and dynamic characteristics of measurement system.
6. Familiar with the principle and working of various sensors and transducers.

UNIT – I
Introduction to measurement system (MS) static characteristics of MS:linearity, Hysteresis, Threshold, Repeatability, Reliability and maintainability, Span, Calibration. ***Sensor Fundamentals***: Basic sensor technology and sensor system Sensor characteristics, system characteristics, instrument selection, data acquisition and readout, and installation.
UNIT – II
Resistive Transducer: Classification of transducers, Basic requirements of transducers, Variable resistance transducers; Potentiometers, Strain gauge (SG), types of Strain Guage.
UNIT – III
Variable capacitive transducers: Capacitance, Principles, Capacitance displacement transducers, Capacitive hygrometer, and capacitive proximity transducers. ***Variable inductive transducers****:* Linear variable differential transformer, Rotary variable differential transformer.
UNIT – IV
Measurement of temperature*:* Standards for calibration of temp. Temperature measuring devices, types of filled in system thermometers — liquid in glass, vapour pressure, bimetallic on solid rod thermometer Resistance temperature detectors, thermostat thermocouple.
UNIT – V
Advance Sensors:Piezoelectric transducers and their signal conditioning, Seismic transducer and its dynamic response, photoelectric transducers, Hall effect sensors, Digital displacement sensors, Fibre optic sensor, Semiconductor sensor and Smart sensors.

Suggested Readings:

1. C.S.Rangan, G R Sarma& V S N Mani, *Instrumentation Devices and Systems*-TMH, 2nd Edition2004.
2. B.Nakra&Chowdhari, *Instrumentation Measurement and Analysis*, TMH, 2nd Edition 2003.
3. D.V.S.Murthy, *Transducers and Instrumentation*, PHI, 1995 4. John P. Bentley, Principles of Measurement Systems, 3rd Edition, Pearson Education,2000.
4. Doebelin E.O, *Measurement Systems - Application and Design*, 4th Edition, McGraw-Hill, New Delhi.
5. PatranabisD, *Principles of Industrial Instrumentation*, 2nd Edition, Tata McGraw Hill, New Delhi,1997.
6. Jon Wilson *Sensor Technology Handbook*, Newness PublicationElsevier.

AUTOMOTIVE MAINTENANCE

OE 621AE

Instruction: 3 periods per week *Duration of SEE: 3 hours*
*CIE: 30 *marks* *SEE: 70 marks*
Credits: 3

Objectives:

1. To study basic types of vehicle maintenance along with its importance
2. To understand the trouble diagnosis procedure for electrical and electronic systems in automobiles
3. To acquaint with various Trouble shooting, fault tracing practices available in automobile industry
4. To understand the maintenance procedure for air-conditioning in automobiles.

Outcomes:

Student will be able to
1. Demonstrate the maintenance procedure for automotive Engine.
2. Illustrate the trouble diagnosis procedure for electrical systems like Battery, Starting Systems
3. Identify the trouble diagnosis procedure for steering and suspension system
4. Illustrate trouble diagnosis procedure for lubrication and fuel delivery system etc.
5. Explain trouble diagnosis procedure for heating system of automobile.

UNIT – I
Maintenance, Workshop Practices, Safety and Tools: Maintenance – Need, importance, primary and secondary functions, policies - classification of maintenance work - vehicle insurance - basic problem diagnosis. vehicles, fire safety - First aid. Basic tools –Scheduled maintenance services – service intervals - Towing and recovering.
UNIT – II
Engine and Engine Subsystem Maintenance: introduction engine IC Engine General Engine service- cooling and lubricating system, fuel system, Intake and Exhaust system, electrical system - Electronic fuel injection and engine management. **S**ervice - fault diagnosis- servicing emission controls.
UNIT – III
Transmission and Driveline Maintenance: Clutch- general checks, adjustment and service- road testing, Rear axle service points- removing axle shaft and bearings- servicing differential assemblies- fault diagnosis.
UNIT – IV
Steering, Brake, Suspension and Wheel Maintenance: *Inspection*, Maintenance and Service of Hydraulic brake, Drum brake, Disc brake, Parking brake. Bleeding of brakes. Inspection, Maintenance and Service of Mc person strut, coil spring, leaf spring, shock absorbers. Wheel

alignment and balance, removing and fitting of tyres, tyre wear and tyre rotation. Inspection, Maintenance and Service of steering linkage.
UNIT – V
***Auto Electrical and Air Conditioning Maintenance*:** Maintenance of batteries, starting system, charging system and body electrical -Fault diagnosis using Scan tools. Maintenance of air conditioning parts like compressor, condenser, expansion valve, evaporator - Vehicle body repair like panel beating, tinkering, soldering, polishing, painting.

Suggested Readings:

1. Ed May, "*Automotive Mechanics Volume One*", McGraw Hill Publications, 2003.
2. Ed May, "*Automotive Mechanics Volume Two*", McGraw Hill Publications, 2003
3. *Vehicle Service Manuals of reputed manufacturers*
4. *Bosch Automotive Handbook*, Sixth Edition, 2004

INDUSTRIAL ROBOTICS

OE 621ME

Instruction: 3 periods per week *Duration of SEE: 3 hours*

*CIE: 30 *marks* *SEE: 70 marks*

Credits: 3

Objectives:

1. To familiarize the student with the anatomy of robot and theirapplications.
2. To provide knowledge about various kinds of end effectorsusage.
3. To equip the students with information about various sensors used in industrialrobots.
4. To make the student understand the importance of spatial transformation of robots using forward and inversekinematics.
5. To specify and provide the knowledge of techniques involved in robot vision inindustry.
6. To equip students with latest robot languages implemented in industrialmanipulators.

Outcomes:

Student will be able to
1. Able to demonstrate knowledge of the relationship between mechanical structures of industrial robots and their operational workspace characteristics and have an understanding of the functionality and limitations of robot actuators andsensors.
2. Able to demonstrate an ability to apply spatial transformation to obtain forward/Inverse kinematics equation of robot manipulators using analytical/numerical/simulationtools.
3. Able to apply knowledge and choose the best & economically suitable sensors/end effectors required for specificapplications.
4. Able to understand the importance of robot vision and apply the learnt techniques to get the required information from inputimages.
5. Able to design and develop a industrial robot for a given purposeeconomically.
6. Appreciate the current state and potential for robotics in new applicationareas.

UNIT – I
Introduction to Robotics: Basic structure of Robots. Degree of freedom of Robots, Work envelope, Classification of Robots based on Drive Technology, Work-Envelope and motion control methods. Application of Robots in Industry, Repeatability, Precision and Accuracy as applied to Robots, Specifications of robots used for various applications. End effectors, Grippers: Mechanical grippers, pneumatic and hydraulic grippers, magnetic grippers, vacuum grippers, RCC grippers, Two fingered and three fingered grippers, internal grippers and external grippers, Selection and design considerations.
UNIT – II
Requirements of a Sensor: Principles and Applications of the following types of sensors- Position of sensors (Piezo electric sensor, LVDT, Resolvers, Optical encoders, Pneumatic position sensors), Range sensors (Triangulation principle, Structured, Lighting approach, Time of flight range finders, Laser range meters), Proximity sensors (Inductive, Hall effect, Capacitive, Ultrasonic and Optical proximity sensors), Touch sensors (Binary sensors, Analog

sensors), Wrist Sensors, Compliance Sensors, Slip Sensors.
UNIT – III
Kinematic Analysis of Robots: Rotation matrix. Homogeneous transformation matrix, Denavit&Hartenberg representation, Euler and RPY angles representation. Representation of absolute position and orientation in terms of joint parameters, Direct Kinematics of manipulators, Inverse kinematics of Robot arm for position and orientation. Redundancy in Robots, Static force analysis
UNIT – IV
Introduction to Techniques used in Robot Vision: Image acquisition, illumination techniques, imaging geometry, basic relationship pixels, preprocessing, segmentation & description of 3-dimensional structures, their recognition and interpretation. Types of Camera, frame grabbing, sensing and digitizing image data, Signal conversion, Image Storage, Lighting techniques, Image processing and analysis, Data reduction, Segmentation, Feature extraction, Object recognition, and various algorithms, Applications, Inspection, identification, visual serving and navigation.
UNIT – V
Robot Programming Languages: Characteristics of robot level languages, task level languages. Teach pendant programming, Lead through programming, Robot programming languages, VAL programming, Motion commands, Sensor commands. End effecter commands, Simple programs. RGV, AGV, Implementation of robots in industries, various steps, Safety considerations for robot operations. Economic analysis of robots, Pay back method, EUAC method and Rate of return method.

Suggested Readings:

1. Groover M P, "Industrial Robotics", McGraw Hill Publications, 1999.
2. Fu. K.S., Gon Zalez R.C., Lee C.S.G. "Robotics, Control-sensing vision and Intelligence", McGraw Hill, Int. Ed., 1987.
3. Spong and Vidyasagar, "Robot Dynamics & Control", John Wiley and Sons, Ed.,1990.
4. Mittal and Nagrath, "Industrial Robotics", Tata McGraw Hill Publications, 2004.
5. Saha&Subirkumarsaha, 'Robotics', TMH, India.

GREEN BUILDING TECHNOLOGIES

OE 602 CE

Instruction: 3 periods per week *Duration of SEE: 3 hours*

*CIE: 30 *marks* *SEE: 70 marks*

Credits: 3

Objectives:

1. To impart knowledge of the principles behind the green building technologies
2. To know the importance of sustainable use of natural resources and energy.
3. To understand the principles of effective energy and resources management in buildings
4. To bring awareness of the basic criteria in the green building rating systems
5. To understand the methodologies to reduce, recycle and reuse towards sustainability.

Outcomes:

Student will be able to
1. Define a green building, along with its features, benefits and rating systems.
2. Describe the criteria used for site selection and water efficiency methods.
3. Explain the energy efficiency terms and methods used in green building practices.
4. Select materials for sustainable built environment & adopt waste management methods.
5. Describe the methods used to maintain indoor environmental quality.

UNIT – I
***Introduction to Green Buildings*:** Definition of green buildings and sustainable development, typical features of green buildings, benefits of green buildings towards sustainable development. Green building rating systems – GRIHA, IGBC and LEED, overview of the criteria as per these rating systems.
UNIT – II
***Site selection and planning*:** Criteria for site selection, preservation of landscape, soil erosion control, minimizing urban heat island effect, maximize comfort by proper orientation of building facades, day lighting, ventilation, etc.
UNIT – III
Water conservation and efficiency:Rainwater harvesting methods for roof & non-roof, reducing landscape water demand by proper irrigation systems, water efficient plumbing systems, water metering, waste water treatment, recycle and reuse systems. ***Energy Efficiency:*** Environmental impact of building constructions, Concepts of embodied energy, operational energy and life cycle energy. ***Methods to reduce operational energy:*** Energy efficient building envelopes, efficient lighting technologies, energy efficient appliances for heating and air-conditioning systems in buildings, zero ozone depleting potential (ODP) materials, wind and solar energy harvesting, energy metering and monitoring, concept of net zero buildings.

UNIT – IV
Building materials: Methods to reduce embodied energy in building materials: (a) Use of local building materials (b) Use of natural and renewable materials like bamboo, timber, rammed earth, stabilized mud blocks, (c) use of materials with recycled content such as blended cements, pozzolona cements, fly ash bricks, vitrified tiles, materials from agro and industrial waste. (d) reuse of waste and salvaged materials
UNIT – V
Indoor Environmental Quality for Occupant Comfort and Wellbeing: Daylighting, air ventilation, exhaust systems, low VOC paints, materials & adhesives, building acoustics. Codes related to green buildings: NBC, ECBC, ASHRAE, UPC etc.

Suggested Readings:

1. *IGBC Green Homes Rating System, Version 2.0.*, Abridged reference guide, 2013, Indian Green Building Council Publishers
2. GRIHA version 2015, GRIHA rating system, *Green Rating for Integrated Habitat Assessment*
3. '*Alternative building materials and technologies*' by K.S. Jagadish, B.V. Venkatarama Reddy and K.S. Nanjunda Rao.
4. '*Non-Conventional Energy Resources*' by G. D. Rai, Khanna Publishers.
5. *Sustainable Building Design Manual, Vol.1 and 2*, TERI, New Delhi 2004

DATA SCIENCE USING R

OE 602CS

Instruction: 3 periods per week *Duration of SEE: 3 hours*
*CIE: 30 *marks* *SEE: 70 marks*
Credits: 3

Objectives:

1. To learn basics of R Programming environment: R language, R- studio and R packages.
2. To learn various statistical concepts like linear and logistic regression, cluster analysis, time series forecasting.
3. To learn Decision tree induction, association rule mining and text mining.

Outcomes:

Student will be able to
6. Use various data structures and packages in R for data visualization and summarization.
7. Use linear, non-linear regression models, and classification techniques for data analysis.
8. Use clustering methods including K-means and CURE algorithm

UNIT – I

Introduction To R: Introduction, Downloading and Installing R, IDE and Text Editors, Handling Packages in R.

Getting Started With R: Introduction, Working with Directory, Data Types In R, Few Commands for Data Exploration.

Loading and Handling Data In R: Introduction, Challenges of Analytical Data Processing, Expression, Variables, Functions, Missing Values Treatment In R, Using _As' Operator To Change The Structure Of The Data, Victors, Matrices, Factors, List, Few Common Analytical Tasks, Aggregation And Group Processing Of A Variable, Simple Analysis Using R, Methods For Reading Data, Comparison Of R GUI's For Data Input, Using R With Databases And Business Intelligence Systems.

UNIT – II

Exploring Data In R: Introduction, Data Frames, R Functions for Understanding Data in Data Frames, Load Data Frames, Exploring Data, Data Summary, Finding the Missing Values, Invalid Values And Outliers, Descriptive Statistics, Spotting Problems In Data with Visualization.

UNIT – III

Linear Regression Using R: Introduction, Model Fitting, Linear Regression, Assumptions of Linear Regression, Validating Linear Assumption.

Logistic Regression: Introduction, What Is Regression?, Introduction To Generalized Linear Model, Logistic Regression, Binary Logistic Regression, Diagnosing Logistic Regression, Multinomial Logistic Regression Model.

UNIT – IV
Decision Tree: Introduction, What Is A Decision Tree?, Decision Tree Representation In R, Appropriate Problems For Decision Tree Learning, Basic Decision Tree Learning Algorithm, Measuring Features, Hypothesis Space Search In Decision Tree Learning, Inductive Bias In Decision Tree Learning, Why Prefer Short Hypotheses, Issues In Decision Tree Learning. **Time Series In R:**Introduction, What Is Time Series Data, Reading Time Series Data, Decomposing Time Series Data, Forecasts Using Exponential Smoothing, ARIMA Models.
UNIT – V
Clustering: Introduction, What Is Clustering, Basic Concepts in Clustering, Hierarchical Clustering, K-Means Algorithm, CURE Algorithm, Clustering in Non-Euclidean Space, Clustering for Streams and Parallelism. **Association Rules:** Introduction, Frequent Itemset, Data Structure Overview, Mining Algorithm Interfaces, Auxiliary Functions, Sampling from Transaction, Generating Synthetic Transaction Data, Additional Measures of Interestingness, Distance Based Clustering Transaction and Association. **Text Mining:** Introduction, Definition of Text Mining, A Few Challenges in Text Mining, Text Mining Verses Data Mining, Text Mining In R, General Architectures of Text Mining Systems, Pre-Processing of Documents In R, Core Text Mining Operations, Using Background Knowledge for Text Mining, Text Mining Query Languages. **Mining Frequent Patterns, Associations and Correlations**: Basic Concepts and Methods. Frequent Itemset, Closed Itemset And Association Rules. Frequent Itemset: Mining Methods, Pattern Evaluation Methods, Sentiment Analysis**.**

Suggested Readings:

1. Data Analytics using R by Seema Acharya. McGraw Hill education.
2. Practical Data Science with R, Nina Zumel and John Mount, Manning Shelter Island.
3. 'The R book, Crawley, Michael J. John Wiley & Sons, Ltd

CYBER SECURITY

OE 603 IT

Instruction: 3 periods per week *Duration of SEE: 3 hours*

*CIE: 30 *marks* *SEE: 70 marks*

Credits: 3

Objectives:

4. To familiarize various types of cyber-attacks and cyber-crimes
5. To give an overview of the cyber laws
6. To study the defensive techniques against these attacks

Outcomes:

Student will be able to
7. Understand different types of cyber-attacks
8. Understand the types of cybercrimes and cyber laws
9. To protect them self and ultimately the entire Internet community from such attacks

UNIT – I
Introduction to Cyber Security: Basic Cyber Security Concepts, layers of security, Vulnerability, threat, Harmful acts, Internet Governance –Challenges and Constraints, Computer Criminals, CIA Triad, Assets and Threat, motive of attackers, active attacks, passive attacks, Software attacks, hardware attacks, Spectrum of attacks, Taxonomy of various attacks, IP spoofing, Methods of defense, Security Models, risk management, Cyber Threats-Cyber Warfare, Cyber Crime, Cyber terrorism, Cyber Espionage, etc., Comprehensive Cyber Security Policy.
UNIT – II
Basic Data Privacy Concepts: Fundamental Concepts, Data Privacy Attacks, Data linking and profiling, privacy policies and their specifications, privacy policy languages, privacy in different domains-medical, financial.
UNIT – III
Logical Design: Blue print for security. Security Policy, standards and Practices, Design of Security Architecture. ***Physical Design:*** Security Technology, Physical Design of Security SDLC Firewalls, Dialup Protection, Intrusion Detection Systems, Scanning and analysis tools, and Content filters.
UNIT – IV
Cryptography: The basic elements of cryptography: symmetric (Symmetric Key-DES, IDEA, and AES), and public key cryptography (Public Key Encryptions-RSA).
UNIT – V
Message digest (MD-5, SHA), and digital signatures. ***SSL and SET:*** SSL and SET protocols, Internet transactions using both SSL and SET.

Suggested Readings:

1. Michael E. Whitman and Herbert J. Mattord, "*Principles of Information Security*", Thomson, 2003.
2. William Stallings, "*Cryptography and Network Security*", Pearson Education, 2000.
3. Nina Godbole, "*Information System Security*", John Wiley & Sons, 2008.

SCHEME OF INSTRUCTION
BE (COMPUTER SCIENCE AND ENGINEERING)
CSE-Semester -VIII

S. No.	Course Code	Course Title	Scheme of Instruction				Scheme of Examination			Credits
			L	T	P/D	Contact Hrs/Wk	CIE	SEE	Duration in Hrs	
Theory Courses										
1	PE-VI	Professional Elective -VI	3	-	-	3	30	70	3	3
2	OE-III	Open Elective – III	3	-	-	3	30	70	3	3
Practical/ Laboratory Courses										
3	PW861 CS	Project Work – II	-	-	10	10	50	100	-	8
Total			**06**	**-**	**10**	**16**	**110**	**240**	**-**	**14**

PE731CS **MOBILE COMPUTING**

Credits: 3

Instruction: (3L) hrs per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*

UNIT-I

Introduction: Wireless Transmission, Frequencies for Radio Transmission, Signals, Antennas, Signal Propagation, Multiplexing, Modulations, Spread Spectrum, MAC, SOMA, FDMA, TDMA, CDMA, Cellular Wireless Networks.

UNIT-II

Telecommunication Systems: GSM, GPRS, Satellite Networks, Basics, Parameters and Configurations, Capacity Allocation, FAMA and DAMA, Broadcast Systems, DAB, DVB, CDMA and 3G.

UNIT-III

Wireless LAN: IEEE 802.11 Architecture, Services, MAC – Physical Layer, IEEE 802.11a – 802.11b standards, Bluetooth.

UNIT-IV

Routing Ad-hoc Network Routing Protocols: Ad-hoc Network Routing Protocols, Destination Sequenced Distance Vector Algorithm, Cluster Based Gateway Switch Routing, Global State Routing, Fish-eye state Routing, Dynamic Source Routing, Ad-hoc on-demand Routing, Location Aided Routing, Zonal Routing Algorithm.

Mobile IP - Dynamic Host Configuration Protocol.

Traditional TCP - Classical TCP Improvements – WAP, WAP 2.0.

UNIT-V

Publishing & Accessing Data in Air: Pull and Push Based Data Delivery models, Data Dissemination by Broadcast, Broadcast Disks, Directory Service in Air, Energy Efficient Indexing scheme for Push Based Data Delivery.

File System Support for Mobility: Distributed File Sharing for Mobility support, Coda and other Storage Manager for Mobility Support.

Mobile Transaction and Commerce: Models for Mobile Transaction, Kangaroo and Joey transactions, Team Transaction, Recovery Model for Mobile Transactions, Electronic Payment and Protocols for Mobile Commerce.

Suggested Reading:

1. Jochen Schiller, *Mobile Communications*, Pearson Education, 2nd Edition, 2009.
2. Kurnkum Garg, *Mobile Computing*, Pearson Education , 2010
3. Asoke K Talukder, Roopa R Yavagal, *Mobile Computing*, TMH 2008.

4. Raj Kamal, *Mobile Computing*, Oxford, 2009.
5."*A Survey of Mobile Transactions appeared in Distributed and Parallel databases*" 16,193-230, 2004, Kluwer Academics Publishers.
6. S. Acharya, M. Franklin and S. Zdonil, "*Balancing Push and Pull for Data Broadcast, Proceedings of the ACM SIGMOD*", Tuscon, AZ, May 1997.
7. S.Acharya, R. Alonso, M.Franklin and S.Zdonik, "*Broadcast Disks: Data Management for Assymetric Communication Environments, Proceedings of the ACM SIGMOD Conference*", San Jose, CA, May 1995.

SEMANTIC WEB

PE732CS
Instruction: 3 periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70marks*
Credits: 3

Objectives:

Outcomes: Student will be able to:

1 Understand the concept structure of the semantic web technology and how this technology revolutionizes the World Wide Web.
2 Understand the concepts of Web Science, semantics of knowledge and resource, ontology.
3 Describe logic semantics and inference with OWL.
4 Use ontology engineering approaches in semantic applications
5 Learn Web graph processing for various applications such as search engine, community detection
6 Program web applications and graph processing techniques using Python

UNIT – I
The Future of the Internet: Introduction, Syntactic Web, Semantic Web, Working of Semantic Web, What is not a Semantic Web, Side Effects. **Descriptive Logic:** Introduction, Definition of the basic formalism, Reasoning algorithms, Language extensions
UNIT – II
Structured Web Documents in XML: Introduction, XML, Structuring, Namespaces, Addressing and querying XML document, Processing **Describing Web Resources**: RDF, Introduction, RDF: Basic Ideas, RDF: XML-Based Syntax , RDF serialization, RDF Schema: Basic Ideas, RDF Schema: The Language , RDF and RDF Schema in RDF Schema
UNIT – III
OWL: Introduction, Requirements for Web Ontology Description Languages, Header Information, Versioning and Annotation Properties, Properties, Classes, Individuals, Data types **SPARQL**: SPARQL simple Graph Patterns, Complex Graph Patterns, Group Patterns, Queries with Data Values, Filters, OWL Formal Semantics.
UNIT – IV
Semantic Web Services: Introduction, Web Service Essentials, OWL-S Service Ontology, OWL-S Example. **Methods for Ontology Development:** Introduction, Uschold and King Ontology Development Method, Toronto Virtual Enterprise Method, Methontology, KACTUS Project Ontology Development Method, Lexicon-Based Ontology Development Method, Simplified Methods.
UNIT – V
Ontology Sources: Introduction, Metadata, Upper Ontologies **Software Agents:** Introduction, Agent Forms, Agent Architecture, Agents in the Semantic Web Context.**Applications:**

Introduction, Horizontal Information Products, Open academia, Bibster, Data Integration, Skill Finding, Think Tank Portal, e-learning, Web Services.

Suggested Readings:

1	Michael C. Daconta, Leo J. Obrst, and Kevin T. Smith, "The Semantic Web: A Guide to the Future of XML, Web Services, and Knowledge Management", Fourth Edition, Wiley Publishing, 2003.
2	John Davies, Rudi Studer, and Paul Warren John, "Semantic Web Technologies: Trends and Research in Ontology-based Systems", Wiley and Son's, 2006.
3	John Davies, Dieter Fensel and Frank Van Harmelen, "Towards the Semantic Web: Ontology- Driven Knowledge Management", John Wiley and Sons, 2003.
4	Karin K Brietman, Marco Antonio Casanova, Walter Truszkowski, "*Semantic Web – Concepts*", Technologies and Applications. Springer 2007.
5	Grigoris Antoniou, Frank van Harmelen, "*A Semantic Web Primer*", PHI 2008.
6	Liyang Yu, "*Semantic Web and Semantic Web Services*", CRC 2007

CYBER SECURITY

PE 733CS

Instruction: 3 periods per week *Duration of SEE: 3 hours*

*CIE: 30 *marks* *SEE: 70 marks*

Credits: 3

Objectives:

7. To familiarize various types of cyber-attacks and cyber-crimes
8. To give an overview of the cyber laws
9. To study the defensive techniques against these attacks

Outcomes:

Student will be able to
10. Understand different types of cyber-attacks
11. Understand the types of cybercrimes and cyber laws
12. To protect them self and ultimately the entire Internet community from such attacks

UNIT – I
Introduction to Cyber Security: Basic Cyber Security Concepts, layers of security, Vulnerability, threat, Harmful acts, Internet Governance –Challenges and Constraints, Computer Criminals, CIA Triad, Assets and Threat, motive of attackers, active attacks, passive attacks, Software attacks, hardware attacks, Spectrum of attacks, Taxonomy of various attacks, IP spoofing, Methods of defense, Security Models, risk management, Cyber Threats-Cyber Warfare, Cyber Crime, Cyber terrorism, Cyber Espionage, etc., Comprehensive Cyber Security Policy.
UNIT – II
Basic Data Privacy Concepts: Fundamental Concepts, Data Privacy Attacks, Data linking and profiling, privacy policies and their specifications, privacy policy languages, privacy in different domains-medical, financial.
UNIT – III
Logical Design: Blue print for security. Security Policy, standards and Practices, Design of Security Architecture. ***Physical Design:*** Security Technology, Physical Design of Security SDLC Firewalls, Dialup Protection, Intrusion Detection Systems, Scanning and analysis tools, and Content filters.
UNIT – IV
Cryptography: The basic elements of cryptography: symmetric (Symmetric Key-DES, IDEA, and AES), and public key cryptography (Public Key Encryptions-RSA).
UNIT – V
Message digest (MD-5, SHA), and digital signatures. ***SSL and SET:*** SSL and SET protocols, Internet transactions using both SSL and SET.

Suggested Readings:

4. Michael E. Whitman and Herbert J. Mattord, "*Principles of Information Security*", Thomson, 2003.
5. William Stallings, "*Cryptography and Network Security*", Pearson Education, 2000.
6. Nina Godbole, "*Information System Security*", John Wiley & Sons, 2008.

DATA SCIENCE USING R

PE 734CS

Instruction: 3 periods per week *Duration of SEE: 3 hours*

*CIE: 30 *marks* *SEE: 70 marks*

Credits: 3

Objectives:

4. To learn basics of R Programming environment: R language, R- studio and R packages.
5. To learn various statistical concepts like linear and logistic regression, cluster analysis, time series forecasting.
6. To learn Decision tree induction, association rule mining and text mining.

Outcomes:

Student will be able to
9. Use various data structures and packages in R for data visualization and summarization.
10. Use linear, non-linear regression models, and classification techniques for data analysis.
11. Use clustering methods including K-means and CURE algorithm

UNIT – I

Introduction To R: Introduction, Downloading and Installing R, IDE and Text Editors, Handling Packages in R.

Getting Started With R: Introduction, Working with Directory, Data Types In R, Few Commands for Data Exploration.

Loading and Handling Data In R: Introduction, Challenges of Analytical Data Processing, Expression, Variables, Functions, Missing Values Treatment In R, Using _As' Operator To Change The Structure Of The Data, Victors, Matrices, Factors, List, Few Common Analytical Tasks, Aggregation And Group Processing Of A Variable, Simple Analysis Using R, Methods For Reading Data, Comparison Of R GUI's For Data Input, Using R With Databases And Business Intelligence Systems.

UNIT – II

Exploring Data In R: Introduction, Data Frames, R Functions for Understanding Data in Data Frames, Load Data Frames, Exploring Data, Data Summary, Finding the Missing Values, Invalid Values And Outliers, Descriptive Statistics, Spotting Problems In Data with Visualization.

UNIT – III

Linear Regression Using R: Introduction, Model Fitting, Linear Regression, Assumptions of Linear Regression, Validating Linear Assumption.

Logistic Regression: Introduction, What Is Regression?, Introduction To Generalized Linear Model, Logistic Regression, Binary Logistic Regression, Diagnosing Logistic Regression, Multinomial Logistic Regression Model.

UNIT – IV
Decision Tree: Introduction, What Is A Decision Tree?, Decision Tree Representation In R, Appropriate Problems For Decision Tree Learning, Basic Decision Tree Learning Algorithm, Measuring Features, Hypothesis Space Search In Decision Tree Learning, Inductive Bias In Decision Tree Learning, Why Prefer Short Hypotheses, Issues In Decision Tree Learning. **Time Series In R:**Introduction, What Is Time Series Data, Reading Time Series Data, Decomposing Time Series Data, Forecasts Using Exponential Smoothing, ARIMA Models.
UNIT – V
Clustering: Introduction, What Is Clustering, Basic Concepts in Clustering, Hierarchical Clustering, K-Means Algorithm, CURE Algorithm, Clustering in Non-Euclidean Space, Clustering for Streams and Parallelism. **Association Rules:** Introduction, Frequent Itemset, Data Structure Overview, Mining Algorithm Interfaces, Auxiliary Functions, Sampling from Transaction, Generating Synthetic Transaction Data, Additional Measures of Interestingness, Distance Based Clustering Transaction and Association. **Text Mining:** Introduction, Definition of Text Mining, A Few Challenges in Text Mining, Text Mining Verses Data Mining, Text Mining In R, General Architectures of Text Mining Systems, Pre-Processing of Documents In R, Core Text Mining Operations, Using Background Knowledge for Text Mining, Text Mining Query Languages. **Mining Frequent Patterns, Associations and Correlations**: Basic Concepts and Methods. Frequent Itemset, Closed Itemset And Association Rules. Frequent Itemset: Mining Methods, Pattern Evaluation Methods, Sentiment Analysis**.**

Suggested Readings:

4. Data Analytics using R by Seema Acharya. McGraw Hill education.
5. Practical Data Science with R, Nina Zumel and John Mount, Manning Shelter Island.
6. 'The R book, Crawley, Michael J. John Wiley & Sons, Ltd

Open Elective – III		
1	OE605 EE	Smart Building Systems (Not for EEE & EIE Students)
2	OE606 EE	Programmable Logic Controllers (Not for EEE & EIE Students)
3	OE631 AE	Automotive Safety and Ergonomics (Not for Auto. Engg students)
4	OE631 ME	Mechatronics (Not for Mech Engg& Prod. Engg. students)
5	OE603 CE	Road Safety Engineering (Not for Civil Engg. Students)
6	OE604 IT	Software Engineering (Not for IT Students)

Open Electives – III

SMART BUILDING SYSTEMS

OE605EE

Instruction: 3 periods per week *Duration of SEE: 3 hours*

*CIE: 30 *marks* *SEE: 70 marks*

Credits: 3

Objectives:

5. To understand the basic blocks of Building Management System.
6. To design various sub systems (or modular system) of building automation
7. To integrate all the sub systems

Outcomes:

Student will be able to
8. Describe the basic blocks and systems for building automation
9. Use different subsystems for building automation and integrate them
10. Understand basic blocks and systems for building automation
11. Design different systems for building automation and integrate those systems

UNIT – I

Introduction: Concept and application of Building Management System (BMS) and Automation, requirements and design considerations and its effect on functional efficiency of building automation system, architecture and components of BMS.

UNIT – II

Fire Alarm (FA) System: concept of fire, Fire modes, History, Components, and Principles of Operation. Different fire sensors, smoke detectors and their types, Fire control panels, design considerations for the FA system. Field Components, Panel Components, Applications. Types of FAS Architectures, Examples. Classification of FAS loops, Examples. FAS Design procedure in brief, NFPA 72A, BS 5839, IS, Concept of IP enabled fire & alarm system, design aspects and components of PA system.

UNIT – III

Access Control System: Access Components, Access control system Design.

CCTV: Camera Operation & types, Camera Selection Criteria, Camera Applications, DVR Based system, DVM, Network design, Storage design. Components of CCTV system like cameras, types of lenses, typical types of cables, controlling system. CCTV Applications.

UNIT – IV

Security Systems Fundamentals: Introduction to Security Systems, Concepts.

Perimeter Intrusion: Concept, Components, Technology, Advanced Applications. Security system design for verticals. concept of automation in access control system for safety, Physical security system with components, RFID enabled access control with components, Computer system access control –DAC, MAC, RBAC.

EPBX System & BMS subsystem integration: Design consideration of EPBX system and its components, integration of all the above systems to design BMS.
UNIT – V
Energy Management: Energy Savings concept & methods, Lighting control, Building Efficiency improvement, Green Building (LEED) Concept & Examples. **Building Management System:** IBMS (HVAC, Fire &Securi-ty) project cycle, Project steps BMS, Advantages & Applications of BMS, IBMS Architecture, Normal & Emergency operation, Advantages of BMS.

Suggested Readings:

2. Jim Sinopoli, *Smart Buildings,* Butterworth-Heinemann imprint of Elsevier,2nd ed., 2010.
4. Reinhold A. Carlson, Robert A. Di Giandomenico, *Understanding Building Automation Systems (Direct Digital Control, Energy Management, Life Safety, Security, Access Control, Lighting, Building Management Programs),* R.S. Means Company Publishing, 1991.
5. Albert Ting-Pat So, WaiLok Chan, Kluwer, *Intelligent Building Systems*, Academic publisher,3rd ed., 2012.
6. Robert Gagnon, *Design of Special Hazards and Fire Alarm Systems*, Thomson Delmar Learning; 2nd edition, 2007.
7. Levenhagen, John I.Spethmann, Donald H, *HVAC Controls and Systems*, McGraw-Hill Pub.
8. Hordeski, Michael F, *HVAC Control in the New Millennium*, Fairmont press, 2001.
9. Bela G. Liptak, *Process Control-Instrument Engineers Handbook*, Chilton book co.

PROGRAMMABLE LOGIC CONTROLLERS

OE606EE

Instruction: 3 periods per week *Duration of SEE: 3 hours*

*CIE: 30 *marks* *SEE: 70 marks*

Credits: 3

Objectives:

1. To be able to understand basics of Programmable logic controllers, basic programming of PLC.
2. To make the students to understand the Functions and applications of PLC

Outcomes:

Student will be able to

1. Develop PLC programs for industrial applications.
2. Acquire the knowledge of PLC counter functions and PLC Arithmetic functions and data handling functions.

UNIT – I

PLC Basics: Definition and History of PLC - PLC advantages and disadvantages - Over all PLC Systems - CPUs and Programmer Monitors - PLC input and output models - Printing PLC Information- Programming Procedures - Programming Equipment - Programming Formats- Proper Construction of PLC Diagrams - Devices to which PLC input and output modules are connected - Input on/off switching devices - Input analog devices - Output analog on/off devices and output analog devices.

UNIT – II

Basic PLC Programming: Programming on/off inputs to produce on/off outputs - PLC input instructions - Outputs - Operational procedures - Contact and coil input/output programming examples - Relation of digital gate logic contact / coil logic - PLC programming and conversion examples - Creating ladder diagrams from process control descriptions - Sequence listings - Large process ladder diagram constructions.

UNIT – III

Basic PLC Functions: General Characteristics of Registers - Module addressing - Holding registers - Input registers - output registers - PLC timer functions - examples of timer functions. Industrial applications - PLC counter functions.

UNIT – IV

Intermediate Functions: PLC Arithmetic functions - PLC additions and subtractions - The PLC repetitive clock - PLC Multiplications, Division and Square Root - PLC trigonometric and log functions - Other PLC arithmetic functions - PLC number comparison functions. PLC basic comparison functions and applications - Numbering systems and number conversion functions - PLC conversion between decimal and BCD-Hexadecimals numbering systems.

UNIT – V

Data Handling Functions: The PLC skip and master control relay functions - Jump functions - Jump with non return - Jump with return. PLC data move Systems - The PLC functions and applications. PLC functions working with bits - PLC digital bit functions and applications - PLC sequence functions - PLC matrix functions.

Suggested Readings:

1. John W. Weff, Ronald A. Reis, Programmable Logic Controllers, Prentice Hall of India Private Limited, Fifth edition, 2003.
2. Frank D. Petruzella, *Programmable Logic Controllers*, 5th Edition, Mc-Graw Hill, 2019.

AUTOMOTIVE SAFETY AND ERGONOMICS

OE 631AE

Instruction: 3 periods per week *Duration of SEE: 3 hours*

*CIE: 30 *marks* *SEE: 70 marks*

Credits: 3

Objectives:

1. To impart knowledge of automotive safety and ergonomics
2. To understand the basics of vehicle collision and its effects.
3. To understand the various safety concepts used in passenger cars
4. To Gain knowledge about various safeties and its equipment.
5. To understand the concepts of vehicle ergonomics.

Outcomes:

Student will be able to
1. Explain the types and importance of vehicle safety.
2. Describe the various safety equipments used in automobiles.
3. Demonstrate the modern tools used for vehicle safety.
4. Explain the role of automotive ergonomics in automobiles.
5. Demonstrate the best comfort and convenience system in vehicle.

UNIT – I
Introduction:Design of the Body for safety, Energy equations, Engine location, Effects of Deceleration inside passenger compartment, Deceleration on impact with stationary and movable obstacle, Concept of Crumble zone and Safety sandwich construction, Active and passive safety, Characteristics of vehicle structures, Optimization of vehicle structures for crash worthiness, Types of crash / roll over tests, Regulatory requirements for crash testing, instrumentation, High speed photography, image analysis.
UNIT – II
Safety Concepts:Active safety- driving safety, Conditional safety, Perceptibility safety and Operating safety, Passive safety: Exterior safety, Interior safety, Deformation behaviour of vehicle body, Speed and acceleration characteristics of passenger compartment on impact, pedestrian safety, human impact tolerance, determination of injury thresholds, severity index, study of comparative tolerance, Study of crash dummies.
UNIT – III
Safety equipments:Seat belt, automatic seat belt fastening system, Collapsible steering column, tilt-able steering wheel, Air bags, electronic systems for activating air bags, Frontal design for safety, collision warning system, Causes of rear end collision, frontal object detection, rear vehicle object detection system, Object detection system with braking system interactions. Anti-lock braking system ESP and EBD systems
UNIT – IV
Vehicle Ergonomics:Introduction to human body - anthropometrics and its application to vehicle ergonomics, Cockpit design, Driver comfort – seating, visibility, Man-machine system-

psychological factors – stress, attention, Passenger comfort - ingress and egress, spaciousness, Ventilation, temperature control, Dust and fume prevention and vibration, Interior features and conveniences, Use of modern technology for the same
UNIT – V
Comfort and Convenience System: Cabin comfort - in-car air conditioning – overall energy efficiency, Air management, central and Unitary systems, air flow circuits, air cleaning, ventilation, air space diffusion, Compact heat exchanger design, controls and instrumentation, Steering and mirror adjustment, central locking system, Garage door opening system, tire pressure control system, rain sensor system, environment information system, Automotive lamps, types, design, construction, performance, Light signalling devices- stop lamp, Rear position lamp, Direction indicator, Reverse lamp, reflex reflector, position lamp, gas discharge lamp, LED, Adoptive front lighting system (AFLS) and Daylight running lamps(DRL).

Suggested Readings:

1. Prasad, Priya and BelwafaJamel, "*Vehicles Crashworthiness and Occupant Protection*", American Iron and Steel Institute,USA.
2. JullianHappian-Smith "*An Introduction to Modern Vehicle Design"* SAE,2002
3. Bosch - "*Automotive Handbook*" - 5th edition - SAE publication -2000.
4. *"Recent development in Automotive Safety Technology*", SAE International Publication. Editor: Daniel J Helt,2013.
5. Keitz H.A.E. "*Light Calculations and Measurements*", Macmillan1971.

MECHATRONICS

OE 631ME

Instruction: 3 periods per week *Duration of SEE: 3 hours*

*CIE: 30 *marks* *SEE: 70 marks*

Credits: 3

Objectives:

Student has to understand the
1. How to identify, formulate, and solve engineeringproblems
2. The design a system, component, or process to meet desired needs within realisticconstraints
3. The how to use the techniques, skills, and modern engineering tools necessary for engineering practice
4. The use of drive mechanisms and fluid powersystems
5. The use of industrial electronicdevices
6. The demonstrate the design of modern CNC machines, and Mechatronicselements

Outcomes:

At the end of the course, the students will be able to
1. Model and analyse electrical and mechanical systems and theirinterconnection
2. Integrate mechanical, electronics, control and computer engineering in the design of Mechatronics systems
3. Do the complete design, building, interfacing and actuation of a Mechatronics system for a set of specifications
4. Be proficient in the use of fluid power systems in various Mechatronicsapplications
5. Demonstrate the use of industrial electronic devices
6. Demonstrate the design of modern CNC machines, and Mechatronics elements

Unit-I
Introduction to mechanization & automation: Need of interface of electrical & electronic devices with mechanical elements, the concept of Mechatronics, Flow chart of Mechatronics system, elements of Mechatronics system, drive mechanisms, actuators, feedback devices and control system, application in industries and systems development
Unit-II:
Drive mechanisms: Feeding and indexing, orientation, escapement and sorting devices, conveyor systems Introduction to electrical actuators: A.C. servomotors, D.C. servomotors, stepper motors
Unit-III
Introduction to fluid power systems: Industrial Pneumatics and hydraulics, merits of fluid power, pneumatic & hydraulic elements symbols, study of hydraulic control valves, pumps & accessories, hydraulic circuits & mechanical servo control circuits, Electro-hydraulic and Hydro pneumatic circuits
Unit-IV
Introduction to industrial electronic devices: Diodes, Transistors, Silicon Controlled Rectifiers (SCR), Integrated Circuits (IC), Digital Circuits, Measurement systems & Data acquisition systems: sensors, digital to analog and analog-to-digital conversion, signal processing using operational amplifiers, introduction to microprocessor & micro controller, Temperature measurement interface and LVDT interface, Systems response

Unit-V
Design of modern CNC machines and Mechatronics elements: machine structures, guide ways, spindles, tool monitoring systems, adaptive control systems, Flexible manufacturing systems, Multipurpose control machines, PLCprogramming

Suggested Reading:

1. William Bolton, Mechatronics: Electronic control systems in mechanical and electrical engineering, 6th edition, Pearson Education
2. HMT Ltd, Mechatronics, Tata McGraw-Hill Publishing Company Limited, New Delhi,1998
3. Michaels Histand& David G, Alciatore, Introduction to Mechatronics and Measurement Systems, Tata McGraw-Hill InternationalEdition
4. Devdas Shetty, Richard A. Kolk, Mechatronics System Design, Cengage Learning
5. S.R. Majumdar, Oil Hydraulic Systems – Principles & Maintenance, McGraw-Hill Publishing Company Limited, NewDelhi
6. Godfrey Onwubolu, Mechatronics: Principles and Applications,Butterworth-Heinemann

ROAD SAFETY ENGINEERING

OE 603 CE

Instruction: 3 periods per week *Duration of SEE: 3 hours*

*CIE: 30 *marks* *SEE: 70 marks*

Credits: 3

Objectives:

1. Introduction to various factors considered for road safety and management
2. Explain the road safety appurtenances and design elements
3. Discuss the various traffic management techniques

Outcomes:

Student will be able to
1. Understand the fundamentals of traffic safety analysis
2. Analyze Accident data
3. Remember the concepts of road safety in urban transport
4. Apply crash reduction techniques
5. Design of urban Infrastructure considering safety aspects.

UNIT – I
Introduction: Road Safety scenario in India and World, Road Accident Characteristics. ***Traffic Safety Analysis:*** Fundamentals of Traffic Engineering - Basic Characteristics of Motor-Vehicle Traffic, Highway Capacity, Applications of Traffic Control Devices, Design of Parking Facilities, Traffic Engineering Studies; Statistical Methods in Traffic Safety Analysis – Regression Methods, Poisson Distribution, Chi- Squared Distribution, Statistical Comparisons.
UNIT – II
Accident Analysis: Accident Investigations and Risk Management, Collection and Analysis of Accident Data, Condition and Collision Diagram, Causes and Remedies, Traffic Management Measures and Their Influence on Accident Prevention, Assessment of Road Safety, Methods to Identify and Prioritize Hazardous Locations and Elements, Determine Possible Causes of Crashes, Crash Reduction Capabilities and Countermeasures, Effectiveness of Safety Design Features, Accident Reconstruction. Application of computer analysis of accident data.
UNIT – III
Road Safety in planning and Geometric Design: Vehicle And Human Characteristics, Road Design and Road Equipment's, Redesigning Junctions, Cross Section Improvements, Reconstruction and Rehabilitation of Roads, Road Maintenance, Traffic Control, Vehicle Design and Protective Devices, Post Accident Care.
UNIT – IV
***Traffic Signals & Road signs*:** Traffic Signals, Factors affecting signal design, street lighting, Provisions for NMT Vehicles in India, Safety Provisions for Pedestrians & Cyclists, Road Signs and Pavement Markings. **Safety at Construction Site:** Safety provisions for workers at construction site, Construction Zone markings, signs.
UNIT – V
Traffic Management safety audit: Traffic Management Systems for Safety, Road Safety Audits and Tools for Safety Management Systems, Road Safety Audit Process, Approach to Safety, Road Safety

Improvement Strategies, ITS and Safety.

Suggested Readings:

1. KadiyaliL.R,.*Traffic Engineering and Transport planning*, 9th Edition, Khanna Tech Publishers, 2013.
2. C.E.G. Justo, A. Veeraragavanand S. K. Khanna, *Highway Engineering*, 10th Edition, Nem Chand Publishers, 2017.
3. Donald Drew, *Traffic Flow Theory Chapter 14 in Differential Equation Models*, Springer, 1983
4. C. Jotinkhisty and B. Kent Lall, *Transportation Engineering – An Introduction, 3rd Edition, Pearson publications, 2017*
5. Rune Elvik, Alena Hoye, TrulsVaa, Michael Sorenson, *Handbook of Road Safety measures, second Edition, Emerald Publishing, 2009.*
6. Highway Research Programme (NCHRP) Synthesis 336.*A synthesis of Highway Research Board, Washington D.C, 2016*.

SOFTWARE ENGINEERING

OE 604 IT

Instruction: 3 periods per week *Duration of SEE: 3 hours*

*CIE: 30 *marks* *SEE: 70 marks*

Credits: 3

Objectives:

6. To introduce the basic concepts of software development processes from defining a product to shipping and maintaining
7. To impart knowledge on various phases, methodologies and practices of software development
8. To understand the importance of testing in software development, study various testing strategies along with its relationship with software quality and metrics

Outcomes:

Student will be able to
12. Acquired working knowledge of alternative approaches and techniques for each phase of software development
13. Judge an appropriate process model(s) assessing software project attributes and analyze necessary requirements for project development eventually composing SRS.
14. Creation of visual models to describe (non-) algorithmic solutions for projects using various design principles.
15. Acquire skills necessary as an independent or as part of a team for architecting a complete software project by identifying solutions for recurring problems exerting knowledge on patterns.

UNIT – I

Introduction to Software Engineering:

A generic view of Process: Software Engineering, Process Framework, CMM Process Patterns, Process Assessment.

Process Models: Prescriptive Models, Waterfall Model, Incremental Process Models, Evolutionary Process Models, Specialized Process Models, The Unified Models, Personal and Team Process Models, Process Technology, Product and Process.

An Agile view of Process: Introduction to Agility and Agile Process, Agile Process Models

UNIT – II

Software Engineering Principles: SE Principles, Communication Principles, Planning Principles, Modeling Principles, Construction Principles, Deployment.

System Engineering:Computer-based Systems, The System Engineering Hierarchy, Business Process Engineering, Product Engineering, System Modeling.

Requirements Engineering: A Bridge to Design and Construction, Requirements Engineering Tasks, Initiating Requirements Engineering Process, Eliciting Requirements, Developing Use-Cases, Building the Analysis Model, Negotiating Requirements, Validating Requirements.

UNIT – III
Building the Analysis Model:Requirements Analysis Modeling Approaches, Data Modeling Concepts, Object-Oriented Analysis, Scenario-based Modeling, Flow-oriented Modeling, Class-based Modeling, Creating a Behavioral Model. ***Design Engineering:***Design within the context of SE, Design Process and Design Quality, Design Concepts, The Design Model, Pattern-based Software Design.
UNIT – IV
Creating an Architectural Design: Software Architecture, Data Design, Architectural Styles and Patterns, Architectural Design. ***Modeling Component-Level Design:***Definition of Component, Designing Class-based Components, Conducting Component-level Design, Object Constraint Language, Designing Conventional Components. ***Performing User Interface Design:***The Golden Rules, User Interface Analysis and Design, Interface Analysis, Interface Design Steps, Design Evaluation.
UNIT – V
Testing: Strategies:A Strategic Approach to Conventional Software Testing, Test Strategies for O-O Software. ***Tactics:***Software Testing Fundamentals, Black-box and White-box Testing, Basis Path Testing, Control Structure Testing, O-O Testing Methods. ***Debugging:***Debugging Techniques, The Art of Debugging. ***Product Metrics:*** A Framework for Product Metrics, Metrics for each phase of software development. ***Software Quality:***Definition, ***Quality Assurance:***Basic Elements, Formal Approaches, Statistical Software Quality Assurance, Software Reliability, ISO9000 Quality Standards, SQA Plan.

Suggested Readings:

1. Roger S. Pressman, *Software Engineering: A Practitioner's Approach*, 7th Edition, McGraw Hill, 2009
2. Ali Behforooz and Frederick J. Hudson, *Software Engineering Fundamentals*, Oxford University Press, 1996
3. Pankaj Jalote, *An Integrated Approach to Software Engineering*, 3rd Edition, Narosa Publishing House, 2008

PROJECT WORK - II

PW 961CS

Instruction: 16 periods per week *Duration of SEE: 3 hours*
CIE: 50 marks *SEE: 100 marks*
Credits : 8

Objectives:

1.	To enhance practical and professional skills
2.	To familiarize tools and techniques of systematic Literature survey and documentation
3.	To expose the students to industry practices and team work.
4.	To encourage students to work with innovative and entrepreneurial ideas

Outcomes: Student will be able to:

1.Demonstrate the ability to synthesize and apply the knowledge and skills acquired in the academic program to real-world problems.
2.Evaluate different solutions based on economic and technical feasibility
3.Effectively plan a project and confidently perform all aspects of project management
4.Demonstrate effective written and oral communication skills

The aim of Project work –II is to implement and evaluate the proposal made as part of Project Work - I. Students can also be encouraged to do full time internship as part of project work-II based on the common guidelines for all the departments . The students placed in internships need to write the new proposal in consultation with industry coordinator and project guide within two weeks from the commencement of instruction.

The department will appoint a project coordinator who will coordinate the following:

- Re-grouping of students - deletion of inters hip candidates from groups made as part of project work-I
- Re-Allotment of internship students to project guides
- Project monitoring at regular intervals

All re-grouping/re -allotment has to be completed by the 1st week of VIIIth semester so that students get sufficient time for completion of the project.

All projects(internship and departmental) will be monitored at least twice in a semester through student presentation for the award of sessional marks. Sessional marks are awarded by a monitoring committee comprising of faculty members as well as by the supervisor. The first review of projects for 25 marks can be conducted after completion of five weeks. The second review for another 25 marks can be conducted after 12 weeks of instruction.

Common norms will be established for the final documentation of the project report by the respective departments. The students are required to submit draft copies of their project report within one week after completion of instruction.

Note: Three periods of contact load will be assigned to each project guide.