FACULTY OF ENGINEERING

Scheme of Instruction & Examination

(AICTE Model Curriculum for the Academic Year 2018-2019)

and

Syllabi

B.E. I and II Semesters (Group-B)

of

Four Year Degree Programme

in

B.E. (Common to All Branches)

(With effect from the Academic Year 2018– 2019)
(As approved in the Faculty Meeting held on 26th June 2018)

Issued by

Dean, Faculty of Engineering

Osmania University, Hyderabad

2018

GROUP DISTRIBUTION

B.E. (I, II – Semesters)

NUMBER OF DIVISIONS PER COURSE OF
O.U. AFFILIATED RESPECTIVE ENGINEERING COLLEGES

S. No	*COLLEGE NAME*	*GROUP – A*					*No. of Div.*	*GROUP – B*				*No. of Div.*	*Total No. of Div.*
		ECE	IT	ME	PE	AE		CSE	CE	EEE	EIE		
1	MVSR	3	2	2	-	1	8	3	2	2	-	7	15
2	MJCET	2	2	2	1	-	7	2	2	1	1	6	13
3	DCET	2	1	2	1	-	6	2	2	1	1	6	12
4	ISL	2	1	1	-	-	4	2	2	1	-	5	9
5	METHODIST	2	-	2	-	-	4	2	2	1	-	5	9
6	MEC	2	-	1	-	-	3	2	1	1	-	4	7
7	SWATHI	1	-	1	-	-	2	1	1	-	-	2	4
8	STANLEY	2	1	-	-	-	3	3	-	1	-	4	7
9	NGIT	-	2	-	-	-	2	3	-	-	-	3	5
*10**	NSAKCET	2	1	4	-	-	7	2	3	1	-	6	13
*11**	LORDS	1	1	4	-	-	6	2	3	1	-	6	12
	TOTAL	19	11	19	2	1	52	24	18	10	2	54	106

Note: * Applied to OU for Affiliation from the academic year 2019-2020

Group – B

CSE : Computer Science and Engineering
CE : Civil Engineering
EEE : Electrical & Electronics Engineering
EIE : Electronics & Instrumentation Engineering

SCHEME OF INSTRUCTION & EXAMINATION
B.E. (All Branches) I - Semester
(Group B – CSE, CE, EEE, EIE)

S. No.	Course Code	Course Title	Scheme of Instructions				Scheme of Examination			Credits
			L	T	P/ D	Contact Hours/Week	CIE	SEE	Duration in Hours	
MC : Three Week Induction Programme										
Theory Course										
1	MC112CE	Environmental Science	2	-	-	2	30	70	3	-
2	MC113PY	Essence of Indian Traditional Knowledge	2	-	-	2	30	70	3	-
3	BS102MT	Mathematics-I	3	1	-	4	30	70	3	4
4	BS105CH	Chemistry	3	1	-	4	30	70	3	4
5	ES107CS	Programming for Problem Solving	3	-	-	3	30	70	3	3
Practical/ Laboratory Course										
6	BS153CH	Chemistry Lab	-	-	3	3	25	50	3	1.5
7	ES155CS	Programming for Problem Solving Lab	-	-	4	4	25	50	3	2
8	ES157ME	Workshop/ Manufacturing Process	1	-	4	5	50	50	3	3
Total			**14**	**02**	**11**	**27**	**250**	**500**		**17.5**

BS: Basic Science **ES**: Engineering Science **MC**: Mandatory Course
L: Lecture **T**: Tutorial **P**: Practical **D**: Drawing
CIE: Continuous Internal Evaluation **SEE**: Semester End Examination (Univ. Exam)

PY: Philosophy **MT**: Mathematics **CH**: Chemistry
CE: Civil Engineering, **CS**: Computer Science and Engineering, **ME**: Mechanical Engineering.

Note:
1. Each contact hour is a Clock Hour.
2. The duration of the practical class is two hours, however it can be extended wherever necessary, to enable the student to complete the experiment.

Course Code	Course Title						Core/Elective
MC112CE	**Environmental Science (Common to All Branches)**						Mandatory Course
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**2**	**-**	**-**	**-**	**30**	**70**	**-**

Course Objectives

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

Course Outcomes

After completing this course, the 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 Reading:

1. A.K. De, *Environmental Chemistry,* Wiley Eastern Ltd.
2. E.P. Odum, *Fundamentals of Ecology,* W.B. Sunders Co., USA.
3. M.N. Rao and A.K. Datta, *Waste Water Treatment,* Oxford and IBK Publications.
4. Benny Joseph, *Environmental Studies,* Tata McGraw Hill, 2005.
5. V.K. Sharma, *Disaster Management,* National Centre for Disaster Management, IIPE,1999.

Course Code	Course Title						Core/Elective
MC113PY	**Essence of Indian Traditional Knowledge (Common to All Branches)**						Mandatory Course
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**2**	**-**	**-**	**-**	**30**	**70**	**-**

Course Objectives

The course will introduce the students to

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

Course Outcomes

After successful completion of the course the students 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 Reading:

1. Kapil Kapoor, "Text and Interpretation: The India Tradition",ISBN: 81246033375, 2005
2. "Science in Samskrit", Samskrita Bharti Publisher, ISBN 13: 978-8187276333, 2007
3. NCERT, "Position paper on Arts, Music, Dance and Theatre", ISBN 81-7450 494-X, 200

4. S. Narain, "Examinations in ancient India", Arya Book Depot, 1993
5. Satya Prakash, "Founders of Sciences in Ancient India", Vijay Kumar Publisher, 1989
6. M. Hiriyanna, "Essentials of Indian Philosophy", Motilal Banarsidass Publishers, ISBN 13: 978-8120810990, 2014

Course Code	Course Title						Core / Elective
BS102MT	**Mathematics - I (Common to All Branches)**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	3	1	-	-	**30**	**70**	4

Course Objectives

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

Course Outcomes

The students will able to

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

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*, Narosa Publications, 2014.
2. Erwin Kreyszig, *Advanced Engineering Mathematics*, John Wiley, 9th Edition, 2012.
3. B.S. Grewal, *Higher Engineering Mathematics*, Khanna Publications, 43rd Edition, 2014.
4. G.B. Thomas, Maurice Weir and Joel Hass, *Thomas' Calculus*, Peterson, 12th Edition,2010.
5. B.V. Ramana, Higher Engineering Mathematics, 23rd reprint, 2015.

Course Code	Course Title						Core / Elective
BS105CH	**Chemistry (Common to All Branches)**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	3	1	-	-	**30**	**70**	4

Course Objectives

- Correlate the properties of materials with their internal structure and use the for Engineering applications
- Apply the principals of electrochemistry in storage of electrical energy in batteries.
- Gains knowledge in causes of corrosion and its prevention.
- Attains knowledge about the disadvantages of hard water for domestic and industrial purposes. Also learns the techniques of softening of hard water and treatment of water for drinking purpose.
- Exposed to qualitative and quantitative parameters of chemical fuels.
- Aware eco-friendly materials and processes.

Course Outcomes

On successful completion of this course, students 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. Explain 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.
6. Relate the concept of green chemistry to modify engineering processes and materials.

UNIT-I

Electrochemistry and Battery Chemistry: 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.

Batteries: 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 and Corrosion: 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 (i) Addition (ii) Condensation (iii) 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 and Composites: Green Chemistry: Concept, Principles of green chemistry – Atom Economy, Catalysis. and examples of clean technology.

Biodiesel: Sources, Concept of Trans esterification 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. Principles of Physical Chemistry by Puri, Sharma and Pathania S.N. Chand & Co. New Delhi (Latest edition).
2. Engineering Chemistry by P C Jain and M Jain Dhanpat Rai & Sons (15th Edn), New Delhi.
3. Chemistry in Engineering and Technology by J C Kuriacose and J Rajaram, TMH, New Delhi.
4. Engineering Chemistry by O G Palanna, TMH, and New Delhi.
5. Engineering Chemistry by S S Dara, S Chand & Sons, New Delhi.
6. Engineering Chemistry by Sashi Chawla. Dhanpat Rai & Sons, New Delhi.
7. Engineering Chemistry by Shikha Agrawal, Cambridge, New Delhi.
8. Engineering Chemistry by Prasanta Rath, Cengage Learning India Pvt. Ltd.

Course Code	Course Title						Core / Elective
ES107CS	**Programming for Problem Solving (Common to All Branches)**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	3	-	-	-	**30**	**70**	3

Course Objectives

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

Course Outcomes

The students will able to

1. Formulate simple algorithms for arithmetic and logical problems.
2. Translate the algorithms to programs (in c language).
3. Test and execute the programs and correct syntax and logical errors.
4. Implement conditional branching, iteration and recursion.
5. Decompose a problem into functions and synthesize a complete program using divide and conquer approach.
6. Use arrays, pointers and structures to formulate algorithms and programs.
7. Apply programming to solve matrix addition and multiplication problems and searching and sorting problems.
8. Apply programming to solve simple numerical method problems, namely rot finding of function, differentiation of function and simple integration.

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, as a different way of solving problems. 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, Schism's Outline of Programming with C, McGraw-Hill
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
4. Brian W. Kernighan and Dennis M. Ritchie, the C Programming Language, Prentice Hall of India.

Course Code	Course Title						Core / Elective
BS 153 CH	**Chemistry Lab (Common to All Branches)**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	-	-	-	3	**25**	**50**	1.5

Course Objectives

- 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.
- Interpret the electro analytical principles with experimental results graphically
- Demonstrate writing skills through clear laboratory reports

Course Outcomes

On successful completion of this course, students 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

   Water Analysis:
5. Preparation of Standard Magnesium sulphate solution, standardization of EDTA and Estimation of Total Hardness.
6. Preparation of Standard Sodium Carbonate Solution, Standardization of HCl and Estimation of Carbonate and Bicarbonate Alkalinity.

   Conductometry:
7. Estimation of HCl
8. Estimation of CH_3COOH and mixture of acids

   Potentiometry
9. Estimation of HCl
10. Estimation of Iron
11. **pH Metry:**
12. Estimation of HCl
13. **Colorimetry:**
14. Verification of Beer-Lambert's law and estimation of Manganese.

    Chemical Kinetics:
15. Determination of rate constant of acid catalysed hydrolysis of methyl acetate.
16. **Drug Synthesis**

    Preparation of Aspirin

Note: Minimum ten experiments should be conducted in the semester

Suggested Readings:

1. Senior Practical Physical Chemistry, B.D. Khosla, A. Gulati and V. Garg (R. Chand & Co., Delhi)
2. An Introduction to Practical Chemistry, K. K. Sharma and D.S. Sharma (Vikas publishing, N. Delhi)

Course Code	Course Title						Core / Elective
ES 155 CS	**Programming for Problem Solving Lab (Common to All Branches)**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	-	-	-	4	**25**	**50**	2

Course Objectives

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

Course Outcomes

The students will 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.

Programming Exercise:

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, Schaum's Outline of Programming with C, McGraw-Hill
2. A.K. Sharma, Computer Fundamentals and Programming in C, Universities Press, 2018.
3. E. Balaguruswamy, Programming in ANSI C, Tata McGraw-Hill
4. Brian W. Kernighan and Dennis M. Ritchie, the C Programming Language, Prentice Hall of India.

Course Code	Course Title						Core / Elective
ES 157 ME	**Workshop/ Manufacturing Process (Common to All Branches)**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	1	-	-	4	**50**	**50**	3

Course Objectives

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

Course Outcomes

The students will 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, chiselling.
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

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.

Suggested Reading:

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.

Note: At least two exercises from each trade.

SCHEME OF INSTRUCTION & EXAMINATION
B.E. (All Branches) II - Semester
(Group B – CSE, CE, EEE, EIE)

S. No.	Course Code	Course Title	Scheme of Instructions				Scheme of Examination			Credits
			L	T	P/D	Contact Hours/Week	CIE	SEE	Duration in Hours	
Theory Course										
1	MC111PO	Indian Constitution	2	-	-	2	30	70	3	-
2	HS101EG	English	2	-	-	2	30	70	3	2
3	BS103MT	Mathematics-II	3	1	-	4	30	70	3	4
4	BS104PH	Physics	3	1	-	4	30	70	3	4
5	ES106EE	Basic Electrical Engineering	3	1	-	4	30	70	3	4
Practical/ Laboratory Course										
6	HS151EG	English Lab	-	-	2	2	25	50	3	1
7	BS152PH	Physics Lab	-	-	3	3	25	50	3	1.5
8	ES154EE	Basic Electrical Engineering Lab	-	-	2	2	25	50	3	1
9	ES156CE	Engineering Graphics & Design	1	-	4	5	50	50	3	3
		Total	**14**	**03**	**11**	**28**	**275**	**550**		**20.5**

HS: Humanities and Social Sciences **BS**: Basic Science **ES:** Engineering Science
MC: Mandatory Course

L: Lectures **T**: Tutorials **P**: Practical **D**: Drawing
CIE: Continuous Internal Evaluation **SEE:** Semester End Examination (Univ. Exam)

PO: Political Science EG: English **MT**: Mathematics **PH**: Physics
EE: Electrical Engineering **CE**: Civil Engineering

Note:

1. Each contact hour is a Clock Hour.
2. The students have to undergo a Summer Internship of Rural Agriculture Work Experience **(RAWE)** of one week duration after II-Semester and credits will be awarded in VII semester after evaluation.
3. Rural Agriculture Work Experience helps the students primarily to understand the rural situations, status of Agricultural Technologies adopted by farmers and village development plans and to develop skills & attitude of working with farm families for overall development in rural area.
4. The main objectives of RAWE component are:
   - To make the students familiar with socio-economic conditions of the farmers.
   - To develop communication skills in students using extension teaching methods in transfer of Technology.

Course Code	Course Title						Core/Elective
MC111PO	**Indian Constitution (Common to All Branches)**						Mandatory Course
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**2**	**-**	**-**	**-**	**30**	**70**	**-**

Course Objectives

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

Course Outcomes

After completing this course, the student will

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. D.D. Basu, Introduction to the constitution of India, Lexis Nexis, New Delhi
2. Subhash Kashyap, Our Parliament, National Book Trust, New Delhi
3. Peu Ghosh, Indian Government &Politics, Prentice Hall of India, New Delhi
4. B.Z. Fadia & Kuldeep Fadia, Indian Government &Politics, Lexis Nexis, New Delhi

Course Code	Course Title						Core / Elective
HS 101 EG	**English (Common to All Branches)**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	2	-	-	-	**30**	**70**	2

Course Objectives: To enhance the English language abilities of Engineering students, especially in reading and writing, by

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

Course Outcomes: On successful completion of the course, the 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.

Course Code	Course Title						Core / Elective
BS 103 MT	**Mathematics – II (Common to All Branches)**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	3	1	-	-	**30**	**70**	4

Course Objectives

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

Course Outcomes

The students will 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*, 23rd reprint, 2015.
5. N. Bali, M. Goyal, A text book of Engineering *Mathematics*, Laxmi publications,2010
6. H.K. Dass, Er. Rajnish Varma, *Higher Engineering Mathematics*, Schand Technical Third Edition.

Course Code	Course Title						Core / Elective
BS 104 PH	**Physics (Common to All Branches)**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	3	1	-	-	**30**	**70**	4

Course Objectives

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

Course Outcomes

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 Reading:

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, Engg. Physics, S. Chand & Co. 1st Edition, 1992.
4. C.M. Srivastava and C. Srinivasan – Science of Engg Materials, New Age International.
5. R.K Gaur and S.L Gupta- Engineering Physics, Dhanpathrai Publications, New edition.
6. Sanjay D Jain & Girish G Sahasrabudhe -Engineering Physics, University Press

Course Code	Course Title						Core / Elective
ES 106 EE	**Basic Electrical Engineering (Common to All Branches)**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	3	1	-	-	**30**	**70**	4

Course Objectives

- To provide an understanding of basics in Electrical circuits.
- To explain the working principles of Electrical Machines and single phase transformers.

Course Outcomes

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 & 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 Reading:

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 Elactrical Engineering” Tata McGraw Hill, Publications,2009
5. Hughes, "Electrical Technology", VII Edition, International Student -on, Addison Welsey Longman Inc., 1995.

Course Code	Course Title						Core / Elective
HS 151 EG	**English Lab (Common to All Branches)**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	-	-	-	2	**25**	**50**	1

Course Objectives

To enhance the listening and speaking skills of students by

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

Course Outcomes

On successful completion of the course, students 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. Balasubramanian, T. A Textbook of English Phonetics for Indian Students. Macmillan, 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.

Course Code	Course Title						Core / Elective
BS 152 PH	**Physics Lab (Common to All Branches)**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	-	-	-	3	**25**	**50**	1.5

Course Objectives

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

Course Outcomes

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 Reading:

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

Course Code	Course Title						Core / Elective
ES 154 EE	**Basic Electrical Engineering Lab (Common to All Branches)**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	-	-	-	2	**25**	**50**	1

Course Objectives

- To impart the practical knowledge on testing of DC and AC Machines and the usage of common electrical measuring instruments

Course Outcomes

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.

Suggested List of Laboratory Experiments/Demonstrations:

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

(ii) Procurement of Demonstration 2 equipments can be done during the course work of that semester. It can be included in the laboratory.

Note - 2:

(i) Experiments 9, 10 and Demonstration 3 can be incorporated in the Lab syllabus if the topics concerned to the above experiments are considered in new BEE syllabus.

Suggested Reading:

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 Elactrical Engineering” Tata McGraw Hill, Publications,2009
4. Hughes, "Electrical Technology", VII Edition, International Student -on, Addison Welsey Longman Inc., 1995.

Course Code	Course Title						Core / Elective
ES 156 CE	**Engineering Graphics & Design (Common to All Branches)**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	1	-	4	-	**50**	**50**	3

Course Objectives

- 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
- To prepare you to communicate effectively
- To prepare you to use the techniques, skills, and modern engineering tools necessary for engineering practice.

Course Outcomes

The students will 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

Sheet No	Description of the Topic	Contact Hours	
		Lecture	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 base 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** Projections of points situated in different quadrants.	1	2
9	**Projections of straight lines – I** Line parallel to both the reference planes, line perpendicular or inclined to one reference plane.	1	2
10	**Projections of straight lines – II** Line inclined 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** Polyhedra and solids of revolution, Projections of solids in simple position.	1	2
14	**Projection of solids – II** Projections of solids when the axes inclined to one or both the reference planes.	1	2 + 2
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 – II** Intersection of cylinder and cone		2
21	**Isometric projection – I** planes and simple solids	1	2
22	**Isometric projection – II** 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 Text:

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

FACULTY OF ENGINEERING

Scheme of Instruction & Examination

(AICTE Model Curriculum for the Academic Year 2020-2021)

and

Syllabi

B.E. III and IV Semester

of

Four Year Degree Programme

in

Computer Engineering

(With effect from the academic year 2020–2021)
(As approved in the faculty meeting held on **-**-2020)

Issued by

Dean, Faculty of Engineering

Osmania University, Hyderabad – 500 007

2020

SCHEME OF INSTRUCTION & EXAMINATION
B.E. (Computer Engineering) III – SEMESTER

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	HS204ME	Operations Research	3	-	-	3	30	70	3	3
2	BS206BZ	Biology for Engineers	3	-	-	3	30	70	3	3
3	BS205MT	Mathematical foundations for Data Science (Probability & Statistics)	3	-	-	3	30	70	3	3
4	ES214EC	Basic Electronics Engineering	3	-	-	3	30	70	3	3
5	ES216CM	Logic and Switching Theory	3	-	-	3	30	70	3	3
6	PC221CM	Data Structures	3	-	-	3	30	70	3	3
7	PC222CM	Discrete Structure & Mathematical Logic	3	-	-	3	30	70	3	3
Practical/ Laboratory Courses										
8	ES251EC	Basic Electronics Engineering Lab	-	-	2	2	25	50	3	1
9	PC252CM	Data Structures Lab	-	-	2	2	25	50	3	1
10	PC253CM	IT Workshop Lab	-	-	2	2	25	50	3	1
			21	**-**	**06**	**27**	**285**	**640**		**24**

HS: Humanities and Social Sciences BS: Basic Science ES: Engineering Science
MC: Mandatory Course PC: Professional Core
L: Lecture T: Tutorial P: Practical D: Drawing
CIE: Continuous Internal Evaluation SEE: Semester End Evaluation (Univ. Exam)
PY: Philosophy, BZ: Biology/ Life Sciences, CE: Civil Engineering, CS: Computer Science and Engineering
EC: Electronics and Communication Engineering, ME: Mechanical Engineering.

Note:

1. Each contact hour is a clock hour.

2. The duration of the practical class is two hours, however it can be extended wherever necessary, to enable the student to complete the experiment.

Course Code	Course Title						Core/Elective
HS204ME	**Operations Research**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**3**	**-**	**-**	**-**	**30**	**70**	**3**

Course Objectives

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

Course Outcomes

After completing this course, the 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
5. Prepare the students to have the knowledge of Sequencing model at the end student would able to develop optimum model for job scheduling.
6. Prepare students to understand Queuing theory concepts and various optimization techniques at the end students would able to develop models for waiting line cases.

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 - Poisson 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. 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.
6. Data Reconciliation by Prof. Shanker Narasimha

Course Code	Course Title						Core/Elective
BS206BZ	**Biology for Engineers**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**3**	**-**	**-**	**-**	**30**	**70**	**3**

Course Objectives

Gain vivid knowledge in the fundamentals and uses of biology, human system and plant system.

Course Outcomes

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

1. Apply biological engineering principles, procedures needed to solve real-world problems.
2. Understand the fundamentals of living things, their classification, cell structure and biochemical constituents.
3. Apply the concept of plant, animal and microbial systems and growth in real life situations.
4. Comprehend genetics and the immune system.
5. Know the cause, symptoms, diagnosis and treatment of common diseases.
6. Apply basic knowledge of the applications of biological systems in relevant industries.

UNIT-I

Introduction to Life: Characteristics of living organisms, Basic classification, cell theory, structure of prokaryotic and eukaryotic cell, Introduction to Biomolecules: definition, general classification and important functions of carbohydrates, lipids, proteins, vitamins and enzymes.

UNIT-II

Biodiversity: Plant System: basic concepts of plant growth, nutrition, photosynthesis and nitrogen fixation. Animal System: Elementary study of digestive, respiratory, circulatory, excretory systems and their functions. Microbial System: History, types of microbes, economic importance and control of microbes.

UNIT-III

Genetics and Evolution: Theories of evolution and Evidences; cell division–mitosis and meiosis; evidence of laws of inheritance; variation and speciation; nucleic acids as a genetic material; central dogma; Mendel laws, gene and chromosomes.

UNIT-IV

Human Diseases: Definition, causes, symptoms, diagnosis, treatment and prevention of diabetes, cancer, hypertension, influenza, AIDS and Hepatitis. Immunity immunization, antigen – antibody immune response

UNIT-V

Biology and its Industrial Applications: Transgenic plants and animals, stem cell and tissue engineering, bioreactors, bio pharming, recombinant vaccines, cloning, drug discovery, biological neural networks, bioremediation, biofertilizer, biocontrol, biofilters, biosensors, biopolymers, bioenergy, biomaterials, biochips, basic biomedical instrumentation.

Suggested Readings:

1. A Text book of Biotechnology, R.C.Dubey, S. Chand Higher Academic Publications, 2013
2. Diseases of the Human Body, Carol D. Tamparo and Marcia A. Lewis, F.A. Davis Company, 2011.
3. Biomedical instrumentation, Technology and applications, R. Khandpur, McGraw Hill Professional, 2004
4. Biology for Engineers, Arthur T. Johnson, CRC Press, Taylor and Francis, 2011
5. Cell Biology and Genetics (Biology: The unity and diversity of life Volume I), Cecie Starr, Ralph Taggart, Christine Evers and Lisa Starr, Cengage Learning, 2008
6. Biotechnology Expanding horizon, B.D. Singh, Kalyani Publishers, 2012.

Course Code	Course Title						Core/Elective
BS205MT	**Mathematical Foundations for Data Science (Probability & Statistics)**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**3**	**-**	**-**	**-**	**30**	**70**	**3**

Course Objectives

- To introduce the solution methodologies for second order Partial Differential Equations with applications in engineering
- To provide an overview of probability and statistics to engineers

Course Outcomes

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

1. Solve field problems in engineering involving PDEs.
2. They can also formulate and solve problems involving random variables and apply statistical methods for analysing experimental data.

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, Exponential 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.

Suggested Readings:

1. R.K.Jain & Iyengar, "Advanced Engineering Mathematics", Narosa Publications.
2. B.S. Grewal, "Higher Engineering Mathematics", Khanna Publishers, 2000.
3. P.Sivaramakrishna Das & C.Vijaya Kumar, "Engineering Mathematics" , Pearson India Education Services Pvt. Ltd.
4. N.P. Bali & M. Goyal, "A Text Book of Engineering Mathematics", Laxmi Publications, 2010.
5. S.C.Gupta & V.K.Kapoor, "Fundamentals of Mathematical Statistics" , S.Chand Pub.
6. P. G. Hoel, S. C. Port & 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.

Course Code	Course Title						Core/Elective
ES214EC	**Basic Electronics Engineering**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**3**	**-**	**-**	**-**	**30**	**70**	**3**

Course Objectives

The objectives of this course is to impart knowledge

- To analyze the behavior of semiconductor diodes in Forward and Reverse bias.
- To design of Half wave and Full wave rectifiers with L,C, LC & CLC Filters.
- To explore V-I characteristics of Bipolar Junction Transistor in CB, CE & CC configurations.
- To explain feedback concept and different oscillators.
- To analyze Digital logic basics and Photo Electric devices.

Course Outcomes

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

1. Able to learn about forward biased and reversed biased circuits.
2. Able to plot the V-I Characteristics of diode and transmission.
3. Able to design combinational logic circuits and PLDs.

UNIT-I

Semi-Conductor Theory: Energy Levels, Intrinsic and Extrinsic Semiconductors, Mobility, Diffusion and Drift current. Hall Effect, Characteristics of P-N Junction diode, Parameters and Applications.

Rectifiers: Half wave and Full wave Rectifiers (Bridge, center tapped) with and without filters, ripple regulation and efficiency. Zener diode regulator.

UNIT-II

Bipolar Junction Transistor: BJT, Current components, CE, CB, CC configurations, characteristics, Transistor as amplifier. Analysis of CE, CB, CC Amplifiers (qualitative treatment only) . JFET: Construction and working, parameters, CS, CG, CD Characteristics, CS amplifier.

UNIT-III

Feedback Concepts – Properties of Negative Feedback Amplifiers, Classification, Parameters. Oscillators – Barkhausen Criterion, LC Type and RC Type Oscillators and Crystal Oscillators. (Qualitative treatment only).

UNIT-IV

Operational Amplifiers – Introduction to OP Amp, characteristics and applications –Inverting and Non-inverting Amplifiers, Summer, Integrator, Differentiator, Instrumentation Amplifier. Digital Systems: Basic Logic Gates, half, Full Adder and Subtractors.

UNIT-V

Data Acquisition Systems: Study of transducer (LVDT, Strain gauge, Temperature, and Force). Photo Electric Devices and Industrial Devices: Photo diode, Photo Transistor, LED, LCD, SCR, UJT Construction and Characteristics only.

Display Systems: Constructional details of C.R.O and Applications.

Suggested Readings:

1. Jocob Millman, Christos C. Halkias and Satyabrata Jit,Electronics Devices and Circuits, 3rd Edition, McGraw Hill Education (India) Private Limited, 2010.
2. Rama Kanth A. Gaykward,Op-AMPS and Linear Integrated Circuit, 4th Edition PrenticeHall of India, 2000.
3. M. Morris Mano,Digital Design, 3rd Edition, Prentice Hall of India, 2002.
4.William D Cooper, and A.D. Helfrick, Electronic Measurements and Instrumentations Techniques, 2nd Edition, Prentice Hall of India, 2008.
5. S. Shalivahan, N. Suresh Kumar, A. Vallava Raj,Electronic Devices and Circuits, 2nd Edition., McGraw Hill Education (India) Private Limited, 2007.

Course Code	Course Title						Core/Elective
ES216EC	**Logic and Switching Theory**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**3**	**-**	**-**	**-**	**30**	**70**	**3**

Course Objectives:

- To introduce concepts of Boolean logic, Postulates and Boolean Theorems.
- To understand the use of logic minimization methods and to solve the Boolean logic expressions
- To understand how to design the combinational and sequential circuits. • To introduce and realize the adder circuits
- To understand the state reduction methods for sequential circuits.

Course Outcomes:

Students will be

- Able to apply the concepts of Boolean logic, Postulates and Boolean Theorems to solve the Boolean expressions.
- Able to solve the Complex Boolean logic expressions using Minimization methods.
- Able to design the combinational, sequential circuits and Various adder circuits.
- Able to apply state reduction methods to solve sequential circuits.

UNIT-I

Boolean Algebra: Axiomatic definition of Boolean Algebra Operators, Postulates and Theorems, Boolean Functions, Canonical Forms and Standard Forms, Simplification of Boolean Functions Using Theorems and Karnaugh Map Method.

UNIT-II

Minimization of Switching Functions: Quine-McCluskey Tabular Method, Determination of Prime Implicants and Essential Prime Implicants. Combinational Logic Design: Single-Output and Multiple-Output

Combinational Circuit Design: AND-OR, OR-AND and NAND/NOR Realizations, Exclusive-OR and Equivalence functions.

UNIT–III

Design of Combinational Logic Circuits: Gate Level design of Small Scale Integration (SSI) circuits, Modular Combinational Logic Elements- Decoders, Encoders, Priority encoders, Multiplexers and De-multiplexers.

Design of Integer Arithmetic Circuits using Combinational Logic: Integer Adders – Binary Adders, Subtractors, Ripple Carry Adder and Carry Look Ahead Adder, and Carry Save Adders.

UNIT-IV

Design of Combinational Circuits using Programmable Logic Devices (PLDs): Programmable Read Only Memories (PROMs), Programmable Logic Arrays (PLAs), Programmable Array Logic (PAL) devices.

Introduction to Sequential Circuit Elements: Latch, Various types of Flip-Flops and their Excitation Tables.

UNIT -V

Models of Sequential Circuits: Moore Machine and Mealy Machine, Analysis of Sequential Circuits-State Table and State Transition Diagrams. Design of Sequential Circuits-Counters. Moore and Mealy State Graphs for Sequence Detection, Methods for Reduction of State Tables and State Assignments.

Suggested Reading:

1. M Morris Mano and Michael D Ciletti, Digital Design, Prentice Hall of India, Fourth Edition, 2008.
2. Zvi Kohavi, Switching and Finite Automata Theory, Tata McGraw Hill, 2nd Edition, 1979.
3. R. P Jain, Modern Digital Electronics,4th ed., McGraw Hill Education (India) Private Limited, 2003.
4. Ronald J.Tocci, Neal S. Widmer &Gregory L.Moss, "Digital Systems: Principles and Applications," PHI, 10/e, 2009.
5. Samir Palnitkar, "Verilog HDL A Guide to Digital Design and Synthesis," 2nd Edition, Pearson Education, 2006.

Course Code	Course Title						Core/Elective
PC221CM	**Data Structures**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**3**	**-**	**-**	**-**	**30**	**70**	**3**

Course Objectives

- To teach the importance of structuring the data for easy access and storage.
- To teach the implementation of various data structures.
- To acquire skills in using generic principles for data representation and manipulation with a view for efficiency, maintainability and code reuse.
- To introduce the basic concepts of advanced data structures.

Course 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. Develop applications using Linear and Non-linear data structures.
5. Apply the suitable data structure for a real world problem and think critically for improvement in solutions.
6. 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, Complexity Analysis Examples.

Stacks and Queues: ADT Stack and its operations: Algorithms and their complexity analysis,

Applications of Stacks: Expression Conversion and evaluation –corresponding algorithms and complexity analysis.

Queue ADT and its operations: Linear Queue, Circular Queue, Algorithms and their analysis.

UNIT-II

Linked Lists: Singly linked lists: Representation in memory, Algorithms of several operations: Traversing, Searching, Insertion into, Deletion from linked list; Linked representation of Stack and Queue, Header nodes,

Doubly linked list: Operations on it and algorithmic analysis; Circular Linked Lists, Doubly Linked Lists, Applications (Polynomial Arithmetic).

Arrays and Matrices: Row And Column Major Representations, Sparse Matrices. Hashing: Hash Table Representation, Application- Text Compression.

UNIT- III

Trees: Definitions and Properties, Representation of Binary Trees, Operations, Binary Tree Traversal. Binary

Search Trees: Definitions, Operations on Binary Search Trees.

Balanced Search Trees: AVL Trees, Red Black Trees and B-Trees, Tree operations on each of the trees and their algorithms.

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 Searching: Objective and properties of different sorting algorithms: Selection Sort, Bubble Sort, Insertion Sort, Quick Sort, Merge Sort, Heap Sort, Linear and Binary Search algorithms.

Suggested Readings:

1. "Fundamentals of Data Structures in C++", Illustrated Edition by Ellis Horowitz, Sartaj Sahni, Dinesh Mehta, 2nd Edition, Universities Press.
2. Algorithms, Data Structures, and Problem Solving with C++", Illustrated Edition by Mark Allen Weiss, 3rd Edition, Pearson India.
3. "Fundamentals of Data Structures", Illustrated Edition by Ellis Horowitz, Sartaj Sahni, Computer Science Press.
4. "How to Solve it by Computer", 2nd Impression by R.G. Dromey, Pearson Education.
5. Michael T. Goodrich, Roberto Tamassia, David M. Mount, Data Structures and Algorithms in C++, John Wiley & Sons, 2010.

Course Code	Course Title						Core/Elective
PC222CM	**Discrete Structures & Mathematical logic**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**3**	**-**	**-**	**-**	**30**	**70**	**3**

Course Objectives

- To Learn mathematical concepts, terminology and notation as applied in computer science for solving logical problems.
- To Construct correct direct and indirect proofs.
- To Use division into cases in a proof.
- To Use counterexamples.
- Apply logical reasoning to solve a variety of problems
- To model relationships, analyse data, apply probability concepts and use functions to solve problems.
- To develop the mathematical skills needed for advanced quantitative courses.

Course Outcomes

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

1. For a given logic sentence express it in terms of predicates, quantifiers, and logical connectives
2. For a given a problem, derive the solution using deductive logic and prove the solution based on logical inference.
3. For a given a mathematical problem, classify its algebraic structure.
4. Evaluate Boolean functions and simplify expressions using the properties of Boolean algebra.
5. Develop the given problem as graph networks and solve with techniques of graph theory.

UNIT -I

Sets, Relation and Function: Operations and Laws of Sets, Cartesian Products, Binary Relation, Partial Ordering Relation, Equivalence Relation, Image of a Set, Sum and Product of Functions, Bijective functions, Inverse and Composite Function, Size of a Set, Finite and infinite Sets, Countable and uncountable Sets, Cantor's diagonal argument and The Power Set theorem, Schroeder-Bernstein theorem. **Principles of Mathematical Induction:** The Well-Ordering Principle, Recursive definition, The Division algorithm: Prime Numbers, The Greatest Common Divisor: Euclidean Algorithm, The Fundamental Theorem of Arithmetic.

UNIT-II

Basic counting techniques-inclusion and exclusion, pigeon-hole principle, permutation and combination.

UNIT-III

Propositional Logic: Syntax, Semantics, Validity and Satisfiability, Basic Connectives and Truth Tables, Logical Equivalence: The Laws of Logic, Logical Implication, Rules of Inference, The use of Quantifiers. **Proof Techniques:** Some Terminology, Proof Methods and Strategies, Forward Proof, Proof by Contradiction, Proof by Contraposition, Proof of Necessity and Sufficiency.

UNIT-IV

Algebraic Structures and Morphism: Algebraic Structures with one Binary Operation, Semi Groups, Monoids, Groups, Congruence Relation and Quotient Structures, Free and Cyclic Monoids and Groups, Permutation Groups, Substructures, Normal Subgroups, Algebraic Structures with two Binary Operation,

Rings, Integral Domain and Fields. Boolean Algebra and Boolean Ring, Identities of Boolean Algebra, Duality, Representation of Boolean Function, Disjunctive and Conjunctive Normal Form

UNIT–V

Graphs and Trees: Graphs and their properties, Degree, Connectivity, Path, Cycle, Sub Graph, Isomorphism, Eulerian and Hamiltonian Walks, Graph Colouring, Colouring maps and Planar Graphs, Colouring Vertices, Colouring Edges, List Colouring, Perfect Graph, definition properties and Example, rooted trees, trees and sorting, weighted trees and prefix codes, Bi-connected component and Articulation Points, Shortest distances.

Suggested books :

1. Kenneth H. Rosen, Discrete Mathematics and its Applications, Tata McGraw – Hill.

2. Susanna S. Epp, Discrete Mathematics with Applications,4th edition, Wadsworth Publishing Co. Inc.

3. C L Liu and D P Mohapatra, Elements of Discrete Mathematics A Computer Oriented Approach, 3rd Edition by, Tata McGraw – Hill.

Suggested reference books:

1. J.P. Tremblay and R. Manohar, Discrete Mathematical Structure and It's Application to Computer Science", TMG Edition, TataMcgraw-Hill

2. Norman L. Biggs, Discrete Mathematics, 2nd Edition, Oxford University Press. Schaum's Outlines Series, Seymour Lipschutz, Marc Lipson,

3. Discrete Mathematics, Tata McGraw - Hill

Course Code	Course Title						Core/Elective
ES251EC	**Basic Electronics Engineering Lab**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	-	-	-	**2**	**25**	**50**	**1**

Course Objectives

- To understand the characteristics of diodes and transistor configurations
- To understand the design concepts of biasing of BJT and FET
- To understand the design concepts of feedback amplifiers and oscillators
- To study the design concepts of OP Amp and data converters

Course Outcomes

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

1. Ability to design diode circuits & understand the application of Zener diode.
2. Ability to analyse characteristics of BJTs & FETs.
3. Ability to understand the different oscillator circuits.
4. Ability to understand operation of HWR & FWR circuits with & without filters.
5. Ability tom design Analog-to-Digital converters & Digital-to-Analog converters.

List of Experiments:

1. CRO-Applications, Measurements of R, L and C using LCR meter, Colour code method and soldering practice.
2. Characteristics of Semiconductors diode (Ge,Si and Zener)
3. Static Characteristics of BJT-Common Emitter
4. Static Characteristics of BJT-Common Base
5. Static Characteristics of FET
6. RC-Phase Shift Oscillator
7. Hartley and Colpitts Oscillators
8. Common Emitter Amplifier
9. Astable Multivibrator
10. Full-wave rectifier with and without filters using BJT
11. Operational Amplifier Applications
12. Strain Gauge Measurement
13. Analog-to-Digital and Digital to Analog Converters

Suggested Readings:

1. Maheshwari and Anand, *Laboratory Experiments and PSPICE Simulations in Analog Electronics,* 1st edition, Prentice Hall of India, 2006.
2. David Bell A., *Laboratory Manual for Electronic Devices and Circuits,* Prentice Hall of India, 2001.

Course Code	Course Title						Core/Elective
PC252CM	**Data Structures Lab**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	-	-	-	**2**	**25**	**50**	**1**

Course Objectives

- Design and construct simple programs by using the concepts of structures as abstract data type.
- To have a broad idea about how to use pointers in the implement of data structures.
- To enhance programming skills while improving their practical knowledge in data structures.
- To strengthen the practical ability to apply suitable data structure for real time applications.

Course Outcomes

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

1. Implement the abstract data type and reusability of a particular data structure.
2. Implement linear data structures such as stacks, queues using array and linked list.
3. Understand and implements non-linear data structures such as trees, graphs.
4. Implement various kinds of searching, sorting and traversal techniques and know when to choose which technique.
5. Understanding and implementing hashing techniques.
6. Decide a suitable data structure and algorithm to solve a real world problem.

1. Implementation of Stacks, Queues (using both arrays and linked lists).
2. Implementation of circular queue using arrays.
3. Implementation of double ended queue (de queue) using arrays.
4. Implement a program to evaluate a given postfix expression using stacks.
5. Implement a program to convert a given infix expression to postfix form using stacks.
6. Implement the following operations on singly linked list:
   i) Creation ii) Insertion iii) Deletion iv) Traversal
7. Implementation of Polynomial arithmetic using linked list.
8. Implement the following operations on doubly linked list:
   i) Creation ii) Insertion iii) Deletion iv) Traversal
9. Implement the following operations on circular linked list:
   i) Creation ii) Insertion iii) Deletion iv) Traversal
10. Implementation of recursive and iterative traversals on binary tree.
11. Implementation of operations on binary tree (delete entire tree, copy entire tree, mirror image, level order, search for a node etc.)
12. Implementation of the following operations on binary search tree (BST):
    (a) Minimum key (b) Maximum key (c) Search for a given key (d) Delete a node with given key
13. Implement the following operations on AVL search tree:
    i) Insertion ii) Deletion
14. Implement the following operations on B-Trees:
    i) Creation ii) Insertion iii) Deletion iv) Traversal
15. Implementation of graph traversals by applying: (a) BFS (b) DFS
16. Implement the following algorithms to find out a minimum spanning tree of a simple connected undirected graph: (a) Prim's algorithm (b) Kruskal's algorithm
17. Implement Dijkstra's algorithm for solving single source shortest path problem.
18. Implementation of recursive and non recursive functions to perform the following searching operations for a key value in a given list of integers: i) Linear search ii) Binary search
19. Implement the following sorting algorithms:
    a) Bubble sort b) Selection sort c) Insertion sort (d) Merge sort (e) Quick sort (f) Heap sort
20. Implementation of hashing with (a) Separate Chaining and (b) Open addressing methods.

Course Code	Course Title						Core/Elective
PC253CM	**IT Workshop Lab**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**-**	**-**	**-**	**2**	**25**	**50**	**1**

Course Objectives

- Introducing a new object oriented programming
- Enabling students to learn Big Data, Machine Learning etc.
- Preparing students to cope up with new Market tendencies
- To learn programs in MATLAB environment
- To handle Functions, Polynomials by using MATLAB commands
- Ability to solve any Mathematical functions
- To learn Mathematical Modelling in a new approach
- To plot Graphics (2-D) easily and effectively

Course Outcomes

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

1. Implement basic syntax in python.
2. Analyse and implement different kinds of OOP concept in real world problems.
3. Implement MATLAB operations and graphic functions.

SECTION 1 : MAT LAB / SCILAB PROGRAMS

1. Introduction to MATLAB/SCIlab Environment. MATLAB Menus, Toolbars, Computing with MATLAB, Script Files and the Editor/Debugger, MATLAB help System.

2. MATLAB controls: Relational Logical Variables. Conditional Statements: if – else – elseif, switch. Loops: for – while – break, continue. User-Defined Functions.

3. Arrays, Matrices and Matrix Operations Debugging MATLAB Programs. Working with Data Files, and Graphing Functions: XY Plots – Sub-plots.

4.To solve linear equation

5. Solution of Linear equations for Underdetermined and Over determined cases.

6. Determination of Eigen values and Eigen vectors of a Square matrix.

7. Solution of Difference Equations.

8. Solution of Difference Equations using Euler Method.

9. Solution of differential equation using 4th order Runge- Kutta method.

10. Determination of roots of a polynomial.

11.Determination of polynomial using method of Least Square Curve Fitting.

12.Determination of polynomial fit, analyzing residuals, exponential fit and error bounds from the given data.

13.Determination of time response of an R-L-C circuit

SECTION 2 : Python Programs

1 Introduction to Python Programming:

A. Running instructions in Interactive interpreter and a Python Script.
B. Write a program to purposefully raise Indentation Error and Correct it
C. Write a program to compute distance between two points taking input from the user
D. Write a program add.py that takes 2 numbers as command line arguments and prints its sum.
E. Program to display the following information: Your name, Full Address, Mobile Number, College Name, Course Subjects
F. Write a Program for checking whether the given number is a even number or not.

2 Control Structures, Lists

A. Program to find the largest three integers using if-else
B. Program that receives a series of positive numbers and display the numbers in order and their sum
C. Program to find the product of two matrices and
D. Program to display two random numbers that are to be added, the program should allow the student to enter the answer.
E. If the answer is correct, a message of congratulations should be displayed.
F. If the answer is incorrect, the correct answer should be displayed.
G. Using a for loop, write a program that prints out the decimal equivalents of 1/2, 1/3, 1/4, . 1/10.
H. Write a program using a while loop that asks the user for a number, and prints a countdown from that number to zero.

3 Functions and Recursion

A. Write recursive and non-recursive functions for the following
B. To find GCD of two integers
C. To find the factorial of positive integer
D. To print Fibonacci Sequence up to given number n
E. To display prime number from 2 to n.
F. Function that accepts two arguments: a list and a number n. It displays all of the numbers in the list that are greater than n
G. Functions that accept a string as an argument and return the number of vowels and consonants that the string contains

4 Files, Exceptions, Lists, Sets, Random Numbers

A. Program to write a series of random numbers in a file from 1 to n and display.
B. Program to write the content in a file and display it with a line number followed by a colon
C. Program to display a list of all unique words in a text file
D. Program to analyse the two text files using set operations
E. Write a program to print each line of a file in reverse order.
F. Write a program to count frequency of characters in a given file. Can you use character frequency to tell whether the given file is a Python program file, C program file or a text file?
G. Write a program combine lists that combines these lists into a dictionary.

5 Object Oriented Programming

A. Program to implement the inheritance
B. Program to implement the polymorphism

6 GUI Programming

A. Program that converts temperature from Celsius to Fahrenheit
B. Program that displays your details when a button is clicked
C. Write a GUI for an Expression Calculator using tk

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. Allen B Downey," Think Python", O'Reilly, 2012.
6. Stormy Attaway, "MATLAB: A Practical Introduction to Programming and Problem Solving".3rd Edition.

SCHEME OF INSTRUCTION & EXAMINATION
B.E. (Computer Engineering) IV – SEMESTER

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	HS201EG	Effective Technical Communication in English	3	-	-	3	30	70	3	3
2	HS202MC	Finance and Accounting	3	-	-	3	30	70	3	3
3	PC231CM	OOP using JAVA	3	-	-	3	30	70	3	3
4	PC234CM	Operating System Concepts	3	-	-	3	30	70	3	3
5	PC233CM	Database Management Systems	3	1	-	4	30	70	4	3.5
6	PC232CM	Computer Organization & Microprocessor	3	-	-	3	30	70	3	3
Practical/ Laboratory Courses										
7	PC261CM	Computer Organization & Microporcessor Lab	-	-	3	3	25	50	3	1.5
8	PC262CM	OOP using JAVA Lab	-	-	2	2	25	50	2	1
9	PC263CM	Database Management Systems Lab	-	-	2	2	25	50	2	1
10	PC264CM	Operating System Concepts Lab	-	-	2	2	25	50	2	1
			18	**1**	**09**	**28**	**280**	**620**		**23**

HS: Humanities and Social Sciences BS: Basic Science ES: Engineering Science
MC: Mandatory Course PC: Professional Core
L: Lecture T: Tutorial P: Practical D: Drawing
CIE: Continuous Internal Evaluation SEE: Semester End Evaluation (Univ. Exam)
PO: Political Science, EG: English, CM: Commerce, MT: Mathematics,
CS: Computer Science and Engineering, EC: Electronics and Communication Engineering,

Note:

1. Each contact hour is a clock hour
2. The duration of the practical class is two hours, however it can be extended wherever necessary, to enable the student to complete the experiment.
3. The students have to undergo a Summer Internship of two-week duration after IV – Semester and credits will be awarded in V – Semester after evaluation.

Course Code	Course Title						Core/Elective
HS201EG	**Effective Technical Communication in English**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**3**	**-**	**-**	**-**	**30**	**70**	**3**

Course Objectives

To expose the students to:

- Features of technical communication
- Types of professional correspondence
- Techniques of report writing
- Basics of manual writing
- Aspects of data transfer and presentations.

Course 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
5. 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 ed.). New Delhi, OUP.
2. Rizvi, Ashraf, M. (2017). *Effective Technical Communication* (2nd ed.). New Delhi, Tata McGraw Hill Education.
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.

Course Code	Course Title						Core/Elective
HS202MC	**Finance and Accounting**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**3**	**-**	**-**	**-**	**30**	**70**	**3**

Course Objectives

The course will introduce the students

- To provide basic understanding of Financial and Accounting aspects of a business unit
- To provide understanding of the accounting aspects of business
- To provide understanding of financial statements
- To provide the understanding of financial system
- To provide inputs necessary to evaluate the viability of projects
- To provide the skills necessary to analyse the financial statements

Course 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 of finances.
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, Pearson Education
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.

Course Code	Course Title						Core/Elective
PC231CM	**OOP using JAVA**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**3**	**-**	**-**	**-**	**30**	**70**	**3**

Course Objectives

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

Course 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 in java.
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-line 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, Scanner

Java 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.

Suggested Reference Readings:

1. Understanding OOP with Java, up dated edition, T. Budd, Pearson education.
2. Head First Java, 2nd Edition by Bert Bates, Kathy Sierra Publisher: O'Reilly Media, Inc.
3. An Introduction to programming and OO design using Java, J. Nino and F.A. Hosch, John Wiley & sons.
4. An Introduction to OOP, second edition, T. Budd, Pearson Education.
5. Introduction to Java programming 6th edition, Y. Daniel Liang, Pearson Education.
6. An introduction to Java programming and object oriented application development, R. A. Johnson-Thomas.

Course Code	Course Title						Core/Elective
PC232CM	**Computer Organization & Microprocessor**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**3**	**-**	**-**	**-**	**30**	**70**	**3**

Course Objectives

- To understand basic components of computers.
- To explore the I/O organizations in depth.
- To explore the memory organization.
- To understand the basic chip design and organization of 8086 with assembly language.

Course Outcomes: Students will be able to

1. After this course students understand in a better way the I/O and memory organization in depth.
2. Ability to understand the merits and pitfalls in computer performance measurements.
3. Identify the basic elements and functions of 8086 microprocessors.
4. Understand the instruction set of 8086 and use them to write assembly language programs.
5. Demonstrate fundamental understanding on the operation between the microprocessor and its interfacing devices.

UNIT-I

Basic Computer Organization: Functions of CPU, I/O Units, Memory: Instruction: Instruction FormatsOne address, two addresses, zero addresses and three addresses and comparison; addressing modes with numeric examples: Program Control- Status bit conditions, conditional branch instructions, Program Interrupts: Types of Interrupts.

UNIT-II

Input-Output Organizations: I/O Interface, I/O Bus and Interface modules: I/O Vs Memory Bus, Isolated Vs Memory-Mapped I/O, Asynchronous data Transfer- Strobe Control, Hand Shaking: Asynchronous Serial transfer- Asynchronous Communication interface, Modes of transfer Programmed I/O, Interrupt Initiated I/O, DMA; DMA Controller, DMA Transfer, IOP-CPU-IOP Communication, Intel 8089 IOP.

UNIT-III

Memory Organizations: Memory hierarchy, Main Memory, RAM, ROM Chips, Memory Address Map, Memory Connection to CPU, associate memory, Cache Memory, Data Cache, Instruction cache, Miss and Hit ratio, Access time, associative, set associative, mapping, waiting into cache, Introduction to virtual memory.

UNIT-IV

8086 CPU Pin Diagram: Special functions of general purpose registers, Segment register, concept of pipelining, 8086 Flag register, Addressing modes of 8086.

UNIT-V

8086-Instruction formats: assembly Language Programs involving branch & Call instructions, sorting, evaluation of arithmetic expressions.

Suggested Readings:

1. Computer system Architecture: Morris Mano (UNIT-1,2,3).

2. Advanced Micro Processor and Peripherals- Hall/ A K Ray(UNIT-4,5).

3. Computer Organization and Architecture – William Stallings Sixth Edition, Pearson/PHI.

4. Structured Computer Organization – Andrew S. Tanenbaum, 4th Edition PHI/Pearson.

5. Fundamentals or Computer Organization and Design, - Sivaraama Dandamudi Springer Int. Edition.

6. Computer Architecture a quantitative approach, John L. Hennessy and David A. Patterson, Fourth Edition Elsevier.

7. Computer Architecture: Fundamentals and principles of Computer Design, Joseph D. Dumas II, BS Publication.

Course Code	Course Title						Core/Elective
PC234CM	**Operating System Concepts**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**3**	**-**	**-**	**-**	**30**	**70**	**3**

Course Objectives:

- To introduce the concepts of OS structure and process synchronization.
- To study different memory management strategies.
- To familiarize the implementation of file system.
- To understand the principles of system security and protection.
- To discuss the design principles and structure of Windows 7 and Linux

Course Outcomes : Student will be able to

1. Evaluate different process scheduling algorithms.
2. Describe the steps in address translation and different page replacement strategies.
3. Compare different file allocation methods and decide appropriate allocation strategy for given type of file.
4. Explain the mechanisms available in an OS to control access to resource.

UNIT-I

Introduction to Operating Systems: OS structure and strategies, Process concepts, Multithreaded Programming, Process scheduling, Process synchronization, Deadlocks.

UNIT-II

Memory management strategies with example architectures: Swapping, Contiguous allocation, Paging, Segmentation, Segmentation with paging, Virtual memory management: Demand paging, Page replacement, Thrashing.

UNIT-III

File system interface: File concepts, Access methods and protection. File system implementation: File system structure, Allocation methods, Directory implementation of file systems, Mass storage structures, I/O systems.

UNIT-IV

System Protection: Principles and Domain, Access Matrix and implementation, Access control and access rights, Capability based systems, and Language based Protection System Security: Problem, Program threats, cryptography, user authentication, implementing security defenses, Firewalling, Computer Security Classification.

UNIT-V

Case Studies: The Linux System–Design principles, Kernel modules, Process management, Scheduling, Memory management, File systems, Input and Output, Inter process communication. Windows7–Design principles, System components, Terminal services and fast user switching File systems, Networking, Programmer interface.

Suggested Reading:

1. Abraham Silberschatz, Peter B Galvin, Operating System Concepts,9th Edition, Wiley, 2016
2. William Stallings, Operating Systems-Internals and Design Principles, 8thedition, Pearson, 2014
3. Andrew S Tanenbaum, Modern Operating Systems, 4th edition, Pearson, 2016.

Course Code	Course Title						Core/Elective
PC233CM	**Database Management Systems**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**3**	**-**	**-**	**-**	**30**	**70**	**3**

Course Objectives

- To Learn mathematical concepts as applied in computer
- To introduce three scheme architecture and DBMS functional components.
- To learn formal and commercial query languages of RDBMS
- To Study different file organization and indexing techniques
- To familiarize theory of serializablity and implementation of concurrency control, and recovery

Course Outcomes

1. Understand the mathematical foundations on which RDBMS are built
2. Model a set of requirements using the Extended Entity Relationship Model (EER), transform an EER model into a relational model and refine the relational model using theory of normalization
3. Develop Database application using SQL and Embedded SQL
4. Use the knowledge of file organization and indexing to improve database application performance
5. Understand the working of concurrency control and recovery mechanisms in RDBMS

UNIT-I

Introduction: Database System Application, Purpose of Database Systems, View of Values, Nested Sub-queries, Complex Queries views, Modification of the Database, Joined Relations

Data, Database Language, Relational Databases, Database Design, Object-Based and Semi-Structured Databases, Data Storages and Querying , Transaction Management ,Data Mining and Analysis, Database Architecture, Database Users and Administrators.

Database Design and the E-R Model: Overview of the Design Process, The Entity Relationship Model Constraints, Entity-Relationship Design issues, Weak Entity Sets Extended E-R Features Database Design for banking Enterprise, Reduction to Relational Schemas, Other Aspects of Database Design

UNIT-II

Relational Model: Structure of Relational Databases, Fundamental Relational-Algebra Operations, Additional Relational-Algebra Operations, Extended Relational-Algebra Operations, Null Values, Modification of the Databases

Structured Query Language: Data Definition, Basic Structure of SQL Queries, Set Operations, Aggregate Functions, Null

UNIT-III

Advanced SQL: SQL Data Types and Schemes, Integrity constraints, Authorization, Embedded SQL, Dynamic SQL, Functions and Procedural Constructs, Recursive Queries, Advanced SQL Features.

Relational Database Design: Features of Good Relational Design, Atomic Domains and First Normal Form, Functional Dependency Theory, Decomposition using Functional Dependencies.

UNIT-IV

Indexing and Hashing: Basic Concepts, Ordered Indices, B*-tree index files, B-tree index files, multiple key access, static hashing, dynamic hashing, comparison of ordered indexing and hashing bitmap indices.
Index definition in SQL transactions: Transaction concepts, transaction state, implementation of atomicity and durability, concurrent executions, serializability, recoverability, implementation of isolation, testing for serializability.

UNIT-V

Concurrency Control: Lock based protocols, timestamp based protocols, validation based protocols, multiple granularity, multi version schemes, deadlock handling, insert and delete operations, weak levels of consistency, concurrency of index structures.
Recovery system: Failure classification, storage structure, recovery and atomicity, log-based recovery, recovery with concurrent transactions, buffer management, failure with loss of non-volatile storage, advanced recovery techniques, remote backup systems.

Suggested Readings:

1. Abraham Silberschatz, Henry F Korth, S Sudarshan, Database System Concepts, McGraw-Hill, 6th Edition, 2010
2. Ramakrishnan, Gehrke, Database Management Systems, McGraw-Hill, 3rd Edition, 2003
3. Elmasri, Navathe, Somayajulu, Fundamentals of Database Systems, Pearson Education, 4th Edition, 2004.

Course Code	Course Title						Core/Elective
PC261CM	**Computer Organization & Microprocessor Lab**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**-**	**-**	**-**	**2**	**25**	**50**	**1**

Course Objectives

The objectives of the course are to impart knowledge of the:

- To become familiar with the architecture and Instruction set of Intel 8086 microprocessor.
- To provide practical hands on experience with Assembly Language Programming.
- To familiarize the students with interfacing of various peripheral devices with 8085 microprocessors.

Course 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 with 8086.
5. Analyse the function of traffic light controller.

List of Experiments:

1. Tutorials with 8086 kit / MASM software tool.
2. Fixed-point multiplication and division.
3. Floating-point multiplication and division.
4. Sorting hexadecimal array.
5. Code conversion from hexadecimal to decimal.
6. Sum of set of BCD numbers.
7. Searching.
8. Display a string of characters using 8279.
9. Interfacing traffic light controller using 8255.
10. Interfacing seven-segment LED using 8255.
11. Interfacing stepper motor using 8255.
12. Interfacing 8253 counter.
13. D/A conversion using 8255.
14. A/D conversion using 8255.

Suggested Readings:

1. Yu-cheng Liu, Glenn A. Gibson, "Microcomputer Systems: The 8086/8088 Family", 2nd Edition, PHI Learning 2011.

2. Douglas Hall. "Microprocessor and Interfacing programming and Hardware", Tata Mc Graw Hill, Revised 2nd Edition, 2007.

3. Brey B. Brey, "The Intel Microprocessor, 8086/8088, 80186/80188, 80286, 80386, 80486, Pentium and Pentium Pro Processors-Architecture, Programming and interfacing", 4th Edition, Prentice Hall, 1993.

Course Code	Course Title						Core/Elective
PC264CM	**Operating Systems Lab**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	-	-	-	**2**	**25**	**50**	**1**

Course Objectives

- To learn shell programming and the use of filters in the LINUX environment.
- To practice multithreaded programming.
- To implement CPU Scheduling Algorithms and memory management algorithms.

Course Outcomes

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

1. Write shell scripts for simple system administration tasks.
2. Write concurrent programs with synchronization constricts.
3. Compare the performance of various CPU Scheduling Algorithm.
4. Critically analyze the performance of the various Memory management algorithms

List of Experiments:

1-3. Memory Management Algorithms
4-5. Examples of Multithreading
6. Producer & Consumer problem using Semaphores and shared memory
7-8. Processor Scheduling algorithms
9. Dining Philosophers problem using Semaphores
10. Readers and Writers problem using Semaphores
11. Shell-programming exercises.

Course Code	Course Title						Core/Elective
PC263CM	**Database Management Systems Lab**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**-**	**-**	**-**	**2**	**25**	**50**	**1**

Course Objectives

- To practice various DDL commands in SQL
- To write simple and complex queries in SQL
- To familiarize PL/SQL

Course Outcomes

After the completion of the course, the student will be able to:

1. Design and implement a database schema for a given problem
2. Populate and query a database using SQL and PL/SQL
3. Develop multi-user database application using locks

Creation of database (exercising the commands for creation)

1. Simple to complex condition query creation using SQL Plus.
2. Usage of triggers and stored procedures
3. Creation of forms for student information, library information, pay roll etc.
4. Writing PL/SQL procedures for data validation.
5. Report generation using SQL reports.
6. Creating password and security features for applications.
7. Using of file locking, table locking facilities in applications.
8. Creation of small full-fledged database application spreading over 3 sessions.

Note: The creation of sample database for the purpose of the experiments is expected to be pre-decided by the instructor.

Course Code	Course Title						Core/Elective
PC262CM	**OOP using JAVA Lab**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**-**	**-**	**-**	**2**	**25**	**50**	**1**

Course Objectives

- Ability to learn the concept of classes, inheritance and abstract classes.
- To Learn to demonstrate multithreaded programs with synchronization.
- To Demonstrate real world applications using java collection frame work and I/O classes.
- To Model Event driven GUI programs using AWT/Swing.
- To build software development skills using java programming for real world applications.
- To implement frontend and backend of an application**.**
- To implement classical problems using java programming.

Course Outcomes

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

1. Able to understand the OOPS features.
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, Hashtable, 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 Result Set.
20) Program to get primary key value (auto-generated keys) from inserted queries using JDBC
21) Program to create a simple JList
22) java Program to create a simple checkbox using JCheckBox
23) Program to create a checkbox and ItemListener to it.
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 web page
    9. Insert teacher record in Database

SCHEME OF INSTRUCTION & EXAMINATION

B.E. (Computer Engineering) – V Semester

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.	ES501 EC	Signals & Systems	3	-	-	3	30	70	3	3
2.	PC321 CM	Design Analysis and Algorithms	3	-	-	3	30	70	3	3
3.	PC322 CM	Artificial Intelligence	3	-	-	3	30	70	3	3
4.	PC323 CM	Automata Theory & Compiler Design	3	-	-	3	30	70	3	3
5.	PC324 CM	Software Engineering	3	-	-	3	30	70	3	3
6.	PE - I	Professional Elective – I	3	-	-	3	30	70	3	3
Practical / Laboratory Courses										
7.	PC351 CM	Artificial Intelligence Lab	-	-	2	2	25	50	3	1
8.	PC352 CM	Compiler Design Lab	-	-	2	2	25	50	3	1
9.	PC353CM	Mini Project	-	-	2	2	25	50	3	1
			18	**-**	**06**	**24**	**255**	**570**		**21**

Professional Elective – I		
Sl. No.	**Course Code**	**Course Title**
1.	PE 501 CM	Web and Internet Technology
2.	PE 502 CM	Computer Graphics
3.	PE 503 CM	Advanced Computer Architecture
4.	PE 504 CM	Information Retrieval System

MC: Mandatory Course PC: Professional Core PE: Professional Elective OE: Open Elective HS: Humanities and Social Sciences L: Lecture T: Tutorial P: Practical D: Drawing CIE: Continuous Internal Evaluation SEE: Semester End Evaluation (Univ. Exam)

Note: 1. Each contact hour is a clock hour . 2. The duration of the Practical class is two hours, however it can be extended wherever necessary, to enable the student to complete the experiment.

Course Code	Course Title						Core/Elective
ES501 EC	**Signals and Systems**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**3**	**-**	**-**	**-**	**30**	**70**	**3**

Course Objectives:

- 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.
- To understand Sampling theorem, with time and frequency domain analysis of discrete time signals with DTFS, DTFT and Z-Transform.
- 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.

Course 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, Prentice Hall
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.

Course Code	Course Title						Core/ Elective
PC 321 CM	**DESIGN AND ANALYSIS OF ALGORITHMS**						**CORE**
Prerequisite	Contact Hours Per Week				CIE	SEE	Credits
	L	T	D	P			
Problem Solving Skills, Data Structures, Discrete Structures	3	-	-	-	30	70	-

Course Objectives

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

Course Outcomes

- Ability to analyze the performance of algorithms.
- Ability to choose appropriate algorithm design techniques for solving problems.
- 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,

References:

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.

Course Code	Course Title						Core/Elective
PC 322 CM	**ARTIFICIAL INTELLIGENCE**						**ELECTIVE**
Prerequisite	Contact Hours Per Week				CIE	SEE	Credits
	L	T	D	P			
-	3	-	-	-	30	70	3

Course Objectives

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

Course Outcomes

Upon completion of the course, the students will be able to:

- ✓ Formalize a problem in the language/framework of different AI methods Illustrate basic principles of AI in solutions that require problem solving, search, inference
- ✓ Represent natural language/English using Predicate Logic to build knowledge through various representation mechanisms
- ✓ Demonstrate understanding of steps involved in building of intelligent agents, expert systems, Bayesian networks
- ✓ 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

With effect from the academic year 2020-21

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 BayesianNetworks**,** 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

Course Code	Course Title						Core/ Elective
PC 323 CM	**AUTOMATA THEORY AND COMPILER DESIGN**						**CORE**
Prerequisite	Contact Hours Per Week				CIE	SEE	Credits
	L	T	D	P			
-	3	1	-	-	30	70	3

Course Objectives (ALC)

- Develop and Design finite automata to accept a set of strings of a language.
- Prove that a given language is regular and apply the closure properties of languages.
- Design context free grammars to generate strings from a context free language and Convert them into normal forms.
- To understand and list the different stages in the process of compilation.
- Design top-down and bottom-up parsers

Course Outcomes

Upon completion of the course, the students will be able to:

- Design finite automata to accept a set of strings of a language.
- For a given language determine whether the given language is regular or not.
- Design context free grammars to generate strings of context free languages.
- Determine equivalence of languages accepted by Pushdown Automata and languages generated by context free grammars
- For a given grammar specification, develop the lexical analyzer.
- For a given parser specification, design top-down and bottom-up parsers.

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**.**

Properties of CFLs: Normal forms for CFGs, EBNF, Pumping Lemma, Closure properties,

Deterministic Context Free Languages, Decision properties.

UNIT-III

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

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.

UNIT-IV

Introduction: The Structure of a Compiler, Phases of Compilation, The Translation Process, Major Data Structures in a Compiler, Bootstrapping and Porting.
Scanning: The scanning Process(LEX Process).
Syntax Analysis (Parser): The Role of Parser.
Top Down Parsing: Recursive descent parsing, L(1) parsing, First and follow sets, Recursive descent parser, and Error recovery in top don parsers.

UNIT-V

Bottom-up parsing: Overview, LR(0) items and LR (0) Parsing, SLR(1) Parsing, general LR(1) and LALR (1) parsing, YACC, and Error recovery in bottom-up parsers.

Semantic Analysis: Attribute and attribute grammars,Algorithms for attribute computation, Symbol table, Data types and Type checking.

Suggested Books:

1. John E. Hopcroft, Rajeev Motwani and Jeffrey D. Ullman, Introduction to Automata Theory, Languages, and Computation, Pearson Education Asia.
2. Alfred V. Aho, Monica S. Lam, Ravi Sethi, & Jeffrey D. Ullman , ***Compilers: Principles, Techniques and Tools***, Pearson Education
3. Kenneth C. Louden***, Compiler Construction: Principles and Practice,*** *Thomson Learning Inc., 1997.*

Suggested Reference Books:

1. Zvi Kohavi, Switching and Finite Automata Theory, TMH, 1976
2. Harry R. Lewis and Christos H. Papadimitriou, Elements of the Theory of Computation, Pearson Education Asia.
3. Dexter C. Kozen, Automata and Computability, Undergraduate Texts in Computer Science, Springer.
4. Michael Sipser, Introduction to the Theory of Computation, PWS Publishing.
5. John Martin, Introduction to Languages and The Theory of Computation, Tata McGraw Hill.
6. P.Trembley and P.S.Sorenson, *The Theory and Practice of Compiler Writing*, TMH-1985.

SOFTWARE ENGINEERING

PC 324 CM

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

Objectives:

To introduce the basic concepts of software development processes from defining a product to shipping and maintaining
To impart knowledge on various phases, methodologies and practices of software development
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:

Acquired working knowledge of alternative approaches and techniques for each phase of software development
Judge an appropriate process model(s) assessing software project attributes and analyze necessary requirements for project development eventually composing SRS
Creation of visual models to describe (non-) algorithmic solutions for projects using various design principles
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.
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 reference:

1	Roger S. Pressman, Software Engineering: A Practitioner's Approach, 7 thEdition, 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, 3rdEdition, Narosa Publishing House, 2008

Course Code	Course Title						Core/ Elective
PC 552CM	**ARTIFICIAL INTELLIGENCE LAB**						**CORE**
Prerequisite	Contact Hours Per Week				CIE	SEE	Credits
	L	T	D	P			
-	**3**	-	-	-	**25**	**50**	**1**

Course Objectives

- ✔ To Learn methods of expressing knowledge by a machine with appropriatereasoning and different mathematics involved behindit
- ✔ To Learn how to reason when an agent has only uncertain information about its task usingprogramming.
- ✔ To implement supervised and unsupervised learning algorithms inapplications.

Course Outcomes

On completion of the course, student will be able to–

- Build intelligent agents for search andgames
- Solve AI problems through programming withPython
- Design and develop programs for an agent to learn and act in a structuredenvironment.

List of Experiments:

1. Implement BFS Un-Informed Search Algorithm by taking suitable input tree.
2. Implement DFS Un-informed Search Algorithm by taking input as a tree.
3. Use Heuristic Search Technique to implement A* Algorithm with suitable input graph.
4. Implement Tic-Tac-Toe problem using A* algorithm.
5. Implement 3 missionaries and 3 cannibals problem using A* algorithm.
6. Implement 8-puzzle problem using A* algorithm. Assume any initial configuration.
7. Implement Min-Max algorithm with proper utilities values.
8. Write a program to remove stop words for a given passage from a text file using NLTK?
9. Write a program to implement stemming for a given sentence using NLTK?
10. Write a program to POS (Parts of speech) tagging for the given sentence using NLTK?
11. Write a program to implement Lemmatization using NLTK?
12. Write a program for text classification for the given sentence using NLTK?.

Course Code	Course Title						Core/ Elective
PC 352CM	**COMPILER DESIGN LAB**						**CORE**
Prerequisite	Contact Hours Per Week				CIE	SEE	Credits
	L	T	D	P			
-	-	-	-	**2**	**25**	**50**	**1**

Course Objectives

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

Course Outcomes

On completion of the course, student will be able to–

- Generate scanner and parser from formal specification
- Generate top down and bottom up parsing tables using predictive parsing, SLR and LR parsing techniques.
- Apply the knowledge of YACC to syntax directed translations for generating intermediate code – 3 address code.
- 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.

MINI PROJECT

PC 353 CM

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

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 coding, written, presentation and oral communication skills

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 can also 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.

- Three periods of contact load will also be assigned to each project guide for project guidance and monitoring at regular intervals.
- 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.

Course Code	Course Title						Core/ Elective
PE 501 CM	**WEB & INTERNET TECHNOLOGY**						**ELECTIVE**
Prerequisite	Contact Hours Per Week				CIE	SEE	Credits
	L	T	D	P			
C, C++, Java, DC	3	-	-	-	30	70	-

Course Objectives

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

Course Outcomes

- ✓ Understand the concepts of HTML and CSS.
- ✓ Acquire the knowledge to build AJAX based applications using Javascript.
- ✓ Understand and apply the concepts of servlet framework.
- ✓ Implement JSP to build interactive web applications.
- ✓ 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.sql 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: Head first Servlets & JSP, 2nd edition, OREILLY, 2008.

Course Code	Course Title						Core/ Elective
PE 502 CM	**COMPUTER GRAPHICS**						**ELECTIVE**
Prerequisite	Contact Hours Per Week				CIE	SEE	Credits
	L	T	D	P			
Mathematics, Engg. Drawing	3	-	-	-	30	70	3

Course Objectives

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

Course Outcomes

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

- ✓ Describe the steps in graphics programming pipeline
- ✓ Write interactive graphics applications using OpenGL geometric primitives
- ✓ Apply affine transformations for viewing and projections
- ✓ 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 Reading

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.

Course Code	Course Title						Core/ Elective
PE 503 CM	**ADVANCED COMPUTER ARCHITECTURE**						**ELECTIVE**
Prerequisite	Contact Hours Per Week				CIE	SEE	Credits
	L	T	D	P			
-	3	-	-	-	30	70	-

Course 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.

Course Outcomes

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

- Know the classes of computers, and new trends and developments in computer architecture
- Understand pipelining, instruction set architectures, memory addressing.
- Understand the performance metrics of microprocessors, memory, networks, and disks
- Understand the performance and efficiency in advanced multiple-issue processors.
- Understand symmetric shared-memory architectures and their performance.

UNIT-I

Introduction - 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 advanced topics- Multi-cores. Multi-processors. Clusters. 105

Suggested Readings:

1. David A. Patterson and John L. Hennessy, Computer Organization and Design: The Hardware and Software Interface, Morgan Kaufmann Publishers, Fourth Edition.(2009)
2. John L. Hennessy and David A. Patterson, Computer Architecture: A Quantitative Approach, Morgan Kaufmann Publishers (2007)
3. Computer Fundamentals Architecture and Organization, B. Ram, New Age International
4. Computer Organization & Architecture, Rajaraman, PHI Learning

Course Code	Course Title						Core/ Elective
PE504CM	**INFORMATION RETRIEVAL SYSTEMS**						**Elective**
Prerequisite	Contact Hours Per Week				CIE	SEE	Credits
	L	T	D	P			
-	**3**	**-**	**-**	**-**	**30**	**70**	**3**

Course Objectives: To prepare the students

- To understand indexing and querying in information retrieval systems
- To learn the different models for information retrieval
- To expose the students to text classification and clustering
- To learn about web searching

.

Course Outcomes: On successful completion of this course student will be

On completion of the course the students will be able to

- Understand the algorithms and techniques for information retrieval (document indexing and retrieval, query processing)
- Quantitatively evaluate information retrieval systems
- Classify and cluster documents
- Understand the practical aspects of information retrieval such as those in web search engines.

UNIT-I

Boolean Retrieval: An example information, Building an inverted index, Processing Boolean queries, The extended Boolean model versus ranked retrieval.

The term vocabulary and postings lists: 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.

Index Construction: Hardware basics, Blocked sort-based indexing, Single-pass in-memory indexing, Distributed indexing, Dynamic indexing, Other types of indexes.

UNIT-II

Index Compression: Statistical properties of terms in information retrieval, Dictionary compression, Postings file compression.

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.

Computing scores in a complete search system: Efficient scoring and ranking, Components of an information retrieval system, Vector space scoring and query operator interaction.

Evaluation in information retrieval: Information retrieval system evaluation, Standard test collections, Evaluation of unranked retrieval sets, Evaluation of ranked retrieval results, Assessing relevance.

UNIT-III

Relevance feedback and query expansion: Relevance feedback and pseudo relevance feedback, Global methods for query reformulation.

XML retrieval: Basic XML concepts, Challenges in XML retrieval, A vector space model for XML retrieval, Evaluation of XML retrieval, Text-centric vs. data-centric XML retrieval.

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 Reading:

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.

SCHEME OF INSTRUCTION & EXAMINATION

B.E. (Computer Engineering) – VI Semester

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 331 CM	Computer Networks	3	-	-	3	30	70	3	3
2.	PC 332 CM	Introduction to Internet Of Things	3	-	-	3	30	70	3	3
3.	PC 333 CM	Data Science	3	-	-	3	30	70	3	3
4.	PE – II	Professional Elective – II	3	-	-	3	30	70	3	3
5.	PE – III	Professional Elective – III	3	-	-	3	30	70	3	3
6.	OE - I	Open Elective – I	3	-	-	3	30	70	3	3
Practical / Laboratory Courses										
7.	PC 361 CM	Computer Networks Lab	-	-	2	2	25	50	3	1
8.	PC 362 CM	Data Science Lab	-	-	2	2	25	50	3	1
9.	SI 671 CM	Summer Internship*	-	-	-	-	-	-	-	-
			18	**-**	**4**	**22**	**230**	**520**		**20**

Professional Elective – II			Professional Elective – III		
Sl. No.	**Course Code**	**Course Title**	**Sl. No.**	**Course Code**	**Course Title**
1.	PE 601 CM	Natural Language Processing	1.	PE 701 CM	Image Processing
2.	PE 602 CM	Data Mining and Data Warehousing	2.	PE 702 CM	Soft Computing
3.	PE 603 CM	Advanced Algorithms	3.	PE 703 CM	Human Computer Interaction
4.	PE 604 CM	Digital Signal Processing	4.	PE 704 CM	Data Modeling & Visualisation

PC: Professional Core PE: Professional Elective MC: Mandatory Course
OE: Open Elective SI: Summer Internship
L: Lecture T: Tutorial P: Practical D: Drawing
CIE: Continuous Internal Evaluation SEE: Semester End Evaluation (Univ. Exam)

Note:

***** The students have to undergo a Summer Internship of four weeks duration after VI semester and credits will be awarded in VII semester after evaluation.

Course Code	Course Title						Core/ Elective
PC 331 CM	**COMPUTER NETWORKS**						**CORE**
Prerequisite	Contact Hours Per Week				Credits	Contact Hours Per Week L	Contact Hours Per Week
	L		L	L			
	3	-	3	3	3	3	3

Course Objectives

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

Course Outcomes

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

- Explain the functions of the different layer of the OSI and TCP/IP Protocol.
- Understand wide-area networks (WANs), local area networks (LANs) and Wireless LANs (WLANs) describe the function of each block.
- Illustrate network layer and transport layer protocols. For a given problem related TCP/IP protocol developed the network programming.
- Configure DNS, EMAIL, SNMP, Bluetooth, Firewalls using open source available software and tools.
- 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 books:

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

Suggested reference books:

1. Computer Networks, 8th Edition, Andrew S. Tanenbaum, Pearson New International Edition.
2. Internetworking with TCP/IP, Volume 1, 6th Edition Douglas Comer, Prentice Hall of India.
3. TCP/IP Illustrated, Volume 1, W. Richard Stevens, Addison-Wesley, United States of America.
4. W.Richard Stevens, Andrew M Rudoff, Bill Fenner, Unix Network Programming: Networking APIs: Sockets and XTI (Volume 1) 3rdEdition, PHI

Course Code	Course Title						Core/ Elective
PC 332 CM	**Introduction to INTERNET OF THINGS**						**ELECTIVE**
Prerequisite	Contact Hours Per Week				CIE	SEE	Credits
	L	T	D	P			
C, OS, CN, WT	3	-	-	-	30	70	3

Course Objectives

Students understanding will be enhanced by:-

- Exploration towards the integration of the physical and logical worlds
- Exposure in understanding how IoT devices are designed & developed

Course 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.

Primary Reference Book

Vijay Madisetti, Arshdeep Bahga," Internet of Things A Hands-On- Approach", 2014, ISBN:978 0996025515

Secondary References

Pallavi Sethi and Smruti R. Sarangi, "Internet of Things: Architectures, Protocols, and Applications", 26 Jan 2017, Volume 2017, Article ID 9324035, 25 pages, https://doi.org/10.1155/2017/9324035,

Online Open-source Hardware and Software Resource

1. "Introduction to ARDUINO", https://www.arduino.cc/en/guide/introduction,
2. "Built-In Examples", https://www.arduino.cc/en/Tutorial/BuiltInExamples
3. "Arduino IoT Cloud", https://www.arduino.cc/en/IoT/HomePage

Suggested Reading

Adrian McEwen, "Designing the Internet of Things", Wiley Publishers, 2013, ISBN: 978-1-118-43062-0

Industry Survey Article

Postscapes, "IoT Standards and Protocols", 01/02/2020, https://www.postscapes.com/internet-of-things-protocols,

Case Studies

ARDUINO Project Hub, https://create.arduino.cc/projecthub,

Online Learning

MOOC courses on Raspberry Pi, https://www.raspberrypi.org/training/online

Course Code	Course Title						Core/ Elective
PC 333 CM	**Data Science**						**ELECTIVE**
Prerequisite	Contact Hours Per Week				CIE	SEE	Credits
	L	T	D	P			
-	3	-	-	-	30	70	3

Course Objectives

- Provide you with the knowledge and expertise to become a proficient data scientist.
- The objective of this course is to impart necessary knowledge of the mathematical foundations needed for data science and develop programming skills required to build data science applications**.**

Course Outcomes

- At end of this course, the students will be able to:
- Demonstrate understanding of the mathematical foundations needed for data science.
- Collect, explore, clean, munge and manipulate data.
- Build data science applications using Python based toolkits.
- Understand the key concepts in data science, including their real-world applications
- Apply data science concepts and methods to solve problems in real-world contexts and will communicate these solutions effectively

UNIT-I

Introduction: Introduction data science process, data science toolkit, Types of data, data acquisition, data preprocessing techniques including data cleaning, selection, integration, transformation and reduction, Example applications

Data collection and management: Introduction, Sources of data, Data collection and APIs, Exploring and fixing data, Data storage and management, Using multiple data sources, Traits of Big data, Web Scraping, Analysis vs Reporting

UNIT-II

Data analysis: Introduction, Terminology and concepts, Introduction to probability, statistics, Central tendencies and distributions, Variance, Distribution properties and arithmetic, correlation coefficient, statistical inference.

Linear Algebra: Vectors, Matrices

Hypothesis and Inference: Statistical Hypothesis Testing, Confidence Intervals, P-hacking, Bayesian Inference

UNIT-III

Data visualisation: Introduction, Types of data visualisation, Data for visualisation: Data types, Data encodings, Retinal variables, Mapping variables to encodings, Visual encodings. exploratory data analysis and visualization.

UNIT-IV

Introduction to Programming Tools for Data Science: Toolkits using Python: Matplotlib, NumPy, Scikit-learn, NLTK

Visualizing Data: Bar Charts, Line Charts, Scatterplots

Working with data: Reading Files, Scraping the Web, Using APIs (Example: Using the Twitter APIs), Cleaning and Munging, Manipulating Data, Rescaling, Dimensionality Reduction

UNIT-V

Case Studies of Data Science Application : Weather forecasting, Stock market prediction, Object

List of Suggested Books:

1. Joel Grus, "Data Science from Scratch: First Principles with Python", O'Reilly Media
2. Aurélien Géron, "Hands-On Machine Learning with Scikit-Learn and Tensor Flow: Concepts, Tools, and Techniques to Build Intelligent Systems", 1st Edition, O'Reilly Media
3. Jain V.K., "Data Sciences", Khanna Publishing House, Delhi.
4. Jain V.K., "Big Data and Hadoop", Khanna Publishing House, Delhi.
5. Jeeva Jose, "Machine Learning", Khanna Publishing House, Delhi.
6. Chopra Rajiv, "Machine Learning", Khanna Publishing House, Delhi.
7. Ian Goodfellow, Yoshua Bengio and Aaron Courville, "Deep Learning", MIT Press http://www.deeplearningbook.org
8. Jiawei Han and Jian Pei, "Data Mining Concepts and Techniques", Third Edition, Morgan Kaufmann Publishers
9. Cathy O'Neil and Rachel Schutt. Doing Data Science, Straight Talk From The Frontline. O'Reilly.
10. Jure Leskovek, AnandRajaraman and Jeffrey Ullman. Mining of Massive Datasets. v2.1, Cambridge University Press.
11. Jake VanderPlas, Python Data Science Handbook: Essential Tools for Working with Data , O'Reilly Media
12. Garrett Grolemund, Hadley Wickham, R for Data Science, O'Reilly Media

Course Code	Course Title						Core/ Elective
PC 361 CM	**COMPUTER NETWORKS LAB**						**CORE**
Prerequisite	Contact Hours Per Week				CIE	SEE	Credits
	L	T	D	P			
DC	-	-	-	2	30	70	-

Course Objectives

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

Course Outcomes

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

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

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: Standalone desktops

SOFTWARE:

1. C / C++ / Java / Python / Equivalent Compiler
2. Network simulator like NS2/NS3/OPNET/ CISCO Packet Tracer / Equivalent

Course Code	Course Title						Core/ Elective
PC 362 CM	**Data Science LAB**						**CORE**
Prerequisite	Contact Hours Per Week				CIE	SEE	Credits
	L	T	D	P			
DC	3	-	-	-	30	70	-

Course Objectives

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

Course Outcomes

Students who complete this course will be able to

- use statistical techniques to carry out the analysis of data.
- gain hands-on skills and experience on data mining tools.

List of Experiments

1. Introduction to Python Libraries-Numpy, Pandas, Matplotlib, Scikit
2. Perform Data exploration and preprocessing in Python
3. Classification and tabulation of data and Graphical and diagrammatic presentation of data.
4. Perform calculations that measure the central tendency and dispersion of data and Implementation of measures of Skewness, moments and kurtosis.
5. Determination of point and interval estimates.
6. Solving linear regression, polynomial regression and non-linear regression based problems and solving multiple regression and correlation analysis based problems.
7. Solving the problems based on Time series analysis and forecasting and implementing statistical quality control charts.
8. Data visualization

Course Code	Course Title						Core/ Elective
SI 671 CM	**SUMMER INTERNSHIP**						**CORE**
Prerequisite	Contact Hours Per Week				CIE	SEE	Credits
	L	T	D	P			
-	-	-	-	2	50	-	2*

Course Objectives: To prepare the students

- 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 industry.

Course Outcomes: On successful completion of this course student will be

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

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.

Course Code	Course Title						Core/ Elective
PE 601 CM	**NATURAL LANGUAGE PROCESSING**						**CORE**
Prerequisite	Contact Hours Per Week				CIE	SEE	Credits
	L	T	D	P			
-	**3**	**-**	**-**	**-**	**30**	**70**	**3**

Course Objectives: To prepare the students

- Teach students the leading trends and systems in natural language processing.
- 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.
- Teach them to recognize the significance of pragmatics for natural language understanding.
- Enable students to be capable to describe the application based on natural language processing and to show the points of syntactic and semantic processing.

Course Outcomes

Upon completion of the course, the students will be able to:

- To tag a given text with basic Language features
- To design an innovative application using NLP components
- To implement a rule based system to tackle morphology/syntax of a language
- To describe approaches to syntax and semantics in NLP.
- To compare and contrast the use of different statistical approaches for different types of NLP applications.
- Reproduce various machine learning techniques used in NLP.

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

Semantic (**Representing Meaning):** Computational desiderata for representations – Meaning structure of language - First order predicate calculus - Some linguistically relevant concepts - Related representational approaches – Alternative approaches to meaning. Semantic Analysis: Syntax-Driven semantic analysis - Attachments for a fragment of English - Integrating semantic analysis into the early parser - Idioms and compositionality - Robust semantic analysis. Lexical semantics: relational among lexemes and their senses - WordNet: A database of lexical relations - The Internal structure of words - Creativity and the lexicon.

UNIT-V

Applications: Word Sense Disambiguation and Information Retrieval: Selectional restriction-based disambiguation - Robust word sense disambiguation – Information retrieval - Other information retrieval tasks.

TEXT BOOKS:

1. Daniel Jurafsky, James H. Martin―Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech, Pearson Publication, 2014.
2. James Allen, "Natural Language Understanding", 2nd Edition, Pearson Education, 2008.
3. Steven Bird, Ewan Klein and Edward Loper, ―Natural Language Processing with Python, First Edition, OReilly Media, 2009.
4. Manning, Christopher D and Hinrich Schütze, "Foundations of Statistical Natural Language Processing", Cambridge, 1st Edition, MA: MIT Press, 1999.

REFERENCES:

1. Breck Baldwin, ―Language Processing with Java and LingPipe Cookbook, Atlantic Publisher, 2015.
2. Richard M Reese, ―Natural Language Processing with Java, OReilly Media, 2015.
3. Nitin Indurkhya and Fred J. Damerau, ―Handbook of Natural Language Processing, Second Edition, Chapman and Hall/CRC Press, 2010.
4. Tanveer Siddiqui, U.S. Tiwary, ―Natural Language Processing and Information Retrieval, Oxford University Press, 2008.
5. Ikrami Eldirawy , Wesam Ashour, ―Visual Speech Recognition, Wiley publications , 2011
6. Himanshu Chaurasiya, ―Soft Computing Implementation of Automatic Speech Recognition, LAP Lambert Academic Publishing, 2010.
7. Kai-Fu Lee, ―Automatic Speech Recognition, The Springer International Series in Engineering and Computer Science, 1999.

Course Code	Course Title						Core/ Elective
PE602CM	**Data Warehousing and Data Mining**						**Elective**
Prerequisite	Contact Hours Per Week				CIE	SEE	Credits
	L	T	D	P			
-	**3**	**-**	**-**	**-**	**30**	**70**	**3**

Course Objectives: To prepare the students

- In this subject the students are going to learn about the how data is collected from various data bases and how it will be transform to understand by search engine and according to the users query, how that query is processed by the warehouse and according to the query the pattern will get as an output.

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Course Outcomes: On successful completion of this course student will be

Upon completion of the course, students shall have ability to

- Understand the functionality of the various data warehousing component
- To study the methodology of engineering legacy databases for data warehousing to derive business rules for decision support systems
- Appreciate the strengths and limitations of various data mining and data warehousing models
- Apply suitable pre-processing and visualization techniques for data analysis
- Apply frequent pattern and association rule mining techniques for data analysis

.

Course Contents:

UNIT-I

Data Warehouse Fundamentals: Introduction to Data Warehouse, OLTP Systems; Differences between OLTP Systems and Data Warehouse: Characteristics of Data Warehouse; Functionality of Data Warehouse: Advantages and Applications of Data Warehouse; Advantages, Applications: Top- Down and Bottom-Up Development Methodology: Tools for Data warehouse development: Data Warehouse Types:

Data Warehouse Architecture: Introductions, Components of Data warehouse Architecture: Technical Architectures; Data warehouse architectures 1: Data warehouse architecture 2: Data warehouse architecture 3: Tool selection: Federated Data Warehouse Architecture:

UNIT-II

Dimensional Modeling: Introduction: E-R Modeling: Dimensional Modeling: E-R Modeling VS Dimensional Modeling: Data Warehouse Schemas; Star Schema, Inside Dimensional Table, Inside Fact Table, Fact Less Fact Table, Granularity, Star Schema Keys: Snowflake Schema: Fact Constellation Schema:

Extract, Transform and Load: Introduction: ETL Overview or Introduction to ETL: ETL requirements and steps: Data Extraction; Extraction Methods, Logical Extraction Methods, Physical Extraction Methods: Data Transformation; Basic Tasks in Transformation, Major Data Transformation Types: Data loading; Data Loading Techniques: ETL Tools:

UNIT-III

Data Warehouse & OLAP: Introduction: What is OLAP?; Characteristics of OLAP, Steps in the OLAP Creation Process, Advantageous of OLAP: What is Multidimensional Data: OLAP Architectures; MOLAP, ROLAP, HOLAP: Data Warehouse and OLAP: Hypercube & Multicubes:

Introduction to Data Mining: Introduction: Scope of Data Mining: What is Data Mining; How does Data Mining Works, Predictive Modeling: Data Mining and Data Warehousing: Architecture for Data Mining: Profitable Applications: Data Mining Tools:

UNIT-IV

Data Mining, Data Mining Task Primitives, Data: Data, Information and Knowledge; Attribute Types: Nominal, Binary, Ordinal and Numeric attributes, Discrete versus Continuous Attributes; Introduction to Data Preprocessing, Data Cleaning: Missing values, Noisy data; Data integration: Correlation analysis; transformation: Min-max normalization, z-score normalization and decimal scaling; data reduction: Data Cube Aggregation, Attribute Subset Selection, sampling; and Data Discretization: Binning, Histogram Analysis

UNIT-V

Market basket Analysis, Frequent item set, Closed item set, Association Rules, a-priori Algorithm, Generating Association Rules from Frequent Item sets, Improving the Efficiency of a-priori, Mining Frequent Item sets without Candidate Generation: FP Growth Algorithm; Mining Various Kinds of Association Rules: Mining multilevel association rules, constraint based association rule mining, Meta rule-Guided Mining of Association Rule

Reference Books:

- Alex Berson and Stephen J.Smith, Data Warehousing, Data Mining and OLAP, Tata McGraw – Hill Edition, 35th Reprint 2016.
- Jiawei Han and Micheline Kamber, Data Mining Concepts and Techniques, Third Edition, Elsevier, 2012.
- Data Ware Housing Fundamentals, Pualraj Ponnaiah, Wiley Student Edition.
- The Data Ware House Life Cycle Toolkit- Ralph Kimball, Wiley Student Edition.
- Data Mining, Vikaram Pudi, P Radha Krishna, Oxford University.

Course Code	Course Title						Core/ Elective
PE 603 CM	**Advanced Algorithms**						**CORE**
Prerequisite	Contact Hours Per Week				CIE	SEE	Credits
	L	T	D	P			
-	**3**	**-**	**-**	**-**	**30**	**70**	**3**

Course Objectives: To prepare the students

- ✓ Introduce students to the advanced methods of designing and analysing algorithms.
- ✓ The student should be able to choose appropriate algorithms and use it for a specific problem.
- ✓ To familiarize students with basic paradigms and data structures used to solve advanced algorithmic problems.
- ✓ Students should be able to understand different classes of problems concerning their computation difficulties.
- ✓ To introduce the students to recent developments in the area of algorithmic design.

Course Outcomes

Upon completion of the course, the students will be able to:

- Analyse the complexity/performance of different algorithms.
- Determine the appropriate data structure for solving a particular set of problems.
- Categorize the different problems in various classes according to their complexity.
- Students should have an insight of recent activities in the field of the advanced data structure.

UNIT-I

Sorting: Review of various sorting algorithms, topological sorting, Graph: Definitions and Elementary Algorithms: Shortest path by BFS, shortest path in edge-weighted case (Dijkasra's), depth-first search and computation of strongly connected components, emphasis on correctness proof of the algorithm and time/space analysis, example of amortized analysis.

UNIT-II

Matroids: Introduction to greedy paradigm, algorithm to compute a maximum weight maximal independent set. Application to MST. Graph Matching: Algorithm to compute maximum matching. Characterization of maximum matching by augmenting paths, Edmond's Blossom algorithm to compute augmenting path.

UNIT-III

Flow-Networks: Maxflow-mincut theorem, Ford-Fulkerson Method to compute maximum flow, EdmondKarp maximum-flow algorithm. Matrix Computations: Strassen's algorithm and introduction to divide and conquer paradigm, inverse of a triangular matrix, relation between the time complexities of basic matrix operations, LUP-decomposition.

UNIT-IV

Shortest Path in Graphs: Floyd-Warshall algorithm and introduction to dynamic programming paradigm. More examples of dynamic programming. Modulo Representation of integers/polynomials: Chinese Remainder Theorem, Conversion between baserepresentation and modulo-representation. Extension to polynomials. Application: Interpolation problem. Discrete Fourier Transform (DFT): In complex field, DFT in modulo ring. Fast Fourier Transform algorithm. Schonhage-Strassen Integer Multiplication algorithm.

UNIT-V

Linear Programming: Geometry of the feasibility region and Simplex algorithm NP-completeness: Examples, proof of NP-hardness and NP-completeness. Approximation algorithms, Randomized Algorithms, Interior Point Method, Advanced Number Theoretic Algorithm. Recent Trends in problem solving paradigms using recent searching and sorting techniques by applying recently proposed data structures.

Suggested Readings:

1. "Introduction to Algorithms", Cormen, Leiserson, Rivest, Stein, 4th edition, McGraw Hill,

2. "The Design and Analysis of Computer Algorithms" Aho, Hopcroft, Ullman.

3. "Algorithm Design" Kleinberg and Tardos.

Course Code	Course Title						Core/ Elective
PE 701 CM	**IMAGE PROCESSING**						**ELECTIVE**
Prerequisite	Contact Hours Per Week				CIE	SEE	Credits
	L	T	D	P			
-	3	-	-	-	30	70	-

Course Objectives

Objectives of the course

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

Course Outcomes

- Understand the basic image enhancement techniques in spatial & frequency domains.
- Understand the basics of multi-resolution techniques.
- Understand the basics of segmentation methods.
- Apply this concept for image handling in various fields.
- 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.

References :

1. AL. Bovik, "The Essential Guide to Image processing", 2nd edition, Elsevier, 2009.
2. Anil K.Jain, "Fundamentals of Digital Image Processing", PHI, 2006.
3. Sanjit K. Mitra, & Giovanni L. Sicuranza, "Non Linear Image Processing", Elsevier, 2007. 4. Maria Petrou, Costas Petrou, "Image Processing: The Fundamentals", Wiley,2nd edition, 2010.
4. William K. Pratt, Digital Image Processing, John Wiley & Sons, Inc., 3rd Edition, 2001

Course Code	Course Title						Core/ Elective
PE 702 CM	**SOFT COMPUTING**						**Elective**
Prerequisite	Contact Hours Per Week				CIE	SEE	Credits
	L	T	D	P			
-	3	-	-	-	30	70	3

Course Objectives

- To Conceptualize the working of human brain using ANN.
- To become familiar with neural networks that can learn from available examples and generalize to form appropriate rules for inference systems.
- To introduce the ideas of fuzzy sets, fuzzy logic and use of heuristics based on human experience.
- To understand genetic algorithm and its applications.

Course Outcomes

Upon completion of the course, the students will be able to:

- Ability to analyze and appreciate the applications which can use fuzzy logic.
- Ability to design inference systems.
- Ability to understand the efficiency of a hybrid system and how Neural Network and fuzzy logic can be hybridized to form a Neuro-fuzzy network .
- Ability analyze genetic algorithm 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, Concepts of Learning and Adaptation.

UNIT-II

Neural Networks -Supervised Learning Neural Networks ,Perceptrons , Adaline ,Back propagation Multilayer Perceptrons,Radial Basis Function Networks,Unsupervised Learning Neural Networks – Competitive Learning Networks ,Kohonen Self-Organizing Networks ,Learning Vector Quantization, Hebbian Learning.

UNIT-III

Introduction to Fuzzy- Fuzzy Sets , Basic Definition and Terminology , Set-theoretic Operations, Member Function Formulation and Parameterization, Fuzzy Rules and Fuzzy Reasoning ,Extension Principle and Fuzzy Relations, Fuzzy If-Then Rules, Fuzzy Reasoning, Fuzzy Inference Systems ,Mamdani Fuzzy Models ,Sugeno Fuzzy Models, Tsukamoto Fuzzy Models,Input Space Partitioning and Fuzzy Modeling.

UNIT-IV

Genetic Algorithm-Difference between Traditional Algorithms and GA, operators in genetic algorithm,Stopping condition for Genetic algorithm flow,Constraints in Genetic algorithm, Schema theorem, Classification of Genetic algorithm.

UNIT-V

Neuro Fuzzy Modeling-Adaptive Neuro-Fuzzy Inference Systems –Architecture ,Hybrid Learning Algorithm ,Learning Methods that Cross-fertilize ANFIS and RBFN,Coactive Neuro Fuzzy Modeling, Framework Neuron Functions for Adaptive Networks ,Neuro Fuzzy Spectrum.

TEXT BOOKS:

1. J.S.R.Jang, C.T.Sun and E.Mizutani, "Neuro-Fuzzy and Soft Computing", PHI,2004, Pearson Education 2004.
2. S.N.Sivanandam, S.N.Deepa "Principles of Soft Computing" Second Edition, Wiley Publication.

REFERENCES:

1. Timothy J.Ross, "Fuzzy Logic with Engineering Applications", McGraw-Hill,1997.
2. Chennakesava R. Alavala,"Fuzzy logic and Neural Networks-Basic concepts & Applications", New Age International Publishers.
3. Satish Kumar "Neural Networks A Classroom Approach" Tata McGrawHill.
4. Davis E.Goldberg, "Genetic Algorithms: Search, Optimization and Machine Learning", Addison Wesley, N.Y.
5. S.Rajasekaran and G.A.Vijayalakshmi Pai "Neural Networks, Fuzzy Logic and Genetic Algorithms" PHI Learning.

Course Code	Course Title						Core/ Elective
PE 703 CM	**HUMAN COMPUTER INTERACTION**						**ELECTIVE**
Prerequisite	Contact Hours Per Week				CIE	SEE	Credits
	L	T	D	P			
-	3	-	-	-	30	70	-

Course Objectives

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

Course Outcomes

- Understand the structure of models and theories of Human Computer Interaction and Vision
- 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

References:

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

FACULTY OF ENGINEERING

Scheme of Instruction & Examination

(AICTE Model Curriculum)

and

Syllabi

B.E. VII and VIII Semesters

of

Four Year Degree Program

in

B.E (COMPUTER ENGINEERING)

(w.e.f: 2022-23)

Issued by

Dean, Faculty of Engineering
Osmania University, Hyderabad – 500 007
2022

Chairperson, BoS **Dean, FoE OU**

SCHEME OF INSTRUCTION & EXAMINATION
AICTE Model Curriculum
B.E. VII- Semester (Computer Engineering)
(Proposed for the Academic year 2022-2023)

S. No.	Course Code	Course Title	Scheme of Instruction				Scheme of Examination			Credits
			L	T	P / D	Contact Hrs / Week	CIE	SEE	Duration in Hrs	
Theory Courses										
1.	PC 701 CM	Machine Learning	3	-	-	3	30	70	3	3
2.	PC 702 CM	Natural Language Processing	3	-	-	3	30	70	3	3
3.	PE 7XX CM	Professional Elective – IV	3	-	-	3	30	70	3	3
4.	PE 7XX CM	Professional Elective – V	3	-	-	3	30	70	3	3
5.	OE -II	Open Elective – II	3	-	-	3	30	70	3	3
Practical / Laboratory Courses										
6.	PC 751 CM	Machine Learning Lab	-	-	2	2	25	50	3	1
7.	PW 752 CM	Project Work – I	-	-	4	4	50	-	3	2
8.	SI 671 CM	Summer Internship	-	-	-	-	25	25	3	2
			15	**-**	**06**	**21**	**250**	**425**		**20**

Professional Elective – IV			Professional Elective – V	
Course Code	Course Title		Course Code	Course Title
PE 741CM	Big Data Analytics		PE 751 CM	Semantic Web
PE 742CM	Speech Processing & Synthesis		PE 752 CM	Distributed Systems
PE 743CM	Digital Forensics		PE 753 CM	Optimization Techniques
PE 744CM	Web Analytics		PE 754 CM	Computer Vision

Open Elective II	
Course Code	Course Title
OE 701 CE	Green BuildingTechnologies
OE 701 CS**	Data Science and Data Analytics
OE701EE	Non-Conventional EnergySources
OE702EE	Transducers and Sensors
OE701EC	Fundamentals of IoT
OE701 IT**	Cyber Security
OE701ME	Start-Up Entrepreneurship
OE701AE	Automotive Maintenance

PC: Professional Course **PE**: Professional Elective
HS: Humanities and social Science
MC: Mandatory Course
L: Lecture **T:** Tutorial
P: Practical **D**: Drawing
CIE: Continuous Internal Evaluation
SEE: Semester End Examination (Univ. Exam)

Note:
1. Each contact hour is a Clock Hour
2. The practical class can be of two and half hour (clock hours) duration as per the requirement of a particular laboratory.

Note-: ** Subject is not offered to the students of CSE and IT Department.

MACHINE LEARNING

PC 701 CM

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

Course Objectives:

1. To introduce the basic concepts of machine learning and range of problems that can be handled by machine learning.
2. To study various supervised learning algorithms.
3. To learn ensemble techniques and various unsupervised learning algorithms.
4. To explore Neural Networks and Deep learning basics.
5. To learn reinforcement learning and study applications of machine learning.

Course Outcomes:

1. Distinguish different learning based applications.
2. Apply the classification and clustering techniques to real world problems.
3. Apply the ensemble learning methods.
4. Apply Convolutional Neural networks techniques to real world problems.
5. Understand how to apply machine learning in various applications.

Unit – I

Introduction: Representation and Learning: Feature Vectors, Feature Spaces, Feature Extraction and Feature Selection, Learning Problem Formulation.

Types of Machine Learning Algorithms: Parametric and Nonparametric Machine Learning Algorithms, Supervised, Unsupervised, Semi-Supervised and Reinforced Learning. **Preliminaries:** Overfitting, Training, Testing, and Validation Sets, The Confusion Matrix. **Evaluation Measures:** SSE, RMSE, R2, Precision, Recall, F-Score, Receiver Operator Characteristic (ROC) Curve. Unbalanced Datasets.

Some basic statistics: Averages, Variance and Covariance, The Gaussian, the bias-variance trade off.

Unit-II

Supervised Algorithms:

Regression: Linear Regression, Logistic Regression.

Classification: Decision Tree, Naïve Bayes, K-Nearest Neighbors, Support Vector Machines,

Evaluation of classification: cross validation, hold out .

Unit – III

Ensemble Learning : Boosting, Random Forest, Bagging

Unsupervised Learning:

Cluster Analysis: Similarity Measures, categories of clustering algorithms, Hierarchical Methods, Partitional Algorithms, Expectation-Maximization Algorithm, Fuzzy c-means algorithm.

Dimensionality Reduction: Linear Discriminant Analysis, Principal Component Analysis.

Unit – IV

Neural Networks: Multilayer Perceptron, Back-propagation algorithm, Training strategies, Activation Functions, Gradient Descent For Machine Learning, Radial basis functions, Hopfield network, Recurrent Neural Networks.

Deep learning: Introduction to deep learning, Convolutional Neural Networks (CNN), CNN Architecture, pre-trained CNN (LeNet, AlexNet).

Unit - V

Reinforcement Learning: Overview, Example: getting lost, State and Action Spaces, The Reward Function, Discounting, Action Selection, Policy, Markov decision processes, Q-learning, uses of Reinforcement learning.

Applications of Machine Learning in various fields: Text classification, Image Classification, Speech Recognition.

Suggested Readings:

1. Machine Learning: An Algorithmic Perspective, Stephen Marsland, Second Edition
   (Chapman & Hall/Crc Machine Learning & Pattern Recognition) (2014).
2. Machine Learning, Tom Mitchell, McGraw-Hill Science /Engineering/ Math; (1997).

3. Deep Learning by Ian Goodfellow, Yoshua Bengio and Aaron Courville, MIT Press (2017).
4. Trevor Hastie, Robert Tibshirani, Jerome Friedman, The Elements of Statistical Learning: Data Mining, Inference, and Prediction. Second Edition, Springer Series in Statistics.(2009).
5. Pattern Recognition and Machine Learning, Christopher M. Bishop, Springer. (2006).
6. An Introduction to Pattern Recognition and Machine Learning, M Narasimha Murty, V Susheela Devi, IISc Press.

NATURAL LANGUAGE PROCESSING

PC 702 CM

Instruction	: 3 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:

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 describe approaches to syntax and semantics in NLP.
5. To compare and contrast the use of different statistical approaches for different types of NLP applications.
6. To Reproduce various machine learning techniques used in NLP

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

Semantic (Representing Meaning): Computational desiderata for representations – Meaning structure of language - First order predicate calculus - Some linguistically relevant concepts - Related representational approaches – Alternative approaches to meaning. **Semantic Analysis:** Syntax-Driven semantic analysis - Attachments for a fragment of English - Integrating semantic analysis into the early parser - Idioms and compositionality - Robust semantic analysis. Lexical semantics: relational among lexemes and their senses - WordNet: A database of lexical relations - The Internal structure of words - Creativity and the lexicon.

UNIT – V

Applications: Word Sense Disambiguation and Information Retrieval: Selectional restriction-based disambiguation - Robust word sense disambiguation – Information retrieval - Other information retrieval tasks.

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 James Allen, "Natural Language Understanding", 2nd Edition, Pearson Education, 2008.

3 Steven Bird, Ewan Klein and Edward Loper, —Natural Language Processing with Python, First Edition, OReilly Media, 2009.

4 Manning, Christopher D and Hinrich Schütze, “Foundations of Statistical Natural Language Processing”, Cambridge, 1st Edition, MA: MIT Press, 1999.

Suggested reference:

1. Breck Baldwin, ―Language Processing with Java and LingPipe Cookbook, Atlantic Publisher, 2015.
2. Richard M Reese, ―Natural Language Processing with Java, OReilly Media, 2015.
3. Nitin Indurkhya and Fred J. Damerau, ―Handbook of Natural Language Processing, Second Edition, Chapman and Hall/CRC Press, 2010.
4. Tanveer Siddiqui, U.S. Tiwary, ―Natural Language Processing and Information Retrieval, Oxford University Press, 2008.
5. Ikrami Eldirawy , Wesam Ashour, ―Visual Speech Recognition, Wiley publications , 2011
6. Himanshu Chaurasiya, ―Soft Computing Implementation of Automatic Speech Recognition, LAP Lambert Academic Publishing, 2010.
7. Kai-Fu Lee, ―Automatic Speech Recognition, The Springer International Series in Engineering and Computer Science, 1999.

MACHINE LEARNING LAB

PC751CM

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

Objectives:

1. To understand the training data and testing data.
2. To implement the various classification algorithms.
3. To implement the clustering algorithms
4. To apply machine learning techniques to real world problems.

Outcomes: Student will be able to:

1 Capture data from different types of Data sets.
2 Implement various algorithms for data analysis
3 Implement various algorithms based on required user requirements
4 Implement various algorithms on real world problems.
5 Implement ensemble methods and evaluate the performance of different methods.

List of Experiments:

Installation of python environment/Anaconda IDE for machine learning: installing
python modules /Packages like scikit-learn, Keras and Tensorflow etc.

1. Implement and demonstrate the use of set of training data samples. Read the training data from a .CSV file.
2. Write a program to demonstrate the working of the decision tree based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.
3. Build an Artificial Neural Network by implementing the Backpropagation algorithm and test the same using appropriate data sets.
4. Write a program to implement the naïve Bayesian classifier for a sample training data set stored as a .CSV file. Compute the accuracy of the classifier, considering few test data sets.

5. Assuming a set of documents that need to be classified, use the naïve Bayesian Classifier model to perform this task. Built-in Java classes/API /Python can be used to write the program. Calculate the accuracy, precision, and recall for your data set.
6. Apply Support Vector Machine to classify the given data set.
7. Apply EM algorithm to cluster a set of data stored in a .CSV file. Use the same data set for clustering using k-Means algorithm. Compare the results of these two algorithms and comment on the quality of clustering. You can add Java/Python ML library classes/API in the program.
8. Write a program to implement k-Nearest Neighbour algorithm to classify the iris data set. Print both correct and wrong predictions. Java/Python ML library classes can be used for this problem.
9. Mini-Project 1 on Genetic Algorithm: Apply the Genetic Algorithm for optimization on a dataset obtained from UCI ML repository.
   For Example: IRIS Dataset or Travelling Salesman Problem or KDD Dataset
10. Mini-Project 2 on SVM: Apply the Support vector machine for classification on a dataset obtained from UCI ML repository.
    For Example: Fruits Classification or Soil Classification or Leaf Disease Classification
11. Mini-Project 3 on PCA: Apply the Principal Component Analysis for feature reduction on any Company Stock Market Dataset
12. Mini-Project 4 : Handwritten digits classification using CNN.

PROJECT WORK – I

PW 752 CM

Instruction	: 4 periods per week
Duration of SEE	: 3
CIE	: -
SEE	: 50 marks
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 To understand project characteristics and various stages of project.
2 Demonstrate the ability to synthesize and apply the knowledge and skills acquired in the academic program to the real-world problems.
3 Evaluate different solutions based on economic and technical feasibility
4 Effectively plan a project and confidently perform all aspects of project management
5. 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.

BIG DATA ANALYTICS

PE-741CM

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

Objectives:

1. Understand big data for business intelligence. Learn business case studies for big data analytics.
2. Understand no sql big data management. Perform map-reduce analytics using Hadoop and related tools.

Outcomes: Student will be able to:

1. Describe big data and use cases from selected business domains.
2. Explain NoSQL big data management
3. Install, configure, and run Hadoop and HDFS
4 Perform map-reduce analytics using Hadoop
5 Use Hadoop related tools such as HBase, Cassandra, Pig, and Hive for big data analytics

UNIT – I

Introduction to big data, Needs of big data, convergence of key trends, unstructured data, industry examples of big data, web analytics, big data and marketing, fraud and big data, risk and big data, credit risk management, big data and algorithmic trading, big data and healthcare, big data in medicine, advertising and big data, big data technologies, introduction to Hadoop, open source technologies, cloud and big data, mobile business intelligence, Crowd sourcing analytics, inter and trans firewall analytics.

UNIT – II

Introduction to NoSQL, aggregate data models, aggregates, key-value and document data models, relationships, graph databases, schemaless databases, materialized views, distribution models, sharding, master-slave replication, peerpeer replication, sharding and replication, consistency, relaxing consistency, version stamps, map-reduce, partitioning and combining, composing map-reduce calculations.

UNIT – III

Data format, analyzing data with Hadoop, scaling out, Hadoop streaming, Hadoop pipes, design of Hadoop distributed file system (HDFS), HDFS concepts, Java interface, data flow, Hadoop I/O, data integrity, compression, serialization, Avro, file-based data structures.

UNIT – IV

MapReduce workflows, unit tests with MRUnit, test data and local tests, anatomy of MapReduce job run, classic Map-reduce, YARN, failures in classic Map-reduce and YARN, job scheduling, shuffle and sort, task execution, MapReduce types, input formats, output formats.

UNIT – V

Hbase, data model and implementations, Hbase clients, Hbase examples, praxis.Cassandra, Cassandra data model, Cassandra examples, Cassandra clients, Hadoop integration. Pig, Grunt, pig data model, Pig Latin, developing and testing Pig Latin scripts. Hive, data types and file formats, HiveQL data definition, HiveQL data manipulation, HiveQL queries.

Suggested Readings:

1. Michael Minelli, Michelle Chambers, and AmbigaDhiraj, "Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses", Wiley, 2013.
2. P. J. Sadalage and M. Fowler, "NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence", Addison-Wesley Professional, 2012.
3. Tom White, "Hadoop: The Definitive Guide", Third Edition, O'Reilley, 2012.
4. Eric Sammer, "Hadoop Operations", O'Reilley, 2012.
5. E. Capriolo, D. Wampler, and J. Rutherglen, "Programming Hive", O'Reilley, 2012
6. Lars George, "HBase: The Definitive Guide", O'Reilley, 2011.
7. Eben Hewitt, "Cassandra: The Definitive Guide", O'Reilley, 2010.
8. Alan Gates, "Programming Pig", O'Reilley, 2011.

SPEECH PROCESSING & SYNTHESIS

PE 742 CM

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

Objectives:

1. To provide fundamental knowledge on speech and signal processing.
2. To analyze the time domain and spectral domain features and the process of feature extraction.
3. To model speech using Hidden markov model
4. To understand the basics of speech recognizition
5. To understand Concatenative and waveform speech synthesis methods and its application

Outcomes: Student will be able to:

1. Understand the basics of speech including production and fundamental approaches of Signal processing.
2. Analyze various feature extraction techniques in time and frequency domain.
3. Build static machine learning architecture for solving real time speech problems using Open Source Programming including Python.
4. Design large vocabulary systems and able to work in real, task-oriented speech recognition projects.
5. Develop new algorithms for speech synthesis based applications.

UNIT – I

Speech Fundamentals: Articulatory Phonetics – Production and Classification of Speech Sounds; Acoustic Phonetics – acoustics of speech production; Review of Digital Signal Processing concepts; Short-Time Fourier Transform, Filter-Bank and LPC Methods.

UNIT – II

Speech Analysis: Features, Feature Extraction and Pattern Comparison Techniques: Speech distortion measures – mathematical and perceptual – Log Spectral Distance, Cepstral Distances, Weighted Cepstral Distances and Filtering, Likelihood Distortions, Spectral

Distortion using a Warped Frequency Scale, LPC, PLP and MFCC Coefficients, Time Alignment and Normalization – Dynamic Time Warping, Multiple Time – Alignment Paths.

UNIT – III

Speech Modeling: Hidden Markov Models: Markov Processes, HMMs – Evaluation, Optimal State Sequence – Viterbi Search, Baum-Welch Parameter Re-estimation, and Implementation issues.

UNIT – IV

Speech Recognition : Large Vocabulary Continuous Speech Recognition: Architecture of a large vocabulary continuous speech recognition system – acoustics and language modelsn- grams, context dependent sub-word units; Applications and present status.

UNIT – V

Speech Synthesis: Text-to-Speech Synthesis: Concatenative and waveform synthesis methods, sub- word units for TTS, intelligibility and naturalness – role of prosody, Applications and present status.

Suggested Readings:

1 Lawrence Rabinerand Biing-Hwang Juang, "Fundamentals of Speech Recognition", Pearson Education, 2003.

2 Daniel Jurafsky and James H Martin, "Speech and Language Processing – An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition", Pearson Education, 2008.

Suggested reference:

1. Steven W. Smith, "The Scientist and Engineer's Guide to DigitalSignalProcessing", California Technical Publishing, 2nd Edition, 1999.
2. homas F Quatieri, "Discrete-Time Speech Signal Processing – Principles and Practice", Pearson Education,2001.
3. Claudio Becchetti and Lucio Prina Ricotti, "Speech Recognition", JohnWileyand Sons, 1999.
4. Frederick Jelinek, "Statistical Methods of Speech Recognition", MIT Press,1997.

DIGITAL FORENSICS

PE743 CM

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

Objectives:

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

Outcomes: Student will be able to:

1. Apply forensic analysis tools to recover important evidence for identifying computer crime.
2. 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, ISBN: 0-619-21706-5.

Suggested References:

1 Vacca, J, Computer Forensics, Computer Crime Scene Investigation, 2nd Ed, Charles River Media, 2005, ISBN: 1-58450-389.

WEB ANALYTICS

PE744 CM

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

Objectives:

1. To understand the growing connectivity and complexity in the world ranging from small groups to World Wide Web.
2. To gain a practical understanding of common monitoring or analysis tasks and techniques used in web analytics.
3. To evaluate different types of software tools, techniques, and reports are relevant to web analytics.
4. To make informed decisions on how to analyze and interpret web channel data and understand the difficulties and issues involved.

Outcomes: Student will be able to:

1. Recognize the role of web analytics within the digital marketing landscape.
2. Measure the success rate and testing options.
3. Use the search engines for retrieving the information.
4. Understand the intelligence analysis and emerging analytics.
5. Analyze Google analytics contribution and study the working of Google analytics, accounts and profiles.

UNIT – I Introduction

Web Analytics 2.0: State of the Analytics Union - State of the Industry - Web Analytics 2.0. Clickstream analysis : Eight Critical Web Metrics - Bounce Rate - Exit Rate - Conversion Rate – Engagement - Web Metrics Demystified - Strategically-aligned Tactics. Practical solution : Web Analytics Primer - Web Analytics Report - Foundational Analytical Strategies - Everyday Clickstream Analyses - Perspectives on Key Web Analytics Challenges.

UNIT – II Measuring success and leveraging qualitative data

Measuring success: Five examples ofactionable outcome - conversion rates - macro and micro conversions - Quantifying Economic Value - measuring success for a non-ecommerce website - Measuring B2B Websites. Leveraging qualitative data: lab usability - usability

alternative – surveys - web enabled emerging user research options. Testing and experimentation: A Primer on Testing Options: A/B and MVT, Actionable Testing Ideas, Controlled Experiments, Creating and Nurturing a Testing Culture.

UNIT – III Information retrieval

Search engines: Search challenge – History of search engines – Architecture and components – Crawling – Indexing. Link analysis: Web graph – link-based ranking - page rank - hypertext induced topic search – Link-based analysis. Recommendation and diversification for the web: Pruning information – Recommendation systems - Result diversification. Advertising in search.

UNIT – IV Competitive Intelligence analysis and emerging analytics

Competitive Intelligence analysis: CI data sources, types and secrets - website traffic analysis - search and keyword analysis - segmentation analysis. Emerging analytics: measuring the new social web - Analysing offline customer experiences - Analysing mobile customer experiences - measuring the success of blogs - quantifying the impact of twitter - Analyzing Performance of Videos.

UNIT – V Google Analytics

Google Analytics contribution - Creating implementation plan - Working of Google analytics: Data collection and processing – Reports – Tracking code. Tracking visitor clicks, Outbound links, Non html files - Google analytics accounts and profiles: Google analytics accounts - Creating a Google Analytics Account - Profiles.

Suggested Readings:

1 Avinash Kaushik, “Web Analytics 2.0: The Art of Online Accountability”, John Wiley & Sons, 2009.

2 Stefano Ceri, Alessandro Bozzon, Marco Brambilla, Emanuele Della Valle, PieroFraternali, Silvia Quarteroni, ”Web Information retrieval”, Springer,2013.

Suggested References:

1 Justin Cutroni, “Google Analytics”, O’Reilly, 2010.
2 Hansen, Derek, Ben Sheiderman, Marc Smith ,”Analyzing Social Media Networks with NodeXL: Insights from a Connected World”, Morgan Kaufmann, 2011.
3 Wasserman. S, Faust. K, “Social network analysis: Methods and applications”, New York: Cambridge University Press,1994.
4 Monge. P. R, Contractor. N. S, “Theories of communication networks”, New York: Oxford University Press,2003.

SEMANTIC WEB

PE751CM

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

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

DISTRIBUTED SYSTEMS

PE-752CM

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 Understand design tradeoffs in large-scale distributed systems
4 Have knowledge of Synchronization and Deadlock.
5 To get knowledge in distributed architecture, naming, consistency and replication, fault tolerance, security, and distributed file 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

Fault Tolerance: Introduction to Fault Tolerance, Process Resilience, Reliable Client-Server Communication, Reliable Group Communication, Distributed Commit, and Recovery.

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

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 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.

OPTIMIZATION TECHNIQUES

PE-753CM

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

Objectives:

1 To know the basics behind the Design and development intelligent systems in the framework of soft computing
2 To acquire knowledge of Artificial Neural Networks Fuzzy sets, Fuzzy Logic, Evolutionary computing and swarm intelligence
3 To explore the applications of soft computing
4 To understand the need of optimization

Outcomes: Student will be able to:

1 Apply soft computing methodologies, including artificial neural networks, fuzzy sets, fuzzy logic, fuzzy inference systems.
2 Design and development of certain scientific and commercial application using computational neural network models, fuzzy models, fuzzy clustering applications and genetic algorithms in specified applications.
3 Understand the basis of evolutionary computing
4 Apply genetic algorithms.
5 Apply Optimization Techniques.

UNIT – I

Introduction: soft computing vs. hard computing, various types of soft computing techniques, and applications of soft computing. Basic tools of soft computing – Fuzzy logic, neural network, evolutionary computing. Introduction: Neural networks, application scope of neural networks, fuzzy logic, genetic algorithm, and hybrid systems.

UNIT – II

Fuzzy Sets and Logic: Basic concepts of fuzzy logic, Fuzzy sets and Crisp sets, Fuzzy set theory and operations, Properties of fuzzy sets, Fuzzy and Crisp relations, Fuzzy to Crisp conversion. Membership functions, interference in fuzzy logic, fuzzy if-then rules, Fuzzy implications and Fuzzy algorithms, Fuzzyfications and Defuzzifications. Fuzzy Systems: Fuzzy Controller, Fuzzy rule base

and approximate reasoning: truth values and tables in fuzzy logic, fuzzy propositions formation of rules, decomposition of compound rules, aggregation of fuzzy rules, fuzzy reasoning, fuzzy inference system, fuzzy expert systems.

UNIT – III

Evolutionary Computing: Basic Evolutionary Processes, EV : A Simple Evolutionary System, Evolutionary Systems as Problem Solvers, A Historical Perspective, Canonical Evolutionary Algorithms – Evolutionary Programming, Evolution Strategies, A Unified View of Simple EAs- A Common Framework, Population Size.

UNIT – IV

Genetic Algorithm: Basic concepts, working principle, procedures of GA, flow chart of GA, Genetic representations, (encoding) Initialization and selection, Genetic operators, Mutation, Generational Cycle, Traditional algorithm vs genetic algorithm, simple GA, general genetic algorithm, schema theorem, Classification of genetic algorithm, Holland classifier systems, genetic programming, applications of genetic algorithm, Convergence of GA. Applications and advances in GA, Differences and similarities between GA and other traditional method, applications.

UNIT – V

Swarm Intelligence: Swarm intelligence, Particle Swarm Optimization (PSO) Algorithm- Formulations, Pseudo-code, parameters, premature convergence, topology, biases, Real valued and binary PSO, Ant colony optimization (ACO)- Formulations, Pseudo-code. Applications of PSO and ACO.

Suggested Readings:

1 S.N. Sivanandam- “Principles of Soft Computing”, Wiley India- ISBN- 9788126527410
2 S. Rajsekaran and G.A. Vijayalakshmi Pai, “Neural Networks, Fuzzy Logic and Genetic Algorithm: Synthesis and Applications” , Prentice Hall of India, ISBN: 0451211243
3 J S R Jang, CT Sun and E.Mizutani, “Neuro-Fuzzy and Soft Computing” , PHI PVT LTD, ISBN 0-13-261066-3.
4 De Jong , “Evolutionary Computation: A Unified Approach”, Cambridge (Massachusetts):MIT Press. ISBN: 0-262-04194-4. 2006

5 Maurice Clerc, “Particle Swarm Optimization”, ISTE, Print ISBN:9781905209040 |OnlineISBN:9780470612163 |DOI:10.1002/9780470612163

Suggested References:

1 Andries P. Engelbrecht, “Computational Intelligence: An Introduction”, 2nd Edition-Wiley India- ISBN: 978-0-470-51250-0
2 N.P.Padhy, “Artificial Intelligence and Intelligent Systems” Oxford University Press, ISBN 10: 0195671546
3 Siman Haykin, “Neural Networks”, Prentice Hall of India, ISBN: 0-7923-9475-5
4 Timothy J. Ross, “Fuzzy Logic with Engineering Applications” , Wiley India, ISBN: 978-0-470-74376-8
5 Eiben and Smith, “Introduction to Evolutionary Computation", Springer, ISBN-10:3642072852

COMPUTER VISION

PE-754CM

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

Objectives:

To understand the basic concepts of computer vision and segmentation.

1. To gain knowledge in foundation of image formation and image analysis.
2. To understand the Basic concepts of Recognition.
3. To learn the various concepts of Computer Vision in other application areas.

Outcomes: Student will be able to:

1. Understand the fundamental problems of computer vision.
2. Implement various techniques and algorithms used in computer vision.
3. Acquire knowledge and understanding of Feature detection and matching.
4. Demonstrate awareness of the current key research issues in computer vision.
5. Exhibit knowledge in Image stitching and Recognition.

UNIT – I Introduction

Image formation - Geometric primitives and transformations - Geometric primitives - 2D transformations - 3D transformations - 3D rotations - 3D to 2D projections - Lens distortions – Photometric image formation - Lighting - Reflectance and shading – Optics - The digital camera - Sampling and aliasing – Color – Compression.

UNIT – II Feature Detection & Matching

Points and patches - Feature detectors - Feature descriptors - Feature matching - Feature tracking - Application: Performance driven animation - Edges - Edge detection - Edge linking - Application: Edge editing and enhancement – Lines - Successive approximation - Hough transforms - Vanishing points -Application: Rectangle detection.

UNIT – III Segmentation

Active contours - Snakes - Dynamic snakes and CONDENSATION – Scissors - Level Sets - Application: Contour tracking and rotoscoping – Split and merge - Watershed - Region splitting - Region merging - Graph-based segmentation - Probabilistic aggregation – Mean shift and mode finding - K-means and mixtures of Gaussians - Mean shift – Normalized cuts - Graph cuts and energy-based methods - Application: Medical image segmentation.

UNIT – IV Structure from Motion

Triangulation - Two-frame structure from motion – Factorization - Bundle adjustment - Constrained structure and motion. Dense motion estimation - Translational alignment - Parametric motion - Spline-based motion - Optical flow - Layered motion.

UNIT – V Image Stitching and Recognition

Motion models - Global alignment – Compositing - Recognition - Object detection - Face detection - Pedestrian detection - Face recognition – Eigenfaces - Active appearance and 3D shape models - Instance recognition - Geometric alignment - Large databases - Category recognition - Bag of words - Part-based models - Recognition with segmentation - Context and scene understanding - Learning and large image collections - Recognition databases and test sets

Suggested Readings:

1 Forsyth, A., D. and Ponce, J., Computer Vision: A Modern Approach, Pearson Education, 2 ndEdition, 2012.

2 Szeliski, R., Computer Vision: Algorithms and Applications, Springer-Verlag London Limited, 1stEdition, 2011.

Suggested References:

1 Gonzalez C. R., and Woods E. R., Digital Image Processing, Addison-Wesley, 4thEdition, 2018.
2 Hartley, R. and Zisserman, A., Multiple View Geometry in Computer Vision, Cambridge University Press, 2ndEdition, 2003
3 Fukunaga, K., Introduction to Statistical Pattern Recognition, Academic Press, Morgan Kaufmann, 2ndEdition, 1990
4 Trucco and Verri, Introductory Techniques for 3D Computer Vision, Prentice Hall, 1998

GREEN BUILDING TECHNOLOGIES

OE701CE

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

Course Objectives:

1. Learn the principles of green building technologies and rating systems
2. Understand the principles of effective energy and resources management in buildings
3. Understand the methodologies to reduce, recycle and reuse towards sustainability.

Course Outcomes:

1. After completing this course, the student will be able to
2. Classify the various features, benefits, and rating systems for a green building
3. Outline the criteria used for site selection and water efficiency methods
4. Select the energy efficiency techniques in designing a green building
5. Select materials for sustainable built environment & adopt waste management methods
6. Identify an appropriate method for maintaining indoor environmental quality in a greenbuilding

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.

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.

UNIT-III

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 (c) use of materials with recycled content such as blended cements materials from agro and industrial waste. (d) reuse of waste and salvaged materials

Waste Management: Handling of construction waste materials, separation of household waste, on-site and off-site organic waste management

UNIT-V

Indoor Environmental Quality for Occupant Comfort and Well being: Day lighting, 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 AND DATA ANALYTICS

OE 701 CS

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

Course Objectives

1. To learn basics of Data Science: Linear Algebra, Linear Equations, Matrices, Eigen Values andEigen Vectors.
2. To learn various statistical concepts like linear and logistic regression, cluster analysis, time seriesforecasting
3. To learn Decision tree induction, association rule mining and text mining

Course Outcomes:

1. At the end of the course, the students will be able to
2. Use various Mathematical models, and Probability and Statics
3. Uselinear, non-linearregression models, and classification techniques for data analysis
4. Use clustering methods including K-means and CURE algorithm

UNIT – I

Data Science: Introduction to data science, Linear Algebra for data science, Linear equations, Distance, Hyper planes, Half spaces, Eigen values, Eigenvectors.

UNIT II

Statistical Modelling, Random variables, Probability mass/density functions, sample statistics,hypothesis testing.

UNIT III

Predictive Modelling: Linear Regression, Simple Linear Regression model building, Multiple LinearRegression, Logistic regression

UNIT IV

Decision Tree: Introduction, What Is A Decision Tree? Appropriate Problems For Decision Tree Learning, Basic Decision Tree Learning Algorithm, Measuring Features, Hypothesis Space Search Decision Tree Learning, Inductive Bias In Decision Tree Learning, Why Prefer Short Hypotheses, Issues In Decision Tree Learning.

Classification: K-Nearest neighbors (KNN), Performance Measures,

UNIT V

Clustering: K-Means Algorithm,

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.

Suggested Readings:

1. Nina Zumel, Practical Data Science with R, Manning Publications, 2014.
2. Peter Bruce and Andrew Bruce, Practical Statistics for Data Scientists, O'Reilly,2017.
3. Hadley Wickham and Garrett Grolemund, R for Data Science, O'Reilly,2017.
4. Roger D Peng, R Programming for Data science, Lean Publishing,2016.
5. Rafael A Irizarry, Introduction to Data Science, LeanPublishing,2016.
6. Vishwa Vishwanathan and Shanthi Vishwanathan, R Data Analysis cookbook 2015

NON-CONVENTIONAL ENERGY SOURCES

OE701EE

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

Course Objectives

1. To imapart the knowledge of basis of different non-conventional types of power generation & power plants in detail so that it helps them in understanding the need and role of Non-Conventional Energy sources particularly when the conventional sources are scarce in nature.

Course Outcomes

On completion of course the student will be able to:

1. Understand the different nonconventional sources and the power generation techniques to generate electrical power.
2. Understand the solar energy power development and different applications.
3. Understand different wind energy power generation techniques and applications.
4. Design a prescribed engineering sub-system.
5. Recognize the need and ability to engage in lifelong learning for further developments in this field.

UNIT-I

Review of Conventional and Non-Conventional energy sources - Need for non-conventional energy sources Types of Non-conventional energy sources - Fuel Cells - Principle of operation with special reference to H_2O_2 Cell - Classification and Block diagram of fuel cell systems - Ion exchange membrane cell – Molten carbonate cells - Solid oxide electrolyte cells - Regenerative system- Regenerative Fuel Cell - Advantages and disadvantages of Fuel Cells-Polarization - Conversion efficiency and Applications of Fuel Cells.

UNIT-II

Solar energy - Solar radiation and its measurements - Solar Energy collectors- Solar Energy storage systems Solar Pond - Application of Solar Pond - Applications of solar energy.

UNIT-III

Wind energy- Principles of wind energy conversion systems - Nature of wind - Power in the Wind-Basic components of WECS -Classification of WECS -Site selection considerations - Advantages and disadvantages of WECS -Wind energy collectors -Wind electric generating and control systems - Applications of Wind energy - Environmental aspects.

UNIT- IV

Energy from the Oceans - Ocean Thennal Electric Conversion (OTEC) methods - Principles of tidal power generation -Advantages and limitations of tidal power generation -Ocean waves - Wave energy conversion devices - Advantages and disadvantages of wave energy - Geo-Thermal Energy - Types of Geo-Thermal Energy Systems - Applications of Geo-Thermal Energy.

UNIT-V

Energy from Biomass - Biomass conversion technologies *I* processes - Photosynthesis - Photosynthetic efficiency - Biogas generation - Selection of site for Biogas plant - Classification of Biogas plants - Details of commonly used Biogas plants in India - Advantages and disadvantages of Biogas generation -The1mal gasification of biomass -Biomass gasifiers.

Suggested Readings:

1. Rai G.D,*Non-Conventional Sources of Energy,* Khandala Publishers, New Delhi, 1999.
2. M.M. El-Wakil, Power *Plant Technology.* McGraw Hill, 1984.

FUNDAMENTALS OF IOT

OE701EC

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

Course Objectives:

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

Course Outcomes:

1. After completing this course, the student will be able to
2. Understand the various applications of IoT and other enabling technologies.
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 aproduct.

UNIT – I

Introduction to Internet of Things: Definition and Characteristics of IoT, Physical Design of IoT: Things in IoT, IoT protocols, Logical Design of IoT: IoT functional Blocks, Communication Models, APIs, IoT enabling Technologies: Wireless Sensor Networks, Cloud Computing, Big Data Analytics (Ref 1)

IoT Applications: Smart Home, Smart Cities, Smart Environment, Smart Energy, Smart Retail and Logistics, Smart Agriculture and Industry, Smart Industry and smart Health (Ref1)

UNIT – II

Internet Principles and communication technology: Internet Communications: An Overview – IP, TCP, IP protocol Suite, UDP. IP addresses – DNS, Static and Dynamic IP addresses, MAC Addresses, TCP and UDP Ports, Application Layer Protocols – HTTP, HTTPS, Cost Vs Ease of Production, Prototypes and Production, Open Source Vs Closed Source. Prototyping Embedded Devices – Sensors, Actuators, Microcontrollers, SoC, Choosing a platform, Prototyping Hardware platforms – Arduino, Raspberry Pi. Prototyping the physical design – Laser Cutting, 3D printing, CNC Milling (Ref 2)

UNIT – III

API Development and Embedded programming: Getting started with API, writing a new API, Real time Reactions, Other Protocols, Techniques for writing embedded code: Memory management, Performance and Battery Life, Libraries, Debugging. (Ref 2)

Developing Internet of Things: IoT design Methodology, Case study on IoT System for weather monitoring (Ref 1)

UNIT – IV

IoT Systems - Logical Design using Python: Introduction to Python, Data Types and Structures, Control Flow, Functions, Modules, Packages, File Handling, Date/Time Operations., Classes, Python packages for IoT (Ref 1 and Ref 3)

IoT Physical Devices and Endpoints: Raspberry Pi, Interfaces of Pi, Programming pi with Python - Controlling LED and LDR using Pi with python programming.

UNIT – V

Cloud computing and Data analytics and IoT Product Manufacturing: Introduction to Cloud storage models and Communication APIs, Amazon web services for IoT, Skynet IoT Messaging Platform. Introduction to Data Analytics for IoT (Ref 1). Case studies illustrating IoT Design – Smart Lighting, Weather Monitoring, Smart Irrigation. (Ref 1) Business model for IoT product manufacturing, IoT Start-ups, Mass manufacturing, Ethical issues in IoT. (Ref 2)

Suggested Readings:

1. Internet of Things (A Hands-On-Approach), Vijay Madisetti, ArshdeepBahga, VPT Publisher, 1stEdition, 2014.
2. Designing the Internet of Things, Adrian McEwen (Author), Hakim Cassimally. Wiley IndiaPublishers.
3. Fundamentals of Python, Kenneth A Lambert and B.L. Juneja, Cengage Learning
4. Internet of Things - Converging Technologies for smart environments and Integrated ecosystems,River Publishers.
5. Internet of things -A hands on Approach, Arshdeep Bahga, Universities press.

CYBER SECURITY

OE 701 IT

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

Course Objectives:

Students should be able to understand

1. The difference between threat and attacks, how threats materialize into attacks.
2. Security in Operating Systems & Networks.
3. Security Countermeasures
4. Privacy in Cyberspace.
5. Security Planning, Risk Analysis, Cyber Warfare, Cyberspace and Law

Course Outcomes:

Student will be able to

1. Acquire adequate knowledge about threat and attacks
2. Enhance their skills to implement security in design of Operating Systems
3. Use various techniques of Security Countermeasures
4. Acquire understanding in Privacy Principles and Policies in Cyberspace
5. Enhance their understanding in Security Planning, Risk Analysis, Cyber Warfare,Cyberspace and Law

UNIT I

Introduction To Cyber Security

Introduction -Computer Security - Threats -Harm - Vulnerabilities - Controls - Authentication - Access Control and Cryptography - Web—User Side - Browser Attacks - Web Attacks Targeting Users - Obtaining User or Website Data - Email Attacks

UNIT II

Security In Operating System & Networks

Security in Operating Systems - Security in the Design of Operating Systems -Rootkit - Network security attack- Threats to Network Communications - Wireless Network Security - Denial of Service -

Distributed Denial-of-Service.

UNIT III

Defences: Security Counter measures

Cryptography in Network Security - Firewalls - Intrusion Detection and Prevention Systems - Network Management - Databases - Security Requirements of Databases - Reliability and Integrity - Database Disclosure - Data Mining and Big Data.

UNIT IV

Privacy In Cyberspace

Privacy Concepts -Privacy Principles and Policies -Authentication and Privacy - Data Mining -Privacy onthe Web - Email Security - Privacy Impacts of Emerging Technologies - Where the Field Is Headed.

UNIT V

Management And Incidents

Security Planning - Business Continuity Planning - Handling Incidents - Risk Analysis - Dealing with Disaster - Emerging Technologies - The Internet of Things - Economics - Electronic Voting - Cyber Warfare- Cyberspace and the Law - International Laws - Cyber crime - Cyber Warfare and Home Land Security.

Suggested for Readings

1. Charles P. Pfleeger Shari Lawrence Pfleeger Jonathan Margulies, Security in Computing, 5thEdition , Pearson Education , 2015

2. George K.Kostopoulous, Cyber Space and Cyber Security, CRC Press, 2013.

START- UP ENTREPRENEURSHIP

OE 701 ME

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

Course Objectives:

Students should be able to understand

1. To motivate students to take up entrepreneurship in future.
2. To learn nuances of starting an enterprise & project management.
3. To understand the design principles of solar energy systems, their utilization andperformance evaluation.
4. To understand the behavioural aspects of entrepreneurs and time management

Course Outcomes:

Student will be able to

1. Understand Indian Industrial Environment, Entrepreneurship and Economic growth, Small and Large Scale Industries, Types and forms of enterprises.
2. Identify the characteristics of entrepreneurs, Emergence of first generation entrepreneurs, Conception and evaluation of ideas and their sources.
3. Practice the principles of project formulation, Analysis of market demand, Financial and profitability analysis and Technical analysis.
4. Understand the concept of Intellectual Property Rights and Patents
5. Comprehend the aspects of Start-Ups.

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

Intellectual Property Rights: Meaning, Nature, Classification and protection of Intellectual Property, the main forms of Intellectual Property, Concept of Patent, Patent document, Invention protection, Granting of patent, Rights of a patent, Licensing, Transfer of technology.

Unit-V

Aspects of Start-Up: What is Start-Up, Start-up Policy, start-up strategy, Progress of startups in India, Principles of future organizations, start-up sectors, action plan for start-ups by Govt. of India.

Suggested Reading:

1. Vasant Desai, *"Dynamics of Entrepreneurial Development and Management",* HimalayaPublishing 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 CompanyLtd., 5lh Ed.,2005.
6. G.B. Reddy, Intellectual Property Rights and the Law 5th Ed. 2005 Gogia Law Agency
7. Ajit Parulekar and Sarita D'Souza, Indian Patents Law – Legal & Business Implications, MacmillanIndia Ltd, 2006.

AUTOMOTIVE MAINTENANCE

OE 701 AE

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

Course Objectives:

Students should be able to understand

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.

Course 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, electricalsystem - 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 repairlike panel beating, tinkering, soldering, polishing, painting.

Suggested Readings:

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

SCHEME OF INSTRUCTION & EXAMINATION
AICTE Model Curriculum
B.E. VIII- Semester (Computer Engineering)
(Proposed for the Academic year 2022-2023)

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.	PW 851 CM	Project Work – II	-	-	16	16	50	100	3	8
			06	-	**16**	**22**	**110**	**240**		**14**

Professional Elective – VI	
Course Code	**Course Title**
PE 861 CM	Block Chain Technology
PE 862 CM	Neural Network & Deep Learning
PE 863 CM	Cloud Computing
PE 864 CM	Virtual Reality

Open Elective III	
Course Code	**Course Title**
OE 801 CE	Road Safety Engineering
OE 801CS**	Fundamentals of AL & ML
OE801EE	Smart Building Systems
OE802EE	Programmable LogicControllers
OE801EC	Principles of ElectronicCommunications
OE801 IT**	Software Engineering
OE801ME	3D Printing Technologies
OE801AE	Elements Of Electric And Hybrid Vehicle Technology

Note- : ** Subject is not offered to the students of CSE and IT Department
MC: Mandatory **PC**: Professional Course **HS**: Humanities and Sciences
L: Lectures T: Tutorials P: Practical D: Drawing
CIE: Continuous Internal Evaluation
SEE: Semester End Examination (Univ. Exam)
Note-2: 1) Each contact hour is a Clock Hour
2) The practical class can be of two and half hour (clock hours laboratory)

PROJECT WORK - II

PW851CM

Instruction	: 4 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
5. Analyze, apply and appreciate contemporary project management tools and methodologies in Indian context.

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 internship 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.

BLOCK CHAIN TECHNOLOGY

PE 861 CM

Instruction	: 3periods 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-stak econsensus.
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, Namecoin

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.

Suggested Readings:

1 Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller and Steven Goldfeder, Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction, Princeton University Press (July 19, 2016).

Suggested References:

1 Satoshi Nakamoto, Bitcoin: A Peer-to-Peer Electronic Cash System

2 DR. Gavin Wood, "ETHEREUM: A Secure Decentralized Transaction Ledger," Yellow paper.2014.

3 Nicola Atzei, Massimo Bartoletti, and Tiziana Cimoli, A survey of attacks on Ethereum smart contracts

NEURAL NETWORK & DEEP LEARNING

PE-862CM

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

Objectives:

1 Understand complexity of Deep Learning algorithms and their limitations.
2 Understand modern notions in data analysis oriented computing.
3 Be capable of confidently applying common Deep Learning algorithms in practice and implementing their own.
4 Be capable of performing distributed computations.
5 Be capable of performing experiments in Deep Learning using real-world data.

Outcomes: Student will be able to:

1 Understand the concepts of TensorFlow, its main functions, operations and the execution pipeline.
2 Implement deep learning algorithms, understand neural networks and traverse the layers of data abstraction which will empower the student to understand data more precisely.
3 Learn topics such as convolutional neural networks, recurrent neural networks, training deep networks and high-level interfaces.
4 Build deep learning models in Tensor Flow and interpret the results.
5 Understand the language and fundamental concepts of artificial neural networks.
6 Troubleshoot and improve deep learning models & Build own deep learning project.
7 Differentiate between machine learning, deep learning and artificial intelligence.

UNIT – I

Introduction to TensorFlow :Computational Graph, Key highlights, Creating a Graph, Regression example, Gradient Descent, TensorBoard, Modularity, Sharing Variables, Activation Functions :Sigmoid, ReLU, Hyperbolic Fns, Softmax.

UNIT – II

Artificial Neural Networks: Concept of a Neural Network. Human Brain. Models of a Neuron. Introduction Artificial Neural Networks, Single - Layer Feed Forward Networks, Multi - Layer Feed Forward Networks, Back-Propagation Algorithm., Radial - Basis Function Networks, Design Issues of Artificial Neural Networks, Recurrent Networks. Gradient Descent and Back propagation: Gradient Descent, Stochastic Gradient Descent, momentum, and adaptive sub-gradient method , Some problems in ANN.

UNIT – III

Optimization and Regularization :Overfitting and Capacity, Cross Validation, Feature Selection, Regularization, Hyperparameters.Introduction to Convolutional Neural Networks: Introduction to CNNs, Kernel filter, Principles behind CNNs, Multiple Filters, CNN applications.

UNIT – IV

Introduction to Recurrent Neural Networks: Introduction to RNNs, Unfolded RNNs, Seq2Seq RNNs, LSTM, RNN applications Auto encoders: Under-complete auto-encoders, regularized auto-encoders, sparse auto-encoders, de-noising auto-encoders, representational power, layer, size, and depth of auto-encoders, stochastic encoders and decoders.

UNIT – V

Deep Learning applications: Image Processing, Natural Language Processing, Speech Recognition, Video Analytics

Suggested Readings:

1 Goodfellow, I., Bengio,Y., and Courville, A., Deep Learning, MIT Press, 2016.
2 Jeff Heaton,Deep Learning and Neural Networks, Heaton Research Inc, 2015.
3 Mindy L Hall, Deep Learning, VDM Verlag, 2011.
4 Li Deng (Author), Dong Yu, Deep Learning: Methods and Applications (Foundations and Trends in Signal Processing), Now Publishers Inc, 2009.

Suggested References:

1. Bishop, C. ,M., Pattern Recognition and Machine Learning, Springer, 2006.
2. Yegnanarayana, B., Artificial Neural Networks PHI Learning Pvt. Ltd, 2009.
3. Golub, G.,H., and Van Loan,C.,F., Matrix Computations, JHU Press,2013.
4. Satish Kumar, Neural Networks: A Classroom Approach, Tata McGraw-Hill Education, 2004.

CLOUD COMPUTING

PE 863 CM

Instruction	: 3 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: Student will be able to:

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
4 Discuss system, network and storage virtualization and outline their role in enabling the cloud computing system model.
5 Analyze various cloud case studies

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, Zaigham Mahood, 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.

Suggested References :

1 Kai Hwang, Geoffrey C. Fox and Jack J. Dongarra, "Distributed and cloud computing from Parallel Processing to the Internet of Things", Morgan Kaufmann, Elsevier – 2012

2 Rajkumar Buyya, Christian Vecchiola, S. Thamarai Selvi, ―Mastering Cloud Computing‖, Tata McGraw-Hill, 2013.

3 George Reese, "Cloud Application Architectures: Building Applications and Infrastructure in the Cloud: Transactional Systems for EC2 and Beyond (Theory in Practice)", O'Reilly, 2009.

VIRTUAL REALITY

PE864 CM

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

Objectives:

1. To understand geometric modeling and virtual environment.
2. To study about Virtual Hardware and Software.
3. To develop Virtual Reality applications.
4. To design virtual environment.

Outcomes: Student will be able to:

1. Design Virtual environment.
2. Implement Virtual Hardware and software.
3. Design geometric modeling applications.
4. Understand Virtual Reality toolkits.
5. Implement Virtual Reality applications.

UNIT – I Introduction to Virtual Reality

Virtual Reality & Virtual Environment : Introduction – Computer Graphics – Real Time Computer Graphics – Flight Simulation – Virtual Environments – Requirement – Benefits of Virtual Reality- Historical development of VR : Introduction – Scientific Landmark – 3D Computer Graphics: Introduction – The virtual world space – positioning the virtual observer – the perspective projection – human vision – stereo perspective projection – 3D clipping – Colour theory – Simple 3D modeling – Illumination models – Reflection models – Shading algorithms- Radiosity – Hidden Surface Removal – Realism- Stereographic image.

UNIT – II Geometric Modeling

Geometric MODELING: From 2D to 3D – 3D space curves – 3D boundary representation - Geometrical Transformations: Introduction – Frames of reference – Modeling transformations – Instances – Picking-Flying – Scaling the VE – Collision detection - A Generic VR system: Introduction – The virtual environment – the Computer environment – VR Technology – Model of interaction – VR Systems.

UNIT – III Virtual Environment

Animating the Virtual Environment: The dynamics of numbers – Linear and Non-linear interpolation - The animation of objects – linear and nonlinear translation - shape & object in betweening – free from deformation – particle system- Physical Simulation: Introduction – Objects falling in a gravitational field – Rotating wheels – Elastic collisions – projectiles – simple pendulum – springs – Flight dynamics of an aircraft.

UNIT – IV VR Hardwares & Softwares

Human factors :eye-ear-somatic senses - VR Hardware : Introduction – sensor hardware – Head-coupled displays –Acoustic hardware – Integrated VR systems-VR Software: Introduction – modelling virtual world –Physical simulation- VR toolkits – Introduction to VRML.

UNIT – V VR Applications

Virtual Reality Applications: Introduction – Engineering – Architecture – Science – Education – Medicine – Entertainment - Training – The Future: Introduction – Virtual environments – modes of interaction.

Suggested Readings:

1. Doug A Bowman, Ernest Kuijff, Joseph J LaViola, Jr and Ivan Poupyrev, 3D User Interfaces, Theory and Practice, Addison Wesley, USA, 2017.
2. William R. Sherman, Alan B. Craig, Understanding Virtual Reality: Interface, Application, and Design, Morgan Kaufmann, 2018.

Suggested References:

1. Alan B Craig, William R Sherman and Jeffrey D Will, Developing Virtual Reality Applications: Foundations of Effective Design, Morgan Kaufmann, 2009.
2. John Vince, Virtual Reality Systems, Pearson Education Asia, 2008.
3. Grigore C. Burdea, Philippe Coiffet ,Virtual Reality Technology, Wiley Interscience, 2nd Edition, 2006.
4. Oliver Bimber and Ramesh Raskar, Spatial Augmented Reality: Meging Real and Virtual Worlds, 2005.

ROAD SAFETY ENGINEERING

OE801CE

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

Course 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

Course Outcomes:

After completing this course, the 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 Equipments, 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 Zonemarkings, 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 toSafety, Road Safety Improvement Strategies, ITS and Safety.

Suggested Readings:

1. Kadiyali L.R,. *Traffic Engineering and Transport planning*, 9th Edition, Khanna TechPublishers, 2013.
2. C.E.G. Justo, A. Veeraragavan and 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 ResearchBoard, Washington D.C, 2016.*

FUNDAMENTALS OF ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

OE801CS

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

Course Objectives:

1. Cover various paradigms that come under the broad umbrella of AI.
2. To understand various key paradigms for machine learning approaches
3. To familiarize with the mathematical and statistical techniques used in machine learning.
4. To understand and differentiate among various machine learning techniques

Course Outcomes:

1. After completing this course, the student will be able to
2. Develop an understanding of modern concepts in AI and where they can be used
3. Design, implement and apply novel AI techniques based on emerging real-world requirements
4. To formulate a machine learning problem
5. Select an appropriate pattern analysis tool for analyzing data in a given feature space.
6. Apply pattern recognition and machine learning techniques such as classification and featureselection to practical applications and detect patterns in the data.
7. Design and program efficient algorithms related to recent machine learning techniques, train models, conduct experiments, and develop real-world ML-based applications and products

UNIT-I:

Introduction: Definitions of Artificial Intelligence, Artificial Intelligence Problems, Topics of Artificial Intelligence, Timelines of Artificial Intelligence, Production Systems, State Space Representation, Branches of Artificial Intelligence, Applications of Artificial Intelligence

UNIT-II:

Heuristic Search Techniques: Generate-and-Test, Hill Climbing, Search Techniques, Problem Reduction, Constraints Satisfaction, Means-ends Analysis

Knowledge Representation: Knowledge Management, Types of Knowledge, Knowledge Representation, Approaches to Knowledge Representation, Issues in Knowledge Representation, Knowledge Base

UNIT-III:

Learning: Types of Learning, Machine Learning, Intelligent Agents
Clustering: k-Means Clustering, Fuzzy Clustering, Hierarchical Clustering, Cluster Similarity, Case Studies,

UNIT-IV:

Statistical Learning: Hidden Markov Models, Linear Classifiers, Quadratic Classifiers, Decision Trees, Bayesian Networks, Case Studies,

Artificial Neural Nets: ANN Basics, ANN—Learning Process, Types of Networks, Perceptron, RBF Networks, ANN Summary, Case Studies

UNIT-V:
Supervised Learning: Support Vector Machines, Inductive Logic Programming, Case-based Reasoning, Ensemble Classifiers, Nearest Neighbourhood, Fuzzy Network, Case Studies,

Unsupervised Learning: Expectation Maximization, Self organizing maps, Adaptive resonancetheory, Case studies

Suggested Readings:

1. Vinod Chandra S.S and Anand Hareendran S, "Artificila Intelligence and Machine Learning", PHI, 2014
2. Prashant Kikani, "Demystifying Artificial intelligence: Simplified AI and Machine Learning concepts for Everyone", January 2021, BPB publication
3. Dr. Nilakshi Jain , "Artificial Intelligence, As per AICTE: Making a System Intelligent" January 2019, WILEY India
4. LavikaGoel , "Artificial Intelligence: Concepts and Applications" January 2021, WILEY India

SMART BUILDING SYSTEMS

OE801EE

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

Course Objectives

1. To understand the basic blocks of Building Management System.
2. To design various sub systems (or modular system) of building automation
3. To integrate all the sub systems

Course Outcomes

At the end of the course students will be able to

1. Describe the basic blocks and systems for building automation
2. Use different subsystems for building automation and integrate them.
3. Understand basic blocks and systems for building automation
4. 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 & Security) project cycle, Project steps BMS, Advantages & Applications of BMS, IBMS Architecture, Normal & Emergency operation, Advantages of BMS.

Suggested Reading:

1. Jim Sinopoli, *Smart Buildings*, Butterworth-Heinemann imprint of Elsevier, 2nd ed., 2010.
2. 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.
3. Albert Ting-Pat So, WaiLok Chan, Kluwer, *Intelligent Building Systems*, Academic publisher, 3rd ed.,2012.
4. Robert Gagnon, *Design of Special Hazards and Fire Alarm Systems*, Thomson Delmar Learning; 2nd edition, 2007.
5. Levenhagen, John I.Spethmann, Donald H, *HVAC Controls and Systems*, McGraw-Hill Pub.
6. Hordeski,Michael F,*HVACControl in the New Millennium*, Fairmont press,2001.
7. Bela G. Liptak, *Process Control-Instrument Engineers Handbook*, Chilton book co.

PROGRAMMABLE LOGIC CONTROLLERS

OE 802 EE

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

Course Objectives

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

Course Outcomes

At the end of the course students will be able to

1. Develop PLC programs for industrial applications.
2. Acquire the knowledge of PLC counter functions and PLC Arithmetic functionsand 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 Reading:

1. John W. Weff, Ronald A. Reis, Programmable Logic Controllers, Prentice Hall of India PrivateLimited, Fifth edition, 2003.
   Frank D. Petruzella, *Programmable*

PRINCIPLES OF ELECTRONICCOMMUNICATIONS

OE 801 EC

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

Course Objectives

1. Provide an introduction to fundamental concepts in the understanding of communicationssystems.
2. Provide an introduction to network model and some of the network layers including physical layer, data link layer, network layer and transport layer.
3. Provide an introduction to the evolution of wireless systems and current wirelesstechnologies.

Course Outcomes

1. Understand the working of analog and digital communication systems
2. Understand the OSI network model and the working of data transmission
3. Understand the evolution of communication technologies from traditional telephony systems to modern wireless communication systems.

UNIT – I

Introduction to communication systems: Electromagnetic Frequency Spectrum, Signal and its representation, Elements of Electronic Communications System, Types of Communication Channels.

Signal Transmission Concepts: Baseband transmission and Broadband transmission,

Communication Parameters: Transmitted power, Channel bandwidth and Noise, Need for modulation **Signal Radiation and Propagation:** Principle of electromagnetic radiation, Types of Antennas, Antenna Parameters and Mechanisms of Propagation.

UNIT– II

Analog and Digital Communications: Amplitude modulation and demodulation, FM modulation and demodulation, Digital converters, Digital modulation schemes – ASK, FSK, PSK, QPSK, Digital demodulation.

UNIT– III

Data Communication and Networking: Network Models, OSI Model, Data Link Layer – Media Access control, Ethernet, Network Layer – Internet Protocol (IPv4/IPv6), Transport Layer – TCP, UDP.

UNIT– IV

Telecommunication Systems: Telephones, Telephone system, Paging systems, InternetTelephony.

Optical Communications: Optical Principles, Optical Communication Systems, Fiber –OpticCables, Optical Transmitters & Receivers, Wavelength Division Multiplexing.

UNIT – V

Wireless Communications: Evolution of Wireless Systems: AMPS, GSM, CDMA, WCDMA, OFDM. Current Wireless Technologies: Wireless LAN, Bluetooth, PAN and ZigBee, Infrared wireless, RFID communication, UWB, Wireless mesh networks, Vehicular adhoc networks.

Suggested Readings:

1. Principles of Electronic Communication Systems, Louis E. Frenzel, 3e, McGraw Hill, 2008.

2. Data Communications and Networking, Behrouz A. Forouzan, 5e TMH, 2012. Kennady, Davis, Electronic Communications

SOFTWARE ENGINEERING

OE 801 IT

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

Course 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 ofsoftware development.
3. To understand the importance of testing in software development, study various testing strategies along with its relationship with software quality and metrics.

Course Outcomes:

After completing this course, the 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. Creation of visual models to describe (non-) algorithmic solutions for projectsusing various design principles.
4. 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 EngineeringTasks, 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 forO-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 softwaredevelopment.

Software Quality: Definition, ***Quality Assurance:*** Basic Elements, Formal Approaches, StatisticalSoftware Quality Assurance, Software Reliability, ISO9000 Quality Standards, SQA Plan.

Suggested Readings:

1. Roger S. Pressman, *Software Engineering: A Practitioner's Approach*, 7th Edition,McGrawHill, 2009
2. Ali Behforooz and Frederick J. Hudson, *Software Engineering Fundamentals*, OxfordUniversity Press, 1996
3. Pankaj Jalote, *An Integrated Approach to Software Engineering*, 3rd Edition, NarosaPublishing House, 2008

3D PRINTING TECHNOLOGIES

OE 801 ME

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

Course Objectives:

1. To understand the fundamental concepts of 3D Printing, its advantages and limitations.
2. To know the working principle, advantages, disadvantages and applications of liquid,solid and Powder based 3D Printing Technologies.
3. To know diversified applications of 3D Printing Technologies.

Course Outcomes:

After completing this course, the student will be able to

1. Interpret the features of 3D Printing and compare it with conventional methods.
2. Illustrate the working principle of liquid, solid and powder-based 3D PrintingTechnologies.
3. Apply the knowledge of various 3D Printing technologies for developing Innovative applications.

Unit-I

Introduction: Prototyping fundamentals, Historical development, Fundamentals of 3D Printing, Advantages and Limitations of 3D Printing, commonly used Terms, 3D Printing Process Chain, 3D Modeling, Data conversion and Transmission, Checking and Preparing, Building, Post-processing, RP Data formats, Classification of 3D printing processes, Fundamental Automated Processes, Distinction between 3D Printing and Conventional Machining Processes.

Unit-II

Liquid-based Systems: Stereo Lithography Apparatus (SLA): Models and specifications, Process, working principle, photopolymers, photo polymerization, Layering technology, laser and laser scanning, Applications, Advantages and Disadvantages, Case studies. Polyjet:

Models and specifications, Process, working principle, Applications, Advantages and Disadvantages, Case studies. Solid ground curing (SGC): Models and specifications, Process, working principle, Applications, Advantages and Disadvantages, Case studies.

Unit-III

Solid-based System: Laminated Object Manufacturing (LOM): Models and specifications, Process, working principle, Applications, Advantages and Disadvantages, Case studies. Fused Deposition Modeling (FDM): Models and specifications, Process, working principle, Applications, Advantages and Disadvantages, Case studies. Multi-Jet Modelling (MJM): Models and specifications, Process, Working principle, Applications, Advantages and Disadvantages, Case studies.

Unit-IV

Powder Based Systems: Selective laser sintering (SLS): Models and specifications, Process, working principle, Applications, Advantages and Disadvantages, Case studies. Three- dimensional Printing (3DP): Models and specifications, Process, working principle, Applications, Advantages and Disadvantages, Case studies. Laser Engineered Net Shaping (LENS): Models and specifications, Process, working principle, Applications, Advantages and Disadvantages, Case studies.

Unit-V

Applications of 3D Printing : Application in Design, Application in Engineering, Analysis and Planning, Aerospace Industry, Automotive Industry, Electronic Industry, Jewelry Industry, Coin Industry, GIS application, Arts and Architecture, Pattern for investment and vacuum casting, Medical Models and Bioengineering Applications: Planning and simulation of complex surgery, Customized Implants & Prosthesis, Design and Production of Medical Devices, Forensic Science and Anthropology, and Web Based Rapid Prototyping Systems.

Suggested Reading:

1. Chee Kai Chua and Kah Fai Leong, “3D Printing and Additive Manufacturing Principlesand Applications” Fifth Edition, World scientific
2. Ian Gibson, David W Rosen, Brent Stucker, “Additive Manufacturing Technologies: 3D Printing, Rapid Prototyping, and Direct Digital Manufacturing” Springer, Second Edition, 2010.
3. Frank W.Liou, “Rapid Prototyping & Engineering Applications”- CRC Press, Taylor &Francis Group, 2011.
4. Rafiq Noorani, “Rapid Prototyping: Principles and Applications in Manufacturing”, John Wiley & Sons, 2006.

ELEMENTS OF ELECTRIC AND HYBRIDVEHICLE TECHNOLOGY

OE 801 AE

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

Course Objectives:

1. To understand the hybrid vehicle technology
2. To know the energy storage requirements and analyze the hybridization of different storagedevices.
3. To understand the configuration of various electric propulsion units.
4. To know the different hybrid drives and the concept of electric drive trains.

Course Outcomes:

After completing this course, the student will be able to

1. Explain the basics of electric and hybrid electric vehicles, their architecture, technologies andfundamentals.
2. Discuss different energy storage technologies used for hybrid electric vehicles and theircontrol.
3. Analyze various electric drives suitable for hybrid electric vehicles.
4. Explain plug – in hybrid electric vehicle architecture, design and component sizing and thepower electronics devices used in hybrid electric vehicles.
5. Demonstrate different configurations of electric vehicles and its components, hybrid vehicle configuration by different techniques, sizing of components and design optimization and energy management.

Unit - I

Introduction: Introduction to Hybrid Electric Vehicles: History of hybrid and electric vehicles,social and environmental importance of hybrid and electric vehicles, impact of modern drive- trains on energy supplies Electric vehicles; configuration of EVs, performance, traction motor characteristics, tractive effort and transmission requirements.

Unit- II

Energy Storage: Introduction to Energy Storage Requirements in Hybrid and Electric Vehicles, Battery based energy storage and its analysis, Fuel Cell based energy storage and its analysis, Hybridization of different energy storage devices.

Unit - III

Electric Propulsion unit: Introduction to electric components used in hybrid and electric vehicles, Configuration and control of DC Motor drives, Configuration and control of Induction Motor drives

Unit - IV

Hybrid Drives: Introduction, features, functional classification, start/stop system, mild hybrid, full hybrid, plug-in-hybrid, batteries for hybrid vehicles, and optimization of hybrid configurations. Changing modes for conductive charging.

Unit - V

Hybrid Electric Vehicles (HEVs) And Drive Structures: Concept of electric drive train, architecture of hybrid electric drive train, series hybrid drive, parallel hybrid electrical drive train.

Electric and Hybrid Vehicles - Case Studies: Honda Insight, Chevrolet Volt, GM EV1, Toyota RAV 4 EV and Ford; Think City

Suggested Reading

1. Iqbal Husain, "Electic and Hybrid vehicles Design Fundamentals" , CRC Press, secondedition 2013
2. James Larminie, John Lowry, "Electric vehicle techonology Explained" 2nd Ed.,Wiley 2012
3. Vehicular Electrical Power Systems – Emadi, Ehasni, Mercel (Marcel Dekker)
4. Electric and Hybrid vehicles – Pistoia (Elsevier)
5. Fuel cells principles and applications - B.Vishwanath, M. Aulice Scibion (University Press)
6. Electrical vehicle machine and drives – K.T.Chau (Wiley).