FACULTY OF ENGINEERING

Scheme of Instruction & Examination

(AICTE Model Curriculum)

and

Syllabi

of

Four Year Degree Program of

Bachelor of Engineering (B.E)

INFORMATION TECHNOLOGY

Issued by

Dean, Faculty of Engineering

Osmania University, Hyderabad – 500 007

30.01.2021

Vision and Mission of Osmania University

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

Program Outcomes

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

SCHEME OF INSTRUCTION
BE (INFORMATION TECHNOLOGY)
AICTE MODEL CURRICULUM

IT: SEMESTER – I

S. No.	Course Code	Course Title	Scheme of Instruction				Scheme of Examination			Credits
			L	T	P/D	Contact Hours/ Week	CIE	SEE	Duration in Hours	
Theory Courses										
	Three Week Induction Programme									
1	MC 801 PO	Indian Constitution	2	0	-	2	30	70	-	-
2	BS 202 PH	Physics	3	1	-	4	30	70	3	4
3	BS 201 MT	Mathematics-I	3	1	-	4	30	70	3	4
4	ES 301 EE	Basic Electrical Engineering	3	1	-	4	30	70	3	4
Practical/ Laboratory Courses										
5	BS 251 PH	Physics Lab	-	-	3	3	25	50	3	1.5
6	ES 354 EE	Basic Electrical Engineering Lab	-	-	2	2	25	50	3	1
7	ES 353 CE	Engineering Graphics	-	-	3x2	6	50	50	3	3
Total			**11**	**03**	**11**	**25**	**220**	**430**		**17.5**

BS: Basic Sciences **ES: Engineering Sciences** **MC: Mandatory Course**

L: Lectures **T: Tutorials** **P:Practicals** **D: Drawing**

CIE: Continuous Internal Evaluation **SEE: Semester End Examination**

IT: SEMESTER – II

S. No	Course Code	Course Title	Scheme of Instruction				Scheme of Examination		
			L	T	P	Contact Hrs/Wk	CIE	SEE	Credits
Theory Courses									
1	MC 802 CE	Environmental Sciences	2	-	-	2	30	70	-
2	MC 803 PY	Essence of Indian Traditional Knowledge	2	-	-	2	30	70	-
3	HS 101 EG	English	2	-	-	2	30	70	2
4	BS 203 MT	Mathematics-II	3	1	-	4	30	70	4
5	BS 204 CH	Chemistry	3	1	-	4	30	70	4
6	ES 302 CS	Programming for Problem Solving	3	-	-	3	30	70	3
Practical/ Laboratory Courses									
7	HS 151EG	English Lab			2	2	25	50	1
8	BS 252CH	Chemistry Lab			3	3	25	50	1.5
9	ES 351 CS	Programming for Problem Solving Lab			2	2	25	50	1
10	ES 352ME	Workshop Practice	-	-	2x3	6	50	50	3
Total			**16**	**3**	**11**	**30**	**305**	**410**	**17.5**

IT: SEMESTER – III

S. No.	Course Code	Course Title	Scheme of Instruction				Scheme of Examination			Credits
			L	T	P/D	Contact Hrs/Wk	CIE	SEE	Duration in Hrs	
Theory Courses										
1	HS 104 EG	Effective Technical Communication in English	3	-	-	3	30	70	3	3
2	HS 105 CM	Finance and Accounting	3	1	-	4	30	70	3	3
3	BS 205 MT	Mathematics- III (Probability & Statistics)	3	1	-	4	30	70	3	3
4	ES 306 EC	Basic Electronics	3	-	-	3	30	70	3	3
5	ES 303 EC	Digital Electronics	3	1	-	4	30	70	3	3
6	PC 301 IT	Data Structures	3	-	-	3	30	70	3	3
7	PC 302 IT	Mathematical Foundations of Information Technology	3	-	-	3	30	70	3	3
Practical/ Laboratory Courses										
8	ES 351EC	Basic Electronics Lab	-	-	2	2	25	50	3	1
9	PC 351 IT	Data Structures Lab	-	-	2	2	25	50	3	1
10	PC 352 IT	IT Workshop Lab	-	-	2	2	25	50	3	1
Total			**21**	**3**	**06**	**30**	**285**	**640**		**24**

IT: SEMESTER – IV

S. No.	Course Code	Course Title	Scheme of Instruction				Scheme of Examination			Credits
			L	T	P/D	Contact Hrs/Wk	CIE	SEE	Duration in Hrs	
Theory Courses										
1	HS 103 ME	Operations Research	3	1	-	3	30	70	3	3
2	ES 305EC	Signals and Systems	3	1	-	3	30	70	3	3
3	PC 401 IT	JAVA Programming	3	1	-	3	30	70	3	3
4	PC 402 IT	Database Systems	3	1	-	3	30	70	3	3
5	PC 403 IT	Computer Organization and Microprocessor	3	1	-	3	30	70	3	3
6	PC 404 IT	Data Communications	3	1	-	3	30	70	3	3
Practical/ Laboratory Courses										
7	PC 451 IT	Microprocessor Lab	-	-	2	2	25	50	3	1
8	PC 452 IT	JAVA Programming Lab	-	-	2	2	25	50	3	1
9	PC 453 IT	Database Systems Lab	-	-	2	2	25	50	3	1
Total			**18**	**06**	**06**	**30**	**285**	**640**		**21**

IT: SEMESTER – V

S. No.	Course Code	Course Title	Scheme of Instruction				Scheme of Examination			Credits
			L	T	D/P	Contact Hrs/Wk	CIE	SEE	Duration in Hrs	
Theory Courses										
1	PC 501 IT	Web Application Development	3	1	-	4	30	70	3	3
2	PC 502 IT	Operating Systems	3	1	-	4	30	70	3	3
3	PC 503 IT	Automata Theory	3	1	-	4	30	70	3	3
4	PC 504 IT	Computer Networks	3	1	-	4	30	70	3	3
5	PC 505 IT	Software Engineering	3	1	-	4	30	70	3	3
6	PE-I	Professional Elective-I	3	-	-	3	30	70	3	3
Practical/Laboratory Courses										
7	PC 551 IT	Computer Networks Lab	-	-	2	2	25	50	3	1
8	PC 552 IT	Operating Systems Lab	-	-	2	2	25	50	3	1
9	PC 553 IT	Web Application Development Lab	-	-	2	2	25	50	3	1
10	PC 554 IT	Software Engineering Lab	-	-	2	2	25	50	3	1
Total			**18**	**05**	**06**	**31**	**310**	**690**		**22**

IT: SEMESTER – VI

S. No	Course Code	Course Title	Scheme of Instruction				Scheme of Examination			Credits
			L	T	D/P	Contact Hrs/Wk	CIE	SEE	Duration in Hrs/Wk	
Theory Courses										
1	PC 601 IT	Embedded Systems	3	1	-	4	30	70	3	3
2	PC 602 IT	Design and Analysis of Algorithms	3	1	-	4	30	70	3	3
3	PE-II	Professional Elective -II	3	-	-	3	30	70	3	3
4	PE –III	Professional Elective -III	3	-	-	3	30	70	3	3
5	PE –IV	Professional Elective -IV	3	-	-	3	30	70	3	3
6	OE – I	Open Elective -I	3	-	-	3	30	70	3	3
Practical/Laboratory Courses										
7	PC651 IT	Embedded Systems Lab	-	-	2	2	25	50	3	1
8	PC652 IT	Design and Analysis of Algorithms Lab	-	-	2	2	25	50	3	1
9	PW653 IT	Mini Project-I	-	-	4	4	25	50	3	2
10	SI 651 IT	Summer Internship*	-	-	-	-	-	-	-	-
Total			**18**	**2**	**10**	**30**	**255**	**570**		**22**

IT: SEMESTER – VII

S. No.	Course Code	Course Title	Scheme of Instruction				Scheme of Examination			Credits
			L	T	P/D	Contact Hrs/Wk	CIE	SEE	Duration in Hrs	
Theory Courses										
1	PC 701 EC	VLSI Design	3	1	-	4	30	70	3	3
2	PC 702 IT	Big Data Analytics	3	1	-	4	30	70	3	3
3	PE-V	Professional Elective-V	3	1	-	4	30	70	3	3
4	PE-IV	Professional Elective – VI	3	-	-	3	30	70	3	3
Practical/ Laboratory Courses										
5	PC 751 EC	VLSI Design Lab	-	-	2	2	25	50	3	1
6	PC 752 IT	Big Data Analytics Lab	-	-	2	2	25	50	3	1
7	PW 761 IT	Project Work – I	-	-	6	6	50	-	-	3
8	SI 762 IT	Summer Internship	`	-	-	-	50	-	-	2
Total			**12**	**03**	**10**	**25**	**270**	**380**	**-**	**19**

IT - SEMESTER - VIII

S. No.	Course Code	Course Title	Scheme of Instruction				Scheme of Examination			Credits
			L	T	P/D	Contact Hrs/Wk	CIE	SEE	Duration in Hrs	
Theory Courses										
1	**OE-II**	**Open Elective – II**	3	-	-	3	30	70	3	3
2	**OE-III**	**Open Elective – III**	3	-	-	3	30	70	3	3
Practical/ Laboratory Courses										
4	PW861 IT	Project Work – II	-	-	16	16	50	100	-	8
			06	**-**	**16**	**22**	**110**	**240**	**06**	**14**

Profession Elective – I	
Course Code	**Course Title**
PE 511 IT	Artificial Intelligence
PE 512 IT	Computer Graphics
PE 513 IT	Image Processing
PE514 IT	Computational Number Theory

Profession Elective – II	
Course Code	**Course Title**
PE 611 IT	Data Mining
PE 612 IT	Compiler Construction
PE 613 IT	Distributed Systems
PE 614 IT	Advanced Computer Architecture

Profession Elective – III	
Course Code	**Course Title**
PE 621 IT	Object Oriented Analysis and Design
PE 622 IT	Multimedia
PE 623 IT	Machine Learning
PE 624 IT	Data Science Using R Programming

Profession Elective – IV	
Course Code	**Course Title**
PE 631 IT	Computational Intelligence
PE 632 IT	Adhoc and Sensor Networks
PE 633 IT	Natural Language Processing
PE 634 IT	Information Storage and Management

Profession Elective – V	
Course Code	**Course Title**
PE 721 IT	Wireless and Mobile Communication
PE 722 IT	Semantic Web
PE 723 IT	Cloud Computing
PE 724 IT	Human Computer Interaction

Profession Elective – VI	
Course Code	**Course Title**
PE 731 IT	Internet of Things
PE 732 IT	Deep Learning
PE 733 IT	Digital Forensics
PE 734 IT	Crytpography and Network Security

Open Elective – I		
1	OE601EE	Electrical Energy Conservation and Safety (Not for EEE & EIE Students)
2	OE602EE	Reliability Engineering (Not for EEE & EIE Students)
3	OE611AE	Automobile Engineering (Not for Auto. Engg. students)
4	OE611ME	Entrepreneurship (Not for Mech Engg & Prod. Engg. students)
5	OE601EG	Soft Skills & Interpersonal Skills
6	OE602MB	Human Resource Development and Organizational Behaviour
7	OE601LW	Cyber Law and Ethics
8	OE601CS	Operating Systems (Not for CSE Students)
9	OE602CS	OOP using Java (Not for CSE Students)
10	OE601IT	Database Systems (Not for IT Students)
11	OE602IT	Data Structures (Not for IT Students)
12	OE601CE	Disaster Mitigation (Not for Civil Engg. Students)
Open Elective – II		
1	OE603EE	Non-Conventional Energy Sources (Not for EEE & EIE Students)
2	OE604EE	Transducers and Sensors (Not for EEE & EIE Students)
3	OE621AE	Automotive maintenance (Not for Auto. Engg. students)
4	OE621ME	Industrial Robotics (Not for Mech Engg & Prod. Engg. students)
5	OE811CE	Green Building Technologies (Not for Civil Engg. Students)
6	OE802CS	Data Science Using R Programming (Not for CSE Students)
7	OE 816 IT	Cyber Security (Not for IT Students)
Open Elective – III		
1	OE605EE	Smart Building Systems (Not for EEE & EIE Students)
2	OE606EE	Programmable Logic Controllers (Not for EEE & EIE Students)
3	OE631AE	Automotive Safety and Ergonomics (Not for Auto. Engg students)
4	OE631ME	Mechatronics (Not for Mech Engg & Prod. Engg. students)
5	OE821CE	Road Safety Engineering (Not for Civil Engg. Students)
6	OE822IT	Software Engineering (Not for IT Students)

Scheme of Instruction & Examination

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

And

Syllabi

B.E. I and II Semesters

of

Four Year Degree Programme

in

B.E. (Information Technology)

SCHEME OF INSTRUCTION
BE (INFORMATION TECHNOLOGY)
AICTE MODEL CURRICULUM

IT: SEMESTER – I

S. No.	Course Code	Course Title	Scheme of Instruction				Scheme of Examination			Credits
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Theory Courses										
	Three Week Induction Programme									
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2	BS 202 PH	Physics	3	1	-	4	30	70	3	4
3	BS 201 MT	Mathematics-I	3	1	-	4	30	70	3	4
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Practical/ Laboratory Courses										
5	BS 251 PH	Physics Lab	-	-	3	3	25	50	3	1.5
6	ES 353 EE	Basic Electrical Engineering Lab	-	-	2	2	25	50	3	1
7	ES 353 CE	Engineering Graphics	-	-	3x2	6	50	50	3	3
Total			**11**	**03**	**11**	**25**	**220**	**430**		**17.5**

BS: Basic Sciences **ES: Engineering Sciences** **MC: Mandatory Course**

L: Lectures **T: Tutorials** **P:Practicals** **D: Drawing**

CIE: Continuous Internal Evaluation **SEE: Semester End Examination**

IT: SEMESTER – II

S. No	Course Code	Course Title	Scheme of Instruction				Scheme of Examination		
			L	T	P	Contact Hrs/Wk	CIE	SEE	Credits
Theory Courses									
1	MC 802 CE	Environmental Sciences	2	-	-	2	30	70	-
2	MC 803 PY	Essence of Indian Traditional Knowledge	2	-	-	2	30	70	-
3	HS 101 EG	English	2	-	-	2	30	70	2
4	BS 203 MT	Mathematics-II	3	1	-	4	30	70	4
5	BS 204 CH	Chemistry	3	1	-	4	30	70	4
6	ES 302 CS	Programming for Problem Solving	3	1	-	3	30	70	3
Practical/ Laboratory Courses									
7	HS 151EG	English Lab			2	2	25	50	1
8	BS 252CH	Chemistry Lab			3	3	25	50	1.5
9	ES 351 CS	Programming for Problem Solving Lab			2	2	25	50	1
10	ES 352ME	Workshop Practice	-	-	2x3	6	50	50	3
Total			**15**	3	**10**	**28**	**305**	**410**	**19.5**

INDIAN CONSTITUTION

MC 801 PO

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

Objectives:

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

Outcomes: Student will be able to:

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

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

Suggested Readings:

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

PHYSICS

BS 202 PH

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

CIE: 30 marks *SEE: 70 marks*

Credits: 4

Objectives:

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

Outcomes: Student will be able to:

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

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

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

Suggested Readings:

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

MATHEMATICS-I

BS 201 MT

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

CIE: 30 marks *SEE: 70 marks*

Credits : 4

Objectives:

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

Outcomes: Student will be able to:

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

UNIT – I
Sequences and Series: Sequences, Series, General properties of series, Series of positive terms, Comparison tests, tests of Convergence D'Alembert's ratio test, Cauchy's n^{th} root test, Raabe's test, Logarithmic test, Alternating series, Series of positive and negative terms, Absolute convergence and Conditional convergence.
UNIT – II
Calculus of one Variable: Rolle's theorem, Lagrange's, Cauchy's mean value theorems, Taylor's series, Curvature, Radius of curvature, Circle of curvature, Envelope of a family of curves, Evolutes and Involutes.
UNIT – III
Multivariable Calculus (Differentiation): Functions of two variables, Limits and continuity, Partial derivatives, Total differential and differentiability, Derivatives of composite and implicit functions (Chain rule), Change of variables, Jacobian, Higher order partial derivatives, Taylor's series of functions of two variables, Maximum and minimum values of functions of two variables, Lagrange's method of undetermined multipliers.
UNIT – IV
***Multivariable Calculus* (*Integration*):** Double integrals, Change of order of integration, Change of Variables from Cartesian to plane polar coordinates, Triple integrals
UNIT – V
Vector Calculus: Scalar and vector fields, Gradient of a scalar field, Directional derivative, Divergence and Curl of a vector field, Line, Surface and Volume integrals, Green's theorem in a plane, Gauss's divergence theorem, Stoke's theorem (without proofs) and their verification.

Suggested Readings:

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

BASIC ELECTRICAL ENGINEERING

ES 301 EE

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

CIE: 30 marks *SEE: 70 marks*

Credits: 4

Objectives:

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

Outcomes: Student will be able to:

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

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

Suggested Readings:

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

PHYSICS LAB

BS 251 PH

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

CIE: 25 marks *SEE: 50 marks*

Credits: 1.5

Objectives:

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

Outcomes: Student will be able to:

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

List of Experiments:

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

Note: Minimum eight experiments should be conducted in the semester

Suggested Readings:

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

BASIC ELECTRICAL ENGINEERING LAB

ES 354 EE

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

CIE: 25 marks *SEE: 50 marks*

Credits: 1

Objectives:

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

Outcomes: Student will be able to:

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

List of Experiments:

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

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

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

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

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

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

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

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

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

Exp 8. OCC characteristics of DC Generator

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

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

Exp 11. Load Test of DC Motor

Note - 1:

(i) List of Experiments and Demonstrations suggested above are already available in the Laboratory of the electrical department. No need to purchase any extra equipment except Demonstration2 equipments

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

Suggested Readings:

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

ENGINEERING GRAPHICS

ES 353 CE

Instruction:6 periods per week *Duration of SEE: 3 hours*

CIE: 50 marks *SEE: 50 marks*

Credits: 3

Objectives:

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

Outcomes: Student will be able to:

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

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

12	Projections of planes-II Oblique planes	-	2
13	Projections of solids – I Polyhydra and solids revolution, projections of solids in simple position	1	2
14	Projections of solids – II Polyhydra and solids when the axes inclined to one or both the reference planes.	1	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 – I Intersection of cylinder and cones	-	2
21	Isometric projection – I- planes and simple solids	1	2
22	Isometric projection – I – Combination of two or three solids	-	2
23	Conversion of Isometric Views to Orthographic Views	1	2
24	Floor plans of 2 or 3 rooms including windows, doors, and fixtures such as WC, bath, sink, shower, etc.	1	2

Suggested Readings:

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

NOTE:

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

ENVIRONMENTAL SCIENCES

MC 802CE

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

CIE: 30 marks *SEE: 70 marks*

Credits : 0

Objectives:

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

Outcomes: Student will be able to:

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

UNIT – I
The Multidisciplinary Nature of Environmental Studies: Definition, scope and importance, need for public awareness. ***Natural Resources*:** Water Resources – Use and over utilization of surface and ground water, flood, drought, conflicts over water, Dams: Benefits and Problems. Food Resources –World Food Problems, effects of modern agriculture, fertilizer-pesticides problems, water logging, salinity, Forest Resources – Use and over exploitation, deforestation & its effect on tribal people.Land Resources –Land Degradation, environmental effect of mining, man induced landslides, soil erosion and desertification. Energy Resources –Growing energy needs, Renewable and Non-renewable energy resources.
UNIT – II
Ecosystems: Concept of an ecosystem, Structure and function of an ecosystem, Producers, consumers and decomposers, Energy flow in ecosystem, food chains, ecological pyramids, ecological succession, types of ecosystems (marine, pond, river, forest, grassland, desert)
UNIT – III
Biodiversity: Levels of Biodiversity, Bio-geographical classification of India, Value of biodiversity, Threats to biodiversity, endangered and endemic species of India, Conservation of biodiversity, global and national efforts.
UNIT – IV
Environmental Pollution: Definition, Causes, effects and control measures of air pollution, water pollution, soil pollution, noise pollution, thermal pollution, solid waste management. ***Environment Protection Act***: Air, water, forest and wildlife Acts, issues in the enforcement of environmental legislation
UNIT – V
Social Issues and the Environment: Watershed management and environmental ethics.

Climate change, global warming, acid rain, ozone layer depletion.

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

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

Suggested Readings:

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

ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE

MC 802 PY

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

Objectives:

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

Outcomes: Student will be able to:

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

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

Suggested Readings:

1	Kapil Kapoor, "*Text and Interpretation*: *The India Tradition*", D. K. Print world, 2005
2	Gopala Krishnan , "*Science in Samskrit*", Samskrita Bharti Publisher, New Delhi, 2017

3	NCERT, "*Position paper on Arts, Music, Dance and Theatre*" NCERT, New Delhi, 2010.
4	S. Narain, "*Examinations in Ancient India*", Arya Book Depot, New Delhi, 1993
5	Satya Prakash, "*Founders of Sciences in Ancient India*", Vijay Kumar Publisher, New Delhi, 1989
6	M. Hiriyanna, "*Essentials of Indian Philosophy*", Motilal Banarsidass Publishers, New Delhi, 2005

ENGLISH

HS 101 EG

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

Objectives:

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

Outcomes: Student will be able to:

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

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

Suggested Readings:

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

MATHEMATICS-II

BS 203 MT

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

CIE: 30 marks *SEE: 70 marks*

Credits: 4

Objectives:

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

Outcomes: Student will be able to:

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

UNIT – I
Matrices: Rank of a matrix, Echelon form, System of linear equations, Linearly dependence and independence of vectors, Linear transformation, Orthogonal transformation, Eigen values, Eigenvectors, Properties of eigen values, Cayley - Hamilton theorem, Quadratic forms, Reduction of quadratic form to canonical form by orthogonal transformation, Nature of quadratic forms.
UNIT – II
Differential Equations of First Order: Exact differential equations, Integrating factors, Linear differential equations, Bernoulli's, Riccati's and Clairaut's differential equations, Orthogonal trajectories of a given family of curves.
UNIT – III
Differential Equations of Higher Orders: Solutions of second and higher order linear homogeneous equations with constants coefficients, Method of reduction of order for the linear homogeneous second order differential equations with variable coefficients, Solutions of non-homogeneous linear differential equations, Method of variation of parameters, solution of Euler-Cauchy equation.
UNIT – IV
Special Function: Gamma Functions, Beta Functions, Relation Between Beta and Gamma Function, Error Functions. Power Series Method, Lengender's Differential Equations and Legender's Polynomial $P_n(x)$, Rodrigue's Formula (without proof).
UNIT – V
Laplace Transforms: Laplace Transforms, Inverse Laplace Transforms, Properties of Laplace Transforms and inverse Laplace Transforms, Convolution Theorem (without proof). Solution of ordinary Differential Equations using Laplace Transforms.

Suggested Readings:

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

CHEMISTRY

BS 204 CH

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

Objectives:

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

Outcomes: Student will be able to:

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

UNIT – I

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

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

UNIT – II

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

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

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

Surface coating methods: Hot Dipping-Galvanizing.

UNIT – III

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

	Types of Polymerization-Addition, Condensation, Co-Polymerization. Mechanism of free radical polymerization.Preparation, Properties & Uses of the following polymers: Plastics - PVC and Bakelite, Fibres - Nylon 6:6, and Kevlar, Elastomers - Buna-S, Butyl and Silicone Rubbers. ***Conducting polymers***: Introduction, Classification and Mechanism of conduction in Poly-acetylene, Applications of conducting polymers. ***Biodegradable polymers:*** Introduction preparation, properties and applications of polylactic acid.
UNIT – IV	
	Chemical Fuels: Classification of fuels: Introduction, definition and classification of chemical fuels-Primary and secondary fuels. Solid, liquid and gaseous fuels. Requirements of a good fuel. Calorific Value – HCV and LCV. Theoretical calculations of calorific value by Dulong's formula – Numerical problems. ***Solid Fuels:*** Coal and its Ranking. Analysis of coal - Proximate and Ultimate analysis. ***Liquid Fuels:*** Fractionation of Petroleum. Composition and uses of Gasoline, Diesel and Kerosene. Cracking & its Significance- Catalytic cracking by moving bed method, Knocking. Fuel rating – Octane and Cetane numbers. ***Gaseous Fuels***: LPG, CNG -Composition and Uses. ***Combustion:*** Ignition temperature of a fuel, calculation of air quantities by weight and volume required for combustion of a fuel- Numerical problems.
UNIT – V	
	Green Chemistry: Concept, Principles of green chemistry – Atom Economy, Catalysis. and examples of clean technology. ***Biodiesel:*** Sources, Concept of Transesterification and carbon neutrality, Properties and significance ***Composites:*** Introduction to composites, composition and characteristic properties of composites. Classification of composites based on matrix, reinforcement and ply. Applications of composites.

Suggested Readings:

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

PROGRAMMING FOR PROBLEM SOLVING

ES 302 CS

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

Objectives:

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

Outcomes: Student will be able to:

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

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

Suggested Readings:

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

ENGLISH LAB

HS 151 EG

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

Objectives:

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

Outcomes: Student will be able to:

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

List of Experiments:

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

Suggested Readings:

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

CHEMISTRY LAB

ES 252 CH

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

Objectives:

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

Outcomes: Student will be able to:

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

List of Experiments:

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

Note: Minimum ten experiments should be conducted in the semester

Suggested Readings:

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

WORKSHOP PRACTICE

ES 352 ME

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

Objectives:

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

Outcomes: Student will be able to:

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

List of Experiments:

A. TRADE FOR EXERCISES:

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

B. TRADES FOR DEMONSTRATION AND EXPOSURE:

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

C. PRESENTATIONS AND VIDEO LECTURES

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

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

Note: At least two exercises from each trade.

Suggested Readings:

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

PROGRAMMING FOR PROBLEM SOLVING LAB

ES 351 CS

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

CIE: 25 marks *SEE: 50 marks*

Credits: 1

Objectives:

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

Outcomes: Student will be able to:

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

List of Experiments:

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

Suggested Readings:

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

SCHEME OF INSTRUCTION & EXAMINATION
B.E. (Information Technology) 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	HS 104 EG	Effective Technical Communication in English	3	-	-	3	30	70	3	3
2	HS 105 CM	Finance and Accounting	3	1	-	3	30	70	3	3
3	BS 205 MT	Mathematics III (Probability &Statistics)	3	1	-	3	30	70	3	3
4	ES 306 EC	Basic Electronics	3	-	-	3	30	70	3	3
5	ES 303 EC	Digital Electronics	3	1	-	3	30	70	3	3
6	PC 301 IT	Data Structures	3	-	-	3	30	70	3	3
7	PC 302 IT	Mathematical Foundations of Information Technology	3	-	-	3	30	70	3	3
Practical/ Laboratory Courses										
8	ES 351EC	Basic Electronics Lab	-	-	2	2	25	50	3	1
9	PC 351 IT	Data Structures Lab	-	-	2	2	25	50	3	1
10	PC 352 IT	IT Workshop Lab	-	-	2	2	25	50	3	1
			21	**3**	**06**	**30**	**285**	**640**		**24**

EFFECTIVE TECHNICAL COMMUNICATION IN ENGLISH

HS 104EG

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

CIE: 30 marks *SEE: 70 marks*

Credits: 3

Objectives:

To expose the students to:
1. Features of technical communication
2. Types of professional correspondence
3.Techniques of report writing
4.Basics of manual writing
5.Aspects of data transfer and presentations

Outcomes:

On successful completion of the course, the students would be able to:
1.Handle technical communication effectively
2.Use different types of professional correspondence
3.Use various techniques of report writing
4.Acquire adequate skills of manual writing
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. "Technical communication: Principles and Practice", 3rd Edition, New Delhi, 2015
2	Rizvi, Ashraf, M. "Effective Technical Communication (2nd Edition", New Delhi, Tata McGraw Hill Education, 2017
3	Tyagi, Kavita &Misra, Padma." Advanced Technical Communication", New Delhi, PHI Learning , 2011
4	Jungk, Dale," Applied Writing for Technicians", New York, McGraw-Hill Higher Education, 2004.

FINANCE AND ACCOUNTING

HS 105CM

Instruction: 4 periods per week *Duration of SEE: 3 hours*

CIE: 30 marks *SEE: 70 marks*

Credits: 3

Objectives:

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

Outcomes:

After successful completion of the course the students will be able to
1. Evaluate the financial performance of the business unit.
2. Take decisions on selection of projects.
3. Take decisions on procurement 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, 1st edition (4 June 2010)
3	Sharma. S.K. and Rachan Sareen, Financial Management, Sultan Chand, July 2019
4	Jonathan Berk, Fundamentals of Corporate Finance, Pearson Education 4th Edition, May 2017
5	Sharan, Fundamentals of Financial Management, Pearson Education, 1 Edition, January 2011

Mathematics – III
(Probability and Statistics)

BS 205 MT

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

Objectives:

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

Outcomes:

After completing this course, the student will be able to:
1.Solve field problems in engineering involving PDEs.
2. Theycanalsoformulateandsolveproblemsinvolvingrandomvariablesandapplystatistical methods for analysing experimental data.

UNIT – I
Definition of Partial Differential Equations, First order partial differential equations, solutions of first order linear PDEs; Solution to homogenous and non-homogenous linear partial differential equations of second order by complimentary function and particular integral method.
UNIT – II
Second-order linear equations and their classification, Initial and boundary conditions, D'Alembert's solution of the wave equation; Heat diffusion and vibration problems, Separation of variables method to simple problems in Cartesian coordinates. The Laplacian in plane, one dimensional diffusion equation and its solution by separation of variables.
UNIT – III
Discrete random variables, expectation of discrete random variables, moments, variance of a sum, continuous random variables & their properties, distribution- functions, anddensities.
UNIT – IV
Basic Statistics, Measures of Central tendency: Moments, skewness and Kurtosis – Probability distributions: Binomial, Poisson and Normal - evaluation of statistical parameters for these three distributions, Correlation and regression – Rank correlation. Curve fitting by the method of least squares- fitting of straight lines, second degree parabolas and more general curves.
UNIT – V
Test of significance; Large sample test for single proportion, difference of properties, Tests for single mean, difference of means, and difference of standard deviations. Test for ratio of variances – Chi- square test for goodness of fit and independence of attributes.

Suggested Readings:

1	B.S. Grewal, "Higher Engineering Mathematics", Khanna Publishers,2000.
2	Advanced Engineering Mathematics, R.K. Jain & Iyengar, NarosaPublications.
3	Engineering Mathematics, P. Sivaramakrishna Das & C. Vijaya Kumar, Pearson India Education Services Pvt.Ltd.
4	N.P. Bali and M. Goyal, "A text book of Engineering Mathematics", Laxmi Publications,2010.
5	E. Kreyszig, "Advanced Engineering Mathematics", John Wiley & Sons,2006.
6	P. G. Hoel, S. C. Port and C. J. Stone, "Introduction to Probability Theory", Universal Book Stall, 2003.
7	S. Ross, "A First Course in Probability", Pearson Education India,2002.
8	W. Feller, "An Introduction to Probability Theory and its Applications", Vol. 1, Wiley,1968.
9	T. Veerarajan, "Engineering Mathematics", Tata McGraw-Hill, New Delhi,2010.
10	Mathematical Statistics, S.C. Gupta & V.K. Kapoor, S. ChandPub, Jan 2014

BASIC ELECTRONICS

ES 306 EC

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

CIE: 30 marks *SEE: 70 marks*

Credits: 3

Objectives:

The objectives of this course is to impart knowledge of
1.To understand the characteristics of diodes and transistorconfigurations
2.To understand the design concepts of biasing of BJT and FET
3.To understand the design concepts of feedback amplifiers andoscillators
4.To study the design concepts of OP Amp and data converters

Outcomes:

After completing this course, the student will be able to:
1. Study and analyse the rectifiers and regulatorcircuits.
2. Study and analyse the performance of BJTs, FETs on the basis of their operation andworking.
3. Ability to analyse& design oscillatorcircuits.
4.Ability to analyse different logic gates & multi-vibrator circuits.
5.Ability to analyse different data acquisition systems

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

Suggested Readings:

1	Robert Boylestad L. and Louis Nashelsky, *Electronic Devices and Circuit Theory*, PHI,2007
2	HelfrickDandDavidCooper,*Modern Electronic Instrumentation and Measurements Techniques*, 1st edition, Prentice Hall of India, 2006.
3	Salivahanan, Suresh Kumar and Vallavaraj, *Electronic Devices and Circuits*, 2nd edition, Tata McGraw-Hill,2010.

DIGITAL ELECTRONICS

ES 303 EC

Instruction: 4 periods per week *Duration of SEE: 3 hours*

CIE: 30 marks *SEE: 70 marks*

Credits: 3

Objectives:

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

Outcomes:

After completing this course, the student will be able to:
1.Understand the deign process of digital hardware, use Boolean algebra to minimize the logical expressions and optimize the implementation of logicalfunctions.
2.Understand the number representation and design combinational circuits like adders, MUXetc.
3.Design Combinational circuits using PLDS and write VHDL code for basic gates and combinationalcircuits.
4.Analyse sequential circuits using flip-flops and design registers,counters.
5.Represent a sequential circuit using Finite State machine and apply state minimization techniques to design aFSM

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

Suggested Readings:

1	Moris Mano and Michael D CIletti, Digital Design, Pearson, fourthedition,2008
2	ZviKohavi, Switching and Finite Automata Theory, 3rd ed., Cambridge University Press-New Delhi, 2011.
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.

DATA STRUCTURES

PC 301 IT

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

CIE: 30 marks *SEE: 70 marks*

Credits: 3

Objectives:

1.To develop proficiency in the specification, representation, and implementation of abstract data types and datastructures.
2.To discuss the linear and non-linear data structures and theirapplications.
3.To introduce the creation, insertion and deletion operations on binary search trees and balanced 0binary search trees.
4.To introduce various internal sorting, searching techniques and their timecomplexities

Outcomes:

After completing this course, the student will be able to:
1.Implement linear, non-linear data structures and balanced binarytrees
2.Understand the basic data structures arrays and linkedlists.
3.Analyse time complexity of both iterative and recursivefunctions.
4.Define ADT necessary for solving problems based on Stacks andQueues.
5.Develop solutions using binary trees, advanced search trees, tries andgraphs.
6.Use hash functions and handlecollisions.
7.Understand various kinds of sorting techniques and apply appropriate techniques for solving a given problem

UNIT – I
Introduction to C++ and Algorithms: Object oriented Design, Data Abstraction and Encapsulation, Basics of C++: Program organization in C++, Input/output in C++, Classes and Constructors, Access Modifiers, Dynamic Memory Allocation in C++, Templates in C++, Exception Handling. **Algorithms:** Introduction, Algorithm Specifications, Recursive Algorithms, Performance Analysis of an algorithm- Time and Space Complexity, Asymptotic Notations.
UNIT – II
Arrays: Abstract Data Types and the C++ Class, Array as an Abstract Data Type, Polynomial Abstract Data Type, Sparse Matrices, Representation of Arrays, String Abstract Data Type. **Stacks and Queues**: Templates in C++, Stack Abstract Data Type, Queue Abstract Data type, Sub typing and Inheritance in C++, Evaluation of Expressions.
UNIT – III
Linked Lists: Singly Linked Lists and Chains, Representing Chains in C++, Template Class Chain, Circular Lists, Available Space Lists, Linked Stacks and Queues, Polynomials, Doubly Linked Lists. **Hashing:** Static Hashing, Hash Tables, Hash Functions, Overflow Handling, Theoretical Evaluation of Overflow Techniques
UNIT – IV
Trees: Introduction, Binary Trees, Binary Tree Traversal and Tree Iterators, Copying Binary Trees, Threaded Binary Trees, Heaps, Efficient Binary Search Trees: AVLTrees.
UNIT – V
Sorting and Searching: Insertion sort, Quick sort, Best computing time for Sorting, Merge sort, Heap sort, shell sort, Sorting on Several Keys, List and Table Sorts, Summary of Internal Sorting, Linear and Binary Search algorithms

Graphs: Graph Abstract Data Type, Elementary Graph operations (DFS and BFS), Minimum Cost Spanning Trees (Prim's and Kruskal's Algorithms).

Suggested Readings:

1	Ellis Horowitz, Dinesh Mehta, S. Sahani. Fundamentals of Data Structures in C++, Universities Press.2007.
2	Data Structures with C++ by John R. Hubbard (Schaum's Outlines Series)2001
3	Mark Allen Weiss, Data Structures and Algorithm Analysis in C++, Pearson Education2006.
4	Michael T. Goodrich, Roberto Tamassia, David Mount, Data Structures and Algorithms in C++, Wiley India Pvt. Ltd,2004.

MATHEMATICAL FOUNDATIONS OF INFORMATION TECHNOLOGY

PC 302 IT

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

CIE: 30 marks *SEE: 70 marks*

Credits: 3

Objectives:

1.To explain with examples, the basic terminology of functions, relations, andsets.
2.To perform the operations associated with sets, functions, andrelations.
3.To relate practical examples to the appropriate set, function, or relation model, and interpret the associated operations and terminology incontext.
4.To describe the importance and limitations of predicatelogic.
5.To relate the ideas of mathematical induction to recursion and recursively definedstructures.
6.To use Graph Theory for solvingproblems.

Outcomes:

After completing this course, the student will be able to:
1.Illustrate by examples the basic terminology of functions, relations, and sets and demonstrate knowledge of their associatedoperations.
2.Understand basics of counting, apply permutations and combinations to handle different types ofobjects.
3.Describe and use recursively-defined relationships to solve problems using generatingfunctions.
4.Analyse semi group, monoid group and abelian group with suitable examples and appreciate group theory applications in computerarithmetic.
5.Demonstrate in practical applications the use of basic counting principles of permutations, combinations, inclusion/exclusion principle and the pigeonhole methodology.
6.Represent and Apply Graph theory in solving computer science problems

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

graphs, Chromatic Numbers.

Suggested Readings:

1	Elements of Discrete Mathematics- A Computer Oriented Approach- C L Liu, D P Mohapatra. Third Edition, Tata McGrawHill 2012, 4 edition
2	Discrete Mathematics for Computer Scientists & Mathematicians, J.L. Mott, A. Kandel, T.P. Baker, PHI December 1985
3	Discrete Mathematics and its Applications, Kenneth H. Rosen, Fifth Edition.TMH 2012
4	Discrete Mathematical Structures Theory and Application-Malik & Sen,Cengage June 2004
5	Discrete Mathematics with Applications, Thomas Koshy,Elsevier, 5 edition Jan 2019
6	Logic and Discrete Mathematics, Grass Man & Trembley, Pearson Education,1 edition December 1995

BASIC ELECTRONICS LAB

ES 351 EC

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

Objectives:

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

Outcomes:

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

List of Experiments:

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

SuggestedReading:

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

DATA STRUCTURES LAB

PC 351 IT

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

Objectives:

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

Outcomes:

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

List of Programs:

1	Write a C++ program for the implementation of ArrayADT
2	Write a C++ program for the implementation of StringADT
3	Write a C++ program to implement the following usingarray a) StackADT b) QueueADT
4	Write a C++ program to implement the following using a single linkedlist a) StackADT b) QueueADT
5	Write a C++ program for evaluation of Infix to postfix conversion, evaluation of postfixexpression.
6	Write a C++ program to implement polynomial arithmetic using linkedlist
7	Write a C++ program to perform followingoperations: a) Insert an element into a binary searchtree b) Delete an element from a binary searchtree c) Search for a key element in a binary searchtree
8	Write a C++ program to implement all the functions of a dictionary(ADT) usinghashing
9	Write C++ program for the implementation of tree traversals on BinaryTrees
10	Write C++ program to perform followingoperations a) Insertion intoB-tree b) Deletion into B-tree
11	Write C++ program to perform followingoperations a) Insertion intoAVLtree b) Deletion into AVLtree
12	Write C++ program for the implementation of bfs and dfs for a givenGraph
13	Write C++ program to implement Kruskal's algorithm to generate a minimum spanningtree.
14	Write C++ program to implement Prim's algorithm to generate a minimum spanningtree
15	Write C++ program to implement searchingalgorithms.
16	Write C++ program for implementing the following sortingmethods a) Selection sort b) Quick sort c) shell sort d) Merge sort e) Heapsort

IT Workshop Lab

PC 352 IT

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

CIE: 25 marks *SEE: 50 marks*

Credits: 1

Objectives:

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

Outcomes:

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

List of Programming Exercises:

1	Python Variables, Executing Python from the Command Line, Editing Python Files, Python Reserved Words.
2	Comments, Strings and Numeric Data Types, Simple Input and Output.
3	Control Flow and Syntax, Indenting, if Statement, Relational Operators, Logical Operators, Bit Wise Operators, while Loop, break and continue, for Loop, Lists, Tuples, Sets, Dictionaries.
4	Functions: Passing parameters to a Function, Variable Number of Arguments, Scope, Passing Functions to a Function, Mapping Functions in a Dictionary, Lambda, Modules, Standard Modules.
5	OOP concepts: Classes, File Organization, Special Methods, Inheritance, Polymorphism, Special Characters, Character Classes, Quantifiers, Dot Character, Greedy Matches, Matching at Beginning or End, Match Objects, Compiling Regular Expressions.
6	MATLAB Menus, Toolbars, Computing with MATLAB, Script Files and the Editor/Debugger, MATLAB help System.
7	MATLAB controls: Relational Logical Variables. Conditional Statements: if – else – elseif, switch2 10. Loops: for – while – break, continue. User-Defined Functions.
8	Arrays, Matrices and Matrix Operations Debugging MATLAB Programs. Working with Data Files, and Graphing Functions: XY Plots –Sub-plots.

Suggested Readings:

1	Mark Summerfield," Programming inPython
2	A Complete introduction to the Python Language", Addison-Wesley Professional,2009.
3	Martin C. Brown," PYTHON: The Complete Reference", McGraw-Hill,2001.
4	W.J. Palm III, Introduction to MATLAB 7 for Engineers, McGraw-Hill International Edn,2005.
5	Wesley J Chun," Core Python Applications Programming", Prentice Hall,2012.
6	Allen B Downey," Think Python", O'Reilly,2012.
7	Stormy Attaway, "MATLAB: A Practical Introduction to Programming and Problem Solving".3rd Edition.

SCHEME OF INSTRUCTION & EXAMINATION

B.E. (Information Technology) 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	HS 103 ME	Operations Research	3	1	-	3	30	70	3	3
2	ES 305EC	Signals and Systems	3	1	-	3	30	70	3	3
3	PC 401 IT	JAVA Programming	3	1	-	3	30	70	3	3
4	PC 402 IT	Database Systems	3	1	-	3	30	70	3	3
5	PC 403 IT	Computer Organization and Microprocessor	3	1	-	3	30	70	3	3
6	PC 404 IT	Data Communications	3	1	-	3	30	70	3	3
Practical/ Laboratory Courses										
7	PC 451 IT	Microprocessor Lab	-	-	2	2	25	50	3	1
8	PC 452 IT	JAVA Programming Lab	-	-	2	2	25	50	3	1
9	PC 453 IT	Database Systems Lab	-	-	2	2	25	50	3	1
			18	**06**	**06**	**30**	**255**	**570**		**21**

OPERATIONS RESEARCH

HS 103 ME

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

Objectives:

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

Outcomes:

Student will be able to
1. Prepare the students to have the knowledge of Linear Programming Problem in Operations
2. Research at the end students would be able to understand the concept and develop the models for different applications
3. 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
4. Prepare the students to have the knowledge of Sequencing model at the end student would able to develop optimum model for job scheduling.
5. 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 - poison arrivals - Exponential service times with infinite population.

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

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

SIGNALS AND SYSTEMS

ES 305 EC

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

CIE: 30 marks *SEE: 70 marks*

Credits: 3

Objectives:

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

Outcomes:

Student will be able to
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 input
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 1997
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 July 2008

JAVA Programming

PC 401 IT

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

CIE: 30 marks *SEE: 70 marks*

Credits: 3

Objectives:

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

Outcomes:

Student will be able to
1. Achieve proficiency in object-oriented concepts and also learns to incorporate the same into the Java programminglanguage
2. Create Java application programs using sound OOP practices e.g. Inheritance, interfaces and proper program structuring by using packages, access controlspecifiers
3. Understand and Implement the concepts of Exception Handling injava.
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 classlibrary.
6. Understand File, Streams, Input and Output Handling in java.
7. 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-linearguments.

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 2004

DATABASE SYSTEMS

PC 402 IT

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

CIE: 30 marks *SEE: 70 marks*

Credits: 3

Objectives:

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

Outcomes:

Student will be able to
1. Developtheknowledgeoffundamentalconceptsofdatabasemanagementand Designingadatabase using ER modelling approach
2. Implement storage of data, indexing, and hashing.
3. Applytheknowledgeabouttransactionmanagement,concurrencycontrolandrecoveryof database systems
4. Ability to design entity relationship model and convert entity relationship diagrams into RDBMS and formulate SQL queries on the data.
5. Apply normalization for the development of application software.

UNIT – I
Introduction to Database: File System Organization: Sequential - Pointer - Indexed – Direct. Purpose of Database System - Database Characteristics - Users of Database System - Advantages of DBMS Approach - Schemas and Instances - Three Schema Architecture and Data Independence - The Database System Environment - Relational Algebra.
UNIT – II
Logical Database Design: Relational DBMS - Codd's Rule - Entity-Relationship model - Extended ER Normalization - Functional Dependencies - Anomaly - 1NF to 5NF - Domain Key Normal Form – Denormalization.
UNIT – III
Indexing: Types of Single Level Ordered Indexes - Multilevel Indexes - Dynamic Multilevel Indexes. **Transaction Processing and Concurrency Control**: Transaction Concepts - ACID Properties - Transaction States - Concurrency Control Problems - Serializability - Recoverability - Pessimistic and Optimistic Concurrency Control Schemes
UNIT – IV
Introduction to the Relational Model – Integrity Constraint Over relations – Enforcing Integrity constraints – Querying relational data – Logical data base Design – Introduction to Views – Destroying /altering Tables and Views. Relational Algebra – Selection and projection set operations – renaming – Joins – Division – Examples of Algebra overviews – Relational calculus – Tuple relational Calculus – Domain relational calculus – Expressive Power of Algebra and calculus
UNIT – V
Form of Basic SQL Query – Examples of Basic SQL Queries – Introduction to Nested Queries – Correlated Nested Queries Set – Comparison Operators – Aggregative Operators – NULL values

– Comparison using Null values – Logical connectivity's – AND, OR and NOT – Impact on SQL Constructs – Outer Joins – Disallowing NULL values – Complex Integrity Constraints in SQL Triggers and Active Data bases.
Advanced Topics: Overview: Parallel Database - Multimedia Database - Mobile Database - Web Database - Multidimensional Database. Data Warehouse - OLTP Vs OLAP - NoSQL Database.

Suggested Readings:

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

COMPUTER ORGANIZATION AND MICROPROCESSOR

PC 403 IT

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

Objectives:

1. To enable the students with the understanding of basic computer architecture with instruction set and programming of 8085 inparticular.
2. To learn the functionality and interfacing of various peripheraldevices

Outcomes:

Student will be able to
1. To understand the architecture of modern computer, Busstructures
2. Analyse the Different memories and evaluate the mappingtechniques.
3. Discuss the architecture, the instruction set and addressing modesof8085processor
4. AnalyseStacks,Subroutine,Interruptsof8085,different PPI techniques, the uses of interfaces 8259, RS 232C, USART (8251), and DMAcontroller
5. Design the applications of interfacing circuits 8254/8253timer, A/D and D/A converter, Keyboard/Displaycontroller.

UNIT – I
Basic Structure of Computers: Computer Types, Functional Units, Basic Operational Concepts, Bus Structures, Performance, Multiprocessors and Multicomputers, Historical perspective. Input/output Organization: Accessing I/O devices, Interrupts, Processor examples, Direct memory access, parallel interface and serial interface.
UNIT – II
The Memory System: Basic concepts, Semiconductor RAM memories, Read-Only memories, Speed, Size and Cost, Cache memories, Performance considerations, Virtual Memories, Memory management requirements, Secondary Storage
UNIT – III
8085 Architecture: Introduction to microprocessors and microcontrollers, 8085 Processor Architecture, Internal operations, Instructions and timings. Programming the 8085 - Introduction to 8085 instructions, Addressing modes and Programming techniques with Additional instructions
UNIT – IV
Stacks and subroutines, interfacing peripherals - Basic interfacing concepts, interfacing output displays, Interfacing input keyboards. Interrupts - 8085 Interrupts, Programmable Interrupt Controller (8259A). Direct Memory Access (DMA) - DMA Controller (Intel 8257), Interfacing 8085 with Digital to Analog and Analog to Digital converters.
UNIT – V
Programmable peripheral interface (Intel 8255A), Programmable communication interface (Intel 8251), Programmable. Interval timer (Intel 8253 and 8254), Programmable Keyboard /Display controller (Intel 8279). Serial and parallel bus standards RS 232 C, IEEE 488.

Suggested Readings:

1	Carl Hamacher, ZvonkoVranesic, SafwatZaky, Computer Organization, 5th Edition, McGraw Hill, 2002.
2	Ramesh S Gaonkar, Microprocessor Architecture, Programming, and Applications with the 8085, 5/E Prentice Hall,2002.
3	Pal Chouduri, Computer Organization and Design, Prentice Hall of India,1994
4	M. M. Mano, Computer System Architecture, 3rd Edition, Prentice Hall 1991.

DATA COMMUNICATIONS

PC 404 IT

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

Objectives:

1. Tounderstandthebasicsofdatatransmission,transmissionmedia,datacommunications system and its components.
2. To describe various encoding and modulation schemes, various data link protocols for flow control, error detection andcorrection.
3. To understand different types of multiplexing, spread spectrum techniques, Ethernet, services of WLANs and Bluetooth

Outcomes:

Student will be able to
1. Demonstrate systematic understanding of Data CommunicationTechniques.
2. Apply various encodingschemes.
3. 3. Understand multiplexingtechniques.
4. Get acquainted with the concepts of virtual circuit networks.
5. Understand various types of switchingtechniques.
6. Understand concepts of wirelessLANs.

UNIT – I
Introduction: Communication model and Modulation Techniques (AM, FM and PM), Data Communication networking, Protocols and Architecture, Standards. **Data Transmission:** Concepts and Terminology, Analog and Digital Transmission, Transmission Impairments, Transmission media. **Data Encoding:** Digital Data Digital Signals, Digital Data-Analog Signals, Analog Data- Digital Signals, Analog Data-Analog Signals.
UNIT – II
Data Communication Interface: Asynchronous and Synchronous Transmission, Line Configuration, Interfacing. **Data Link Control:** Flow Control, Error Detection, Error Control, HDLC, Other Data link Control Protocols, Performance Issues**.**
UNIT – III
Multiplexing & Switching: Frequency Division Multiplexing, Wavelength Division Multiplexing, Synchronous Time Division Multiplexing, Statistical Time Division Multiplexing. Asymmetric Digital Subscriber Line, xDSL. Circuit Switching, Packet Switching & Frame Relay. ATM: Architecture, Logical Connection, ATM Cells, Transmission of ATM cells.
UNIT – IV
Ethernets: Traditional Ethernet Topologies and Transmission Media, LAN protocol architecture, MAC sub layer, CSMA/CD, Physical Layer, Bridged, Switched and Full Duplex Ethernets. Fast

Ethernet: MAC sub Layer, Physical layer, Gigabit Ethernet: MAC sub Layer, Physical Layer
UNIT – V
Cellular Wireless Networks: Principles of Cellular Networks, First Generation Analog, Second Generation CDMA and Third Generation Systems. **Wireless LANs:** Overview, Wireless LAN Technology, IEEE 802.11 Architecture and Services, IEEE 802.11 Medium Access Control, IEEE 802.11 Physical Layer. **Bluetooth & Zigbee:** Architecture, Layers and Protocols.

Suggested Readings:

1	William Stallings, "Data and Computer Communication", 8th Edition, Pearson Education, Asia-2004.
2	Behrouz A. Forouzan, "Data Communications and Networking", 4th Edition, Tata McGraw Hill, 2006.
3	Simon Haykins "Communication Systems", John Wiley &Sons, 5 edition (16 March 2009)
4	Drew Gislason "Zigbee Wireless Networking" Elsevier Published: August2008

MICROPROCESSOR LAB

PC 451 IT

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

CIE: 25 marks *SEE: 50 marks*

Credits: 1

Objectives:

1. To become familiar with the architecture and Instruction set of Intel 8085microprocessor.
2. To provide practical hands on experience with Assembly LanguageProgramming.
3. Tofamiliarizethestudentswithinterfacingofvariousperipheraldeviceswith8085microprocessors

Outcomes:

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

List of Experiments

1	Tutorials on 8085Programming.
2	Interfacing and programming of 8255. (E.g. traffic lightcontroller).
3	Interfacing and programming of8254.
4	Interfacing and programming of8279.
5	A/D and D/A converterinterface.
6	Stepper motorinterface.
7	Displayinterface

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

JAVA Programming Lab

PC 452 IT

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

CIE: 25 marks *SEE: 50 marks*

Credits: 1

Objectives:

1. To build software development skills using java programming for real world applications.
2. To implement frontend and backend of an application
3. To implement classical problems using java programming.

Outcomes:

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

List of Experiments

1	Write a Java program to illustrate the concept of class with methodoverloading
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 levelInheritance.
4	Write a Java program to demonstrate the Interfaces & AbstractClasses.
5	Write a Java program to implement the concept of exceptionhandling.
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 Threadsynchronization.
8	Write a Java program that correctly implements producer consumer problem using the concept of inter threadcommunication.
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 inbytes
13	Write a Java program to illustrate the concept of I/OStreams
14	Write a Java program to implement serializationconcept
15	Write a Java applet program to implement Colour and Graphicsclass
16	Write a Java applet program for handling mouse & keyevents
17	Write a Java applet program to implement Adapterclasses

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 theresult.
19	Write an example for JDBC prepared statement withResultSet
20	Program to get primary key value (auto-generated keys) from inserted queries usingJDBC
21	Program to create a simpleJList
22	java Program to create a simple checkbox usingJCheckBox
23	Program to create a checkbox and ItemListener toit
24	1. Write Servlet application to print current date &time
	2. Html & ServletCommunication
	3. Auto refresh apage
	4. Demonstrate sessiontracking
	5. Select record fromdatabase
	6. Application for loginpage
	7. Insert record intodatabase
	8. Count the visits on webpage
	9. Insert teacher record inDatabas

Database Systems Lab

PC 453 IT

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

CIE: 25 marks *SEE: 50 marks*

Credits: 1

Objectives:

1. To practice various DDL commands inSQL
2. To write simple and Complex queries inSQL
3. To familiarizePL/SQL

Outcomes:

Student will be able to
1. Design and implement a database schema for a givenproblem.
2. Develop the query statements with the help of structured querylanguage
3. Populate and query a database using SQL andPL/SQL
4. Develop multi-user databaseapplication
5. Design GUI using forms and implement databaseconnectivity.

List of Programs

1	Creation of database (exercising the commands forcreation)
2	Simple condition query creation using SQLPlus
3	Complex condition query creation using SQLPlus
4	Usage of Triggers and StoredProcedures.
5	Creation of Forms for student Information, library information, Pay rolletc.
6	Writing PL/SQL procedures for datavalidation
7	Generation using SQLreports
8	Creating Password and Security features forapplications.
9	Usage of File locking table locking, facilities inapplications
10	Creation of small full pledged database application spreading over to 3sessions.

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

Suggested Readings:

1	Nilesh Shah, Database System Using Oracle, PHI,2007.
2	Rick F Vander Lans, Introduction to SQL, Fourth edition, PearsonEducation,2007.
3	Benjamin Rosenzweig, Elena Silvestrova, Oracle PL/SQL by Example, Third edition, Pearson Education,2004
4	Albert Lulushi, Oracle Forms Developer's Handbook, Pearson Education,2000

SCHEME OF INSTRUCTION & EXAMINATION
B E (INFORMATION TECHNOLOGY)
V SEMESTER

S. No.	Course Code	Course Title	Scheme of Instruction				Scheme of Examination			Credits
			L	T	D/P	Contact Hrs/Wk	CIE	SEE	Duration in Hrs	
Theory Courses										
1	PC 501 IT	Web Application Development	3	1	-	4	30	70	3	3
2	PC 502 IT	Operating Systems	3	1	-	4	30	70	3	3
3	PC 503 IT	Automata Theory	3	1	-	4	30	70	3	3
4	PC 504 IT	Computer Networks	3	1	-	4	30	70	3	3
5	PC 505 IT	Software Engineering	3	1	-	4	30	70	3	3
6	PE-I	Professional Elective-I	3	-	-	3	30	70	3	3
Practical/Laboratory Courses										
7	PC 551 IT	Computer Networks Lab	-	-	2	2	25	50	3	1
8	PC 552 IT	Operating Systems Lab	-	-	2	2	25	50	3	1
9	PC 553 IT	Web Application Development Lab	-	-	2	2	25	50	3	1
10	PC 554 IT	Software Engineering Lab	-	-	2	2	25	50	3	1
Total			**18**	**05**	**08**	**31**	**280**	**620**		**22**

WEB APPLICATION DEVELOPMENT

PC 501 IT

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

CIE: 30 marks *SEE: 70 marks*

Credits: 3

Objectives:

1. To develop dynamic web applications using the concepts of HTML 5.0 and CSS
2. To understand the document structure and schemas and represent data in that format
3. To develop applications using JQuery and represent objects in JSON notation
4. To implement applications using angular JS
5. To understand the MEAN Stack and SMACK stack and develop applications using the framework

Outcomes:

Student will be able to
1. Design and develop dynamic web sites using Html 5.0, CSS, JQuery.
2. Develop web content publishing applications that accesses data in XML or JSON format
3. Develop single page web applications using Angular JS
4. Design and develop big data applications using Mean stack and SMACK stack Frameworks.

UNIT – I
HTML and CSS Introduction: Web Application Fundamentals: protocols and web servers HTML 5.0: Basic tags, Form elements and attributes, validation Cascading Style Sheets CSS selectors, CSS BOX Model, CSS Positioning
UNIT – II
XML: The Syntax of XML, XML Document Structure, Document Type Definitions, Name Space, XML Schemas
UNIT – III
Java Script and JQuery: JQuery: Introduction to JQuery, JQuery Syntax, Selectors, HTML Manipulation, Effects and Events JSON: JSON Introduction, Syntax, Data Types, Objects, Schema, Comparison with XML. Java Script: Introduction to JavaScript, Selecting elements in the documents, Event handling
UNIT – IV
Angular JS: Preparing Development Environment, Angular modules and Controllers, Input Validation, Data Binding and Templates, Angular JS Services
UNIT – V
MEAN Stack, SMACK Stack : Introduction to MEAN Stack, SMACK Stack, Apache, Building Backend and Testing- Angular JS, Node JS, Express and Mongo DB

Suggested Readings:

1. Robert W. Sebesta, “Programming with World Wide Web”, Eighth Edition, Pearson Education, 2008.
2. John Pollak, “JQuery - A Beginners Guide”, McGraw Hill Education, 2014..
3. AgusKurniawan,”AngularJS Programming by Example”,PE Press, First Edition
4. Colin J Ihrig, : Full Stack JavaScript Development with MEAN, SitePoint, 2015 Edition
5. Raul Estrada,:Fast Data Processing Systems with SMACK Stack,Packt, December 2016

OPERATING SYSTEMS

PC 502 IT

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

CIE: 30 marks *SEE: 70 marks*

Credits: 3

Objectives:

1. To understand the working of computer system and the basic concepts of operating system and the services provided by it.
2. To understand the functions and management of different resources of the operating system (Processor, I/O, and Memory etc)
3. To understand process management concepts including scheduling, synchronization, deadlocks
4. To learn the mechanisms involved in memory management and I/O subsystems of an operating system.
5. To understand issues of protection and security

Outcomes:

Student will be able to
1. Explain the fundamental concepts and functions of operating system. .
2. Understand process scheduling in a multi-programming environment and implementing process scheduling algorithms.
3. Write application and system calls related programs for managing processes, memory, I/O and inter-process Communication related system calls.
4. Understand memory management, disk management techniques, including virtual memory and file system structure
5. Explain protection and security related issues of the computer system.

UNIT – I
Introduction: Computer System organization & Architecture, Operating System Structure &Operations, Process, Memory and Storage Managements, Protection and Security, Distributed and Special-Purpose Systems, Computing Environments. System Structures: Operating-System Services, User Operating System Interface, System calls, Types of System Calls, System Programs, Operating-System Structure, Virtual Machines, Operating – System Generation, System Boot. Process Concept: Overview, Process Scheduling, Operations on Processes, Interprocess communication, Examples of IPC Systems, Communication in Client/Server Systems. Multithreaded Programming*:* Overview, Multithreading Models, Thread Libraries, Threading Issues, Operating-System Examples.
UNIT – II
Process Scheduling: Basic Concepts, Scheduling Criteria, Scheduling Algorithms, Multi-Processor Scheduling, Thread Scheduling: Pthreads , Operating System Examples, Algorithm Evaluation. Process Coordination and Synchronization: Background, The Critical-Section Problem, Peterson'sSolution,Synchronization, Monitors, Synchronization Examples. Deadlocks: System Model, Deadlock characterization, Methods for Handling Deadlocks,DeadlockPrevention, Deadlock Avoidance, Deadlock Detection, Recovery from Deadlock.

UNIT – III
Memory-Management Strategies: Background, Swapping, Contiguous Memory Allocation, Paging, Structure of the Page Table, Segmentation, Example: The Intel Pentium. Virtual Memory Management: Background, Demand paging, Copy-on-write, Page Replacement, Allocation of Frames, Thrashing, Memory-Mapped Files, Allocating Kernel Memory, Other Considerations, Storage Management: File System, File Concept, Access Methods, Directory Structure, File-System Mounting, File sharing, Protection.
UNIT – IV
Implementing File Systems: File System-Structure, File-System Implementation, Directory Implementation, Allocation Methods, Free-Space Management, Efficiency and Performance, Recovery, Log-Structured File Systems, NFS. Secondary –Storage Structure: Overview of Mass-Storage Structure, Disk Structure, Disk Attachment, RAID Structure, Stable-Storage Implementation, Tertiary-Storage Structure. I/O Systems: Overview, I/O Hardware, Application I/O Interface, Kernel I/O Subsystems, Transforming I/O Request to Hardware Operations, STREAMS, Performance
UNIT – V
Protection *and Security:* Goals of Protection, Principles of Protection, Domain of protection, Access Matrix, Implementation of Access Matrix, Access control, Revocation of access rights, Capability-based Systems, Language-based protection. System Security: The security problem, program Threats, System and System Network Threats, Cryptography as a Security tool, User Authentication, Implementing Security Defences, firewalling to protect Systems and Networks, Computer Security Classification, Case Studies- Linux System. Real-time systems: - Overview, System Characteristics, Features of Real time kernels, Implementing Real time operating Systems, Real Time CPU Scheduling, An Example: VxWorks, Linux System.

Suggested Readings:

1. Abraham Silberschatz, Peter Galvin, Greg Gagne, Operating System principles, seventh Edition, John wiley& sons publication,2006 .
2. A.Tanenbaum-Modern Operation Systems. Third edition, Pearson Education, 2008.
3. William Stallings-Operating Systems, Fifth Edition, Pearson Education, 2005.
4. Ida M.Flynn, Understanding Operating Systems, Sixth Edition, Cengage, 2011

AUTOMATA THEORY

PC 503 IT

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

CIE: 30 marks *SEE: 70 marks*

Credits: 3

Objectives:

1. Provides basic properties of formal languages and formal grammars, deterministic and nondeterministic finite automata, relation between types of languages and types of finite automata.
2. Provides basic properties of Pushdown Automata and Turing machines and computing with Turing machines and PDA.
3. Understand the challenges for Theoretical Computer Science and its contribution to other sciences

Outcomes:

Student will be able to
1. Design and use deterministic, nondeterministic, and epsilon transition finite state automata and illustrate state transition on symbols of input words and establish the corresponding language of automata.
2. Analyze Regular Expressions and use Laws and establish the corresponding Regular Language. Prove a given language is regular or otherwise. Use Closure and Decision Properties of Regular Language.
3. Analyze ambiguity. Develop Context Free Grammars, Parse Tees and establish Context Free Language. Use Closure and Decision Properties of Regular Language.
4. Design Pushdown Automata and illustrate the working. Develop deterministic Pushdown Automata and establish equivalence of language of PDA and CFG.
5. Design Turing Machine and illustrate its working, implement programming techniques for Turing Machines, analyze extended and restricted Turing Machines for computational abilities, and establish the Recursively Enumerable language of Turing Machine and analyze the Undecidable problems.

UNIT – I
Automata: Introduction to Finite Automata, Central Concepts of Automata Theory. Finite Automata: An informal picture of Finite Automata, Deterministic Finite Automata, Nondeterministic Finite Automata, An Application, Finite Automata with Epsilon Transitions.
UNIT – II
Regular Expression And languages: Regular Expressions, Finite Automata and Regular Expression, Applications of Regular Expressions, Algebric Laws for Regular Expression. Properties of Regular Languages: Proving Languages not to be Regular, Closure Properties of Regular Languages, Decision Properties of Regular Languages, Equivalence and Minimization of Automata.
UNIT – III
Context Free Grammars and Languages: Context-Free Grammars, Parse Trees, Applications, Ambiguity in Grammars and Languages Properties of Context Free Languages: Normal Forms for Context-Free Grammars, Pumping Lemma, Closure Properties, Decision Properties of CFL's.
UNIT – IV
Pushdown Automata: Definition, Language of PDA, Equivalence of PDA's and; CFG's, Deterministic Pushdown Automata.
UNIT – V

Turning Machines: Problems that Computer Cannot Solve ,The Turning Machine, Programming Techniques for Turning Machines, Extensions to the Turning Machines, Restricted Turning Machines, Turning Machine and Computers. Undecidable Problems about Turning Machines, Post's Correspondence Problem, Other Undecidable Problems.

Suggested Readings:

1. John E.Hopcroft, Rajeev Motwani,Jeffery D Ulman. Introduction to Automata Theory Languages And Computation, third edition, Pearson Education, 2009.
2. John C.Martin, Introduction to Languages and the Theory of computation ,third Edition, Tata McGrawHill,2003.

COMPUTER NETWORKS

PC 504 IT

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

CIE: 30 marks *SEE: 70 marks*

Credits: 3

Objectives:

1. To study the design issues in network layer and various routing algorithms
2. To introduce internet routing architecture and protocols
3. To learn the flow control and congestion control algorithms in Transport Layer
4. To introduce the TCP/IP suite of protocols and the networked applications supported by it
5. To learn basic and advanced socket system calls

Outcomes:

Student will be able to
1. Explain the function of each layer of OSI and trace the flow of information from one
2. node to another node in the network
3. Understand the principles of IP addressing and internet routing
4. Describe the working of various networked applications such as DNS, mail, file transfer and www
5. Implement client-server socket-based networked applications

UNIT – I
Introduction: Uses of Computer Networks, Network Hardware, Network Software: Reference Models (ISO - OSI, TCP/IP). Network Layer: Network Layer Design Issues, Routing Algorithms, Congestion Control Algorithms
UNIT – II
Internetworking: Concatenated virtual circuits, Connectionless internetworking, Tunneling, Fragmentation. Network layer in the Internet: IP protocol, IP addresses, Internet control protocols, OSPF, BGP, Mobile IP, IPv6. The Internet Transport Protocols: UDP, Internet Transport Protocols: TCP.
UNIT – III
Network Programming: Socket Interface: Sockets, Socket Address, Elementary Sockets, Advanced Sockets, Socket Options, Remote Procedure Calls: Introduction, Transparency Issues and Sun RPC.
UNIT – IV
Application Layer: Domain Name System: DNS Name Space, Resource Records, Name Servers. Electronic Mail: Architecture and Services, User Agent, Message Formats, Message transfer and Final Delivery. World Wide Web: Architectural Overview, Static Web Documents, Dynamic Web Documents,HTTP, Wireless Web..

UNIT – V
Network Security: Cryptography, Symmetric Key Algorithms, Public Key Algorithms, Digital Signatures, Communication Security, Authentication Protocols, Email Security, Web Security.

Suggested Readings:

1. Andrew S. Tanenbaurn, Computer Nerworks, Fourth Edition, Pearson Education.
2. W. Richard stevens, Unix Network Programming" Prentice Hall/Pearson Education,2009.
3. James F. Kurose, Keith W, Ross, Computer Networking, Atop-Down Approach Featuring the Internet, Third Edition, Pearson Education , 2005.
4. William Stallings, Computer Networking with Internet Protocols and Technology, Pearson Education,2009

SOFTWARE ENGINEERING

PC 505 IT

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

CIE: 30 marks *SEE: 70 marks*

Credits: 3

Objectives:

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

Outcomes:

Student will be able to
1. Define different software development processes and their usability in different problem domains..
2. Explain the process of requirements collection, analyzing, and modeling requirements for effective understanding and communication with stakeholders.
3. Design and Develop the architecture of real world problems towards developing a blueprint for implementation.
4. Understand the concepts of software quality, testing and maintenance
5. Discuss the concepts related to Risk management and Software project Estimation

UNIT – I
Introduction to Software Engineering: A generic view of process, Software Engineering process framework, The Nature of Software, Software Engineering, Software Myths. Process Models: A Generic Process Model, Prescriptive Process Models, Specialized Process Models, The Unified Process 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
Understanding Requirements: Requirements Engineering, Establishing the Groundwork, Eliciting Requirements, Building the Requirement Model, Negotiating Requirements, Validating Requirements. Design Concepts: Design within the Context of Software Engineering, the Design Process, Design Concepts. Architectural Design: Software Architecture, Architecture Genres, Architecture Styles, Architecture Design, Assessing Alternative Architecture Designs, Architecture Mapping Using Data Flow.

UNIT – III
Software Quality Assurance: Background Issues, Elements of Software Quality Assurance, SQA Tasks, Goals and Metrics, Formal Approaches to SQA, Statistical Software Quality Assurance, Software Reliability, The ISO 9000 Quality Standards, The SQA Plan. **Risk Management**: Reactive versus Proactive Risk Strategies, Software Risks, Risk Identification, Risk Projection, Risk Refinement, Risk Mitigation, Monitoring, and Management, The RMMM Plan.
UNIT – IV
Software Testing Strategies: A Strategic Approach to Software Testing, Strategic Issues, Test Strategies for Conventional Software, Validation Testing, System Testing, The Art of Debugging. **Testing Conventional Applications:** Software Testing Fundamentals, Internal and External Views of Testing, White-Box Testing, Basis Path Testing, Control Structure Testing, Black – Box Testing.
UNIT – V
Product Metrics: A Framework for Product Metrics, Metrics for the Requirements Model, Metrics for the Design Model, Metrics for Testing, Metrics for Maintenance. **Estimation:** Software Project Estimation, Decomposition Techniques, Empirical Estimation Models, Specialized Estimation Techniques, The Make/Buy Decision. **Software Configuration Management:** Software Configuration Management. **Software Process Improvement:** The SPI Process, The CMMI, The people CMM, Other SPI Frameworks, SPI Return on Investment, SPI Trends.

Suggested Readings:

1. Roger S.Pressman, Software Engineering: A Practitioners Approach, Seventh Edition, McGrawHill, 2009.
2. Ali Behforoz and Frederic J.Hadson, Software Engineering Fundamentals, Oxford University Press, 1996.
3. Pankaj Jalote "An Integrated Approach to Software Engineering, Third Edition, Narosa Publishing house, 2008.

PROFESSIONAL ELECTIVE-I

ARTIFICIAL INTELLIGENCE

PE 511 IT

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

CIE: 30 marks *SEE: 70 marks*

Credits: 3

Objectives:

1. To understand foundations and Applications of AI
2. To learn Probabilistic Reasoning and other search algorithms.
3. To design Bayesian Networks and Markov model
4. To learn aspects of Reinforcement Learning

Outcomes:

Student will be able to
1. Identify problems that are amenable to solution using State space search algorithms
2. Understand and analyze working of an AI technique using Heuristic search
3. Understand and design the Bayesian Networks
4. Understand and apply the concepts of Markov Decision process.
5. Apply the program and apply Reinforcement Learning

UNIT – I
Introduction: History of AI, Intelligent Systems, Foundations of AI, Subareas of AI, Applications. Problem Solving – State-Space Search. State space representation.
UNIT – II
Search Algorithms: Random search, Search with closed and open list, Depth first and Breadth first search, Heuristic search, Best first search, A* algorithm.
UNIT – III
Probabilistic Reasoning: Probability, conditional probability, Bayes Rule, Bayesian Networks-representation, construction and inference, temporal model, hidden Markov model.
UNIT – IV
Markov Decision process: MDP formulation, utility theory, utility functions, value iteration, policy iteration and partially observable MDPs.
UNIT – V
Reinforcement Learning: Passive reinforcement learning, direct utility estimation, adaptive dynamic programming, temporal difference learning, active reinforcement learning- Q learning.

Suggested Readings:

1. Stuart Russell and Peter Norvig, "Artificial Intelligence: A Modern Approach" , 3rd Edition, Prentice Hall
2. 2. Elaine Rich and Kevin Knight, "Artificial Intelligence", Tata McGraw Hill
3. 3. Trivedi, M.C., "A Classical Approach to Artifical Intelligence", Khanna Publishing House, Delhi.
4. 4. Saroj Kaushik, "Artificial Intelligence", Cengage Learning India, 2011
5. .NilsJ Nilsson (1998), Artificial Intelligence, A NewSynthesis. Elsevier.
6. David Poole and Alan Mackworth, "Artificial Intelligence: Foundations for Computational Agents", Cambridge University Press 2010.

WEBSITES FOR REFERENCE

https://nptel.ac.in/courses/106105077
https://nptel.ac.in/courses/106106126
https://aima.cs.berkeley.edu
https://ai.berkeley,edu/project_overview.html (for Practicals)

IMAGE PROCESSING

PE 513 IT

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

CIE: 30 marks *SEE: 70 marks*

Credits: 3

Objectives:

1. To gain the fundamentals of digital image processing.
2. To provide mathematical foundations for digital manipulation of images; image
3. acquisition; preprocessing; segmentation; Fourier domain processing; and compression.
4. To be able to formulate solutions to general image processing problems

Outcomes:

Student will be able to
1. Understand the fundamental concepts of a digital image processing.
2. Evaluate the techniques for image enhancement and image restoration.
3. Categorize various compression techniques.
4. Interpret Image compression standards.
5. Interpret image segmentation and representation techniques

UNIT – I
FUNDAMENTALS Digital image, Elements of digital geometry, Components of DIP, Visual detail. Visual preliminaries- Brightness adaptation and Contrast, Acuity and contour, Texture and pattern discrimination, Shape detection and recognition, Perception of color. Image formation- Geometric Model and Photometric Model.
UNIT – II
IMAGE ENHANCEMENT Spatial Domain Methods –Binary Image, Negative of an Image, Log Transformations, Power law Transformation, contrast enhancement, Histogram equalization, Spatial Domain Filters-Smoothing filters, Sharpening filters. Frequency Domain Methods- Steps for filtering in the frequency domain, Smoothing filters, Sharpening filters.
UNIT – III
IMAGE RESTORATION A model of the image degradation, noise models, restoration in the presence of noise-spatial filtering, periodic noise reduction by frequency domain filtering, linear & position-invariant degradations, estimating the degradation function.
UNIT – IV
SEGMENTAION Points detection, line detection, edge detection methods, Histogram based image segmentation, segmentation using split and merge method, region growing method, watershed method, k-means clustering method, self-similar fractal method.
UNIT – V
REPRESENTAION, DESCRIPTION AND RECOGNITION Representation, boundary descriptors, regional descriptors, principal component analysis, relational descriptors. Recognition based on decision-theoretic and structural methods.

Suggested Readings:

1. R.C Gonzalez and R.E. Woods, Digital Image Processing, 2nd Ed, Prentice Hall. 2002.
2. 2 Anil K. Jain, Fundamentals of Image Processing, Prentice Hall, Englewood clifs, New Jersey,1989
3. 3.G.R.Sinha and BhagavathiCharan Patel, Medical Image Processing concepts and
4. applications,PHI,2014 4.Chanda&Majumdar, Digital image processing and analysis, Second edition PHI, 2013.

COMPUTER GRAPHICS

PE 512 IT

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

CIE: 30 marks *SEE: 70 marks*

Credits: 3

Objectives:

1. Acquire knowledge about device level algorithms for displaying two dimensional output primitives for raster graphics system.
2. Acquire knowledge about the basic concepts of representing 3D objects in 2D.
3. To introduce computer graphics techniques transformations, clipping, curves an

Outcomes:

Student will be able to
1. Describe the steps in graphics programming pipline
2. Apply affine transformations for viewing and projections
3. Create realistic images of geometrical objects in 2-D and modeling implementation
4. Describe the mathematical principles to represent curves and surfaces

UNIT – I
Overview of Graphics Systems-Video display devices, raster-scansystems, Random-scan system, graphics monitors and workstations, InputDevices, hard copy devices, Graphics Software. Output Primitives, Line driving, algorithms, Circle generating algorithms, ellipse generating algorithms, pixel addressing, Filled-area primitives, Fill area functions, cell array, character generation.
UNIT – II
Attributes of output primitives: Line attributes, curve attributes, color and Gray scale level, Area fill attributes, character attributes, Bundled attributes, Enquiry function. Two dimensional Geometric transformations:Basic transformations, Homogeneous coordinates, composite transformations, other transformations, transformations between coordinate systems, affine transformations, transformation functions, Raster methods for transformations.
UNIT – III
Two dimensional viewing: Viewing pipeline, viewing transformation, viewing functions, line clipping-Cohen Sutherland line clipping Liang Bar skyline clipping. Sutherland-Hodgman polygon clipping, Weller Atherton polygon clipping.
UNIT – IV
Structures and Hierarchical Modeling: Structure concepts, editing structures, Basic modeling concepts, hierarchical modeling with structures. Graphical user interfaces and Interactive input methods: The user Dialogue, logical classification of input devices, input functions and Models, Interactive picture construction techniques..

UNIT – V
Three dimensional object representations: Polygon surface, curved lines and surfaces, splinere presentations, Bezeir curves and surfaces, B-spline curves and surfaces, CSG methods: Octress, BSP Trees. Three Dimensional Transformation Three dimensional viewing: Viewing coordinates, projections, visible surface detection methods :Back- face Detections, Depth-buffer methods, depth sorting methods, Gourand shading, Phong shading.

Suggested Readings:

1. HeamDonald, PaulineBakerM.,"Computer Graphics",2nd edition, PHI,1995.
2. 2.HaningtonS.,"ComputerGraphicsAProgramming Approach",2nd edition,McGraw Hill.
3. 3.David F. Rogers.,"Procedural ElementsforComputerGraphics",2nd edition,TataMcGraw Hill, 2001.

Computer Networks Lab

PC 551 IT

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

CIE: 25 marks *SEE: 50 marks*

Credits: 1

Objectives:

1. To understand the use of client/server architecture in application development.
2. To understand and use elementary socket system calls, advanced socket system calls and TCP and UDP based sockets
3. To implement network routing algorithms, application layer protocols and encryption algorithms.

Outcomes:

Student will be able to
1. Understand the usage of basic commands ipconig, ifconfig, netstat, ping, arp, telnet,ftp,finger,traceroute, whois of LINUX platform.
2. Develop and Implement Client-Server Socket based programs using TCP,and UDP sockets
3. Develop and Implement Distance Vector Routing Algorithm
4. Develop and Implement RSA Public Key algorithm
5. Construct simple network by using any modern Open Source Network Simulation Tool

List of Programs
1. Familiarization of Network Environment, Understanding and using network utilities: ipconig, ifconfig, netstat, ping, arp, telnet,ftp,finger,traceroute, whois.
2. Write a program to implement connection oriented and connectionless client for well known services i.e standard ports
3. Implementation of concurrent server service using connection oriented socket system calls(Service: Daytime, Time)
4. Implementation of concurrent server using connection less socket system calls. (Service: Echo server,String Concateation)
5. Implementation of Iterative server using connection oriented socket system calls.(Service:Calculate Employee Salary)
6. Implementation of Iterative server using connection less socket system calls. (Service: Student Grade)
7. Program to demonstrate the use of advanced socket sytem calls: readv(),writev() ,getsockname(),setsockname(),getpeername(),gethostbyname(), gethostbyaddr(),getnetbyname(),getnetbyaddr(),getprotobyname(), getservbyname(),getprotobynumber(),getserbyport().
8. Implementation of remote command execution using socket system calls.
9. Program to implement simple program using RPC.
10. Implementation of Distance Vector Routing Protocol.
11. Implementation of RSA public key algorithm
12. Case study on any open source network simulation tool.(simple routin g protocol implementation)

Note: Well known services(standard ports): DAYTIME, TIME, CHARGEN, ECHO.

Suggested Readings:

1. W. Richard Stevens, “Unix Network Programming”, Prentice Hall, Pearson Education,2009.
2. Douglas E.Comer,“Hands-on Networking with Internet Technologies”, Pearson Education.

Operating Systems Lab

PC 552 IT

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

CIE: 25 marks *SEE: 50 marks*

Credits: 1

Objectives:

1. To practice

Outcomes:

Student will be able to
1. Explore the LINUX low level I/O and Construct applications using process management and file management System calls.
2. Demonstrate how threads can be created and simultaneously handled in LINUX POSIX environment.
3. Understand possible Inter-Process Communication implementations using LINUX IPC Constructs.
4. Assess the working behaviour of various synchronization approaches used in Deadlock management.
5. Analyze the performance of process scheduling algorithms, page replacement Algorithms, and Disk scheduling Algorithms

List of experiments:
1. Familiarity and usage of Linux System calls : a. Process management: fork(), exec(), wait(), sleep() ..., b. File management: open (), read (), write (), seek (), close ()...,
2. Write a program to Implement two process communication using IPC constructs. a)pipes b) shared memory c) message queues d)Semaphores..
3. Demonstrate the use of threads under LINUX platform using appropriate thread API
4. Write a program to Implement Producer Consumer Problem solution.
5. Write a program to Implement Dining philosopher's problem solution.
6. write a program to implement Processor Scheduling Algorithms a) FCFS b) SJF c) Round Robin.
7. Write a program to simulate Bankers Algorithm for Dead Lock Avoidance.
8. Write a program to implement Bankers Algorithm for Dead Lock Prevention.
9. Write a program to Implement Page replacement Algorithms: a) FIFO b) LRU
10. Write a program to implement disk scheduling algorithms. a) FCFS b) SCAN c) C-SCAN

WEB APPLICATION DEVELOPMENT LAB

PC 553 IT

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

CIE: 25 marks *SEE:50 marks*

Credits: 1

Objectives:

1. To develop web pages using HTML tags and perform validation using scripting
2. To implement various types of styling using CSS and transform data into various forms
3. To implement applications using JQuery and Angular JS
4. To understand and implement the concepts of MEAN Stack and SMACK stack

Outcomes:

Student will be able to
1. Design Web pages and perform form validation using HTML 5.0 inbuilt functions.
2. Apply Styles to the web content using CSS.
3. Create and process web publishing content using XML and JSON.
4. Use JQuery to perform client side Dynamics.
5. Create single page applications (Front End) using Angular JS.
6. Design Big data applications using Mean stack or SMACK stack Frameworks.

a. Implement Basic HTML Tags
b. Implement Table Tag i. Implement FRAMES
c. Design a form in HTML (CV/Photos/Data Storage/Publish) i. Validation of form Using Java Script
d. Implement various types of CSS
e. Display the various forms of XML document i. i. Raw XML ii. XML using CSS iii. XML using XSLT
f. Using JQuery implement the following: i) Selecting Elements, Getting Values, and Setting Values. ii) Events
g. Using angular JS implement the following i) Input Validation ii) Backend building
h. Case study on i) MEAN Stack ii) SMACK Stack

SOFTWARE ENGINEERING LAB

PC 531 CS

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

CIE: 25 marks *SEE: 50 marks*

Credits: 1

Objectives:

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

Outcomes:

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

I. FORWARD ENGINEERING
Students have to form a team with a batch size of two or three and take up a **case study based project** to analyze, plan, design UML models and create a prototypical model (identifying deliverables) by coding the developed designs and finally documenting considering any one example of the following domains
1. Academics (Course Registration System, Student marks analyzing system)
2. Health Care (Expert system to prescribe medicines for given symptoms, Remote Diagnostics, Patient/Hospital Management System)
3. Finance (Banking:ATM/NetBanking, UPI:PayTM/PhonePay, Stocks:Zerodha)
4. E-Commerce (various online shopping portals like FlipKart/Amazon/Myntra)
5. Logistics (Postal/Courier:IndiaPost/DTDC/UPS/FedEx, Freight:Maersk)
6. Hospitality (Tourism Management:Telangana Tourism/Incredible India, Event Management: MeraEvents/BookMyShow/Explara/EventBrite)
7. Social Networking (LinkedIn, FaceBook, Shaadi.com, BharatMatrimony, Tinder)
8. Customer Support (Banking Ombudsman,Indian Consumer Complaints Forum)
9. Booking/Ticketing(Food:Zomato/Swiggy/BigBasket/Grofers/JioMart, Hotel:OYO/Trivago or Travel: {Cars:Uber/OLA/Zoom, Railways:IRCTC, Buses:OnlineTSRTC/RedBus/AbhiBus, Flights:MakeMyTrip/Goibibo, Ships:Lakport})

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

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

Software Required **:**

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

SCHEME OF INSTRUCTION & EXAMINATION
B.E. - VI SEMESTER
(INFORMATION TECHNOLOGY)

S. No	Course Code	Course Title	Scheme of Instruction				Scheme of Examination			Credits
			L	T	D/P	Contact Hrs/Wk	CIE	SEE	Duration in Hrs/Wk	
Theory Course										
1.	PC 601 IT	Embedded Systems	3	1	-	4	30	70	3	3
2.	PC 602 IT	Design and Analysis of Algorithms	3	1	-	4	30	70	3	3
3.	PE-II	Professional Elective -II	3	-	-	3	30	70	3	3
4.	PE -III	Professional Elective -III	3	-	-	3	30	70	3	3
5	PE -IV	Professional Elective -IV	3	-	-	3	30	70	3	3
6.	OE - I	Open Elective -I	3	-	-	3	30	70	3	3
Practical/Laboratory Course										
7.	PC 651 IT	Embedded Systems Lab	-	-	2	2	25	50	3	1
8.	PC 652 IT	Design and Analysis of Algorithms Lab	-	-	2	2	25	50	3	1
9	PW 653 IT	Mini Project-I	-	-	4	4	25	50	3	2
10	SI 651 IT	Summer Internship*	-	-	-	-	-	-	-	-
Total			**18**	**2**	**8**	**28**	**255**	**570**		**22**

EMBEDDED SYSTEMS

PC 601 IT

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

CIE: 30 marks *SEE: 70 marks*

Credits: 3

Objectives:

1. To understand the architecture of 8051 microcontrollers.
2. To understand the various applications of Embedded Systems using the concepts of Interfacing.
3. To familiarize with smart sensors and understand various sensor applications.
4. To learn the concepts of RTOS and the design process using RTOS.
5. To familiarize with the design principles of SOC.

Outcomes:

Student will be able to
1. Study and analysis of embedded systems.
2. Design and develop embedded systems (hardware, software and firmware)
3. Analyze, real time systems using RTOS and develop applications.
4. Apply knowledge to interface various sensors and its applications in embedded systems.
5. Understand principles of SOC design.

UNIT – I
Embedded Computing: Introduction, Complex Systems and Microprocessor, Embedded System Design Process, Formalisms for System Design, Design Examples. Microprocessors and Microcontrollers: Microprocessors and Microcontrollers, The 8051 Architecture: Introduction, 8051 Micro controller Hardware, Input/output Ports and Circuits, External Memory. Counter and Timers, Serial data Input/output, Interrupts.
UNIT – II
Programming using 8051. Data Transfer and Logical Instructions. Arithmetic Operations, Decimal Arithmetic. Jump and Call Instructions, Applications: Interfacing with Keyboards, Displays, D/A and A/D Conversions, Multiple Interrupts, Serial Data Communication. Introduction to advanced architectures: ARM and SHARC, Processor and memory organization, Bus protocols: I^2C bus and CAN bus.
UNIT – III
Smart Sensors Introduction – Primary Sensors – Excitation – Amplification – Filters – Converters – Compensation– Information Coding/Processing - Data Communication – Standards for Smart Sensor Interface – The Automation. **Sensors –Applications** Introduction – On-board Automobile Sensors (Automotive Sensors)– Home Appliance Sensors – Aerospace Sensors — Sensors for Manufacturing –Sensors for environmental Monitoring
UNIT – IV
Introduction to Real-Time Operating Systems: Tasks and task states, tasks and data, semaphores, and shared data; message queues, mailboxes and pipes, timer functions, events, memory management, interrupt routines in an RTOS environment. Basic Design Using a Real-Time Operating System: Principles, semaphores and queues, hard real-time scheduling considerations, saving memory and power, An example RTOS like µ-COS (open source)..

UNIT – V
Introduction to the System Approach System Architecture, Components of the system, Hardware & Software, Processor Architectures, Memory and Addressing. System level interconnection, An approach for SOC Design, System Architecture and Complexity.

Suggested Readings:

1. Muhammad Ali Mazidi, Janice GillispieMazidi, Rolin D. McKinlay, " The 8051 Micro controller and Embedded Systems using Assembly and C", Prentice Hall India, 2nd Edition
2. D. Patranabis – "Sensors and Transducers" –PHI Learning Private Limited.
2. Wayne Wolf, "Computers and Components", Elsevier, Second Edition.
3. Kenneth J.Ayala, "The8051 Microcontroller", Third Edition, , Thomson.
4. David E. Simon, "An Embedded Software Primer", Pearson Education

DESIGN AND ANALYSIS OF ALGORITHMS

PC 602 IT

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

CIE: 30 marks *SEE: 70 marks*

Credits: 3

Objectives:

1. To review elementary data structures, order notation and algorithm analysis.
2. To learn algorithm design strategies such as Divide-and-Conquer, greedy method, dynamic programming, back tracking and branch & bound technique.
3. To understand the concepts of NP-hard and NP-complete.
4. To review elementary data structures, order notation and algorithm analysis.
5. To learn algorithm design strategies such as Divide-and-Conquer, greedy method, dynamic programming, back tracking and branch & bound technique.

Outcomes:

Student will be able to
1. Compute and analyse complexity of algorithms using asymptotic notations.
2. Write algorithms to solve various computing problems and analyse their time and space complexity.
3. Understand and apply different algorithm design techniques to solve real world problems and analyse their complexities.
4. To describe algorithmic complexities of various well known computing problems

UNIT – I
Introduction: Algorithm Specification, Performance analysis, Space Complexity, Time Complexity, Asymptotic Notation(O,Omega,Theta), Practical Complexities, Performance Measurement, Review of elementary data structures, Heap and Heap Sort, Hashing, Set representation, UNION, FIND.
UNIT – II
Divide- and Conquer: The general method, finding maximum minimum. Merge sort quick sort and selection. Greedy Method: Knapsack problem, Optimal Storage on tapes, Job sequencing with deadlines, Optimal merge patterns, Minimum Spanning Trees.
UNIT – III
Dynamic Programming and Traversal Technique: Multistage graph, All Pair Shortest Path, Optimal Binary Search trees,0/1 Knapsack, Reliability Traveling Salesman Problem, Bi connected Components and Depth First Search.
UNIT – IV
Backtracking and Branch and Bounds: 8-Queens Problem, Graph Coloring Hamilton cycle, Knapsack Problem, 0/1 Knapsack Problem, Traveling salesperson problem, Lower-Bound Theory.
UNIT – V
NP-Hard and NP-Completeness: Basic concepts, cook's theorem, NP-hard graph problems and scheduling problem, NP-hard generation problems, Decision problem, Node covering problem.

Suggested Readings:

1. Horowitz E. Sahani S: Fundamentals of Computer Algorithm, 2010

EMBEDDED SYSTEMS LAB

PC 651 IT

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

CIE: 25 marks *SEE: 50 marks*

Credits: 1

Objectives:

1. To understand basic concepts and structure of embedded systems.
2. To design and develop real time applications of embedded systems

Outcomes:

Student will be able to
1. Apply the basic concepts to develop an Interface for 8051 and ARM processors.
2. Demonstrate the RTOS Concepts by designing real time applications.

A. Use of 8-bit and 32-bit Microcontrollers, (such as 8051 Microcontroller, ARM2148 / ARM2378, LPC 2141/42/44/46/48) Microcontroller and C compiler (Keil, Ride etc.) to:
1. Interface Input-Output and other units such as: Relays, LEDs, LCDs, Switches,
2. Keypads, Stepper Motors, Sensors, ADCs, Timers
3. 2. Demonstrate Communications: RS232, IIC and CAN protocols
B. Development of Embedded Application using FPGAs, CPLDs, VHDL and Xilinx
A. Programmable Logic Design Tools:
B. Four bit ALU
C. Development and Porting of Real Time Applications on to Target machines such as Intel or other Computers using any RTOS
I. Understanding Real Time Concepts using any RTOS through Demonstration of:
1. Timing
2. Multi-Tasking
3. Semaphores
4. Message Queues
5. Round-Robin Task Scheduling
6. Preemptive Priority based Task Scheduling
7. Priority Inversion
8. Signals
9. Interrupt Service Routines
II. Application Development using any RTOS:
1. Any RTOS Booting
2. Application Development under any RTOS

DESIGN AND ANALYSIS OF ALGORITHMS LAB

PC 652 IT

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

CIE: 25 marks *SEE: 50 marks*

Credits: 1

Objectives:

1. To learn various searching and sorting techniques and estimate the complexities of searching and sorting algorithms.
2. To Solve knapsack problem using greedy method and dynamic programming.

Outcomes:

Student will be able to
3. Develop and implement various searching and sorting techniques and estimate the complexities of searching and sorting algorithms.
4. Solve knapsack problem using greedy method and dynamic programming.
5. Develop and implement shortest path algorithms using Travelling salesman problem and All pair shortest path problem.
6. Apply backtracking technique to solve N-queen problem.
7. Construct graph traversals using breath first search and depth first search

List of Experiments:
1. Implement Recursive Binary search and determine the time taken to search an element
2. Implement Linear search and determine the time taken to search an element.
3. Sort a given set of elements using Merge sort method and determine the time taken to sort the elements.
4. Sort a given set of elements using Quick sort method and determine the time taken to sort the elements.
5. Implement Knapsack problem using greedy method.
6. Implement 0/1 Knapsack problem using dynamic programming.
7. Implement any scheme to find the optimal solution for the Traveling Sales Person problem
8. Print all the nodes reachable from a given starting node in a digraph using BFS method.
9. Check whether a given graph is connected or not using DFS method
10. Develop a program to implement All pair shortest path.
11. Find Minimum Cost Spanning Tree of a given undirected graph using Kruskal's algorithm-
12. Find Minimum Cost Spanning Tree of a given undirected graph using Prim's algorithm-
13. Implement N Queen's problem using Back Tracking.

MINI PROJECT - I

PW 653 IT

Instruction: 4 periods per week *Duration of SEE: 3 hours*
CIE: 25 marks *SEE: 50 marks*
Credits: 2

Objectives:

1. To develop capability to analyse and solve real world problems with an emphasis on applying/integrating knowledge acquired.
2. To take responsibility of the end product.

Outcomes:

Student will be able to
1. Implement the system using SQL, data structures, C/C++, JAVA, Python and different software engineering models

The Students are required to take one of larger projects listed in the suggested readings or assigned by the teacher, implement and submit the report. The workbooks and project reports should be evaluated.

DATA MINING

PE 611 IT

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

CIE: 30 marks *SEE: 70 marks*

Credits: 3

Objectives:

1. To understand data classification, data preprocessing and data mining applications.
2. To understand how patterns, associations and correlations can be obtained on data.
3. To understand how classification and clustering techniques can be implemented and perform its evaluation.
4. To learn how complex data mining can be performed.

Outcomes:

Student will be able to
1. Classify types of data
2. Analyze data for mining frequent patterns
3. Perform the classification by using decision tree induction
4. Select and perform clustering
5. Perform Text mining

UNIT – I
Introduction: fundamentals of Data Mining, Kinds of Patterns can be mined, Technologies used, Applications and issues in Data Mining.Types of Data: Attribute types, Basic Statistical Descriptions of Data, Measuring data similarity and Dissimilarity.Data Pre-Processing: Need of Pre-processing, Data Cleaning, Data Integration, Data Reduction, Data Transformation**.**
UNIT – II
Mining Frequent Patterns, Associations and Correlations: Market Basket Analysis, Association rule mining, frequent item set mining methods, mining various kinds of association rule, Constraint based frequent pattern mining.
UNIT – III
Classification: General approach to classification, Classification by Decision tree induction, Classification by back Propagation, Lazy learners, other classification methods, Prediction, Evaluating the accuracy of classifier, Increasing the accuracy of classifier.
UNIT – IV
Cluster Analysis: Basic Clustering methods, Partitioning methods, Density-based methods, Grid-based methods, and Evaluation of clustering, Outlier Analysis and detection methods.
UNIT – V
Mining Complex Data, Applications and Trends: Mining complex data: Spatial mining, Text Mining, Multimedia Mining, Web Mining, Data Mining Applications and Data Mining Trends.

Suggested Readings:

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

COMPILER CONSTRUCTION

PC 612 IT

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

CIE: 30 marks *SEE: 70 marks*

Credits: 3

Objectives:

1. To understand various phases in Compiler Design.
2. To design Parsers and generate code for target machine.
3. Understand the role of a symbol table and error recovery strategies

Outcomes:

Student will be able to
1. Identify and describe the various concepts underlying the components of a compiler and the translation process.
2. Explain various techniques to Scan and Parse the source code.
3. Analyze attribute grammars and evaluations for SDT's and use the terminology for generating intermediate code representations.
4. Analyze fundamentals of storage allocation strategies towards run-time management of data.
5. Explain basic code generation, code optimization techniques.

UNIT – I
I Introduction: Programs related to compilers, Translation process, Major data structures, Other issues in compiler structure, Boot strapping and porting. **Lexical analysis**: The role of Lexical Analyzer, Input Buffering, Specification of Tokens, Recognition of Tokens, The Lexical-Analyzer Generator Lex.
UNIT – II
Syntax Analysis: Introduction, Top-Down parsing, Bottom-Up parsing, Introduction to LR Parsing, More powerful LR parsers, Using Ambiguous Grammars, Parser Generators YACC.
UNIT – III
Syntax Directed Translation: Syntax Directed Definitions, Evaluation Orders for SDDs, Applications of Syntax Directed Translation. **Intermediate code generation:** Variants of Syntax Trees, Three-Address Code, Types and Declarations, Translation of Expressions, Type Checking, Control Flow.
UNIT – IV
Symbol Table Organization: Structure of Symbol table, Symbol Table organization for Block Structured and non-Block Structured languages, Data Structures of symbol Table. **Runtime Environments:** Storage Organization, Stack Allocation of Space, Access to Non local Data on the Stack, Heap Management, Introduction to Garbage Collection.
UNIT – V
Code Generation : Issues in the Design of a Code Generator, The Target Language, Addresses in the Target Code, Basic Blocks and Flow Graphs, Optimization of Basic Blocks, Peephole Optimization, Register Allocation and Assignment. **Machine Independent Optimizations:** The Principal Sources of Optimizations.

Suggested Readings:

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

Distributed Systems

PC 613 IT

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

CIE: 30 marks *SEE: 70 marks*

Credits: 3

Objectives:

1. To learn the concept and issues of distributed systems in detail.
2. To study architectures and working of distributed file systems.
3. To understand the processes in distributed system and communication.
4. To make students understand how names are assigned in distributed systems.
5. To learn examples of distributed file systems.

Outcomes:

After completing this course, the student will be able to
1. Describe the problems and issues associated with distributed systems.
2. Understand how coordination occurs in distributed systems.
3. How replicas are handled in distributed systems and consistency is maintained.
4. How security is implemented in distributed systems.
5. Understand design trade-offs in large-scale distributed systems

UNIT – I
Introduction: What is Distributed Systems?, Design Goals, Types of Distributed System. **Architectures**: Architectural Styles, Middleware Organization, System Architectures, Example Architectures..
UNIT – II
Processes: Threads, Virtualization, Clients,Servers, Code migration. **Communication:** Foundations, Remote Procedure Call, Message-Oriented Communication, Multicast Communication.
UNIT – III
Naming: Names, Identifiers and Addresses, Flat Naming, Structured Naming, and Attribute-Based Naming. **Coordination**: Clock Synchronization, Logical Clocks, Mutual Exclusion, Election Algorithms, Location System, Distributed event matching, Gossip-based coordination.
UNIT – IV
Consistency and Replication: Introduction, Data-Centric Consistency Models, Client-Centric Consistency Models, Replica Management, and Consistency Protocols. **Fault Tolerance:** Introduction to Fault Tolerance, Process Resilience, Reliable Client-Server Communication, Reliable Group Communication, Distributed Commit, and Recovery. **Security:** Introduction to security, Secure channels, Access control, Secure naming, Security management.

UNIT – V
Distributed File Systems: Introduction, File service architecture, Case study: Sun Network File System, Case study: The Andrew File System, Enhancements and further developments. **Distributed Multimedia Systems:** Introduction, Characteristics of multimedia data, Quality of service management, Resource management, Stream adaptation, Case studies: Tiger, BitTorrent and End System Multicast. **Designing Distributed Systems:** GOOGLE CASE STUDY Introduction, Overall architecture and design philosophy, Underlying communication paradigms,Data storage and coordination services, Distributed computation services.

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.

ADVANCED COMPUTER ARCHITECTURE

PE 614 IT

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

CIE: 30 marks *SEE: 70 marks*

Credits: 3

Objectives:

1. To learn various types of parallel computer model and Multi processors.
2. To learn the model of computer architecture the architecture beyond the classical von Neumann model pipelining, vector and array processors.
3. To understand different performance enhancement techniques of scalar architecture.
4. To study the memory management and synchronization of multiprocessor and mutlicomputers.

Outcomes:

After completing this course, the student will be able to
1. Understand the limitations of uni processor and appreciate the need of parallel processing.
2. Explain the branch prediction and its utility and pipeline processors
3. Explain the Vector processing models and its performance evaluation.
4. Understand interconnection of networks and characteristics different approaches.
5. Compare and contrast shared memory and distributed memory archite

UNIT – I
Uni processor systems, enhancement to uni processor models, measuring performance and cost, Benchmarks, introduction to advanced computer architecture. Theory of Parallelism, Parallel Computer models, The State of Computing, Multiprocessors and Multicomputer.
UNIT – II
Pipelining and superscalar techniques: Linear Pipeline Processors, Non-Linear Pipeline Processors, Instruction Pipeline design, Arithmetic pipeline design, superscalar pipeline design. Branch predication technique, performance evaluation, case study-sun micro systems-microprocessor.
UNIT – III
Vector processor: Vector processing principles models, vector processor model, vector architecture and design, multi vector and SIMD computers, performance evaluation.
UNIT – IV
Array processors: Parallel array processor model, memory organization, interconnection networks, performance measures, static and dynamic topologies.
UNIT – V
Multi processors and multi computers: Multiprocessor model, shared memory and distributed memory architecture, cache coherence and synchronization mechanism, Three Generations of Multicomputer, Parallel computer model, performance model.

Suggested Readings:

1. John L. Hennessy and David A. Patterson, Advanced Computer Architecture Second Edition, 2010 Morgan Kaufmann
2. William Stallings, “Advanced Computer Architectures” , Prentice Hall , 2016

OBJECT ORIENTED ANALSIS AND DESIGN

PE 621 IT

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

CIE: 30 marks *SEE: 70 marks*

Credits: 3

Objectives:

1. To introduce the basic concepts of Unified Modeling Language from defining Unified process and Core workflows
2. To impart knowledge on various UML diagrams for the software development
3. To understand the importance of each diagram in software development and understand rules to develop each diagram

Outcomes:

Student will be able to
1. Understand the activities in the different phases of the object-oriented development life cycle.
2. Model a real-world application by using a UML diagrams.
3. Provide a snapshot of the detailed state of a system at a point in time using object diagram.
4. Recognize when to use generalization, aggregation, and composition relationships.
5. Specify different types of business rules in a class diagram.

UNIT – I
UML Introduction: Why we Model, Introducing the UML, Elements of UML **Basic Structural Modeling:** Classes, Relationships, Common Mechanisms, Diagrams, Class Diagrams. **Advanced Structural Modeling:** Advanced Classes, Advanced Relationships, Interfaces, Types and Roles, Packages, Instances, Object Diagrams, Components.
UNIT – II
Basic Behavioral Modeling: Interactions, Use Cases, Use Case Diagrams, Interaction diagrams, Activity diagrams. **Advanced Behavioral Modeling:** Events and Signals, State Machines, Processes and Threads, Time and space, State Chart Diagrams.
UNIT – III
Architectural Modeling: Artifacts, Deployment Collaborations, Patterns and Frame-works, Artifact Diagrams, Deployment Diagrams, Systems and Models
UNIT – IV
Unified Software Development Process: The Unified Process, The Four Ps, A Use-Case-Driven Process, An Architecture-Centric Processes, An Iterative and Incremental Process.
UNIT – V
Core Workflows: Requirements Capture, Capturing requirements as use cases, Analysis, Design, Implementation, Test

Suggested Readings:

1. THE UNIFIED MODELING LANGUAGE USER GUIDE, Pearson Education
2. OBJECT-ORIENTED ANALYSIS AND DESIGN WITH APPLICATIONS, Pearson Education, 3rd Edition- Booch, Jacobson, Rumbaugh

MULTIMEDIA

PE 622 IT

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

CIE: 30 marks *SEE: 70 marks*

Credits: 3

Objectives:

1. A cquire knowledge about the basic concepts of multimedia data formats, protocols, and
2. Compression techniques of digital images.
3. To learn JPEG and MPEG families of standards and wired and wireless networking protocols.

Outcomes:

Student will be able to
1. Understand the technical details of common multimedia data formats, protocols,
2. and compression techniques of digital images, video and audio content.
3. Describe the technical details of JPEG and MPEG families of standards.
4. Discuss the significance of "Quality of Service" in multimedia networking.
5. Describe the principles and technical details of several wired and wireless networking protocols.

UNIT – I
Introduction to Multimedia: What is Multimedia, Multimedia and hypermedia, World Wide Web, Overview of Multimedia software Tools. Multimedia Authorizing and Tools, Multimedia Authoring, Some Useful Editing and Authoring Tools, VRML
UNIT – II
Graphics and Image Data Representation: Graphics/image data types, Popular File Formats, Color in image and Video and Color Science, color Models in Images, Color Models in Video
UNIT – III
Fundamental Concepts in Video and audio: Types of Video signals, Analog Video, Digital Video, Digitization of sound, Musical instrument Digital interface (MIDI), quantization and transmission of Audio
UNIT – IV
Multimedia Data Compression: Lossless Compression Algorithms, lossy Compression Algorithms, Image Compression Standards, The JPEG2000 Standard, Basic Video Compression Techniques, MPEG Video coding I— MPEG –I and 2, Basic Audio Compression techniques..
UNIT – V
Multimedia communication and Retrieval: Multimedia Network Communications and Applications, Wireless Networks, Content Based Retrieval in Digital Libraries

Suggested Readings:

1. Ze-Nian Li & Mark S. Drew. Fundamentals of Multimedia.. Upper Saddle River, NJ: Pearson Education.

Machine Learning

PE 623 IT

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

CIE: 30 marks *SEE: 70 marks*

Credits: 3

Objectives:

1. To introduce the basic concepts of machine learning and range of problems that can be handled by

machine learning
2. To introduce the concepts of instance based learning and decision tree induction
3. To introduce the concepts of linear separability, Perceptron and SVM
4. To learn the concepts of probabilistic inference, graphical models and evolutionary learning
5. To learn the concepts of ensemble learning, dimensionality reduction and clustering

Outcomes:

After completing this course, the student will be able to
1. Explain the strengths and weaknesses of many popular machine learning approaches
2. Recognize and implement various ways of selecting suitable model parameters for different machine learning techniques
3. Design and implement various machine learning algorithms in a range of real-world applications

UNIT – I
Introduction: Learning, Types of Machine Learning. Concept learning: Introduction, Version Spaces and the Candidate Elimination Algorithm. Learning with Trees: Constructing Decision Trees, CART, Classification Example
UNIT – II
Linear Discriminants: The Perceptron, Linear Separability, Linear Regression Multilayer Perceptron (MLP): Going Forwards, Backwards, MLP in practices, Deriving back Propagation SUPPORT Vector Machines: Optimal Separation, Kernels
UNIT – III
Some Basic Statistics: Averages, Variance and Covariance, The Gaussian, The Bias-Variance Tradeoff Bayesian learning: Introduction, Bayes theorem. Bayes Optimal Classifier, Naive Bayes Classifier. Graphical Models: Bayesian networks, Approximate Inference, Making Bayesian Networks, Hidden Markov Models, The Forward Algorithm.
UNIT – IV
Evolutionary Learning: Genetic Algorithms, Genetic Operators, Genetic Programming Ensemble learning: Boosting, Bagging Dimensionality Reduction: Linear Discriminant Analysis, Principal Component Analy.
UNIT – V
Clustering: Introduction, Similarity and Distance Measures, Outliers, Hierarchical Methods, Partitional Algorithms, Clustering Large Databases, Clustering with Categorical Attributes, Comparison

Suggested Readings:

1. Tom M. Mitchell, Machine Learning, Mc Graw Hill, 1997
2. Stephen Marsland, Machine Learning - An Algorithmic Perspective, CRC Press, 2009
3. Margaret H Dunham, Data Mining, Pearson Edition., 2003.
4. Galit Shmueli, Nitin R Patel, Peter C Bruce, Data Mining for Business Intelligence, Wiley India Edition, 2007
5. Rajjan Shinghal, Pattern Recognition, Oxford University Press, 2006.

Data Science using R Programming

PE 624 IT

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

CIE: 30 marks *SEE: 70 marks*

Credits: 3

Objectives:

1. To learn basics of R Programming environment: R language
2. To learn various statistical concepts like linear and logistic regression
3. To learn Decision tree induction

Outcomes:

After completing this course, the student will be able to
1. Use various data structures and packages in R for data visualization and summarization
2. Use linear, non-linear regression models, and classification techniques for data analysis
3. Use clustering methods including K-means and CURE algorithm

UNIT – I
Introduction to R: Introduction, Downloading and Installing R, IDE and Text Editors, Handling Packages in R. Getting Started with R: Introduction, Working with Directory, Data Types in R, Few Commands for Data Exploration. Loading and Handling Data in R: Introduction, Challenges of Analytical Data Processing, Expression, Variables, Functions, Missing Values Treatment in R, using as 'Operator to Change the Structure of the Data, Victors, Matrices, Factors, List, Few Common Analytical Tasks, Aggregation and Group Processing of a Variable, Simple Analysis Using R, Methods for Reading Data, Comparison of R GUI's for Data Input, Using R with Databases and Business Intelligence Systems.
UNIT – II
Exploring Data in R: Introduction, Data Frames, R Functions for Understanding Data in Data Frames, Load Data Frames, Exploring Data, Data Summary, Finding the Missing Values, Invalid Values and Outliers, Descriptive Statistics, Spotting Problems in Data with Visualization.
UNIT – III
Linear Regression Using R: Introduction, Model Fitting, Linear Regression, Assumptions of Linear Regression, Validating Linear Assumption. Logistic Regression: Introduction, What Is Regression? Introduction to Generalized Linear Model, Logistic Regression, Binary Logistic Regression, Diagnosing Logistic Regression, Multinomial Logistic Regression Model.

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

Suggested Readings:

1. 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, Lean Publishing,2016
6. Seema Acharya, Data Analytics using R, McGraw Hill, 2018.
7. Crawley, Michael J., The R book, John Wiley & Sons, 2017

Computational Intelligence

PE 631 IT

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

CIE: 30 marks *SEE: 70 marks*

Credits: 3

Objectives:

1. To introduce the concepts of Biological and Artificial neural networks
2. To understand different neural architectures with supervised learning and their learning mechanisms
3. To study different neural architectures with unsupervised learning such as PCA Networks Kohenen's Self-Organizing Maps
4. To introduce Markov decision processes, Q-Learning and TD-Learning
5. To study different models of evolution and learning, neuro-fuzzy techniques, rough set theory and their applications

Outcomes:

After completing this course, the student will be able to
1. Design single and multi-layer feed-forward neural networks
2. Implement various unsupervised learning networks
3. Design new evolutionary operators, representations and fitness functions for specific practical problems
4. Apply fuzzy logic and rough sets to handle uncertainty and vagueness in practical problems

UNIT – I
Introduction to Computational Intelligence / Soft computing: Soft versus Hard Computing, Various paradigms of computing Foundations of Biological Neural Networks: Introduction to Neural Networks, Humans and Computers, Organization of the Brain, Biological Neuron, Biological and Artificial Neuron Models, Hodgkin-Huxley Neuron Model, Integrate-and-Fire Neuron Model, Spiking Neuron Model, Characteristics of ANN (Learning, Generalization, Memory, Abstraction, Applications), McCulloch-Pitts Model, Historical Developments Essentials of Artificial Neural Networks: Introduction, Artificial Neuron Model, Operations of Artificial Neuron, Types of Neuron Activation Function, ANN Architectures, Classification Taxonomy of ANN – Connectivity (Feed forward, feedback, Single and Multi-layer), Neural Dynamics (Activation and Synaptic), Learning Strategy (Supervised, Unsupervised, Reinforcement), Learning Rules (Error Correction, Hebbian, Competitive, Stochastic), Types of Application (Pattern Classification, Pattern Clustering, Pattern Association / Memory, Function Approximation, Prediction, Optimization)
UNIT – II
Neural Architectures with Supervised Learning: Single Layer Feed Forward Neural Networks(Perception), Multilayer Feed Forward Neural Networks (Back propagation learning), Radial Basis Function Networks, Support Vector Machines, Simulated Annealing, Boltzmann Machine, Feedback (Recurrent) Networks and Dynamical Systems Associative Memories: Matrix memories, Bidirectional Associative Memory, Hopfield Neural Network,
UNIT – III
Neural Architectures with Unsupervised Learning: Competitive learning, Principal Component Analysis Networks (PCA), Kohonen's Self-Organizing Maps, Linear Vector Quantization, Adaptive Resonance Theory (ART) Networks, Independent Component Analysis Networks (ICA)
UNIT – IV

Reinforcement Learning: Markov Decision Processes, Value Functions, Bellman Optimality Criterion, Policy and Value Iterations, Q-Learning, TD Learning
UNIT – V
Fuzzy Logic: Basic concepts, fuzzy set theory, basic operations, fuzzification, defuzzification, neurofuzzy approach, applications Evolutionary and Genetic Algorithms: Basic concepts of evolutionary computing, genetic operators, fitness function and selection, genetic programming, other models of evolution and learning, ant colony systems, swarm intelligence, applications Rough Set Theory: Basic concepts, indiscernability relation, lower and upper approximation, decision systems based on rough approximation, applications

Suggested Readings:

1. Jacek M. Zurada. Introduction to Artificial Neural Systems, Jaico Publishers, 1992.
2. S. Haykin. Neural Networks: A Comprehensive Foundation, Prentice Hall, 1999.
3. P. S. Churchland and T. J. Sejnowski. The Computational Brain. MIT Press, 1992
4. A. M. Ibrahim. Introduction to Applied Fuzzy Electronics. PHI, 2004
5. Z. Pawlak. Rough Sets, Kluwer Academic Publishers, 1991.

Adhoc and Sensor Networks

PE 632 IT

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

CIE: 30 marks *SEE: 70 marks*

Credits: 3

Objectives:

1. To provide students with an understanding of wireless ad-hoc and sensor networks
2. To enable them to recognize the wide range of applicability of these networks
3. To provide an understanding of the major design issues, including topics such as protocol mechanisms and resource constraints.

Outcomes:

After completing this course, the student will be able to
1. Understand the needs of Wireless Adhoc and Sensor Network in current scenario of technology.
2. Describe current technology trends for the implementation and deployment of wireless adhoc/sensor networks.
3. Discuss the challenges in designing MAC, routing and transport protocols for wireless ad-hoc/sensor networks.
4. Explain the principles and characteristics of wireless sensor networks

UNIT – I
Wireless Transmission Technology and Systems: Introduction, Radio Technology Primer, Available Wireless Technologies. Medium Access Control Protocols for Wireless Networks: Introduction, Background, Fundamentals of MAC Protocols.
UNIT – II
Adhoc Networks: Introduction and Definitions, Adhoc Network Applications, Design Challenges. Evaluating Adhoc Network Protocols -the Case for a Test bed. Routing in Mobile Adhoc Networks: Introduction, Flooding. Proactive Routing. On Demand Routing. Proactive Versus On Demand Debate. Location based Routing.
UNIT – III
Multicasting in Adhoc Networks: Introduction, Classifications of Protocols, Multicasting Protocols, Broadcasting. Protocol Comparisons, Overarching Issues. Transport layer Protocols in Adhoc Networks: Introduction, TCP and Adhoc Networks, Transport Layer for Adhoc Networks: Overview, Modified TCP, TCP-aware Cross-Layered Solutions. Adhoc Transport Protocol.
UNIT – IV
QoS Issue in Adhoc Networks: Introduction, Definition of QoS, Medium Access Layer, Q0S Routing, Inter- Layer Design Approaches. Security in Mobile Adhoc Networks: Vulnerabilities of Mobile Adhoc Networks, Potential Attacks, Attack Prevention Techniques. Intrusion Detection Techniques.

UNIT – V
Basic Wireless Sensor Technology: Introduction, Sensor Node Technology, Sensor Taxonomy. Introduction and Overview of Wireless Sensor Networks: Introduction, Overview MAC Protocols for Wireless Sensor networks. Applications of Wireless Sensor Networks: Examples of Category 1 and Category 2 WSN applications.

Suggested Readings:

1. Prasant Mohapatra and Srihanamurthy, "Ad Hoc Networks Technologies and Protocols", Springer, Springer International Edition, 2009.
2. Kazem Sohraby, Daniel Minoli, Taieb Znati, "Wireless Sensor Networks", John Wiley & Sons.
3. Shivaram Murthy and B. S. Manoj, "Adhoc Networks – Principles and Protocols", Pearson Education, 2012.

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

Objectives:

1. To represent and analyse natural language both spoken and written, using statistical and finite sta methods for modelling and classification. To use grammar for natural language processing.
2. To study knowledge representation from its semantics view point with emphasis on applications. T study basic logical form language to encode ambiguity.
3. To study augmented grammars and parsers for feature systems.
4. To resolve and encode ambiguity using statistical methods to estimate lexical probabilities along with critical study of probabilistic context free grammars and parsing.
5. To interpret semantics covering ambiguity and link syntax to semantics

Outcomes:

After completing this course, the student will be able to
1. Use statistical and finite state methods for modelling and classification for representation and analysis of natural languages, and use grammars for natural language processing.
2. Apply knowledge representation and semantics to machine translation and database semantic interpretation.
3. Perform top-down and bottom-up parsing, and parsing with features.
4. Estimate lexical probabilities, resolve ambiguity, and use probabilistic context-free grammar.
5. Able to encode ambiguity in logical form language and deal with word-sense and ambiguity and to link syntax to semantics.

UNIT – I
Natural Language Processing: Introduction to Natural Language Processing, the study of Language, Applications of NLP, Evaluating Language Understanding Systems, Different levels of Language Analysis, Representations and Understanding, Organization of Natural Language Understanding Systems, Linguistic Background: An outline of English syntax Spoken Language input and output Technologies. Written language Input – Mathematical Methods – statistical Modelling and classification Finite State Methods. Grammar for Natural Language Processing – Parsing – Semantic and Logic Form –
UNIT – II
Introduction to Semantics and Knowledge Representation: some applications like Machine translation, database interface Semantic Interpretation, word senses and ambiguity, Basic logical form language, Encoding ambiguity in logical from, Thematic roles, Linking syntax and semantics, Recent trends in NLP..

UNIT – III
Grammars and Parsing: Grammars and sentence Structure, Top-Down and Bottom-Up Parsers, Transition Network Grammars, Top- Down Chart Parsing. Feature Systems and Augmented Grammars: Basic Feature system for English, Morphological Analysis and the Lexicon, Parsing with Features, Augmented Transition Networks.
UNIT – IV
Semantic Interpretation: word senses and ambiguity, Basic logical form language, Encoding ambiguity in logical from, Thematic roles, Linking syntax and semantics, Recent trends in NLP.
UNIT – V
Ambiguity Resolution: Statistical Methods, Probabilistic Language Processing, Estimating Probabilities, Part- of-Speech tagging, Obtaining Lexical Probabilities, Probabilistic Context- Free Grammars, Best First Parsing. Semantics and Logical Form, Word senses and Ambiguity, Encoding Ambiguity in Logical Form.

Suggested Readings:

1. James Allen, "Natural Language Understanding", Pearson Education
2. Christopher D Manning and Hinrich Schutze, "Foundations of Statistical Natural Language Processing" MIT Press, 1999.
3. Akshar Bharti, Vineet Chaitanya and Rajeev Sangal, "NLP: A Paninian Perspective", Prentice Hall, New Delhi
4. D. Jurafsky, J. H. Martin, "Speech and Language Processing", Pearson

Information Storage and Management

PE 634 IT

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

CIE: 30 marks *SEE: 70 marks*

Credits: 3

Objectives:

1. To introduce the concept of storage, emphasize the significance of storage technologies in IT infrastructure.
2. To provides a comprehensive understanding of the various storage infrastructure components in data center environments.
3. To learn about the architectures, features, and benefits of Intelligent Storage Systems.
4. To understand various storage networking technologies such as FC-SAN, NAS, and IP-SAN; long- term archiving solution – CAS.
5. To know about various business continuity solutions such as backup and replication.
6. To understand information security role in storage networks and the emerging field of storage virtualization including storage resource management

Outcomes:

After completing this course, the student will be able to
1. Evaluate storage architecture; understand logical and physical components of a storage infrastructure including storage subsystems.
2. Describe storage networking technologies such as FC-SAN, NAS, IP-SAN and data archival solution – CAS.
3. Identify different storage virtualization technologies and their benefits.
4. Understand and articulate business continuity solutions including, backup and recovery technologies, and local and remote replication solutions.
5. Identify parameters of managing and monitoring storage infrastructure and describe common storage

UNIT – I
Introduction to Information Storage: Information Storage, Evolution of Storage Architecture, Data Center Infrastructure, Virtualization and Cloud Computing. Data Center Environment: Application, Database Management System (DBMS), Host, Connectivity, Storage, Disk Drive Components, Disk Drive Performance, Host Access to Data, Direct-Attached Storage, Storage Design Based on Application, Disk Native Command Queuing, Introduction to Flash Drives.
UNIT – II
Data Protection: RAID, Implementation Methods, Array Components, Techniques, Levels, RAID Impact on Disk Performance, RAID Comparison, Hot Spares. Intelligent Storage Systems: Components of an Intelligent Storage System, Storage Provisioning, Types of Intelligent Storage Systems.

UNIT – III
Fibre Channel Storage Area Networks: Overview, The SAN and Its Evolution, Components of FC SAN, FC Connectivity, Switched Fabric Ports, Fibre Channel Architecture, Zoning, FC SAN Topologies, Virtualization in SAN. IP SAN and FCoE: iSCSI, FCIP, FCoE. Network-Attached Storage: General-Purpose Servers versus NAS Devices, Benefits of NAS, File Systems and Network File Sharing, Components of NAS, I/O Operation, Implementations, File-Sharing Protocols, Factors Affecting NAS Performance, FileLevel Virtualization. Object-Based and Unified Storage: Object-Based Storage Devices, Content Addressed Storage, CAS Use Cases.
UNIT – IV
Introduction to Business Continuity: Information Availability, BC Terminology, BC Planning Life Cycle, Failure Analysis, Business Impact Analysis, BC Technology Solutions. Backup and Archive: Backup Purpose, Backup Considerations, Backup Granularity, Recovery Considerations, Backup Methods, Backup Architecture, Backup and Restore Operations, Backup Topologies, Backup in NAS Environments. Local Replication: Replication Terminology, Uses of Local Replicas, Replica Consistency, Local Replication Technologies. Remote Replication: Modes of Remote Replication, Remote Replication Technologies, Three- Site Replication..
UNIT – V
Cloud Computing: Cloud Enabling Technologies, Characteristics of Cloud Computing, Benefits of Cloud Computing Cloud Service Models, Cloud Deployment Models, Cloud Computing Infrastructure, Cloud Challenges. Securing the Storage Infrastructure: Information Security Framework, Risk Triad, Storage Security Domains, Storage Security Domains. Managing the Storage Infrastructure: Monitoring the Storage Infrastructure, Storage Infrastructure Management Activities, Storage Infrastructure Management Challenges, Developing an Ideal Solution, Information Lifecycle Management.

Suggested Readings:

1. EMC Corporation, Information Storage and Management, Wiley India, 2nd Edition, 2011.
2. Robert Spalding, Storage Networks: The Complete Reference, Tata McGraw Hill, Osborne, 2003.
3. Marc Farley, Building Storage Networks, Tata McGraw Hill, Osborne,2nd Edition, 2001.
4. Meeta Gupta, Storage Area Network Fundamentals, Pearson Education Limited, 2002.

SCHEME OF INSTRUCTION & EXAMINATION
B.E (IT) - VII SEMESTER
(INFORMATION TECHNOLOGY)

S. No.	Course Code	Course Title	Scheme of Instruction				Scheme of Examination			Credits
			L	T	P/D	Contact Hrs/Wk	CIE	SEE	Duration in Hrs	
Theory Courses										
1	PC 701 EC	VLSI Design	3	1	-	4	30	70	3	3
2	PC 702 IT	Big Data Analytics	3	1	-	4	30	70	3	3
3	PE-V	Professional Elective-V	3	1	-	4	30	70	3	3
4	PE-IV	Professional Elective – VI	3	-	-	3	30	70	3	3
Practical/ Laboratory Courses										
5	PC 751 EC	VLSI Design Lab	-	-	2	2	25	50	3	1
6	PC 752 IT	Big Data Analytics Lab	-	-	2	2	25	50	3	1
7	PW 761 IT	Project Work – I	-	-	6	6	50	-	-	3
8	SI 762 IT	Summer Internship	`	-	-	-	50	-	-	2
Total			**12**	**03**	**10**	**25**	**270**	**380**	**-**	**19**

VLSI DESIGN

PC 701 EC

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

CIE: 30 marks *SEE: 70 marks*

Credits: 3

Objectives:

1. To provide a perspective on Digital Design in the Deep Sub-micron Technology.
2. To focus on CMOS and Bi CMOS Short-channel Transistor Models
3. To Study CMOS Inverter elaborately
4. To explore static and dynamic implementations of combinational and sequential circuit designs and introduce Testability of VLSI circuits.

Outcomes:

Student will be able to
1. Explain VLSI Design hierarchy and analyse logic gates using CMOS & transmission gate structures.
2. Identify the layers in the physical structure of ICs and draw the layouts of CMOS logic gates
3. Summarize the fabrication process of CMOS ICs and analyse the DC, switching characteristics of CMOS inverter.
4. Analyse dynamic CMOS & pseudo nMOS structures of logic gates, SRAM & DRAM cells
5. Develop Verilog code for logic gates, examine the effects of interconnect elements in logic cascades and Explain the floor-planning , routing techniques of VLSI circuits.

UNIT – I
Moore's law ,VLSI Design Hierarchy, MOSFET as switches, pass characteristics, Basic logic gates and complex logic gates using CMOS, Bubble pushing, XOR and XNOR gates, AOI and OAI logic gates, Transmission gates-TG based 2-to-1 MUX, XOR, XNOR circuits. Electrical Characteristics of MOSFETs, Threshold voltage, nFET Current-Voltage equations, trans-conductance and drain characteristics of nFET, RC model of a FET, MOS capacitances, gate-source and gate- drain capacitances, Junction capacitances in a MOSFET, scaling concept of MOSFETs
UNIT – II
Moore's law ,VLSI Design Hierarchy, MOSFET as switches, pass characteristics, Basic logic gates and complex logic gates using CMOS, Bubble pushing, XOR and XNOR gates, AOI and OAI logic gates, Transmission gates-TG based 2-to-1 MUX, XOR, XNOR circuits. Electrical Characteristics of MOSFETs, Threshold voltage, nFET Current-Voltage equations, trans-conductance and drain characteristics of nFET, RC model of a FET, MOS capacitances, gate-source and gate- drain capacitances, Junction capacitances in a MOSFET, scaling concept of MOSFETs
UNIT – III
Layouts of Basic Structure: nwells, active area definition, design of n^+, p^+ regions, masks for the nFET, pFET,active contact cross section and mask set, metal1 line with active contact, poly contact: cross section and layout,. Latchup and its prevention, Cell based Design DC characteristics of the CMOS inverter , Expression for midpoint voltage of CMOS inverter, Symmetrical inverter, Inverter switching characteristics- RC switch model equivalent for the CMOS inverter, rise time and fall time expressions,fan-out, input capacitance and loading due to

fan-out, propagation delay of CMOS inverter.
UNIT – IV
Pseudo nMOS logic gates, tri-state inverter circuit, Clocked CMOS circuit, charge leakage in C^2MOS circuit, Dynamic CMOS logic circuits : pre-charge and evaluation modes of operation, Domino logic, Dual rail logic networks- Differential Cascade Voltage Switch Logic (DCVSL) AND/NAND, OR/NOR gates, Complementary Pass Transistor Logic (CPL) structures. SRAM – General SRAM cell, 4T &6T SRAM cell design parameters, Writing to SRAM, resistor model, SRAM arrays. Dynamic RAMs: 1T DRAM cell, charge leakage and refresh in a DRAM cell
UNIT – V
VLSI Design flow, structural gate level modeling, gate primitives, gate delays, switch level modeling, behavioral and RTL operators, timing controls, blocking and non blocking assignments, conditional statements, Data flow modeling and RTL, Comparator and priority encoder , D latch and Master-Slave D flip-flop- verilog code. Arithmetic circuits: half adder, full adder, ripple carry adder, carry look ahead adder- verilog code. Interconnect modeling; Interconnect resistance and capacitance ,sheet resistance R_s, time delay, single and multiple rung ladder circuits, simple RC inter connect model, modeling inter connect lines with a series pass FET, Crosstalk, Floor planning and routing.

Suggested Readings:

1. John P. Uyemura, "Introduction to VLSI circuits and Systems", John Wiley & Sons, 2002
3. John P. Uyemura, "Chip design for submicron VLSI: CMOS layout and simulation" IE, Cengage learning, 2006.
4. Douglas A. Pucknell, Kamran Eshraghian, "Basic VLSI Design" 3rd Edition, PHI, 2000.
5. Jan M. Rabey and others "Digital Integrated Circuits A design perspective", Pearson Education 2016

BIG DATA ANALYTICS

PC 702 IT

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

CIE: 30 marks *SEE: 70 marks*

Credits: 3

Objectives:

1. Understand big data for business intelligence.
2. Identify business case studies for big data analytics.
3. Defend big data Without SQL.
4. Discuss the process of data analytics using Hadoop and related tools.

Outcomes:

Student will be able to
1. Demonstrate big data and use cases from selected business domains.
2. Apply the knowledge of NoSQL big data management and experiment with Install, configure, and run Hadoop and HDFS.
3. Analyze map-reduce analytics using Hadoop.
4. Adapt Hadoop related tools such as HBase, Cassandra, Pig, and Hive for big data Analytics.

UNIT – I
Understanding Big Data: Characteristics of Data, Introduction to Big Data and its importance, Evolution of Big Data, Challenges posed by Big Data, Big data analytics and its classification, Big data applications: big data and healthcare – big data in medicine – advertising and big data, big data technologies.
UNIT – II
Hadoop Distributed File System: Hadoop Ecosystem, Hadoop Architecture, Analyzing data with Hadoop, HDFS Concepts, Blocks, Namenodes and Datanodes, Hadoop FileSystems, The Java Interface, Reading Data from a Hadoop URL, Reading Data Using the FileSystem API, Writing Data, Directories, Querying the FileSystem, Deleting Data, Anatomy of File Read and Write
UNIT – III
NOSQL Data Management: Introduction to NOSQL – aggregate data models , aggregates keyvalue and document data models, relationships – graph databases, schema less databases , materialized views , distribution models , sharding - version – map reduce – partitioning and combining – composing map-reduce calculations
UNIT – IV
MapReduce and Yarn: Hadoop MapReduce paradigm, Map and Reduce tasks, Job and Task trackers, Writing a Unit Test with MRUnit, Mapper, Reducer, 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
Pig: Installing and Running Pig, an Example, Generating Examples, Comparison with Databases, Pig Latin, User-Defined Functions, Data Processing Operators, Pig in Practice. Hive: Installing Hive, The Hive Shell, An Example, Running Hive, Comparison with Traditional Databases, HiveQL, Tables, Querying Data, User-Defined Functions, Writing a User Defined Functions, Writing a User Defined Aggregate Function.

Suggested Readings:

1.Tom White, "Hadoop: The Definitive Guide", Third Edition, O'Reilly, 2012.
2. Eric Sammer, "Hadoop Operations", O'Reilly, 2012.
3. VigneshPrajapati, Big data analytics with R and Hadoop, 2013.
4. E. Capriolo, D. Wampler, and J. Rutherglen, "Programming Hive", O'Reilly, 2012.

WIRELESS AND MOBILE COMMUNICATION

PE 721 IT

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

CIE: 30 marks *SEE: 70 marks*

Credits: 3

Objectives:

Students shall be able to

Outcomes:

Student will be able to
1. Understand the fundamental concepts of wireless and cellular Network s.
2. Understand Spread spectrum modulation techniques and compare various Medium Access Control mechanisms
3. Describe WLAN and GSM
4. Analyze different variations of TCP for mobile communication systems.
5. Discuss protocols for MANETs and WAP

UNIT – I

Introduction to Wireless Communication Systems: Evolution of Mobile Radio Communications,

Examples of Wireless Communication Systems. Modern Wireless Communication Systems : Second Generation (2G) Cellular Networks, Third Generation (3G) Wireless Networks, Wireless local Loop, Wireless.

Local Area Networks.The Cellular Concept: Introduction, Frequency Reuse, Channel Assignment Strategies, Handoff Strategies, Interference and Systems Capacity, Trunking and Grade of Service, Improving Coverage & Capacity in Cellular Systems.

UNIT – II

Spread spectrum modulation techniques: Pseudo-noise sequence, direct sequence spread spectrum (DS-SS), frequency hopped spread spectrum(FHSS), performance of DS-SS, performance of FH-SS

Medium Access Control: Motivation for a specialized MAC: Hidden and Exposed terminals. Near and Far terminals; SDMA, FDMA, TDMA, and CDMA

UNIT – III

Wireless LAN: IEEE 802-11 Protocol, System Architecture, Protocol Architecture, Physical Layer & MAC Layer, Newer developments, Hiper LAN

GSM: Mobile services, System architecture, Localization, Call Handling, Handover, Security, New data services.

UNIT – IV

Mobile Network Layer: Mobile IP: Goals, assumptions and requirements, Entities and Terminology, IP packet delivery, Agent advertisement and discovery, Registration, Tunneling and Encapsulation, Optimizations, Reverse tunneling, Ipv6; Dynamic host configuration protocol.

Mobile Transport Layer : Traditional TCP: Congestion control, Slow start, Fast retransmit/fast recovery, Implications on mobility; Indirect TCP, Snooping TCP, Mobile TCP, Fast retransmit/fast recovery, Transmission/timeout freezing, Selective retransmission, Transaction

oriented TCP
UNIT – V
Mobile Ad hoc Networks (MANETs): Introduction, Applications & Challenges of a MANET, Routing, Classification of Routing Algorithms, Algorithms such as DSR, AODV, DSDV, etc. , Mobile Agents, Service Discovery. **PROTOCOLS AND TOOLS:** Wireless Application Protocol-WAP. (Introduction, protocol architecture, and treatment of protocols of all layers), Bluetooth (User scenarios, physical layer, MAC layer, networking, security, link management) and J2ME.

Suggested Readings:

1. Theodore S. Rappaport, "Wireless Communications Principles and Practice", 2nd Edition, Pearson Education, 2003
2. Jochen Schiller, "Mobile Communication", 2nd Edition, Pearson Education 2003

SEMANTIC WEB

PE 722 IT

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

CIE: 30 marks *SEE: 70 marks*

Credits: 3

Objectives:

1. To introduce the concept of Semantic Web.
2. To provides a comprehensive understanding of the layered architecture of Semantic Web.
3. To learn about the various Semantic Web technologies i.e. RDF,RDFS and OWL2.
4. To understand the role of ontology in Semantic Web.
5. To represent logic in Semantic Web and perform inference.
6. To understand the concepts in ontology construction.
7. To analyze the applications based on Semantic Web Technology

Outcomes:

Student will be able to
1. To understand the vision of Semantic Web.
2. To evaluate the role played by each layer in bringing up the Semantic Web.
3. To analyze the ontology construction steps in detail with a possibility to reuse existing ontologies.
4. To design queries in Semantic Web using SPARQL.
5. To perform reasoning on ontologies using user defined rules.
6. To gain an understanding of the use of Semantic Web technologies in various applications

UNIT – I
The Semantic Web Vision: Introduction, Semantic Web Technologies, A Layered Approach.
UNIT – II
Describing Web Resources RDF: Introduction , RDF: Data Model, RDF Syntaxes, RDFS: Adding Semantics, RDF Schema: The Language, RDF and RDF Schema in RDF Schema, An Axiomatic Semantics for RDF and RDF Schema , A Direct Inference System for RDF and RDFS.
UNIT – III
Web Ontology Language OWL2: Introduction, Requirements for Ontology Languages, Compatibility of OWL2 with RDF/RDFS, The OWL Language, OWL2 Profiles. **Querying the Semantic Web**: SPARQL Infrastructure, Basics: Matching Patterns, Filters, Constructs for Dealing with an Open World, Organizing Result Sets, Other Forms of SPARQL Queries, Querying Schemas,Adding Information with SPARQL Update.
UNIT – IV
Logic and Inference Rule: Introduction, Example of Monotonic Rules: Family Relationships, Monotonic Rules: Syntax, Monotonic Rules: Semantics, OWL2 RL: Description Logic Meets Rules, Rule Interchange Format: RIF, Semantic Web Rules Language (SWRL), Rules in SPARQL: SPIN, Nonmonotonic Rules: Motivation and Syntax, Example of Nonmonotonic Rules: Brokered Trade, Rule Markup Language (RuleML).

UNIT – V
Ontology Engineering: Introduction, Constructing Ontologies Manually, Reusing Existing Ontologies, Semiautomatic Ontology Acquisition, Ontology Mapping, Exposing Relational Databases, Semantic Web Application Architecture. **Applications:** GoodRelations, BBC Artists, BBC World Cup 2010 Website, Government Data, New York Times, Sig.ma and Sindice, OpenCalais, Schema.org.

Suggested Readings:

1. Groth, Paul, Frank van Harmelen, Rinke Hoekstra, and Grigoris Antoniou. A Semantic Web Primer, MIT Press, Third edition 2012.
2. Pascal Hitzler, Markus Krotzsch, Sebastian Rudolph, Foundations of Semantic Web Technologies, CRC Press, 2009.
3. Dean Allemang, James Hendler, Semantic Web for the Working Ontologist: Effective Modeling in RDFS and OWL, Morgan Kauffmann, ISBN-10: 0-12-373556-4 2008.
4. Thinking on the Web - Berners Lee, Godel and Turing, Wiley inter science, 2008.

CLOUD COMPUTING

PE 723 IT

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

CIE: 30 marks *SEE: 70 marks*

Credits: 3

Objectives:

1. To introduce basic concepts cloud computing and enabling technologies
2. To learn about Auto-Scaling, capacity planning and load balancing in cloud
3. To introduce security, privacy and compliance issues in clouds
4. To introduce cloud management standards and programming models

Outcomes:

Student will be able to
1. Understand the architecture and concept of different cloud models: IaaS, PaaS, SaaS
2. Create virtual machine images and deploy them on cloud
3. Identify security and compliance issues in clouds.

UNIT – I
Introduction, Benefits and challenges, Cloud computing services, Resource Virtualization, Resource pooling sharing and provisioning
UNIT – II
Scaling in the Cloud, Capacity Planning , Load Balancing, File System and Storage
UNIT – III
Multi-tenant Software, Data in Cloud , Database Technology, Content Delivery Network, Security Reference Model , Security Issues, Privacy and Compliance Issues
UNIT – IV
Portability and Interoperability Issues, Cloud Management and a Programming Model Case Study, Popular Cloud Services
UNIT – V
Enterprise architecture and SOA, Enterprise Software , Enterprise Custom Applications, Workflow and Business Processes, Enterprise Analytics and Search, Enterprise Cloud Computing Ecosystem.

Suggested Readings:

1. Cloud Computing - Sandeep Bhowmik, Cambridge University Press, 2017
2. Enterprise Cloud Computing - Technology, Architecture, Applications by Gautam Shroff, Cambridge University Press, 2016.
3. Kai Hwang, Geoffrey C.Fox, Jack J.Dongarra, ―Distributed and Cloud Computing From ParallelProcessing to the Internet of Things‖,Elsevier, 2012.

HUMAN COMPUTER INTERACTION

PE 724IT

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

Objectives:

1. Describe typical human–computer interaction (HCI) models and styles
2. Understand that the interfaces' design emerges iteratively

Outcomes:

Student will be able to
1. Describe typical human–computer interaction (HCI) models and styles
2. Understand that the interfaces' design emerges iteratively
3. Outline how to characterize the user experience in terms of usability
4. Analyze and identify user models

UNIT – I
Interaction Paradigms: Computing Environments, Analyzing Interaction Paradigms, Interaction Paradigms **Interaction Frameworks and Styles:** Frameworks for Understanding Interaction, Coping with Complexity, Interaction Styles.
UNIT – II
Interaction Design **Process:** Iterative Design, User-Centered Design, Interaction Design Models, Overview of Interaction Design Models **Discovery:** Discovery Phase Framework, Collection, Interpretation, Documentation **Design:** Conceptual Design, Physical Design, Evaluation, Interface Design Standards, Designing the Facets of the Interface
UNIT – III
Design Principles: Principles of Interaction Design, Comprehensibility, Le ability, Effectiveness/Usefulness, Efficiency/Usability, Grouping, Stimulus Intensity, Proport Screen Complexity, Resolution/Closure, and Usability Goals **Interaction Design Models:** Model Human Processor , Keyboard Level Model, GOI Modeling Structure, Modeling Dynamics, Physical Models **Usability Testing:** Usability, Usability Test, Design the Test, Prepare for the Test, Perform the Test, Process the Data
UNIT – IV
Interface Components: The WIMP Interface, Other Components **Icons:** Human Issues Concerning Icons, Using Icons in Interaction Design, Technical Issues Concerning Icons **Color:** The Human Perceptual System, Using Color in Interaction Design, Color Concerns for Interaction Design, Technical Issues Concerning Color
UNIT – V
Text: Human Issues Concerning Text, Using Text in Interaction Design, Technical Issues Concerning Text **Speech and Hearing :** The Human Perceptual System, Using Sound in Interaction Design, Technical Issues Concerning Sound **Touch and Movement:** The Human Perceptual System, Using Hap-tics in Interaction Design, Technical Issues Concerning Haptics

Suggested Readings:

1. Steven Heim, The Resonant Interface: HCI Foundations for Interaction Design, Addison-Wesley, 2007
2. J. Preece, Y. Rogers, and H. Sharp, Interaction Design: Beyond Human-Computer Interaction, Wiley & Sons, 2nd Ed., 2007
3. Ben Shneiderman, Catherine Plaisant, Designing the User Interface: Strategies for Effective Human-Computer Interaction, 5th edition,, Addison-Wesley, 2009

QUANTUM COMPUTING

PE 731 IT

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

CIE: 30 marks *SEE: 70 marks*

Credits: 3

Objectives:

The objective of this course is to impart necessary knowledge to the learner so that he/she can develop and implement algorithm and write programs using these algorithm.

Outcomes:

Student will be able to
1. Explain the working of a Quantum Computing program, its architecture and program model
2. Develop quantum logic gate circuits
3. Develop quantum algorithm
4. Program quantum algorithm on major toolkits

UNIT – I
Introduction to Quantum Computing: Motivation for studying Quantum Computing, Major players in the industry (IBM, Microsoft, Rigetti, D-Wave etc.) Origin of Quantum Computing, Overview of major concepts in Quantum Computing Qubits and multi-qubits states, Bra-ket notation: Bloch Sphere representation, Quantum Superposition, Quantum Entanglement
UNIT – II
Math Foundation for Quantum Computing: Matrix Algebra: basis vectors and orthogonality, inner product and Hilbert spaces, matrices and tensors, unitary operators and projectors, Dirac notation, Eigen values and Eigen vectors.
UNIT – III
Building Blocks for Quantum Program: Architecture of a Quantum Computing platform, Details of q-bit system of information representation: Block Sphere, Multi-qubits States, Quantum superposition of qubits (valid and invalid superposition), Quantum Entanglement, Useful states from quantum algorithmic perceptive e.g. Bell State, Operation on qubits: Measuring and transforming using gates. Quantum Logic gates and Circuit: Pauli, Hadamard, phase shift, controlled gates.
UNIT – IV
Programming model for a Quantum Computing Program: Steps performed on classical computer, Steps performed on Quantum Computer, Moving data between bits and qubits..
UNIT – V
Quantum Algorithms: Amplitude amplification, Quantum Fourier Transform, Phase Kick-back, Quantum Phase estimation, Quantum Walks.

Suggested Readings:

1. Michael A. Nielsen, “Quantum Computation and Quantum Information”, Cambridge

University Press. October 2000.
2. David McMahon, “Quantum Computing Explained”, Wiley 2007
3. IBM Experience: https://quantumexperience,ng,bluemix.net
4. Microsoft Quantum Development Kit
5. Michael A. Nielsen, “Quantum Computation and Quantum Information”, Cambridge University Press. October 2000.
https://www.microsoft.com/en-us/quantum/development-kit
6. Forest SDK PyQuil: https://pyquil.readthedocs.io/en/stable/

DEEP LEARNING

PE 732 IT

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

CIE: 30 marks *SEE: 70 marks*

Credits: 3

Objectives:

1. Understand the concept of neural networks, convolutional neural networks, and recurrent neural networks.
2. Implement deep learning algorithms, and learn how to train deep networks.
3. Gain in-depth knowledge of TensorFlow along with its functions, operations, and the execution pipeline.
4. Understanding the major Architectures of Neural Networks and getting into the Convolutional neural Networks.
5. Understand the applications of implementing deep learning such as image processing, natural language processing, speech recognition, deep face - facial recognition system, etc.

Outcomes:

Student will be able to
1. To understand the fundamentals of deep learning.
2. To be able to understand deep learning algorithms and design neural network.
3. To be able to train and implement a neural network.
4. To be able to have knowledge about convolutional neural networks.
5. To be able to apply neural networks in various fields.
6. To understand the fundamentals of deep learning.

UNIT – I
What is deep learning? Artificial intelligence, Machine learning,and Deep learning - Artificial intelligence -Machine learning - Learningrepresentations from data - The "deep" in deep learning -Understanding how deep learning works, in three figures -What deep learning has achieved so far- The promise of AI **Brief history of machine learning**-Probabilistic modeling -Early neural networks -Kernel methods-Decision trees-Random forests, and gradient boosting machines -Back to neural networks -What makes deep learning different -The modern machine-learning landscape**.**
UNIT – II
Getting started with neural networks - Anatomy of a neural network - Layers: the building blocks of deep learning - Models: networks of layers - Loss functions and optimizers: keysto configuring the learning process **The Neural Network**-Building Intelligent Machines, The Limits of Traditional Computer Programs, The Mechanics of Machine Learning, The Neuron, Expressing Linear Perceptrons as Neurons, Feed-Forward Neural Networks, Linear Neurons and Their Limitations, Sigmoid, Tanh, and ReLU Neurons, Softmax Output Layers.
UNIT – III
Training Feed-Forward Neural Networks - The Fast-Food Problem - Gradient Descent - The Delta Rule and Learning Rates - Gradient Descent with Sigmoidal Neurons - The Backpropagation Algorithm - Stochastic and Mini batch Gradient Descent - Test Sets, Validation Sets, and Overfitting - Preventing Overfitting in Deep Neural Networks **Implementing Neural Networks in TensorFlow** - What is TensorFlow? - How Does

TensorFlow Compare to Alternatives?- Installing TensorFlow - Creating and Manipulating TensorFlow Variables - TensorFlow Operations - Placeholder Tensors - Sessions in TensorFlow - Navigating Variable Scopes and Sharing Variables - Managing Models over the CPU and GPU - Specifying the Logistic Regression Model in TensorFlow - Logging and Training the Logistic Regression Model - Leveraging TensorBoard to Visualize Computation Graphs and Learning - Building a Multilayer Model for MNIST in TensorFlow
UNIT – IV
Introduction to Major Architectures of Deep Networks–Unsupervised Pretrained Networks (UPNs), Convolutional Neural Networks (CNNs), Recurrent Neural Networks, Recursive Neural Networks **Convolutional Neural Networks** -Neurons in Human Vision - The Shortcomings of Feature Selection - Vanilla Deep Neural Networks Don't Scale - Filters and Feature Maps - Full Description of the Convolutional Layer - Max Pooling - Full Architectural Description of Convolution Networks - Closing the Loop on MNIST with Convolutional Networks - Image Preprocessing Pipelines Enable More Robust Models - Accelerating Training with Batch Normalization - Building a Convolutional Network for CIFAR-10 - Visualizing Learning in Convolutional Networks
UNIT – V
Deep Learning Applications - Large Scale Deep Learning - Computer Vision - Speech Recognition - Natural Language Processing - Other Applications

Suggested Readings:

1. Nikhil Buduma and Nicholas Locascio - Fundamentals of Deep Learning : Designing Next-Generation Machine Intelligence Algorithms – First Edition - O'Reilly , 2017
3. Francois Chollet-Deep Learning with Python-Second Edition,Manning Publications, 2017
3.Josh Patterson and Adam Gibson- Deep Learning: A Practitioner's Approach - First Edition - O'Reilly , 2017
4. Ian Goodfellow, Yoshua Bengio, Aaron Courville - Deep Learning – Second Edition-MIT Press , 2016

CRYPTOGRAPHY AND NETWORK SECURITY

PE 734 IT

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

CIE: 30 marks *SEE: 70 marks*

Credits: 3

Objectives:

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

Outcomes:

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

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

architecture, Authentication Header, Encapsulating security payload, Combining security associations.

Suggested Readings:

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

VLSI DESIGN LAB

PC 751 IT

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

CIE: 25 marks *SEE: 50 marks*

Credits: 1

Objectives:

1. To introduce the students to understand basics in Hardware design using CAD tools
2. Understand and Experience Verilog Design Flow
3. Learn Transistor-Level CMOS Logic Design using both Verilog and VHDL
4. Understand VLSI Fabrication and experience CMOS Physical Design using backend tools

Outcomes:

Student will be able to
1. Demonstrate Xilinx ISE suite to write Verilog code for logic gates, combinational circuits and sequential circuits.
2. Write Verilog code for basic logic gates, complex logic gates, combinational circuits, and sequential circuits using switch level, gate level, data flow and behavioural modelling.
3. Develop test bench code using Verilog and verify the simulation results.
4. Demonstrate the FPGA implementation of digital circuits and generate the synthesis report.
5. Draw the layouts of basic logic gates using Microwind

List of Experiments to be performed

1. Switch level modelling using Verilog a) Logic gates b) AOl and OAI gates c) Transmission gate d) Complex logic gates using CMOS
2. Gate-level Modelling—Digital circuits using gate primitives—using Verilog.

a) Half adder and full adders b) AOl gate with and without delay c) OAl gate with and without delay d) 2:1 MUX using tri-state buffers e) S-R latch

3. RTL Modelling of general VLSI system components.

a) 4:1 MUX b) 2 to 4 Decoder c) 8:3 Priority encoder d) Flip-flops

4. Mixed gate-level and Switch-level modelling using Verilog a) Constructing a 4-input AND gate using CMOS 2-input NAND and NOR gates. b) Constructing a 2 to 4 decoder using CMOS 2-input AND gates and NOT gates etc.
5. Synthesis of Digital Circuits a) Ripple carry adder and carry look-ahead adder
6. Verilog code for finite state machine
7. Simple layouts of Inverter, NAND2 and NOR2 gates
8. Stick diagram representations of Inverter, NAND2 and NOR2 gates

BIG DATA ANALYTICS LAB

PC 752 IT

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

CIE: 25 marks *SEE: 50 marks*

Credits: 1

Objectives:

1. To provide the knowledge to setup a Hadoop Cluster
2. To impart knowledge to develop programs using MapReduce Technique
3. To learn file handling in HDFS
4. To introduce Pig, PigLatin and HiveQL to process big data
5. To learn machine learning operations using Mahout Hadoop
6. To introduce NoSQL databases

Outcomes:

Student will be able to
1. Understand Hadoop working environment
2. Work with big data applications in multi node clusters
3. Write scripts using Pig to solve real world problems
4. Write queries using Hive to analyse the datasets
5. Model and build a recommendation system using Mahout Hadoop
6. Apply big data and echo system techniques for real world

List of Experiments to be performed

1. Understanding and using basic HDFS commands
2. Word count application using Mapper Reducer on single node cluster
3. Analysis of Weather Dataset on Multi node Cluster
4. Working with files in Hadoop file system: Reading, Writing and Copying
5. Writing User Defined Functions/Eval functions for filtering unwanted data in Pig
6. Retrieving user login credentials from /etc/passwd using Pig Latin
7. Working with HiveQL.
8. Writing User Defined Functions in Hive
9. Perform classification & clustering in Mahout Hadoop
10. Building a Mahout Recommendation System on a Hadoop Cluster

Suggested Readings:

1. Tom White, "Hadoop: The Definitive Guide", 4th Edition, O'Reilly Media Inc, April 2015.
2. Alan Gates, "Programming Pig", O'Reilly Media Inc, 2011.

PROJECT WORK – I

PW 761 IT

Instruction: 6 periods per week
CIE: 50 marks
Credits: 3

Objectives:

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

Outcomes:

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

The department can initiate the project allotment procedure at the end of VI semester and finalize it in the first two weeks of VII semester.
The department will appoint a project coordinator who will coordinate the following:

- Collection of project topics/ descriptions from faculty members (Problems can also be invited from¬ the industries)
- Grouping of students (max 3 in a group)
- Allotment of project guides

The aim of project work is to develop solutions to realistic problems applying the knowledge and skills obtained in different courses, new technologies and current industry practices. This requires students to understand current problems in their domain and methodologies to solve these problems. To get awareness on current problems and solution techniques, the first 4 weeks of VII semester will be spent on special lectures by faculty members, research scholars, post graduate students of the department and invited lectures by engineers from industries and R&D institutions. After completion of these seminars each group has to formalize the project proposal based on their own ideas or as suggested by the project guide. Seminar schedule will be prepared by the coordinator for all the students from the 5th week to the last week of the semester which should be strictly adhered to.

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

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

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

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

SUMMER INTERNSHIP

SI 762 IT

CIE: 50 marks

Credits: 2

Objectives:

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

Outcomes: Student will be able to:

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

Summer Internship

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

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

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

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

SCHEME OF INSTRUCTION
BE (INFORMATION TECHNOLOGY)
Semester -VIII

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

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

Open Electives– II

NON-CONVENTIONAL ENERGY SOURCES

OE 603 EE

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

Objectives:

1. To impart the knowledge of basics of different non Conventional types of power generation & power plants
2. To help the misunderstanding the need and role of Non-Conventional Energy sources particularly when the conventional sources are scarce in nature

Outcomes:

Student will be able to
1. Understandthedifferentnonconventionalsourcesandthepowergenerationtechniquestogenerate electrical power.
2. UnderstandtheSolarenergypowerdevelopmentanddifferentapplications.
3. Understanddifferentwindenergypowergenerationtechniquesandapplications.
4. Design a prescribedengineering sub-system.
5. Recognizetheneedandabilityto engagein lifelonglearningforfurtherdevelopmentsin thisfield.

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

efficiency-Biogas generation-SelectionofsiteforBiogasplant-Classification ofBiogas plants-Details ofcommonlyusedBiogasplantsinIndia-Advantagesanddisadvantages ofBiogasgeneration-Thermal gasificationofbiomass-Biomassgasifiers.

Suggested Readings:

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

TRANSDUCERS AND SENSORS

OE 604 EE

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

Objectives:

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

Outcomes:

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

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

Suggested Readings:

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

AUTOMOTIVE MAINTENANCE

OE 621AE

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

CIE: 30 marks *SEE: 70 marks*

Credits: 3

Objectives:

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

Outcomes:

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

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

Auto Electrical and Air Conditioning Maintenance: Maintenance of batteries, starting system, charging system and body electrical -Fault diagnosis using Scan tools. Maintenance of air conditioning parts like compressor, condenser, expansion valve, evaporator - Vehicle body repair like panel beating, tinkering, soldering, polishing, painting.

Suggested Readings:

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

INDUSTRIAL ROBOTICS

OE 621ME

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

Objectives:

1. To familiarize the student with the anatomy of robot and their applications.
2. To provide knowledge about various kinds of end effectors usage.
3. To equip the students with information about various sensors used in industrial robots.
4. To make the student understand the importance of spatial transformation of robots using forward and inverse kinematics.
5. To specify and provide the knowledge of techniques involved in robot vision in industry.
6. To equip students with latest robot languages implemented in industrial manipulators.

Outcomes:

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

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

sensors), Wrist Sensors, Compliance Sensors, Slip Sensors.

UNIT – III

Kinematic Analysis of Robots: Rotation matrix. Homogeneous transformation matrix, Denavit&Hartenberg representation, Euler and RPY angles representation. Representation of absolute position and orientation in terms of joint parameters, Direct Kinematics of manipulators, Inverse kinematics of Robot arm for position and orientation. Redundancy in Robots, Static force analysis

UNIT – IV

Introduction to Techniques used in Robot Vision: Image acquisition, illumination techniques, imaging geometry, basic relationship pixels, preprocessing, segmentation & description of 3-dimensional structures, their recognition and interpretation. Types of Camera, frame grabbing, sensing and digitizing image data, Signal conversion, Image Storage, Lighting techniques, Image processing and analysis, Data reduction, Segmentation, Feature extraction, Object recognition, and various algorithms, Applications, Inspection, identification, visual serving and navigation.

UNIT – V

Robot Programming Languages: Characteristics of robot level languages, task level languages. Teach pendant programming, Lead through programming, Robot programming languages, VAL programming, Motion commands, Sensor commands. End effecter commands, Simple programs. RGV, AGV, Implementation of robots in industries, various steps, Safety considerations for robot operations. Economic analysis of robots, Pay back method, EUAC method and Rate of return method.

Suggested Readings:

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

GREEN BUILDING TECHNOLOGIES

OE 602 CE

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

CIE: 30 marks *SEE: 70 marks*

Credits: 3

Objectives:

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

Outcomes:

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

UNIT – I

***Introduction to Green Buildings*:** Definition of green buildings and sustainable development, typical features of green buildings, benefits of green buildings towards sustainable development. Green building rating systems – GRIHA, IGBC and LEED, overview of the criteria as per these rating systems.

UNIT – II

***Site selection and planning*:** Criteria for site selection, preservation of landscape, soil erosion control, minimizing urban heat island effect, maximize comfort by proper orientation of building facades, day lighting, ventilation, etc.

UNIT – III

Water conservation and efficiency: Rainwater harvesting methods for roof & non-roof, reducing landscape water demand by proper irrigation systems, water efficient plumbing systems, water metering, waste water treatment, recycle and reuse systems.

Energy Efficiency: Environmental impact of building constructions, Concepts of embodied energy, operational energy and life cycle energy.

Methods to reduce operational energy: Energy efficient building envelopes, efficient lighting technologies, energy efficient appliances for heating and air-conditioning systems in buildings, zero ozone depleting potential (ODP) materials, wind and solar energy harvesting, energy metering and monitoring, concept of net zero buildings.

UNIT – IV

Building materials: Methods to reduce embodied energy in building materials: (a) Use of local

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

Suggested Readings:

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

DATA SCIENCE USING R

OE 602CS

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

Objectives:

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

Outcomes:

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

UNIT – I

Introduction To R: Introduction, Downloading and Installing R, IDE and Text Editors, Handling Packages in R. **Getting Started With R:** Introduction, Working with Directory, Data Types In R, Few Commands for Data Exploration.

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

UNIT – II

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

UNIT – III

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

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

UNIT – IV

Decision Tree: Introduction, What Is A Decision Tree?, Decision Tree Representation In R, Appropriate Problems For Decision Tree Learning, Basic Decision Tree Learning Algorithm, Measuring Features, Hypothesis Space Search In Decision Tree Learning, Inductive Bias In

Decision Tree Learning, Why Prefer Short Hypotheses, Issues In Decision Tree Learning.

Time Series In R: Introduction, What Is Time Series Data, Reading Time Series Data, Decomposing Time Series Data, Forecasts Using Exponential Smoothing, ARIMA Models.

UNIT – V

Clustering: Introduction, What Is Clustering, Basic Concepts in Clustering, Hierarchical Clustering, K-Means Algorithm, CURE Algorithm, Clustering in Non-Euclidean Space, Clustering for Streams and Parallelism.

Association Rules: Introduction, Frequent Itemset, Data Structure Overview, Mining Algorithm Interfaces, Auxiliary Functions, Sampling from Transaction, Generating Synthetic Transaction Data, Additional Measures of Interestingness, Distance Based Clustering Transaction and Association.

Text Mining: Introduction, Definition of Text Mining, A Few Challenges in Text Mining, Text Mining Verses Data Mining, Text Mining In R, General Architectures of Text Mining Systems, Pre-Processing of Documents In R, Core Text Mining Operations, Using Background Knowledge for Text Mining, Text Mining Query Languages.

Mining Frequent Patterns, Associations and Correlations: Basic Concepts and Methods.

Frequent Itemset, Closed Itemset And Association Rules.

Frequent Itemset: Mining Methods, Pattern Evaluation Methods, Sentiment Analysis**.**

Suggested Readings:

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

CYBER SECURITY

OE 603 IT

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

CIE: 30 marks *SEE: 70 marks*

Credits: 3

Objectives:

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

Outcomes:

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

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

Suggested Readings:

1. Michael E. Whitman and Herbert J. Mattord, "*Principles of Information Security*",

Thomson, 2003.

2. William Stallings, "*Cryptography and Network Security*", Pearson Education, 2000.
3. Nina Godbole, "*Information System Security*", John Wiley & Sons, 2008.

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

Open Electives – III

SMART BUILDING SYSTEMS

OE605EE

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

Objectives:

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

Outcomes:

Student 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 &Securi-ty) project cycle, Project steps BMS, Advantages & Applications of BMS, IBMS Architecture, Normal & Emergency operation, Advantages of BMS.

Suggested Readings:

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, *HVAC Control in the New Millennium*, Fairmont press, 2001.
7. Bela G. Liptak, *Process Control-Instrument Engineers Handbook*, Chilton book co.

PROGRAMMABLE LOGIC CONTROLLERS

OE606EE

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

Objectives:

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

Outcomes:

Student will be able to

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

UNIT – I

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

UNIT – II

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

UNIT – III

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

UNIT – IV

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

UNIT – V

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

Suggested Readings:

1. John W. Weff, Ronald A. Reis, Programmable Logic Controllers, Prentice Hall of India Private Limited, Fifth edition, 2003.

2. Frank D. Petruzella, *Programmable Logic Controllers*, 5th Edition, Mc-Graw Hill, 2019.

AUTOMOTIVE SAFETY AND ERGONOMICS

OE 631AE

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

CIE: 30 marks *SEE: 70 marks*

Credits: 3

Objectives:

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

Outcomes:

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

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

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

Suggested Readings:

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

MECHATRONICS

OE 631ME

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

CIE: 30 marks *SEE: 70 marks*

Credits: 3

Objectives:

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

Outcomes:

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

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

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

Suggested Reading:

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

ROAD SAFETY ENGINEERING

OE 603 CE

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

Objectives:

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

Outcomes:

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

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

Suggested Readings:

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

SOFTWARE ENGINEERING

OE 604 IT

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

CIE: 30 marks *SEE: 70 marks*

Credits: 3

Objectives:

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

Outcomes:

Student will be able to
1. Acquired working knowledge of alternative approaches and techniques for each phase of software development
2. Judge an appropriate process model(s) assessing software project attributes and analyze necessary requirements for project development eventually composing SRS.
3. Creation of visual models to describe (non-) algorithmic solutions for projects using 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 Engineering Tasks, Initiating Requirements Engineering Process, Eliciting Requirements, Developing Use-Cases, Building the Analysis Model, Negotiating Requirements, Validating Requirements.

UNIT – III

Building the Analysis Model:Requirements Analysis Modeling Approaches, Data Modeling

Concepts, Object-Oriented Analysis, Scenario-based Modeling, Flow-oriented Modeling, Class-based Modeling, Creating a Behavioral Model.

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

UNIT – IV

Creating an Architectural Design: Software Architecture, Data Design, Architectural Styles and Patterns, Architectural Design.

Modeling Component-Level Design:Definition of Component, Designing Class-based Components, Conducting Component-level Design, Object Constraint Language, Designing Conventional Components.

Performing User Interface Design:The Golden Rules, User Interface Analysis and Design, Interface Analysis, Interface Design Steps, Design Evaluation.

UNIT – V

Testing: Strategies:A Strategic Approach to Conventional Software Testing, Test Strategies for O-O Software.

Tactics:Software Testing Fundamentals, Black-box and White-box Testing, Basis Path Testing, Control Structure Testing, O-O Testing Methods.

Debugging:Debugging Techniques, The Art of Debugging.

Product Metrics: A Framework for Product Metrics, Metrics for each phase of software development.

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

Suggested Readings:

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

PROJECT WORK - II

PW 961CS

Instruction: 16 periods per week *Duration of SEE: 3 hours*
CIE: 50 marks *SEE: 100 marks*
Credits : 8

Objectives:

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

Outcomes: Student will be able to:

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

The aim of Project work –II is to implement and evaluate the proposal made as part of Project Work - I. Students can also be encouraged to do full time internship as part of project work-II based on the common guidelines for all the departments . The students placed in internships need to write the new proposal in consultation with industry coordinator and project guide within two weeks from the commencement of instruction.

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

- Re-grouping of students - deletion of inters hip candidates from groups made as part of project work-I
- Re-Allotment of internship students to project guides
- Project monitoring at regular intervals

All re-grouping/re -allotment has to be completed by the 1st week of VIIIth semester so that students get sufficient time for completion of the project.

All projects(internship and departmental) will be monitored at least twice in a semester through student presentation for the award of sessional marks. Sessional marks are awarded by a monitoring committee comprising of faculty members as well as by the supervisor. The first review of projects for 25 marks can be conducted after completion of five weeks. The second review for another 25 marks can be conducted after 12 weeks of instruction.

Common norms will be established for the final documentation of the project report by the

respective departments. The students are required to submit draft copies of their project report within one week after completion of instruction.

Note: Three periods of contact load will be assigned to each project guide.