19BMC01 **HUMAN ANATOMY & PHYSIOLOGY** **L T P C 3 0 0 3**

COURSE OBJECTIVES

1. Know basic structural and functional elements of human body.
2. Learn organs and structures involving in system formation and functions.
3. Understand circulatory system.
4. Learn urinary and special sensory system
5. Study about nervous system

COURSE OUTCOMES

1. To Know basic structural and functional elements of human body.
2. To Learn organs and structures involving in system formation and functions.
3. To Understand circulatory system.
4. To Learn urinary and special sensory system
5. To Study about nervous system

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19BMC01.CO1	x	x	x	-	-	-	-	-	-	x	-	x	x	-	-
19BMC01.CO2	x	x	x	-	-	x	-	-	x	x	-	x	x	-	-
19BMC01.CO3	x	x	x	-	-	x	-	-	x	x	-	x	x	-	-
19BMC01.CO4	x	x	x	-	-	x	-	-	x	x	-	x	x	-	-
19BMC01.CO5	x	x	x	-	-	x	-	-	x	x	-	x	x	-	-

UNIT I **BASIC ELEMENTS OF HUMAN BODY** 9

Cell: Structure and organelles - Functions of each component in the cell. Cell membrane – transport across membrane – origin of cell membrane potential – Action potential Tissue: Types – Specialized tissues – functions. Types of glands.

UNIT II **SKELETAL SYSTEM** 9

Bone, Types of bone, structure, bone cells, functions of bone. Axial skeleton- skull, sinuses, Fontanelles, vertebral column- characteristics of typical vertebra, different parts of vertebral column (parts only), features of vertebral column, movements and functions of vertebral column, sternum, ribs, shoulder girdle and upper limb, pelvic girdle and lower limb

UNIT III **CIRCULATORY SYSTEM** 9

Blood composition - functions of blood – functions of RBC. WBC types and their functions Blood groups – importance of blood groups – identification of blood groups. Blood vessels - Structure of heart – Properties of Cardiac muscle – Conducting system of heart – Cardiac cycle – ECG - Heart sound - Volume and pressure changes and regulation of heart rate –Coronary Circulation. Factors regulating Blood flow.

UNIT IV **URINARY AND NERVOUS SYSTEM** 9

Urinary system: Structure of Kidney and Nephron. Mechanism of Urine formation and acid base regulation – Urinary reflex – Homeostasis and blood pressure regulation by urinary system. -Structure of a Neuron – Types of Neuron. Synapses and types. Conduction of action potential in neuron Brain – Divisions of brain lobes - Cortical localizations and functions - EEG. Spinal cord – Tracts of spinal cord - Reflex mechanism – Types of reflex. Autonomic nervous system and its functions.

UNIT V **MUSCLES AND JOINTS** 9

Muscle tissue:Skeletal muscle, Smooth muscle, Cardiac muscle, functions of muscle tissue, muscle tone and fatigue. Types of joint- Fibrous, Cartilaginous, Synovial, characteristics of synovial joints, shoulder joint, elbow joint, radioulnar joint, wrist joint, joints of hands and fingers, Hip joint, Knee joint, ankle joint, joints of foot and toes.

TOTAL: 45

REFERENCE BOOK

Sl.No	AUTHOR(s)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	William F. Ganong	Review of Medical Physiology	Mc Graw Hill New Delhi	22nd edition
2.	Eldra Pearl Solomon	Introduction to Human Anatomy and Physiology	W.B.Saunders Company	2003
3.	Arthur C. Guyton	Text book of Medical Physiology	11 th Edition, Elsevier Saunders.	11th Edition, 2006
4.	Juergen Mai George Paxinos	The Human nervous System	Academic Press 3rd Edition	2011
5.	Midthun Joseph	The Digestive and Urinary Systems	World Book, Inc	2011

WEB REFERENCE(s)

1. https://nptel.ac.in/courses/104101093/3
2. .https://nptel.ac.in/courses/122103039/16
3. .https://nptel.ac.in/noc/individual_course.php?id=noc18-ch11
4. https://nptel.ac.in/courses/102104058/19
5. https://nptel.ac.in/courses/102104058/19

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19BMC05 **BIOMECHANICS AND REHABILITATION ENGINEERING** **L T P C 3 1 0 4**

COURSE OBJECTIVES

1. To understand the rehabilitation concepts and Rehabilitation team members for future development and applications.
2. To study various Principles of Rehabilitation Engineering.
3. To understand different types of Therapeutic Exercise Technique
4. To understand the tests to assess the hearing loss, development of electronic devices to compensate for the loss and various for visually and auditory impaired
5. To study the various orthotic devices and prosthetic devices to overcome orthopedic problems

COURSE OUTCOMES

1. Ability to apply knowledge of mathematics, science and engineering to understand the fundamentals of moving systems and familiarity with human anatomy to competently analyze the movement of the human body.
2. Ability to analyze the dynamics of human movement flow properties of blood and comprehend the biomechanical principles that relate to movement and communication disabilities.
3. Have an in depth idea about Engineering Concepts in Sensory & Motor rehabilitation.
4. Apply the different types of Therapeutic Exercise Technique to benefit the society.
5. Gain in-depth knowledge about different types of models of Hand and arm replacement.

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19BMC05.CO1	x	x	x	-	-	-	-	-	-	x	-	x	x	-	-
19BMC05.CO2	x	x	x	-	-	x	-	-	x	x	-	x	x	-	-
19BMC05.CO3	x	x	x	-	-	x	-	-	x	x	-	x	x	-	-
19BMC05.CO4	x	x	x	-	-	x	-	-	x	x	-	x	x	-	-
19BMC05.CO5	x	x	x	-	-	x	-	-	x	x	-	x	x	-	-

UNIT I **INTRODUCTION TO BIOMECHANICS** 9

What Is Biomechanics, Mechanics in Physiology Definition of Stress ,Strain and Strain Rate,The Non viscous Fluid, Newtonian Viscous Fluid, The Hookean Elastic Solid, Viscoelasticity, Response of a Viscoelastic Body to Harmonic Excitation, Use of Viscoelastic Models ,Methods of Testing .

UNIT II **THE FLOW PROPERTIES OF BLOOD** 9

Blood rheology,the constitutive equation of blood based on viscometric Data and casson's equation, Laminar flow of blood in tube, blood with viscosity described by casson's equation. **Bioviscoelastic fluids** Introduction, small deformation experiments, mucus from the respiratory tract, saliva, cervical mucus and semen, synovial fluid, flow properties of synovial fluid,

UNIT III **INTRODUCTION TO REHABILITATION** 9

What is Rehabilitation, Epidemiology of Rehabilitation, Health, Levels of Prevention, Preventive Rehabilitation, Diagnosis of Disability, Functional Diagnosis, Importance of Psychiatry in Functional diagnosis, Impairment disability handicap, Primary & secondary Disabilities

UNIT IV **REHABILITATION TEAM & THERAPEUTIC EXERCISE TECHNIQUE** 9

Rehabilitation team Classification of members, The Role of Psychiatrist, Occupational therapist, Physical therapist, Recreation therapist, Prosthetist - Orthotist, Speech pathologist, Rehabilitation nurse, Social worker, Corrective therapist, Psychologist, Music therapist, Dance therapist & Biomedical engineer, Co-ordination exercises, Frenkels exercises, Gait analyses-Pathological Gaits, Gait Training, Relaxation exercises-Methods for training Relaxation, Strengthening exercises-Strength training, Types of Contraction, Mobilization exercises, Endurance exercises.

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UNIT V **ORTHOTIC, PROSTHETIC DEVICES & RESTORATION TECHNIQUES** 9

General orthotics. Classification of orthotics-functional & regional, General principles of Orthosis, Calipers- FO, AFO, KAFO, HKAFO. Prosthetic devices: Hand and arm replacement, Body powered prosthetics, Myo-electric controlled prosthetics and externally powered limb prosthetics. Functional Electrical Stimulation systems. Restoration of hand function, restoration of standing and walking, Hybrid Assistive Systems (HAS).

TOTAL :45

REFERENCE BOOK

Sl.No	AUTHOR(s)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	Y.C.Fung	Biomechanics-Mechanical Properties of Living tissues	Springer Verlag.	2nd Edition
2.	Sunder	Textbook of Rehabilitation 2nd Edition	Jaypee Brothers Medical Publishers Pvt. Ltd, New Delhi	2007
3.	Schneck and Bronzino	Biomechanics principles and applications	CRC:	2003
4.	Keswick. J	What is Rehabilitation Engineering, Annual Reviews of Rehabilitation	Springer	1982
5.	Warren E. Finn,Peter G. LoPresti	Handbook of Neuroprosthetic Methods	CRC	2002

WEB REFERENCE(s)

Sl.No	WEB URL
1.	Cs-fundamentals.com/data-structures/introduction-to-data-structures.
2.	https://en.wikibooks.org/wiki/Advanced_Data_Structures_and_Algorithms
3.	https://www.cambridge.org/9780521880374
4.	https://www.coursera.org/specializations/data-structures-algorithms
5.	https://www.cs.auckland.ac.nz/~jmor159/PLDS210/ds_ToC.html

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19BMC07 **ANALOG ELECTRONICS** **L T P C 3 1 0 4**

COURSE OBJECTIVES

1. Design and construct amplifiers
2. Construct JFET and MOSFET amplifiers
3. Study rectifiers and power supplies
4. Learn about feedback amplifiers
5. Learn about oscillators

COURSE OUTCOMES

1. To learn about Design and construct amplifiers
2. To Construct JFET and MOSFET amplifiers
3. To Study rectifiers and power supplies
4. ToLearn about feedback amplifiers
5. To Learn about oscillators

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19BMC07.CO1	x	x	x	x	x	-	-	-	-	-	-	x	x	x	x
19BMC07.CO2	x	x	x	x	x	-	-	-	x	-	-	x	x	X	x
19BMC07.CO3	x	x	x	x	x	-	-	-	x	-	-	x	x	X	x
19BMC07.CO4	x	x	x	x	x	-	-	-	x	-	-	x	x	X	x
19BMC07.CO5	x	x	x	x	x	-	-	-	x	-		x	x	X	x

UNIT I **BJT AMPLIFIERS** 9

CE, CB and CC amplifiers - Method of drawing small-signal equivalent circuit- Analysis of transistor amplifier Configurations-current and voltage gain, input and output impedance -Differential amplifiers- CMRR- Darlington Amplifier- Bootstrap technique - Multistage amplifiers -Cascaded stages - Cascode Amplifier. Large signal Amplifiers – Class A, Class B and Class C Power Amplifiers

UNIT II **JFET AND MOSFET AMPLIFIERS** 9

Small signal analysis of JFET amplifiers- Small signal Analysis of MOSFET and JFET, Common source amplifier, Voltage swing limitations, Small signal analysis of MOSFET and JFET Source follower and Common Gate amplifiers, - BiCMOS,Cascode amplifier

UNIT III **RECTIFIERS AND POWER SUPPLIES** 9

Rectifiers - Half-wave, full-wave and bridge rectifiers – Rectifiers with filters- C, L, and CLC filters Voltage regulators Zener diode regulator regulator with current limiting, Over voltage protection, Switched mode power supply (SMPS

UNIT IV **FEEDBACK AMPLIFIERS** 9

General Feedback Structure – Properties of negative feedback – Basic Feedback Topologies –Feedback amplifiers – Series – Shunt, Series – Series, Shunt – Shunt and Shunt – Series Feedback – Determining the Loop Gain – Stability Problem

UNIT V **OSCILLATORS** 9

Classification, Barkhausen Criterion - Mechanism for start of oscillation and stabilization of amplitude, General form of an Oscillator, Analysis of LC oscillators - Hartley, Colpitts,Clapp, Tuned collector oscillators, RC oscillators - phase shift –Wienbridge - Twin-T Oscillators, Frequency range of RC and LC Oscillators, Quartz Crystal Construction, Electrical equivalent circuit of Crystal, Miller and Pierce Crystal Oscillators, frequency stability of oscillators.

TOTAL :45

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REFERENCE BOOK

Sl. No	AUTHOR(s)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	Donald .A. Neamen	Electronic Circuit Analysis and Design	Tata Mc Graw Hill	2nd Edition, 2009
2.	Robert L. Boylestad and Louis Nasheresky	Electronic Devices and Circuit Theory	Pearson Education / PHI	10th Edition 2008
3.	Adel .S. Sedra, Kenneth C. Smith	Micro Electronic Circuits	Oxford University Press	6th Edition, 2010
4.	Behzad Razavi	Design of Analog CMOS Integrated Circuits	Tata Mc Graw Hill,	2007
5.	Paul Gray, Hurst, Lewis, Meyer	Analysis and Design of Analog Integrated Circuits	John Willey & Sons	4th Edition 2005

WEB REFERENCE(s)

1. www.nptel.ac.in/courses/117101106/7
2. www.nptel.ac.in/courses/117101106/9
3. www.nptel.ac.in/courses/117101106/8
4. www.nptel.ac.in/courses/117106088/1
5. www.nptel.ac.in/courses/117106088/14

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19BMC10 **BIOCHEMISTRY** **L T P C 3 0 0 3**

COURSE OBJECTIVES

1. To learn the concept of how to learn patterns and concepts from data without being explicitly programmed in various IOT nodes
2. To design and analyse various machine learning algorithms and techniques with a modern outlook focusing on recent advances
3. Explore supervised and unsupervised learning paradigms of machine learning
4. To explore Deep learning technique and various feature extraction strategies
5. To learn the concept of how to learn patterns and concepts from data without being explicitly programmed in various IOT nodes

COURSE OUTCOMES

1. Identify the perspectives of machine learning
2. Apply decision tree and Artificial neural networks for real world problems
3. Design a Bayesian classifier for solving a problem
4. Illustrate the principles of instance based learning and genetic algorithm
5. Describe the algorithms for rule and reinforcement learning

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19BMC10.CO1	x	x	x	-	-	-	-	-	-	x	-	x	x	-	-
19BMC10.CO2	x	x	x	-	-	x	-	-	x	x	-	x	x	-	-
19BMC10.CO3	x	x	x	-	-	x	-	-	x	x	-	x	x	-	-
19BMC10.CO4	x	x	x	-	-	x	-	-	x	x	-	x	x	-	-
19BMC10.CO5	x	x	x	-	-	x	-	-	x	x	-	x	x	-	-

UNIT I **INTRODUCTION TO BIOCHEMISTRY** 9

Introduction to Biochemistry, water as a biological solvent, weak acid and bases, pH, buffers, Handerson – Hasselbalch equation, physiological buffers in living systems, Energy in living organism. Properties of water and their applications in biological systems. Introduction to Biomolecules, Biological membrane, Clinical application of Electrolytes and radioisotopes

UNIT II **CARBOHYDRATES** 9

Classification of carbohydrates – mono, di, oligo and polysaccharides. Structure, physical and chemical properties of carbohydrates Isomerism, racemisation and mutarotation. Digestion and absorption of carbohydrates. Metabolic pathways and bioenergetics – Glycolysis, glycogenesis, glycogenolysis and its hormonal regulation, TCA cycle and electron transport chain. Oxidative phosphorylation. Biochemical aspect of Diabetes mellitus and Glycogen storage Disease.

UNIT III **LIPIDS** 9

Classification of lipids- simple, compound and derived lipids. Nomenclature of fatty acid, physical and chemical properties of fat..Metabolic pathways: Synthesis and degradation of fatty acid (beta oxidation), hormonal regulation of fatty acid metabolism, ketogenesis, Biosynthesis of Cholesterol. Disorders of lipid metabolism.

UNIT IV **NUCLEIC ACID & PROTEIN** 9

Structure of purines and pyrimidines, nucleoside, nucleotide. DNA act as a genetic material, chargoffs rule. Watson and crick model of DNA. Structure of RNA and its type. Metabolism and Disorder of purines and pyrimidines nucleotide Classification, structure and properties of proteins, structural organization of proteins, classification and properties of amino acids. Separation of protein, Inborn Metabolic error of amino acid metabolis

UNIT V **ENZYME AND ITS CLINICAL APPLICATION** 9

Classification of enzymes, apoenzyme, coenzyme, holoenzyme and cofactors. Kinetics of enzymes – Michaelis-Menten equation. Factors affecting enzymatic activity: temperature, pH, substrate concentration and enzyme concentration. Inhibitors of enzyme action: Competitive, non- competitive, irreversible. Enzyme; Mode of action.

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allosteric and covalent regulation. Clinical enzymology. Measurement of enzyme activity and interpretation of units.

TOTAL :45

REFERENCE BOOK

Sl.No	AUTHOR(s)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	RAFI MD	Text book of biochemistry for Medical Student	Second Edition, University Press	2014.
2.	David.W.Martin, Peter.A.Mayes , Victor. W.Rodwell,.	Harper's Review of Biochemistry	LANGE Medical Publications	1981
3.	Keith Wilson & John Walke	Practical Biochemistry – Principles & Technique	Oxford University Press	2009
4.	Pamela.C.Champe & Richard.A.Harvey,	Lippincott Biochemistry	Lippincott's Illustrated Reviews, Raven publishers	1994

WEB REFERENCE(s)

1. https://study.com/academy/lesson/what-is-system-analysis-in-software-engineering.html
2. https://onlinelibrary.wiley.com/doi/abs/10.1002/spe.4380220402
3. https://medium.com/the-andela-way/system-design-in-software-development-f360ce6fcbb9
4. https://searchcio.techtarget.com/definition/change-management

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19BMC22	ANALOG ELECTRONICS LABORATORY	L	T	P	C
		0	0	2	1

Sl.No **List of Experiments**

1. Frequency Response of CE amplifier
2. Frequency Response of CS amplifier
3. Frequency response of feedback amplifier circuit-current series
4. Frequency response of feedback amplifier circuit- voltage shunt
5. .Transistor based design of RC phase Shift Oscillator circuit
6. Transistor based design of Wein Bridge Oscillator circuit
7. Power Supply circuit - Half wave rectifier and Full wave rectifier with simple capacitorfilter
8. Mini Project

19BMC23	LINEAR INTEGRATED CIRCUITS LABORATORY	L	T	P	C
		0	0	2	1

Sl.No **List of Experiments**

1. Inverting, Non inverting and Differential amplifiers.
2. Integrator and Differentiator.
3. Instrumentation amplifier
4. Schmitt Trigger using op-amp.
5. Phase shift and Wien bridge oscillators using op-amp.
6. Astable and monostable multivibrators using NE555 Timer.
7. Mini Projects

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19BMC24	MEDICAL SIGNAL PROCESSING LABORATORY	L T P C 0 0 2 1

Sl.No	List of Experiments
1.	To simulate Electrocardiogram Waveform
2.	To simulate Electroencephalogram Signal
3.	To simulate Electromyogram Signal
4.	To Simulate Defibrillator
5.	To simulate Pacemaker
6	To simulate Haemodialysis Machine
7	To simulate Biopotential Amplifier
8	To simulate ECG Pulse missing detector
9	To simulate 12 Lead Ecg Signals

19BMC25	PATHOLOGY AND MICROBIOLOGY LABORATORY	L T P C 0 0 2 1

Sl.No	List of Experiments
1.	Urine physical and chemical examination (protein, reducing substances, ketones, bilirubin andblood)
2.	Study of parts of compound microscope
3.	Histopathological slides of benign and malignant tumours.
4.	Manual paraffin tissue processing and section cutting (demonstration)
5.	Cryo processing of tissue and cryosectioning (demonstration)
6	Basic staining – Hematoxylin and eosin staining.
7	Special stains – cresyl fast Blue (CFV)- Trichrome – oil red O – PAS
8	Capsule stain
9	Simple stain.
10	Gram stain.
11	AFB stain.

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19BMC30	MICROPROCESSOR AND MICROCONTROLLER LABORATORY	L	T	P	C
		0	0	2	1

Sl.No	List of Experiments
1.	Addition, subtraction, multiplication, division using 8086 processor 5 C,I 1 1,7
2.	Sorting of numbers in ascending order using 8086 processor 1 C,I 1 1
3.	Sorting of numbers in descending order using 8086 processor 1 C,I 1 1
4.	Palindrome and Fibonacci series using 8086 processor 1 C,I 1 1
5.	Sorting of even numbers in an array using 8086 processor 1 C,I 1 1
6	Finding the largest and smallest number in an array using 8086 processor 1 C,I 1 1
7	Addition of two numbers using 8051 processor 2 C,I 2 7
8	Subtraction of two numbers using 8051 processor 2 C,I 2 7
9	Multiplication of two numbers using 8051 processor 2 C,I 2 7
10	. Sorting of numbers in ascending order using 8051 processor 2 C,I 2
11	Sorting of numbers in descending order using 8051 processor 2 C,I 2 7
12	Palindrome and fibonacci series using 8051 processor 2 C,I 2 7
13	Sorting of even numbers in an array using 8051 processor 3 C,I 2 7
14	Basic programs using ARM controller 5 C,I 3 7

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19EEC02	MEASURING INSTRUMENTS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To discuss the classification, application characteristics, error and basics of measuring Instruments
- To measure the voltage, current, power energy, frequency and phase by using measuring Instruments
- To measure the resistance, inductance and capacitance using various bridges
- To discuss the various types of digital measurements and display devices for measuring Electrical parameters.
- To explain the types, working selection of transducer and data acquisition system.

COURSE OUTCOMES:

19EEC02.CO1	Discuss the classification, application characteristics, error and basics of measuring Instruments
19EEC02.CO2	Measure the voltage, current, power energy, frequency and phase by using measuring Instruments
19EEC02.CO3	Measure the resistance, inductance and capacitance using various bridges
19EEC02.CO4	Discuss the various types of digital measurements and display devices for measuring Electrical parameters.
19EEC02.CO5	Explain the types, working selection of transducer and data acquisition system.

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19EEC02.CO1	x	x	-	-	-	-	-	-	-	x	-	x	x	-	-
19EEC02.CO2	x	x	x	x	-	-	-	-	-	x	-	x	x	x	-
19EEC02.CO3	x	x	x	x	-	-	-	-	-	x	-	x	x	x	-
19EEC02.CO4	x	x	x	x	-	-	-	-	-	x	-	x	x	x	-
19EEC02.CO5	x	x	x	x	-	-	-	-	-	x	-	x	x	x	-

UNIT I INTRODUCTION 9

Instruments: Classification, Applications - Functional elements of an instrument - Static and dynamic characteristics – Errors in measurement – Statistical evaluation of measurement data – Standards and calibration.

UNIT II MEASURING INSTRUMENTS 9

Classification of instruments: PMMC Instruments, Moving iron instruments, Electrodynamometer type instruments. – Single and three phase wattmeters and energy meters – Magnetic measurements – Determination of B-H curve – Instrument transformers – Instruments for measurement of frequency and phase.

UNIT III BRIDGES 9

Resistance measurement - Wheatstone bridge, Kelvin Bridge, substitution method - Transformer ratio bridges, self-balancing bridges.Measurement of Earth resistance, insulation resistance – Megger - Measurement of inductance and capacitance – Maxwell's bridge, Anderson Bridge, Desauty's bridge and Schering Bridge.

UNIT IV DIGITAL INSTRUMENTS AND DISPLAY DEVICES 9

Digital Voltmeter – Types – digital plotters and printers, Magnetic disk and tape – Recorders- CRT display - digital CRO - LED, LCD & dot matrix display - Data Loggers.

UNIT V TRANSDUCERS AND DATA ACQUISITION SYSTEMS 9

Classification of transducers – Selection of transducers – Resistive, capacitive & inductive transducers – Piezoelectric, Hall effect, optical and digital transducers – Elements of data acquisition system – A/D, D/A converters – Smart sensors.

TOTAL: 45 Periods

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TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	A.K. Sawhney	A Course in Electrical & Electronic Measurements & Instrumentation	Dhanpat Rai and Co	2004
2.	Gupta JB	A Course in Electronic and Electrical Measurements	S. K. Kataria & Sons	2003

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Doebelin E.O. and Manik D.N	Measurement Systems – Applications and Design	Tata McGraw Hill	2007
2.	D.V.S. Moorthy	Transducers and Instrumentation	Prentice Hall of India Pvt Ltd	2007
3.	Kalsi H.S	Electronic Instrumentation	Tata McGraw Hill	2004
4.	Alan. S. Morris	Principles of Measurements and Instrumentation	Prentice Hall of India Pvt Ltd	2003
5.	A.J. Bouwens	Digital Instrumentation	Tata McGraw Hill	1997

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19EEC03	LINEAR INTEGRATED CIRCUITS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To discuss the characteristics of an OPAMP
- To design the various amplifier circuits and switching circuits using OPAMP
- To develop the various waveform generator circuits using OPAMP
- To create the ADCs, DACs and PLL circuit using OPAMP
- To construct the multivibrator circuits and voltage regulator using IC 555 timer

COURSE OUTCOMES:

19EEC03.CO1 Discuss the characteristics of an OPAMP
19EEC03.CO2 Design the various amplifier circuits and switching circuits using OPAMP
19EEC03.CO3 Develop the various waveform generator circuits using OPAMP
19EEC03.CO4 Create the ADCs, DACs and PLL circuit using OPAMP
19EEC03.CO5 Construct the multivibrator circuits and voltage regulator using IC 555 timer

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19EEC03.CO1	x	x	x	x	-	-	-	-	-	x	-	x	x	x	-
19EEC03.CO2	x	x	x	x	-	-	-	-	-	x	-	x	x	x	-
19EEC03.CO3	x	x	x	x	-	-	-	-	-	x	-	x	x	x	-
19EEC03.CO4	x	x	x	x	-	-	-	-	-	x	-	x	x	x	-
19EEC03.CO5	x	x	x	x	-	-	-	-	-	x	-	x	x	x	-

UNIT I CHARACTERISTICS OF OPAMP 9

Block diagram of a typical op-amp - characteristics of ideal and practical op-amp - parameters of opamp – inverting and non-inverting amplifier configurations - frequency response - circuit stability.

UNIT II APPLICATIONS OF OPERATIONAL AMPLIFIER 9

DC and AC amplifiers - summing amplifier – difference amplifier – voltage follower - differentiator – integrator- clamper - clipper– filters.

UNIT III WAVEFORM GENERATOR 9

Oscillators, sine wave, square wave, triangular wave, saw tooth wave generation, Schmitt trigger, window detector.

UNIT IV D/A & A/D CONVERTORS AND PHASE LOCKED LOOP 9

Analog-to-digital, digital-to-analog, sample and hold circuits; voltage controlled oscillator, phase locked loop – operating principles, applications of PLL.

UNIT V SPECIAL ICs 9

IC555 Timer, monostable and astable modes of operation; voltage regulators - fixed voltage regulators, adjustable voltage regulators - switching regulators.

TOTAL: 45 Periods

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TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Gayakwad R.A	Op-amps & Linear Integrated Circuits	Prentice Hall of India, New Delhi, 4 th Edition,	2009.
2.	Roy Choudhury and Shail Jain,	Linear Integrated Circuits	New Age International Publishers, 4th Edition,	2010

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Sergio Franco	Design with Operational Amplifiers and Analog Integrated Circuits	Tata McGraw Hill, 3rd Edition	2002
2.	Sedra Smith,	Microelectronic Circuits	Oxford University Press, 6th Edition	2009.
3.	R P Jain	Modern Digital Electronics	Tata McGraw-Hill Education, 3rd Edition,	2003
4.	David A.Bell	Op-amp & Linear ICs	Oxford	2013
5.	Floyd Buchla	Fundamentals of Analog Circuits	Pearson	2013

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19EEC04	DC MACHINES AND TRANSFORMERS	L	T	P	C
		2	1	0	3

COURSE OBJECTIVES

- To discuss the operation and Characteristics of Electro-Mechanical Energy Conversion systems
- To elaborate the operation and Characteristics of DC Generators
- To explain the operation and Characteristics of DC Motors
- To discuss the operation and Characteristics Transformers
- To test the DC Machines and Transformers using various methods

COURSE OUTCOMES:

19EEC04.CO1	Discuss the operation and Characteristics of Electro-Mechanical Energy Conversion systems
19EEC04.CO2	Elaborate the operation and Characteristics of DC Generators
19EEC04.CO3	Explain the operation and Characteristics of DC Motors
19EEC04.CO4	Discuss the operation and Characteristics Transformers
19EEC04.CO5	Test the DC Machines and Transformers using various methods

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19EEC04.CO1	x	x	x	x	-	-	-	-	-	x	-	x	x	x	-
19EEC04.CO2	x	x	x	x	-	-	-	-	-	x	-	x	x	x	-
19EEC04.CO3	x	x	x	x	-	-	-	-	-	x	-	x	x	x	-
19EEC04.CO4	x	x	x	x	-	-	-	-	-	x	-	x	x	x	-
19EEC04.CO5	x	x	x	x	-	-	-	-	-	x	-	x	x	x	-

UNIT I ELECTRO-MECHANICAL ENERGY CONVERSION 6+3

Introduction - Principles of electromechanical energy conversion - Single excited system - Energy in terms of Electrical parameters - Multiple excited systems - Role of Airgap – Statically and Dynamically induced EMF.

UNIT II DC GENERATORS 6+3

Constructional details - Principle of operation – EMF equation – Methods of excitation – Types of DC generators – Armature reaction - Commutation – Methods of Improving Commutation – Interpoles – Equalizing Connections – Characteristics of DC generators –No load and Load Characteristics – Parallel operation of D.C. Generators - Load Sharing – Procedure for Paralleling DC Generators – Applications of D.C. Generators.

UNIT III DC MOTORS 6+3

Principle of operation – Back EMF – Types of DC Motors – Voltage & Torque equations - Condition for maximum power - Characteristics of DC motors – Speed torque and Performance Characteristics – Speed control of D.C. motors – Methods of speed control - Starters: Necessity of a starter, Types of starters - Applications of DC Motors.

UNIT IV TRANSFORMERS 6+3

Constructional details – Principle of operation – EMF equation – Transformation ratio – Transformer on no-load –Transformer on load – Equivalent circuit – Regulation – Parallel operation of single phase transformers – Auto transformer – Three phase transformers - Types of Connections..

UNIT V TESTING OF DC MACHINES AND TRANSFORMERS 6+3

Losses and efficiency in DC machines and transformers – Condition for maximum efficiency - Testing of DC machines – Brake test, Swinburne's test, Hopkinson's test and Retardation test – Testing of transformers – Polarity test, open circuit and short circuit test – Sumner's test – All day efficiency.

TOTAL: 45 Periods

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TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	D.P. Kothari and I.J. Nagrath	Electric Machines	Tata McGraw Hill	2002
2.	B.L.Theraja and A.K.Theraja	A text book of Electrical Technology – Volume II (AC & DC Machines	S.Chand & Company Ltd., New Delhi	2005

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	E. Fitzgerald, Charles Kingsley, Stephen.D.Umans	Electric Machinery	Tata McGraw Hill	2003
2.	K. Murugesh Kumar	DC Machines and Transformers	Vikas publishing house Pvt Ltd	2002
3.	S.Sarma & K.Pathak	Electric Machines	Cengage Learning India (P) Ltd., Delhi,	2011
4.	Syed A. Nasar	Electric Machines and Power Systems	Volume I, Mcgraw-Hill College; International Edition	1995
5.	M.N.Bandyopadhyay	Electrical Machines Theory and Practice	PHI Learning PVT LTD., New Delhi	2009

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19EEC05	AC MACHINES	L	T	P	C
		2	1	0	3

COURSE OBJECTIVES

- To analyze the operation and regulation of an Alternator
- To explain the characteristics and operation of synchronous motor
- To discuss the characteristics and operation of 3 phase Induction Motor
- To elaborate the starting and speed control of 3 phase Induction Motor
- To explain the operation of single phase and special Electrical Machines

COURSE OUTCOMES:

19EEC05.CO1 Analyze the operation and regulation of an Alternator
19EEC05.CO2 Explain the characteristics and operation of synchronous motor
19EEC05.CO3 Discuss the characteristics and operation of 3 phase Induction Motor
19EEC05.CO4 Elaborate the starting and speed control of 3 phase Induction Motor
19EEC05.CO5 Explain the operation of single phase and special Electrical Machines

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19EEC05.CO1	x	x	x	-	-	-	-	-	-	x	-	x	x	-	-
19EEC05.CO2	x	x	x	-	-	-	-	-	-	x	-	x	x	-	-
19EEC05.CO3	x	x	x	-	-	-	-	-	-	x	-	x	x	-	-
19EEC05.CO4	x	x	x	-	-	-	-	-	-	x	-	x	x	-	-
19EEC05.CO5	x	x	x	-	-	-	-	-	-	x	-	x	x	-	-

UNIT I ALTERNATOR 6+3

Basic principle, construction, types of rotor, pitch factor, distribution factor, emf equation, armature reaction - alternator on load, voltage regulation, synchronous impedance(emf) method, mmf method, ZPF method, synchronization and parallel operation of alternator.

UNIT II SYNCHRONOUS MOTOR 6+3

Principle of operation – Methods of Starting - Torque equation – Operation on infinite bus bars - V and Inverted V curves – Power developed equations –Current loci for constant power input, constant excitation and constant power developed - -Hunting - damper windings - synchronous condenser – Applications

UNIT III THREE PHASE INDUCTION MOTOR 6+3

Constructional details – Types – Principle of operation - Slip - Equivalent circuit – Torque developed by an induction motor – Torque-Slip characteristics - Losses and efficiency – Load test - No load and blocked rotor tests – Construction of Circle diagram – Separation of losses – Double cage rotors- Induction generators – Applications.

UNIT IV STARTING AND SPEED CONTROL OF THREE PHASE INDUCTION MOTORS 6+3

Need for starting – Methods of starting - Direct on Line starter, autotransformer, Star-delta and Rotor resistance starters – Speed control methods– Ward Leonard scheme Voltage control, Frequency control and pole changing – Cascaded connection- V/f control – Slip power recovery scheme- Crawling and Cogging – Braking.

UNIT V SINGLE PHASE INDUCTION MOTORS AND SPECIAL MACHINES 6+3

Constructional details of single phase induction motor – Double field revolving theory and operation – Equivalent circuit – No load and blocked rotor test – Performance analysis – Capacitor-start capacitor run Induction motor- Shaded pole induction motor - Linear induction motor – Repulsion motor - Hysteresis motor - AC series motor- Universal Motor.

TOTAL: 45 Periods

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TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	A.E. Fitzgerald, Charles Kingsley, Stephen. D.Umans.	Electric Machinery	Tata Mc Graw Hill publishing Company Ltd	2003
2.	D.P. Kothari and I.J. Nagrath	Electric Machines	Tata Mc Graw Hill publishing Company Ltd	2002

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	M.N.Bandyopadhyay	Electrical Machines Theory and Practice	PHI Learning pvt Ltd., New Delhi	2009
2.	Charless A. Gross	Electric Machines	CRC Press	2010
3.	K. Murugesh Kumar	Electrical Machines	Vikas Publishing House Pvt. Ltd,	2002
4.	Syed A. Nasar	Electric Machines and Power Systems: Volume I	Mcgraw Hill College International	1995
5.	A.K. Sawhney Alexander S. Langsdorf,	Theory of Alternating-Current Machinery,	Tata McGraw Hill Publications	2001

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19EEC06	CONTROL SYSTEMS	L	T	P	C
		2	1	0	3

COURSE OBJECTIVES

- To analyze electromechanical systems using mathematical modeling
- To determine Transient and Steady State behavior of systems using standard test signals
- To discuss the linear systems for steady state errors, absolute stability and relative stability
- To design a stable control system satisfying requirements of stability and reduced steady state error
- To elaborate the concepts of modern control theory using state-space approach

COURSE OUTCOMES:

19EEC06.CO1	Analyze electromechanical systems using mathematical modeling
19EEC06.CO2	Determine Transient and Steady State behavior of systems using standard test signals
19EEC06.CO3	Discuss the linear systems for steady state errors, absolute stability and relative stability
19EEC06.CO4	Design a stable control system satisfying requirements of stability and reduced steady state error
19EEC06.CO5	Elaborate the concepts of modern control theory using state-space approach

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19EEC06.CO1	x	x	x	x	x	-	-	-	x	x	x	x	x	x	-
19EEC06.CO2	x	x	x	x	x	-	-	-	x	x	x	x	x	x	-
19EEC06.CO3	x	x	x	x	x	-	-	-	x	x	x	x	x	x	-
19EEC06.CO4	x	x	x	x	x	-	-	-	x	x	x	x	x	x	-
19EEC06.CO5	x	x	x	x	x	-	-	-	x	x	x	x	x	x	-

UNIT I SYSTEMS AND THEIR REPRESENTATION 6+3

Concepts of control systems – Open and closed loop systems – Electrical analogy of mechanical and thermal systems – Transfer function – Synchros – AC and DC servomotors – Block diagram reduction techniques – Signal flow graphs - Transfer function of DC generator and motor .

UNIT II TIME RESPONSE ANALYSIS 6+3

Standard test signals -Time response – Time domain specifications – Types of test input – I and II order system response – Error coefficients – Generalized error series – Steady state error - Effects of P, PI, PID modes of feedback control –Time response analysis using MATLAB (only simulation).

UNIT III FREQUENCY RESPONSE ANALYSIS 6+3

Frequency response – Bode plot – Polar plot – Determination of closed loop response from open loop response - Correlation between frequency domain and time domain specifications- Analysis using MATLAB (only simulation).

UNIT IV STABILITY ANALYSIS &CLASSICAL CONTROL DESIGN TECHNIQUES 6+3

Characteristics equation – Routh Hurwitz criterion – Root locus construction-Nyquist stability criterion-applications of Nyquist criterion to find the stability – Lag, lead and lag-lead networks – Lag/Lead compensator design using bode plots.

UNIT V STATE SPACE &VARIABLE ANALYSIS OF CONTINUOUS SYSTEMS 6+3

Concept of state variables – State models for linear and time invariant Systems – Solution of state and output equation in controllable canonical form – Concepts of controllability and observability – Effect of state feedback. State Transition Matrix and its Properties

Total = 45 Periods

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TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	M. Gopal	Control Systems, Principles and Design	Tata McGraw Hill	2012
2.	S.K.Bhattacharya	Control System Engineering	Pearson education	2013.

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Nise	Control Systems Engineering	John wiley, 6th Edition,	2011
2.	Richard C. Dorf and Robert H. Bishop	Modern Control Systems	Pearson Prentice Hall	2012
3.	Benjamin C. Kuo	Automatic Control systems	PHI press	2010.
4.	K. Ogata	Modern Control Engineering	PHI press	2012
5.	S.N.Sivanandam, S.N.Deepa	Control System Engineering using Mat Lab	Vikas Publishing	2012

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19EEC20	DC MACHINES AND TRANSFORMERS LABORATORY	L	T	P	C
		0	0	2	1

COURSE OBJECTIVES

- To measure the operation and Characteristics of Electro-Mechanical Energy Conversion systems
- To test the DC Generator for calculating the efficiency using various methods
- To test the DC Motors for calculating the efficiency using various methods
- To develop and calculating the efficiency of the Transformers using various methods
- To discuss and calculate the performance of DC Machines and Transformers using various methods

COURSE OUTCOMES

19EEC20.C01	Measure the operation and Characteristics of Electro-Mechanical Energy Conversion systems
19EEC20.C02	Test the DC Generator for calculating the efficiency using various methods
19EEC20.C03	Test the DC Motors for calculating the efficiency using various methods
19EEC20.C04	Develop and calculating the efficiency of the Transformers using various methods
19EEC20.C05	Discuss and calculate the performance of DC Machines and Transformers using various methods

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19EEC20.C01	x	x	x	x	-	-	-	-	-	x	-	x	x	x	-
19EEC20.C02	x	x	x	x	-	-	-	-	-	x	-	x	x	x	-
19EEC20.C03	x	x	x	x	-	-	-	-	-	x	-	x	x	x	-
19EEC20.C04	x	x	x	x	-	-	-	-	-	x	-	x	x	x	-
19EEC20.C05	x	x	x	x	-	-	-	-	-	x	-	x	x	x	-

LIST OF EXPERIMENTS

1	Open circuit and load characteristics of DC shunt generator- critical resistance and critical speed.
2	Load characteristics of DC compound generator with differential and cumulative connections.
3	Load test on DC shunt and compound motor.
4	Load test on DC series motor.
5	Swinburne's test.
6	Speed control of DC shunt motor.
7	Study of starters and 3-phase transformers connections
8	Load test on single-phase transformer and three phase transformers.
9	Open circuit and short circuit tests on single phase transformer
10	Polarity Test and Sumpner's test on single phase transformers
11	Separation of no-load losses in single phase transformer.

TOTAL: 30 Periods

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19EEC21	AC MACHINES LABORATORY	L	T	P	C
		0	0	2	1

COURSE OBJECTIVES

- To determine the regulation of an alternator by EMF, MMF, ZPF and Slip test Methods
- To measure the negative sequence and zero sequence impedance of alternators
- To compare the characteristics of Synchronous Motor
- To test the performance of single phase Induction Motor
- To test the performance of three phase Induction Motor

COURSE OUTCOMES:

19EEC21.CO1 Determine the regulation of an alternator by EMF, MMF, ZPF and Slip test Methods
19EEC21.CO2 Measure the negative sequence and zero sequence impedance of alternators
19EEC21.CO3 Compare the characteristics of Synchronous Motor
19EEC21.CO4 Test the performance of single phase Induction Motor
19EEC21.CO5 Test the performance of three phase Induction Motor

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19EEC21.CO1	x	x	-	-	x	-	-	-	x	-	-	x	x	x	-
19EEC21.CO2	x	x	-	-	x	-	-	-	x	-	-	x	x	x	-
19EEC21.CO3	x	x	-	-	x	-	-	-	x	-	-	x	x	x	-
19EEC21.CO4	x	x	-	-	x	-	-	-	x	-	-	x	x	x	-
19EEC21.CO5	x	x	-	-	x	-	-	-	x	-	-	x	x	x	-

LIST OF EXPERIMENTS

1. Regulation of three phase alternator by EMF and MMF methods.
2. Regulation of three phase alternator by ZPF methods.
3. Regulation of three phase salient pole alternator by slip test.
4. Measurements of negative sequence and zero sequence impedance of alternators
5. V and Inverted V curves of Three Phase Synchronous Motor.
6. Load test on three-phase induction motor.
7. No load and blocked rotor test on three-phase induction motor (Determination of equivalent circuit parameters).
8. Separation of No-load losses of three-phase induction motor.
9. Load test on single-phase induction motor.
10. No load and blocked rotor test on single-phase induction motor.
11. Study of Induction motor Starters

TOTAL: 30 Periods

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19EEC22	CONTROL SYSTEMS LABORATORY	L	T	P	C
		0	0	2	1

COURSE OBJECTIVES

- To formulate transfer function for the control system
- To evaluate time response of the given control system model
- To plot Root Locus, Nyquist plot and Bode plot for the given control system model.
- To design Lead, Lag, Lead-Lag compensator for the given control system
- To develop P,PI and PID controllers for the given system

COURSE OUTCOMES:

19EEC22.CO1	Formulate transfer function for the control system
19EEC22.CO2	Evaluate time response of the given control system model
19EEC22.CO3	Plot Root Locus, Nyquist plot and Bode plot for the given control system model.
19EEC22.CO4	Design Lead, Lag, Lead-Lag compensator for the given control system
19EEC22.CO5	Develop P,PI and PID controllers for the given system

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19EEC22.CO1	x	x	x	x	-	-	-	-	x	x		x	x	x	-
19EEC22.CO2	x	x	x	x	x	-	-	-	x	x		x	x	x	x
19EEC22.CO3	x	x	x	x	x	-	-	-	x	x		x	x	x	x
19EEC22.CO4	x	x	x	x	x	-	-	-	x	x		x	x	x	x
19EEC22.CO5	x	x	x	x	x	-	-	-	x	x		x	x	x	x

LIST OF EXPERIMENTS

1. Regulation of three phase alternator by EMF and MMF methods.
2. Regulation of three phase alternator by ZPF methods.
3. Regulation of three phase salient pole alternator by slip test.
4. Measurements of negative sequence and zero sequence impedance of alternators.
5. V and Inverted V curves of Three Phase Synchronous Motor.
6. Load test on three-phase induction motor.
7. No load and blocked rotor test on three-phase induction motor (Determination of equivalent circuit parameters).
8. Separation of No-load losses of three-phase induction motor.
9. Load test on single-phase induction motor.
10. No load and blocked rotor test on single-phase induction motor.
11. Study of Induction motor Starters

TOTAL: 30 Periods

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19BSS27 PROBABILITY & RANDOM PROCESSES

L	T	P	C
3	1	0	4

COURSE OBJECTIVES

- Analyze random or unpredictable experiments and investigate important features of random experiments.
- Construct probabilistic models for observed phenomena through distributions which play an important role in many engineering applications.
- To acquire the knowledge the concept of convergence of random sequence and the study of random signals
- To be familiar with application of auto correlation and cross correlation functions.
- To learn the concept of spectral density

COURSE OUTCOMES

19BSS27.CO1	The students will have a fundamental knowledge of the probability concepts.
19BSS27.CO2	It helps to use standard distributions to the real life problems.
19BSS27.CO3	Associate random variables by designing joint distributions and correlate the random variables.
19BSS27.CO4	It also helps to understand and characterize phenomenon which evolve with respect to time in a 0probabilistic manner.
19BSS27.CO5	Gained knowledge in correlation and spectral densities

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19BSS27.CO1	X	X	X	-	-	-	-	-	-	-	X	X	-	X	-
19BSS27.CO2	X	X	X	-	-	-	-	-	-	-	X	X	-	X	-
19BSS27.CO3	X	X	X	-	-	-	-	-	-	-	X	X	-	X	-
19BSS27.CO4	X	X	X	-	-	-	-	-	-	-	X	X	-	X	-
19BSS27.CO5	X	X	X	-	-	-	-	-	-	-	X	X	-	X	-

UNIT - I PROBABILITY AND RANDOM VARIABLES 9+3

Axioms of probability–conditional probability– Baye's theorem, random variables– Discrete and continuous random variables – MGF

UNIT – II STANDARD DISTRIBUTIONS 9+3

Discrete distributions : Binomial, Poisson, Geometric, Negative Binomial and their properties – Continuous distributions : Uniform, Exponential, Gamma, Normal distributions and their properties

UNIT – III TWO - DIMENSIONAL RANDOM VARIABLES 9+3

Joint distributions – Marginal and conditional distributions – Covariance – Correlation and regression – Transformation of random variables

UNIT – IV RANDOM PROCESSES 9+3

Classification – Stationary process – Markov process - Poisson process – Discrete parameter Markov chain – Chapman Kolmogorov equations

UNIT – V CORRELATION AND SPECTRAL DENSITIES 9+3

Auto correlation - Cross correlation - Properties – Power spectral density – Cross spectral density - Properties – Wiener-Khintchine relation – Relationship between cross power spectrum and cross correlation function

TOTAL: 45 + 15=60 Hours

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TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Oliver. C Ibe.	Fundamentals of Applied Probability and Random Processes, 2nd Edition	Academic Press	2014
2.	Stark. H., Woods. J.W.	Probability and Random Processes with Applications to Signal Processing, 4th Edition	Pearson Education, Asia	2014

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	HweiP.Hsu	Schaum"s Outline of Theory and Problems of Probability, Random Variables and Random Processes	Mc Graw Hill Publishing Company, New Delhi	2014
2.	Henry Stark , John W. Woods	Probability, Statistics, and Random Processes for Engineers" , 2nd Edition	Pearson Education	2014
3.	Miller. S.L., Childers. D.G.	Probability and Random Processes with Applications to Signal Processing and Communications , 2nd Edition	Academic Press (Elsevier)	2012
4.	Yates. R.D., Goodman. D.J.	Probability and Stochastic Processes, 2nd Edition	Wiley India Pvt. Ltd., Bangalore	2012
5.	Peyton Peebles	Problems and Solutions in Probability, Random Variables and Random Signal Principles (SIE), 1st Edition	Mc Graw Hill Publishing Company, New Delhi	2012

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19BSS28 STATISTICS AND NUMERICAL METHODS L T P C
3 1 0 4

COURSE OBJECTIVES

- To understand concepts of testing of hypothesis
- To develop design of experiments model for research problems
- To find the trend information from discrete data set through numerical differentiation and summary information through numerical integration
- To predict the system dynamic behaviour through solution of ODEs modeling the system
- To introduce numerical tools for the solutions of ordinary differential equations that model several physical processes

COURSE OUTCOMES

19BSS28.CO1 Provides knowledge to apply testing of hypothesis to real life problems.
19BSS28.CO2 This course enhances the students in design of experiments model for research problems
19BSS28.CO3 The students will have a clear perception of the power of numerical techniques
19BSS28.CO4 It equips the knowledge in numerical differentiation and numerical integration
19BSS28.CO5 This course makes students easy in solving ordinary differential equations

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19BSS28.CO1	X	X	X	-	-	-	-	-	-	-	X	X	-	X	-
19BSS28.CO2	X	X	X	-	-	-	-	-	-	-	X	X	-	X	-
19BSS28.CO3	X	X	X	-	-	-	-	-	-	-	X	X	-	X	-
19BSS28.CO4	X	X	X	-	-	-	-	-	-	-	X	X	-	X	-
19BSS28.CO5	X	X	X	-	-	-	-	-	-	-	X	X	-	X	-

UNIT - I TESTING OF HYPOTHESIS 9+3

Sampling distributions - Tests for single mean, Difference of means (large and small samples) – Tests for single variance and equality of variances – chi-square test for goodness of fit – Independence of attributes.

UNIT – II DESIGN OF EXPERIMENTS 9+3

Completely randomized design – Randomized block design – Latin square design – One way- Two way Classification.

UNIT – III SOLUTION OF EQUATIONS AND EIGENVALUE PROBLEMS 9+3

Newton-Raphson method- Gauss Elimination method – Gauss-Jordan methods – Iterative methods of Gauss-Jacobi and Gauss-Seidel - Horner's Method – Eigen values of a matrix by Power method .

UNIT – IV INTERPOLATION, NUMERICAL DIFFERENTIATION AND NUMERICAL INTEGRATION 9+3

Lagrange's and Newton's divided difference interpolation –Newton's forward and backward difference interpolation - Approximation of derivatives using interpolation polynomials - Numerical integration using Trapezoidal and Simpson's 1/3 rules

UNIT – V NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS 9+3

Taylor's series method - Euler's method - Modified Euler's method - Fourth order Runge-Kutta method for solving first and second order equations – Adam's and Milne's predictor corrector methods for solving first order equations

TOTAL: 45 + 15

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TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	S. K. Gupta	Numerical Methods for Engineers , 3rd Edition	New Age International Pvt Ltd Publishers	2015
2.	Walpole. R.E., Myers. R.H., Myers. S.L., Ye. K.	Probability and Statistics for Engineers and Scientists, 8th Edition	Pearson Education, Asia	2013

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Douglas C. Montgomery, George C. Runger	Applied Statistics and Probability for Engineers (International Student Version)", 6th Edition	John Wiley & Sons, Inc.	2016
2.	Spiegel. M.R., Schiller. J., Srinivasan.R.A.	Schaum's Outlines on Probability and Statistics, 4th Edition	Tata McGraw Hill Education	2013
3.	Chapra. S.C., Canale.R.P.	Numerical Methods for Engineers, 6th Edition	Tata McGraw Hill, , New Delhi	2012
4.	Johnson. R.A., and Gupta. C.B.	Miller,Freund's Probability and Statistics for Engineers,11th Edition	Pearson Education, Asia	2011
5.	Grewal. B.S.	Numerical Methods in Engineering & Science: with Programs in C and C++, 10th Edition	Khanna Publishers, New Delhi	2010

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19GES21 **ELECTRICAL DRIVES AND CONTROLS** **L T P C**
3 0 0 3

COURSE OBJECTIVES

- To understand the basics of electrical drives.
- To study the drive motor characteristics,
- To study the different methods of starting D.C motors and Induction Motors.
- To study the Conventional and Solid-State DC Drives.
- To study the Speed Control of AC Drives.

COURSE OUTCOMES

19GES21.CO1 Able to explain the basics of electrical drives.
19GES21.CO1 Able to describe drive motor characteristics
19GES21.CO1 Able to demonstrate the methods of starting D.C motors and Induction Motors.
19GES21.CO1 Able to describe speed control of DC drives.
19GES21.CO1 Able to explain the conventional and solid state speed control of AC drives.

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19GES21.CO1	X	X	X	-	-	-	-	-	-	X	-	X	X	-	-
19GES21.CO2	X	X	X	-	-	-	-	-	-	X	-	X	X	-	-
19GES21.CO3	X	X	X	-	-	-	-	-	-	X	-	X	X	-	-
19GES21.CO4	X	X	X	-	-	-	-	-	-	X	-	X	X	-	-
19GES21.CO5	X	X	X	-	-	-	-	-	-	X	-	X	X	-	-

UNIT I INTRODUCTION **9**

Basic Elements - Types of Electric Drives - Factors are influencing the choice of Electrical Drives -Heating and Cooling Curves - Loading conditions and classes of duty - Selection of power rating for drive motors with regard to thermal overloading and Load variation factors.

UNIT II DRIVE MOTOR CHARACTERISTICS **9**

Dynamics of Motor load system – Multiquadrant operation – DC Motor (Types, Torque Equation, Characteristics and Applications) - Single phase induction motor (Types and Applications) - Three phase induction motors(Types, Characteristics) - Braking of Electric motors.

UNIT III STARTING METHODS **9**

Necessity of a starters - Types of DC Motor Starters – Types of 3 phase squirrel cage and slip ring Induction Motor Starters.

UNIT IV CONVENTIONAL AND SOLID STATE SPEED CONTROL OF DC DRIVES **9**

Speed control of DC series and shunt motors - Armature and field control - Ward-Leonard control system using controlled rectifiers and DC choppers.

UNIT V CONVENTIONAL AND SOLID STATE SPEED CONTROL OF AC DRIVES **9**

Speed control of three phase induction motor - Voltage control, voltage / frequency control and slip power recovery scheme using inverters and AC voltage regulators.

TOTAL: 45 Hours

TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	G. K. Dubey	Fundamentals of Electrical Drives	CRC press	2002
2.	Vedam Subrahmaniam	Electric Drives (Concepts and Applications)	Tata McGraw-Hill	2010

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REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Gnanavadivel J Karthikeyan J Chitra Selvi S	Electrical Drives and Controls	Anuradha Publishers	2004
2.	Thiyagarajan V	Electrical Drives and Controls	A.R. Publications	2015
3.	Pillai SK	A First Course on Electric Drives	New age international publishers	2013
4.	Jagadeesh Babu V	Electrical Drives and Controls	Scitech Publications	2015
5.	Austin Hughes and Bill Drury	Electric Motors and Drives	Newness Heinemann Publishers	2018

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19GES22	ELECTRICAL DRIVES AND CONTROLS LABORATORY	L	T	P	C
		0	0	3	1

OBJECTIVES:

- To study the conventional and solid-state drives
- To study the different methods of starting D.C motors and induction motors.
- To understand the basic concepts of different types of electrical machines and their performance.

LIST OF EXPERIMENTS:

1. Load test on DC Shunt & DC Series motor.
2. O.C.C & Load characteristics of DC Shunt and DC Series generator.
3. Speed control of DC shunt motor (Armature, Field control).
4. Load test on single phase transformer.
5. O.C & S.C Test on a single phase transformer.
6. V curves and inverted V curves of synchronous Motor.
7. Load test on three phase squirrel cage Induction motor.
8. Speed control of three phase slip ring Induction Motor.
9. Load test on single phase Induction Motor.
10. Study of DC & AC Starters.

TOTAL: 45 Hours

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19GES23 **ANALOG AND DIGITAL COMMUNICATION** **L T P C**
3 0 0 3

COURSE OBJECTIVES

1. To Understand basic elements of a communication system
2. To Conduct analysis of baseband signals in time domain and in frequency domain
3. To Demonstrate understanding of various analog and digital modulation and demodulation techniques technique
4. To Analyses the performance of modulation and demodulation techniques in various transmission environments
5. To appreciate the importance of synchronization in communication systems

COURSE OUTCOMES

19GES23.CO1 Explain and apply various types of modulation and demodulation in analog and digital Communication.
19GES23.CO2 Describe the concept of digital communicationtechniques.
19GES23.CO3 Describe the concept of various digital transmission techniques.
19GES23.CO4 Comprehend the Cellular communicationtechniques.
19GES23.CO5 Explain the concepts of Satellite communication and Optical communication

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19GES23.CO1	X	X	X	-	-	-	-	-	-	X	-	X	X	-	-
19GES23.CO2	X	X	X	-	-	-	-	-	-	X	-	X	X	-	-
19GES23.CO3	X	X	X	-	-	-	-	-	-	X	-	X	X	-	-
19GES23.CO4	X	X	X	-	-	-	-	-	-	X	-	X	X	-	-
19GES23.CO5	X	X	X	-	-	-	-	-	-	X	-	X	X	-	-

UNIT I FUNDAMENTALS OF ANALOG COMMUNICATION 9

Principles of amplitude modulation - AM envelope - frequency spectrum and bandwidth - modulation index andpercent modulation - AM Voltage distribution - AM power distribution - Angle modulation - FM and PM waveforms - phase deviation and modulation index - frequency deviation and percent modulation - Frequency analysis of angle modulated waves - Bandwidth requirements for Angle modulated waves.

UNIT II DIGITAL COMMUNICATION 9

Shannon limit for information capacity - Digital amplitude modulation - Frequency Shift Keying - FSK bit rateand baud - FSK transmitter - BW consideration of FSK - FSK receiver - Phase Shift Keying – BPSK, QPSK8- PSK - Quadrature Amplitude modulation – 8-QAM - bandwidth efficiency - Carrier recovery – squaring loop, Costas loop - DPSK.

UNIT III DIGITAL TRANSMISSION 9

Pulse modulation - PCM – PCM sampling - Sampling rate - Signal to Quantization noise rate - Commanding-analog and digital - Delta modulation PCM - Adaptive Delta modulation PCM - Differential PCM – Inter symbol interference - Eye patterns.

UNIT IV CELLULAR COMMUNICATION 9

Fundamental concept of Cellular telephone - Frequency reuse, Interference - Co-channel Interference, Adjacent channel Interference - Cell splitting - Cell sectoring - Segmentation and Dualization - Roaming and Handoff.

UNIT V SATELLITE AND OPTICAL COMMUNICATION 9

Kepler's Law - Satellite Orbits - Geo synchronous satellites - satellite system link models -Optical Fiber Communication system - Optical Fiber configurations - Optical Fiber classification Losses in Optical fiber cables - Optical sources - LED , Injection laser diode - Light detector - PIN diodes, Avalanche photo diode.

Total:45

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TEXT BOOK

Sl.No	AUTHOR(s)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	Wayne Tomasi.	Electronic Communication Systems Fundamentals through Advanced	Pearson Education	2008
2.	H.Taub,D L Schilling,G Saha	Principles of Communication	Pearson Education	2008

REFERENCE BOOK

Sl.No	AUTHOR(s)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	B.P.Lathi	Modern Analog and Digital Communication systems	Oxford University Press	2008
2.	Blake	Electronic Communication Systems	Thomson Delmar Publications	2002
3.	Martin S.Roden	Analog and Digital Communication System	PHI	2002
4.	B.Sklar	Digital Communication Fundamentals and Applications	Pearson Education	2007
5.	Simon Haykin	Communication Systems	John Wiley & Sons	2010.

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19MEC03 FLUID MECHANICS AND MACHINERY

L T P C
3 0 0 3

COURSE OBJECTIVES

- To understand the applications of fluid in various engineering requirements
- To explain the various losses in pipes
- To understand the importance of dimensional analysis
- To interpret the various types pumps and its principles
- To comprehend the types of flow in turbine

COURSE OUTCOMES

19MEC03.CO1 Understand and recall the definitions and fundamental concepts of fluid properties
19MEC03.CO2 Illustrate the concepts of flow through circular conduits and solve losses in pipes
19MEC03.CO3 Make use of dimensional analysis and dimensionless parameters
19MEC03.CO4 Demonstrate the working of different types of pumps
19MEC03.CO5 Demonstrate the working of different types of turbines

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19MEC03.CO1	X	X	X	-	-	X	X	X	-	X	-	X	X	-	-
19MEC03.CO2	X	X	X	X	-	-	X	X	-	X	-	X	X	-	-
19MEC03.CO3	X	X	X	X	-	-	X	X	-	X	-	X	X	-	-
19MEC03.CO4	X	X	X	X	-	-	X	X	-	X	-	X	X	-	-
19MEC03.CO5	X	X	X	X	-	-	X	X	-	X	-	X	X	-	-

UNIT I: FLUID PROPERTIES AND FLOW CHARACTERISTICS 9

Units and dimensions- Properties of fluids- mass density, specific weight, specific volume, specific gravity, viscosity, compressibility, vapor pressure, surface tension and capillarity. Flow characteristics concept of control volume - application of continuity equation, energy equation and momentum equation

UNIT II: FLOW THROUGH CIRCULAR CONDUITS 9

Hydraulic and energy gradient - Laminar flow through circular conduits and circular annuli-Boundary layer concepts – types of boundary layer thickness – Darcy Weisbach equation –friction factor- Moody diagram- commercial pipes- minor losses – Flow through pipes in series and parallel.

UNIT III: DIMENSIONAL ANALYSIS 9

Need for dimensional analysis – methods of dimensional analysis – Similitude –types of similitude Dimensionless parameters- application of dimensionless parameters – Model analysis.

UNIT IV: PUMPS 9

Impact of jets - Euler"s equation - Theory of roto-dynamic machines – various efficiencies– velocity components at entry and exit of the rotor- velocity triangles - Centrifugal pumps– working principle -work done by the impeller - performance curves - Reciprocating pump- working principle – Rotary pumps classification.

UNIT V: TURBINES 9

Classification of turbines – heads and efficiencies – velocity triangles, axial, radial and mixed flow turbines, Pelton wheel, Francis turbine and Kaplan turbines- working principles - work done by water on the runner – draft tube. Specific speed - unit quantities – performance curves for turbines – governing of turbines.

TOTAL: L: 45: = 45

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TEXT BOOKS:

S.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Dr. P.N. Modi& Dr. S.M. Seth	Hydraulics and Fluid Mechanics Including Hydraulics Machines	Rajsons Publications Pvt. Ltd. 20th edition	2015
2.	Dr. R. K. Bansal	A Textbook of Fluid Mechanics and Hydraulic Machines	Laxmi Publications, Ninth edition	2017

REFERENCE BOOKS:

S. No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Streeter, V. L. and Wylie E. B.	Fluid Mechanics	McGraw Hill Publishing Co.	2010
2	Kumar K. L.	Engineering Fluid Mechanics	Eurasia Publishing House(p) Ltd., New Delhi	2004
3	Robert W.Fox, Alan T. McDonald. Philip J.Pritchard,	Fluid Mechanics	Wiley, 9th Edition	2015
4	Graebel. W.P,	Engineering Fluid Mechanics	Taylor & Francis, Indian Reprint	2011
5	R.K.Rajput	A text book of Fluid Mechanics	S.Chand& co, New Delhi	2007

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19MEC04 STRENGTH OF MATERIALS

L T P C
3 0 0 3

COURSEOBJECTIVES

- To develop the theoretical basis and to derive the theories of the strength of materials with sound mathematical principles
- To enable to systematically solve engineering problems regardless of difficulty.
- To establish an understanding of the fundamental concepts of mechanics of deformable solids; including static equilibrium, geometry of deformation, and material constitutive behavior.
- To provide students with exposure to the systematic methods for solving engineering problems in solid mechanics.
- To discuss the basic mechanical principles underlying modern approaches for design of various types of structural members subjected to axial load, torsion, bending, transverse shear, and combined loading.

COURSE OUTCOMES

19MEC04.CO1 Demonstrate the basic concepts of stress, strain and fundamentals of elasticity.

19MEC04.CO2 Compute stresses on inclined plane and principal planes by graphical and analytical method

19MEC04.CO3 Construct Shear force Diagram, Bending Moment Diagram for different beam and load configurations

19MEC04.CO4 Determine the slope and deflection of different beams.

19MEC04.CO5 Determine pure Torsion of shafts and deformation of helical springs and apply it in different situations.

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19MEC04.CO1	X	X	X	X	-	-	-	-	-	-	-	X	X	X	X
19MEC04.CO2	X	X	X	X	-	-	-	-	-	-	-	X	X	-	-
19MEC04.CO3	X	X	X	X	-	-	-	-	-	-	-	X	X	X	X
19MEC04.CO4	X	X	X	X	-	-	-	-	-	-	-	X	X	X	X
19MEC04.CO5	X	X	X	X	-	-	-	-	-	-	-	X	X	-	-

UNIT I: STRESS, STRAIN AND DEFORMATION OF SOLIDS 9

Rigid bodies and deformable solids – Tension, Compression and Shear Stresses – Deformation of simple and compound bars – Thermal stresses – Elastic constants – Volumetric strains –Stresses on inclined planes – principal stresses and principal planes – Mohr's circle of stress.

UNIT II: TRANSVERSE LOADING ON BEAMS AND STRESSES IN BEAM 9

Beams – types transverse loading on beams – Shear force and bending moment in beams –Cantilevers – Simply supported beams and over – hanging beams. Theory of simple bending–bending stress distribution – Load carrying capacity – Proportioning of sections–Shear stress distribution.

UNIT III: TORSION 9

Torsion formulation stresses and deformation in circular and hollows shafts – Stepped shafts–Deflection in shafts fixed at the both ends – Stresses in helical springs – Deflection of helical springs, carriage springs

UNIT IV: DEFLECTION OF BEAMS 9

Slope and deflection of simply supported beams and cantilevers- Double integration- Macaulay's Method- moment area method- conjugate beam method.

UNIT V: THIN CYLINDERS, SPHERES AND THICK CYLINDERS 9

Stresses in thin cylindrical shell due to internal pressure circumferential and longitudinal stresses and deformation in thin and thick cylinders – spherical shells subjected to internal pressure –Deformation in spherical shells – Lame's theorem.

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TOTAL: L : 45= 45

TEXT BOOKS:

Sl. No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Bansal, R.K	Strength of Materials	Laxmi Publications (P) Ltd.,	2017
2.	Egor. P.Popov	Engineering Mechanics of Solids	Prentice Hall of India, New Delhi	2015

REFERENCE BOOKS:

Sl. No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Jindal U.C	Strength of Materials	Asian Books Pvt. Ltd., New Delhi	2007
2.	Subramanian R	Strength of Materials	Oxford University Press, Oxford Higher Education Series	2007
3.	Ferdinand P. Been, Russell Johnson, J.r. and John J. Dewole	Mechanics of Materials	TataMcGraw Hill Publishingco. Ltd., New Delhi	2005
4.	D. K. Singh	Mechanics of Solids	Pearson Education New Delhi	2006
5.	B. K. Sarkar	Strength of Materials	Tata McGraw Hill Publishing Company Pvt Ltd, New Delhi	2006

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19MEC06 **MANUFACTURING TECHNOLOGY** **L T P C**
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COURSEOBJECTIVES

- To impart knowledge on the concepts and basic mechanism of metal cutting.
- To understand the constructional features and working principle of centre lathe, and special purpose lathes.
- To familiarize the working principle of various machining operations such as milling, shaping, planning, slotting, drilling and broaching.
- To understand the various abrasive processes.
- To understand the concepts of computer numerical control (CNC) machine tool and CNC programming

COURSE OUTCOMES

19MEC06.CO1	Explain the concepts and basic mechanism of metal cutting in different working conditions.
19MEC06.CO2	Compare the constructional features and working principle of centre lathe, and special purpose lathes.
19MEC06.CO3	Distinguish between the working principle of various machining operations such as milling, shaping, planning, slotting, drilling and broaching.
19MEC06.CO4	Comprehend and illustrate the abrasive and broaching processes
19MEC06.CO5	Demonstrate the concepts of computer numerical control (CNC) machine tool and CNC programming

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19MEC06.CO1	X	X	X	-	-	X	-	-	-	-	-	X	-	-	X
19MEC06.CO2	X	X	-	X	X	X	-	-	-	-	-	X	-	-	X
19MEC06.CO3	X	-	X	X	X	-	-	-	-	-	-	X	-	-	X
19MEC06.CO4	X	X	-	-	-	-	-	-	-	-	-	X	-	-	X
19MEC06.CO5	X	X	-	-	-	-	-	-	-	-	-	X	-	-	X

UNIT I: THEORY OF METAL CUTTING 9

Mechanics of chip formation, single point cutting tool, forces in machining, Types of chip, cutting tools– nomenclature, orthogonal metal cutting, thermal aspects, cutting tool materials, tool wear, tool life, surface finish, cutting fluids and Machinability.

UNIT II: TURNING MACHINES 9

Centre lathe, constructional features, specification, operations – taper turning methods, thread cutting methods, special attachments, machining time and power estimation. Capstan and turret lathes- tool layout – automatic lathes: semi-automatic – single spindle: Swiss type, automatic screw type – multi spindle

UNITIII: SHAPER, MILLING AND GEAR CUTTING MACHINES 9

Shaper - Types of operations. Drilling, reaming, boring, Tapping. Milling operations-types of milling cutter. Gear cutting – forming and generation principle and construction of gear milling, hobbling and gear shaping processes –finishing of gears.

UNIT IV: ABRASIVE PROCESS AND BROACHING 9

Abrasive processes: grinding wheel – specifications and selection, types of grinding process– cylindrical grinding, surface grinding, centerless grinding and internal grinding- Typical applications – concepts of surface integrity, broaching machines: broach construction – push, pull, surface and continuous broaching machines.

UNIT V: CNC MACHINING 9

Numerical Control (NC) machine tools – CNC types, constructional details, special features, machining centre, part programming fundamentals CNC – manual part programming – micromachining – wafer machining

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TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	HajraChoudhury	Elements of Workshop Technology	Media Promoters	2008
2	Rao. P.N	Manufacturing Technology - Metal Cutting and Machine Tools	Tata McGraw-Hill	2013

REFERENCE BOOKS:

S. No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Richerd R Kibbe, John E. Neely, Roland O. Merges and Warren J.White	Machine Tool Practices	Prentice Hall of India	2010
2	Jain.R.K	Production Technology : Manufacturing Processes, Technology and Automation	Khanna Publishers	2011
3	GeofreyBoothroyd	Fundamentals of Metal Machining and Machine Tools	McGraw Hill	2007
4	Roy. A.Lindberg	Manufacturing Technology - Metal Cutting and Machine Tools	PHI/Pearson Education	2006
5	Dr. B. Kumar	Manufacturing Technology	Khanna Publishers	2009

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19MEC07 THERMAL ENGINEERING

L T P C
3 0 0 3

(Use of standard refrigerant property data book, Steam Tables, Mollier diagram and Psychometric chart permitted)

COURSE OBJECTIVES

- To know about gas power cycles.
- To familiarize the working of IC engines.
- To learn the thermodynamic concepts in steam nozzles and turbine.
- To apply the concept in steam turbine and in air compressors
- To understand the concept of Refrigeration and air conditioning system

COURSE OUTCOMES

19MEC07.CO1	Understand gas laws and gas cycles and apply it to problems.
19MEC07.CO2	Familiarize working of IC engine and heat balance calculations.
19MEC07.CO3	Applying the thermodynamic concept in steam nozzles and turbine.
19MEC07.CO4	Knowing the concept in steam turbine and nozzle calculations.
19MEC07.CO5	Understanding the concept and applications in air compressors, Refrigeration and air conditioning system

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19MEC07.CO1	X	X	X	X	-	X	X	-	X	-	-	X	X	-	-
19MEC07.CO2	X	X	X	X	X	X	X	-	X	-	-	X	X	X	-
19MEC07.CO3	X	X	X	X	-	-	X	-	X	X	-	X	X	X	X
19MEC07.CO4	X	X	X	X	X	X	X	-	X	-	-	X	X	-	X
19MEC07.CO5	X	X	X	X	X	X	X	-	X	-	X	X	X	-	X

UNIT I: GAS POWER CYCLES 9

Otto, Diesel, Dual, Brayton cycles, Calculation of mean effective pressure, and air standard efficiency- Comparison of cycles.

UNIT II: INTERNAL COMBUSTION ENGINES 9

Classification - Components and their function, Valve timing diagram and port timing diagram – actual and theoretical p-V diagram of four stroke and two stroke engines. Simple and complete Carburetor. MPFI, Diesel pump and injector system. Battery and Magneto Ignition System - Principles of Combustion and knocking in SI and CI Engines. Lubrication and Cooling systems. Performance calculation.

UNIT III: STEAM NOZZLES AND TURBINES 9

Flow of steam through nozzles, shapes of nozzles, effect of friction, critical pressure ratio, supersaturated flow. Impulse and Reaction principles, compounding, velocity diagram for simple and multi-stage turbines, speed regulations –Governors.

UNIT IV: AIR COMPRESSOR 9

Classification and working principle of various types of compressors, work of compression with and without clearance, volumetric efficiency, Isothermal efficiency and isentropic efficiency of reciprocating compressors, multistage air compressor and inter cooling –work of multistage air compressor

UNIT V: REFRIGERATION AND AIR CONDITIONING 9

Refrigerants - Vapour compression refrigeration cycle- super heat, sub cooling – Performancecalculations - working principle of vapour absorption system, Ammonia –Water, Lithium bromide –water systems (Description only). Air conditioning system - Processes, Types and WorkingPrinciples. - Concept of RSHF, GSHF, ESHF- Cooling Load calculations

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TEXT BOOKS

Sl. No.	Author(s)	Title of the Book	Publisher	Year of Publication
1	Rajput. R. K.,	Thermal Engineering	S.Chand publishers	2013
2	Kothandaraman.C.P	A course in Thermal Engineering	Fifth Edition, Dhanpat Rai & sons	2004

REFERENCE BOOKS

Sl. No.	Author(s)	Title of the Book	Publisher	Year of Publication
1	Sarkar. B.K	Thermal Engineering	Tata McGraw-Hill Publishers	2007
2	Arora.C.P	Refrigeration and Air Conditioning	Tata McGraw-Hill Publishers	1994
3	Ganesan V	Internal Combustion Engines	Tata Mcgraw-Hill	2007
4	Rudramoorthy. R	Thermal Engineering	Tata McGraw-Hill	2003
5	Ramalingam. K.k	Thermal Engineering	SCITECH Publications	2009

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19MEC14 APPLIED HYDRAULICS AND PNEUMATICS

L T P C
3 0 0 3

COURSE OBJECTIVES

- To know the applications of Fluid Power Engineering in Power transmission system.
- To familiarize hydraulic system and its components.
- To design hydraulic circuits for various application.
- To understand pneumatic systems, related components used in a system.
- To design the pneumatic system circuits.

COURSE OUTCOMES

19MEC14.CO1 Understand the fundamentals of fluid power systems
19MEC14.CO2 Comprehend and analyse the hydraulic systems and its components
19MEC14.CO3 Apply the design principles in developing hydraulic circuits.
19MEC14.CO4 Comprehend and analyse the pneumatic systems and its components
19MEC14.CO5 Apply the design principles in creating pneumatic circuits.

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19MEC14.CO1	X	X	X	X	-	X	X	-	-	X	-	X	X	-	-
19MEC14.CO2	X	X	X	-	-	X	X	-	-	X	-	X	X	-	-
19MEC14.CO3	X	X	X	-	-	-	X	-	X	X	-	-	X	-	-
19MEC14.CO4	X	X	X	-	-	X	X	-	-	X	-	-	X	-	-
19MEC14.CO5	X	X	X	-	-	-	X	-	X	X	-	-	X	-	-

UNIT I: FLUID POWER SYSTEMS AND FUNDAMENTALS 9

Introduction to fluid power, Advantages of fluid power, Application of fluid power system. Types of fluid power systems. Properties of hydraulic fluids – General types of fluids –Fluid power symbols. Basics of Hydraulics-Applications of Pascal's Law- Laminar and Turbulent flow – Reynold's number – Darcy's equation – Losses in pipe, valves and fittings.

UNIT II: HYDRAULIC SYSTEM & COMPONENTS 9

Sources of Hydraulic Power: Pumping theory – Pump classification – Gear pump, Vane Pump, piston pump, construction and working of pumps – pump performance – Variable displacement pumps. Fluid Power Actuators: Linear hydraulic actuators – Types of hydraulic cylinders – Single acting, Double acting special cylinders like tanden, Rodless, Telescopic, Cushioning mechanism, Construction of double acting cylinder, Rotary actuators – Fluid motors, Gear, Vane and Piston motors.

UNIT III: DESIGN OF HYDRAULIC CIRCUITS 9

Construction of Control Components: Directional control valve – 3/2 way valve – 4/2 way valve – Shuttle valve – check valve – pressure control valve – pressure reducing valve, sequence valve, Flow control valve – Fixed and adjustable, electrical control solenoid valves, Relays, ladder diagram. Accumulators and Intensifiers: Types of accumulators – Accumulators circuits, sizing of accumulators, intensifier – Applications of Intensifier – Intensifier circuit.

UNIT IV: PNEUMATIC SYSTEMS AND COMPONENTS 9

Pneumatic Components: Properties of air – Compressors – Filter, Regulator, and Lubricator Unit – Air control valves, Quick exhaust valves, and pneumatic actuators. Fluid Power Circuit Design, Speed control circuits, synchronizing circuit, Pneumohydraulic circuit, Sequential circuit design for simple applications using cascade method.

UNIT V: DESIGN OF PNEUMATIC CIRCUITS 9

Servo systems – Hydro Mechanical servo systems, Electro hydraulic servo systems and proportional valves. Fluidics – Introduction to fluidic devices, simple circuits, Introduction to Electro Hydraulic Pneumatic logic circuits, ladder diagrams, PLC applications in fluid power control. Fluid power circuits; failure and troubleshooting.

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TOTAL: L: 45

TEXT BOOKS:

Sl. No.	Author(s)	Title of the Book	Publisher	Year of Publication
1	Anthony Esposito	Fluid Power with Applications	Pearson Education	2013
2	Majumdar S.R	Oil Hydraulics Systems- Principles and Maintenance	Tata McGraw-Hill	2001

REFERENCE BOOKS:

Sl. No.	Author(s)	Title of the Book	Publisher	Year of Publication
1	Srinivasan.R	Hydraulic and Pneumatic controls	Vijay Nicole	2006
2	Shanmugasundaram. K	Hydraulic and Pneumatic controls	Chand & Co.	2006
3	Majumdar S.R	Pneumatic systems– Principles and maintenance	Tata McGraw Hill	1995
4	Anthony Lal	Oil hydraulics in the service of industry	Allied publishers	1982
5	Harry L. Stevart D.B	Practical guide to fluid power	Taraoeala sons and Port Ltd.	1976

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19PSB01 LINEAR AND NON LINEAR SYSTEMS THEORY

COURSE OBJECTIVES

- To educate on modeling and representing systems in state variable form.
- To educate on solving linear state equations.
- To educate on solving non-linear state equations.
- To illustrate the role of controllability and observability.
- To educate on stability analysis of systems using Lyapunov"s theory.
- To educate on modal concepts and design of state and output feedback controllers and estimators.

COURSE OUTCOMES

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

- Identify the stability of the given linear system
- Design pole placement controller and/or observer for the given system to achieve desired specifications.
- Identify the existence of limit cycle(s) for the given nonlinear system using describing function method.
- Explain the concept of Lyapunov stability.
- Explain optimal state regulator and stochastic optimal regulator.
- Explain the concept of adaptive control and fuzzy logic.

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19PSB01.CO1	x	-	x	-	x	-	-	-	x	x	x	x	-	-	x
19PSB01.CO2	x	-	x	-	x	-	-	-	x	x	x	x	-	-	x
19PSB01.CO3	x	x	x	-	x	-	-	-	x	x	x	x	-	-	x
19PSB01.CO4	x	x	x	-	x	-	-	-	x	x	x	x	-	-	x
19PSB01.CO5	x	x	x	-	x	-	-	-	x	x	x	x	-	-	x

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UNIT I LINEAR SYSTEMS 9

Concepts of state, state variables and state model - State model for linear time invariant continuous systems. Diagonalization – Solution of state equations – Concepts of Controllability and Observability- Pole placement by state feedback – Observer systems.

UNIT II NON-LINEAR SYSTEMS 9

Types of non-linearity – Typical examples – Phase plane analysis – Singular points – Limit cycles –Construction of phase trajectories – Describing function method – Derivation of describing functions

UNIT III LIAPUNOV STABILITY 9

Liapunov stability analysis – Stability in the sense of Liapunov – Definiteness of scalar Functions – Quadratic forms – Second method of Liapunov – Liapunov stability analysis of linear time invariant systems and nonlinear systems.

UNIT IV OPTIMAL CONTROL SYSTEMS 9

Parameter Optimization: Servomechanisms – Optimal Control Problems: Transfer function Approach – State variable approach – the state regulator problem – The Infinite-time regulator problem – Output regulator and the tracking Problems – Parameter Optimization: Regulators.

UNIT V ADVANCED CONTROL SYSTEMS 9

Adaptive Control: Model-Reference Adaptive Control fundamental concepts – Self tuning control – Robust Control: Parameter perturbations - Design of robust control system – PID controllers – Fuzzy Logic Control –Neural Network Controller.

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REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	M. Gopal	Modern Control System Theory	New Age International	2005
2.	K. Ogatta	Modern Control Engineering	PHI	2002
3.	John S. Bay	Fundamentals of Linear State Space Systems	McGraw-Hill	1999
4	D.Roy Choudhury	Modern Control Systems	New Age International	2005
5	John J.D.Azzo, C.H.Houpis and S.N.Sheldon	Linear Control System Analysis and Design with MATLAB	Taylor Francis	2003

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19PSB02 ELECTRICAL TRANSIENTS IN POWER SYSTEMS

COURSE OBJECTIVES

- To gain knowledge in the sources and effects of lightning.
- To gain knowledge in switching and temporary over voltages.
- Ability to model and estimate the over voltages in power system.
- To coordinate the insulation of power system and protective devices.
- To gain knowledge about the effects of travelling waves on transmission lines.
- Ability to model and analyze power system and equipment for transient over voltages using Electromagnetic Transient Program (EMTP).

COURSE OUTCOMES

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

- Know the effects of lightning.
- Know the effects of switching and temporary over voltages.
- Model and estimate the over voltages in power system.
- Know about the effects of travelling waves on transmission lines.
- Apply insulation coordination principles for power system protective devices.
- To model and analyze power system equipment for transient over voltages using Electromagnetic Transient Program (EMTP).

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19PSB02.CO1	x	x	x	-	-	-	-	-	-	x	-	x	x	-	-
19PSB02.CO2	x	x	x	x	-	-	-	-	-	x	-	x	x	x	-
19PSB02.CO3	x	x	x	x	-	-	-	-	-	x	-	x	x	x	-
19PSB02.CO4	x	x	x	x	-	-	-	-	-	x	-	x	x	x	-
19PSB02.CO5	-	x	x	-	-	-	-	-	-	x	-	x	x	-	-

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3	0	0	3

UNIT I LIGHTNING OVERVOLTAGES 9

Mechanism and parameters of lightning flash, protective shadow, striking distance, electro geometric model for lightning strike, Grounding for protection against lightning – Steady-state and dynamic tower-footing resistance, substation grounding Grid, Direct lightning strokes to overhead lines, without and with shield Wires.

UNIT II SWITCHING AND TEMPORARY OVERVOLTAGES 9

Switching transients – concept – phenomenon – system performance under switching surges, Temporary over voltages – load rejection – line faults – Ferro resonance, VFTO.

UNIT III TRAVELLING WAVES ON TRANSMISSION LINE 9

Circuits and distributed constants, wave equation, reflection and refraction – behavior of travelling waves at the line terminations – Lattice Diagrams – attenuation and distortion – multi-conductor system and multi velocity waves.

UNIT IV INSULATION CO-ORDINATION 9

Classification of over voltages and insulations for insulation co-ordination– Characteristics of protective devices, applications, location of arresters – insulation coordination in AIS and GIS

UNIT V COMPUTATION OF POWER SYSTEM TRANSIENTS 9

Modeling of power apparatus for transient studies – principles of digital computation – transmission lines, cables, transformer and rotating machines – Electromagnetic Transient program – case studies: line with short and open end, line terminated with R,L, C, transformer, and typical power system case study: simulation of possible over voltages in a high voltage substation.

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REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Pritindra Chowdhari	Electromagnetic transients in Power System	John Wiley and Sons Inc.	2009
2.	Allan Greenwood	Electrical Transients in Power System	Wiley &Sons Inc. New York	2012
3.	Klaus Ragaller	Surges in High Voltage Networks	Plenum Press. New York	1980
4.	Rakosh Das Begamudre	Extra High Voltage AC Transmission Engineering	New age International (P) Ltd.	2006
5.	Juan.A Martinez velasco	Power System Transients Parameter Determination	CRC Press	2009

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19PSB03 ADVANCED POWER SYSTEM ANALYSIS

COURSE OBJECTIVES

- To introduce the different power system components.
- To introduce different techniques of dealing with sparse matrix for large scale power systems.
- To impart in-depth knowledge on different methods of power flow solutions.
- To perform optimal power flow solutions in detail.
- To perform short circuit fault analysis and understand the consequence of different type of faults.

COURSE OUTCOMES

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

- Model various power system components that are adequate for the basic system studies of load flow.
- Model various power system components that are adequate for the basic system studies of short-circuit.
- Facilitate the modification of the Bus admittance matrix to reflect the network changes.
- Perform power flow analysis using NR, FDLF methods.
- Perform short circuit fault analysis and understand the consequence of different type of faults.

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19PSB03.CO1	x	-	x	x	x	x	-	-	-	x	x	x	x	x	-
19PSB03.CO2	x	x	-	x	x	x	-	-	x	x	-	x	x	-	-
19PSB03.CO3	x	x	x	x	x	x	-	-	x	x	x	x	x	x	-
19PSB03.CO4	x	x	x	x	x	x	-	-	x	x	x	x	x	x	-
19PSB03.CO5	x	x	x	x	x	x	-	-	x	x	x	x	x	x	-

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UNIT I POWER SYSTEM COMPONENTS AND ADMITTANCE MODEL 9+3

Classical Model of Synchronous machine – Modeling of transmission Network consisting of Transmission lines (long, medium and short lines) – Transformers (two winding, ULTC, phase shifting and three winding) –Branch and Node Admittances - Mutually Coupled Branches in Ybus - An Equivalent Admittance Network - Modification of Ybus - The Network Incidence Matrix and Ybus.

UNIT II THE IMPEDANCE MODEL AND NETWORK CALCULATIONS 9+3

The Method of Successive Elimination - Node Elimination (Kron Reduction) - Triangular Factorization - Sparsity and Near-Optimal Ordering. The Bus Admittance and Impedance Matrices - Thevenin's Theorem and Zbus - Modification of an Existing Zbus - Direct Determination of Zbus - Calculation of Zbus Elements from Ybus - Mutually Coupled Branches in Zbus.

UNIT III POWER-FLOW SOLUTIONS 9+3

The Power-flow Problem - Review of Newton-Raphson Power-flow Solution - Power-flow Studies in System Design and Operation - Fast Decoupled Power Flow method; Sensitivity factors for P-V bus adjustment - solution of optimal power flow (OPF) - Gradient method, newton's method.

UNIT IV SHORTCIRCUITANALYSIS 9+3

Formation of bus impedance matrix with mutual coupling (single phase basis and three phase basis) - Computer method for fault analysis using ZBUS and sequence components. Derivation of equations for bus voltages, fault current and line currents, both in sequence and phase – symmetrical and un symmetrical faults.

UNIT V TRANSIENTSTABILITYANALYSIS 9+3

Introduction, Numerical Integration Methods: Euler and Fourth Order Runge-Kutta methods, Algorithm for simulation of SMIB and multi-machine system with classical synchronous machine model ; Factors influencing transient stability, Numerical stability and implicit Integration methods.

TOTAL: 60

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19PSB04 ADVANCED POWER SYSTEM OPERATION AND CONTROL

COURSE OBJECTIVES

- To understand the various load forecasting techniques.
- To understand the fundamentals of speed governing system and the concept of control areas.
- To provide knowledge about Hydro thermal scheduling and Unit commitment techniques
- To understand the role of energy control center, SCADA and EMS functions.
- To have hands on experience on various system studies and different techniques used for system planning.

COURSE OUTCOMES

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

- Explain the concept of load forecasting techniques.
- Explain the concept of AGC and analysis of multi-area system.
- Acquire knowledge about Hydrothermal scheduling
- Understand Unit commitment techniques.
- Illustrate various operating states of power system and control actions.

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19PSB04.CO1	x	x	-	-	-	-	-	-	-	x	-	x	x	-	-
19PSB04.CO2	x	x	x	x	-	-	-	-	-	x	-	x	x	x	-
19PSB04.CO3	x	x	x	x	-	-	-	-	-	x	-	x	x	x	-
19PSB04.CO4	-	x	x	x	-	-	-	-	-	x	-	x	-	x	-
19PSB04.CO5	x	x	x	x	-	-	-	-	-	x	-	x	x	x	-

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UNIT I INTRODUCTION 9

System load variation: System load characteristics, load curves-daily, weekly and annual load-duration curve, load factor, diversity actor. Reserve requirements: Installed reserves, spinning reserves, cold reserves, hot reserves. Overview of system operation: Load forecasting, techniques of forecasting, basics of power system operation and control.

UNIT II REAL POWER-FREQUENCY CONTROL 9

Fundamentals of speed governing mechanism and modeling: Speed-load–characteristics – Load sharing between two synchronous machines in parallel: concept of control area, LFC control of a single-area system: Static and dynamic analysis of uncontrolled and controlled cases, Economic Dispatch Control. Multi-area systems

UNIT III HYDROTHERMAL SCHEDULING PROBLEM 9

Hydrothermal scheduling problem: short term and long term-mathematical model, algorithm. Dynamic programming solution methodology for Hydro-thermal scheduling with pumped hydro plant: Optimization with pumped hydro plant-.

UNITIV UNITCOMMITMENT AND ECONOMIC DISPATCH 9

Statement of Unit Commitment (UC) problem; constraints in UC: spinning reserve, thermal unit constraints, hydro constraints, fuel constraints and other constraints - UC solution methods: Priority-list methods, forward dynamic programming approach, numerical problems. Incremental cost curve, co-ordination equations without loss and with loss, solution by direct method and λ-iteration method. Base point and participation factors.-Economic dispatch controller added to LFC control.

UNIT V COMPUTER CONTROL OF POWER SYSTEMS 9

Energy control Centre: Functions–Monitoring, data acquisition and control. System hardware configuration–SCADA and EMS functions: Network topology determination, state estimation, security analysis and control. Various operating states:

TOTAL: 45

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REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Olle. I. Elgerd	Electric Energy Systems Theory – An Introduction	Tata McGraw Hill Publishing Company Ltd	2003
2.	L.L. Grigsby	The Electric Power Engineering, Hand Book	CRC Press & IEEE	-
3.	D.P. Kothari and I.J. Nagrath	Modern Power System Analysis	Tata McGraw Hill Publishing Company Limited	2003
4.	Allen.J.Wood and Bruce F.Wollenberg	Power Generation, Operation and Control	John Wiley & Sons, Inc	2003
5.	P.Kundur	Power System Stability & Control	McGraw Hill Publications	1994

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19PSB14 POWER SYSTEM PLANNING AND RELIABILITY

COURSE OBJECTIVES

- To introduces the objectives of Load forecasting.
- To study the fundamentals of Generation system reliability analysis.
- To study the fundamentals of transmission system reliability analysis.
- To illustrate the basic concepts of Expansion planning.
- To study the fundamentals of and Distribution system reliability analysis.

COURSE OUTCOMES

- Understand how the Power Market operates in a deregulated Electrical Power Industry.
- Know the significance of generation planning and transmission planning for power system reliability and security assessment.
- Understand the concept of probability theory, distribution, network modelling and reliability analysis.
- Describe the reliability functions with their relationships and Markov modeling.
- Evaluate reliability models using frequency and duration techniques and generate various reliability models.

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19PSB14.CO1	-	X	X	-	-	X	X	-	-	X	-	X	-	-	-
19PSB14.CO2	X	X	X	-	-	X	-	-	-	X	-	X	X	-	-
19PSB14.CO3	X	X	X	-	-	X	-	-	-	X	-	X	X	-	-
19PSB14.CO4	X	X	X	-	-	X	X	-	-	X	-	X	X	-	-
19PSB14.CO5	X	X	X	-	-	X	-	-	-	X	-	X	X	-	-

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UNIT I LOAD FORECASTING 9

Objectives of forecasting - Load growth patterns and their importance in planning - Load forecasting Based on discounted multiple regression technique-Weather sensitive load forecasting-Determination of annual forecasting-Use of AI in load forecasting.

UNIT II GENERATION SYSTEM RELIABILITY ANALYSIS 9

Probabilistic generation and load models- Determination of LOLP and expected value of demand not served – Determination of reliability of iso and interconnected generation systems.

UNIT III TRANSMISSION SYSTEM RELIABILITY ANALYSIS 9

Deterministic contingency analysis-probabilistic load flow-Fuzzy load flow probabilistic transmission system reliability analysis-Determination of reliability indices like LOLP and expected value of demand not served.

UNIT IV EXPANSION PLANNING 9

Basic concepts on expansion planning-procedure followed for integrate transmission system planning, current practice in India-Capacitor placer problem in transmission system and radial distributions system.

UNIT V DISTRIBUTION SYSTEM PLANNING OVERVIEW 9

Introduction- Sub transmission lines and distribution substations- Design primary and secondary systems-distribution system protection and coordination of protective devices.

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REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Roy Billinton & Ronald N. Allan	Reliability Evaluation of Power System	Springer Publication.	-
2.	R.L. Sullivan	Power System Planning	Tata McGraw Hill Publishing Company Ltd	-
3.	X. Wang & J.R. McDonald	Modern Power System Planning	McGraw Hill Book Company	-
4.	T. Gönen,	Electrical Power Distribution Engineering	McGraw Hill Book Company	-
5.	B.R. Gupta	Generation of Electrical Energy	S. Chand Publications	-

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19PSC01 FLEXIBLE AC TRANSMISSION SYSTEMS

COURSE OBJECTIVES

- To emphasis the need for FACTS controllers.
- To learn the characteristics, applications and modeling of series FACTS controllers.
- To learn the characteristics, applications and modeling of shunt FACTS controllers.
- To learn the characteristics of phase angle regulators.
- To learn the characteristics of UPFC.

COURSE OUTCOMES

- Understand the basic principles, characteristics of different types of series FACTS controllers.
- Understand the basic principles, characteristics of different types of shunt FACTS controllers
- Compare the performance of various FACTS controllers.
- Model FACTS controller for power flow and stability applications.
- Understand the concepts of phase angle regulators and UPFC

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19PSC01.CO1	X	X	-	-	-	-	-	-	-	X	-	X	X	-	-
19PSC01.CO2	X	X	X	X	-	-	-	-	-	X	-	X	X	X	-
19PSC01.CO3	X	X	X	X	-	-	-	-	-	X	-	X	X	X	-
19PSC01.CO4	X	X	X	X	-	-	-	-	-	X	-	X	X	X	-
19PSC01.CO5	X	X	X	X	-	-	-	-	-	X	-	X	X	X	-

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INTRODUCTION 9

Reactive power control in electrical power transmission lines -Uncompensated transmission line – Fixed series and shunt compensation – Basic types of FACTS controllers – Brief description and definitions of FACTS controllers.

UNIT II STATIC SHUNT COMPENSATORS 9

Objective of Shunt Compensation - Variable Impedance Type Static VAR Generators – Switching Converter Type VAR Generators - Basic operating principle and V-I Characteristics and Control Schemes – Comparison between thyristor based VSC and STATCOM. Applications: Enhancement of transient stability – Steady state power transfer – Enhancement of Power system damping – Prevention of voltage instability.

UNIT III STATIC SERIES COMPENSATORS 9

Objective of Series Compensation - Variable Impedance Type Static Series Compensator -TCSC,TSSC – Switching Converter Type Series Converters - Operation, Characteristics and Control Schemes – Modeling of TCSC – Variable reactance model- Applications: Improvement of the system stability limit- Enhancement of system damping – SSR Mitigation

UNIT IV PHASE ANGLE REGULATORS AND UPFC 9

Power Flow Control using TCPAR – UPFC – Operation – Transmission Control Capabilities – Real and Reactive Power Control Scheme – Applications-UPQC & IPFC.

UNIT V MODELING OF FACTS CONTROLLERS 9

Modeling of Shunt and Series Controllers for Power Flow and Transient stability. Modeling of UPFC.

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REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	K.R.Padiyar	FACTS Controllers in Power Transmission and Distribution	New Age International (P)Ltd. ,Publishers New Delhi	Reprint 2008
2.	MohanMathur,R. , Rajiv.K.Varma.	Thyristor–Based Facts Controllers for Electrical Transmission Systems	IEEE press and John Wiley & Sons, Inc	2009
3	A.T.John	Flexible AC Transmission System	Institution of Electrical and Electronic Engineers (IEEE)	1999
4	Narain G.Hingorani, Laszio. Gyugyl	Understanding FACTS Concepts and Technology of Flexible AC Transmission System	Standard Publishers, Delhi	2001
5	V. K.Sood	HVDC and FACTS controllers – Applications of Static Converters in Power System	Kluwer Academic Publishers	2004

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19PSB08 ADVANCED POWER SYSTEM PROTECTION

COURSE OBJECTIVES

- To emphasis the need for overcurrent protection.
- To learn about various protections of Transformers.
- To learn about various protections of generators.
- To emphasis the need for distance and carrier protection of transmission system.
- To learn about different protection schemes for busbar.

COURSE OUTCOMES

- Understand the basic principles of overcurrent protection.
- Understand the different types of protection for Transformers.
- Understand the different types of protection for generators.
- Understand the different types of protection schemes for distance and carrier protection of transmission system
- Understand the different protection schemes for busbar.

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19PSB08.CO1	x	x	x	-	-	-	-	-	-	x	-	x	x	-	-
19PSB08.CO2	x	x	x	-	-	x	-	-	x	x	-	x	x	-	-
19PSB08.CO3	x	x	x	-	-	x	-	-	x	x	-	x	x	-	-
19PSB08.CO4	x	x	x	-	-	x	-	-	x	x	-	x	x	-	-
19PSB08.CO5	x	x	x	-	-	x	-	-	x	x	-	x	x	-	-

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UNIT I OVER CURRENT PROTECTION 9

Zones of protection – Primary and Backup protection – operating principles and Relay Construction - Time – Current characteristics-Current setting – Time setting-Over current protective schemes - Reverse power or directional relay - Protection of parallel feeders

UNIT II EQUIPMENT PROTECTION 9

Types of transformers – Phasor diagram for a three – Phase transformer-Equivalent circuit of transformer – Types of faults in transformers- Over – current protection Percentage Differential Protection of Transformers - Inrush phenomenon-High resistance Ground Faults in Transformers - Inter-turn faults in transformers - Incipient faults in transformers

UNIT III DISTANCE AND CARRIER PROTECTION OF TRANSMISSION LINES 9

Drawback of over – Current protection – Introduction to distance relay – Simple impedance relay – Reactance relay – mho relays comparison of distance relay – Distance protection of a three – Phase line-reasons for inaccuracy of distance relay reach - Three stepped distance protection - Trip contact configuration for the three - Stepped distance protection

UNIT IV BUSBAR PROTECTION 9

Introduction – Differential protection of bus bars-external and internal fault - Actual behaviors of a protective CT - Circuit model of a saturated CT - External fault with one CT saturation :need for high impedance – Minimum internal fault that can be detected by the high – Stability ratio of high impedance bus bar differential scheme

UNIT V NUMERICAL PROTECTION 9

Introduction–Block diagram of numerical relay - Sampling theorem- Correlation with a reference wave–Least error squared (LES) technique-Digital filtering-numerical over - Current protection–Numerical transformer differential protection-Numerical distance protection of transmission line.

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REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	P.Kundur	Power System Stability and Control	TATA McGraw Hill	1993
2.	Stanley Horowitz	Protective Relaying for Power System	IEEE press	2008
3.	T.S.M. Rao	Digital Relay / Numerical relays	Tata McGraw Hill	1989
4.	Y.G. Paithankar and S.R Bhide	Fundamentals of Power System Protection	Prentice-Hall of India	2003
5.	C/Christo Polous , A.Wright	Electrical Power system Protection	Kluwer Academic Publisher	1999

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19PSB09 RESTRUCTURED POWER SYSTEM

COURSE OBJECTIVES

- To introduce the restructuring of power industry and market models.
- To impart knowledge on fundamental concepts of congestion management.
- To analyze the concepts of locational marginal pricing and financial transmission rights.
- To analyze ancillary service management.
- To analyze pricing of transmission network.

COURSE OUTCOMES

- Explain the restructuring process, new entities in power market and benefits.
- Apply the concepts and terminologies used in interchange evaluation, power pools and transaction issues.
- Explain the Indian power system, issues, regulatory and policy developments and acts.
- Determine available transfer capability in restructured environment.
- Analyze ancillary service management and pricing of transmission network.

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19PSB09.CO1	x	x	x	-	-	-	-	-	x	x	-	x	x	-	-
19PSB09.CO2	x	x	x	-	-	-	-	-	x	x	-	x	x	-	-
19PSB09.CO3	x	x	x	-	-	-	-		x	x	-	x	x	-	-
19PSB09.CO4	x	x	x	-	-	-	-	-	x	x	-	x	x	-	-
19PSB09.CO5	x	x	x	-	-	-	-	-	x	x	-	x	x	-	-

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UNIT I INTRODUCTION TO RESTRUCTURING OF POWER INDUSTRY 9

Introduction: Deregulation of power industry, Restructuring process, Issues involved in deregulation, Deregulation of various power systems – Fundamentals of Economics: Consumer behavior, Supplier behavior, Market equilibrium, Short and long run costs, Various costs of production – Market models: Market models based on Contractual arrangements, Comparison of various market models, Electricity vis – a – vis other commodities, Market architecture, Case study.

UNIT II TRANSMISSION CONGESTION MANAGEMENT 9

Introduction: Definition of Congestion, reasons for transfer capability limitation, Importance of congestion management, Features of congestion management – Classification of congestion management methods – Calculation of ATC - Non – market methods – Market methods.

UNIT III LOCATIONAL MARGINAL PRICES AND FINANCIAL TRANSMISSION RIGHTS 9

Mathematical preliminaries: - Locational marginal pricing– Lossless DCOPF model for LMP calculation – Loss compensated DCOPF model for LMP calculation – ACOPF model for LMP calculation – Financial Transmission rights – Risk hedging functionality.

UNIT IV ANCILLARY SERVICE MANAGEMENT 9

Introduction of ancillary services – Types of Ancillary services – Classification of Ancillary services – Load generation balancing related services – Voltage control and reactive power support devices – Black start capability service - How to obtain ancillary service –Co-optimization of energy and reserve services - International comparison Transmission pricing – Principles.

UNIT V REFORMS IN INDIAN POWER SECTOR 9

Introduction – Framework of Indian power sector – Reform initiatives - Availability based tariff – Electricity act 2003 – Open access issues – Power exchange – Reforms in the near future.

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REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Sally Hunt	Making competition work in electricity	John Willey and Sons Inc	2002
2.	Steven Stoft	Power system economics: designing markets for electricity	John Wiley & Sons	2002
3.	Mohammad Shahidehpour, Muwaffaq Alomoush and Marcel Dekker,	Restructured electrical power systems: operation, trading and volatility	Kluwer Academic Pub	2001
4.	Kankar Bhattacharya, Jaap E. Daadler and Math H.J. Boolen,	Operation of restructured power systems	Kluwer Academic Pub	2001
5.	S.A.Khaparde and A.R.Abhyankar	Restructured power systems	Alpha Science	2011

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19PSB12 POWER SYSTEM SECURITY

COURSE OBJECTIVES

- To understand the need for power system security.
- To analyze state estimation in power system.
- To study the security assessment of power system.
- To study the techniques for security enhancement.
- To study the recent techniques in voltage security assessment.

COURSE OUTCOMES

- Assess the security level status of the large power system, if n-1 contingency takes place in the system.
- Analyze the large power system in terms of real power performance index (PI) or other PIs.
- Estimate the state of the power system in terms of its measured values.
- Optimize the power flow in terms of real and reactive power with the possible various objectives and constraints involved in energy management system.
- Use appropriate OPF technique depending on the formulation of optimization which involves non-linear objective and constraints.

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19PSB12.CO1	-	x	x	x	-	-	-	-	-	x	-	x	-	x	-
19PSB12.CO2	x	x	x	x	-	-	-	-	-	x	-	x	-	x	-
19PSB12.CO3	-	x	x	x	-	-	-	-	-	x	-	x	-	x	-
19PSB12.CO4	x	x	x	x	-	-	-	-	-	x	-	x	-	x	-
19PSB12.CO5	-	x	x	x	-	-	-	-	-	x	-	x	-	x	-

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UNIT I BASICS OF POWER SYSTEM SECURITY 9

Factors affecting power system security- decomposition and multilevel approach- state estimation- system monitoring- security assessment and security enhancement.

UNIT II POWER SYSTEM STATE ESTIMATION 9

Maximum likelihood weighted least-square estimation- state estimation- detection and identification of bad measurements- estimation of quantities not being measure- network observability and pseudo measurements.

UNIT III SECURITY ASSESSMENT 9

Detection of network problems- network equivalent for external system- network sensitivity methods- calculation of network sensitivity factors- fast contingency algorithms- contingency ranking- dynamic security indices.

UNIT IV SECURITY ENHANCEMENT 9

Correcting the generator dispatch by sensitivity methods- compensated factors- security constrained optimization- preventive- emergency and restorative control through NLP and LP methods.

UNIT V RECENT TECHNIQUES 9

Voltage security assessment-Transient Security assessment-methods-Comparison

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REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	John J.Graignaer and William D. Stevenson	Power system analysis	Tata McGraw Hill	2003
2.	P.Venkatesh, B.V.Manikandan, S.Charles raja and A.Srinivasan	Electrical power systems analysis, Security and Deregulation	PHI	2012
3.	A.J.Wood and B.F.Wollenberg	Power generation, operation and control	John Wiley and sons	1996
4.	Miceaeremia, Mohammed Shahidhpour	Handbook of Electrical Power system Dynamics, Modeling, Stablity	Jhon wiley and Sons	2013
5.	Hyungchulkim	Evaluation of Power system security and development of transmission pricing methods	Texas A&H University	2003

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19VLB01 **VLSI SIGNAL PROCESSING** **L T P C**
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COURSE OBJECTIVES:

- To understand the various VLSI architectures for digital signal processing
- To know the methods of critical path reduction.
- To know the techniques of critical path and algorithmic strength reduction in the filter structures.
- To study the performance parameters, viz. area, speed and power
- To carry out HDL simulation of various DSP algorithms.
- To understand synchronous ,asynchronous pipelining

COURSE OUTCOMES:

- To be able to design architectures for DSP algorithms.
- To be able to optimize design in terms of area, speed and power
- To be able to design recursive and adaptive filters.
- To be able to incorporate pipeline based architectures in the design
- To be able to carry out HDL simulation of various DSP algorithms
- To be able to analyze synchronous, asynchronous pipelining

UNIT I: INTRODUCTION 9
Overview of DSP – FPGA Technology – DSP Technology requirements – Design Implementation.

UNIT II: METHODS OF CRITICAL PATH REDUCTION 9
Binary Adders – Binary Multipliers – Multiply-Accumulator (MAC) and sum of product (SOP) –Pipelining and parallel processing – retiming – unfolding – systolic architecture design.

UNIT III: ALGORITHMIC STRENGTH REDUCTION METHODS AND RECURSIVE FILTER DESIGN 9
Fast convolution-pipelined and parallel processing of recursive and adaptive filters – fast IIR filters design.

UNIT IV: DESIGN OF PIPELINED DIGITAL FILTERS 9
Designing FIR filters – Digital lattice filter structures – bit level arithmetic architecture – redundant arithmetic – scaling and round-off noise.

UNIT V: SYNCHRONOUS, ASYNCHRONOUS PIPELINING AND PROGRAMMABLE DSP 9
Numeric strength reduction – synchronous – wave and asynchronous pipelines – low power design – programmable DSPs – DSP architectural features/alternatives for high performance and low power.

TOTAL: 45 Hours

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Keshab K.Parhi	VLSI Digital Signal Processing Systems, Design and Implementation	John Wiley	2007
2.	U. Meyer – Baese	Digital Signal Processing with Field Programmable Arrays	Springer, Second Edition,	2007
3.	S.Y.Kuang, H.J. White house, T. Kailath	VLSI and Modern Signal Processing	Prentice Hall	1995
4.	Gary Yeap	Practical Low Power Digital VLSI Design	Kluwer Academic Publishers	1998
5.	Mohammed Ismail and Terri Fiez	Analog VLSI Signal and Information Processing	Mc Graw-Hill	1994

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WEB URLs :

1. nptel.kmeacollege.ac.in/syllabus/117101006/
2. www.smdp2vlsi.gov.in/smdp2vlsi/publicationIEP-vlsi-dsp-design-iikgp-n.jsp
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19VLB02 VLSI DESIGN TECHNIQUES

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COURSE OBJECTIVES:

- To understand the concepts of MOS transistors operations and their AC and DC characteristics.
- To know the fabrication process of cmos technology and its layout design rules
- To understand the latch up problem in cmos circuits.
- To study the concepts of cmos invertors and their sizing methods
- To know the concepts of power estimation and delay calculations in cmos circuits.
- To study the concepts of digital VLSI circuits

COURSE OUTCOMES:

- To be able to understand the concepts of MOS transistors operations and their AC and DC characteristics.
- To be able to know the fabrication process of cmos technology and its layout design rules
- To be able to understand the latch up problem in cmos circuits.
- To be able to know the concepts of cmos invertors and their sizing methods
- To be able to know the concepts of power estimation and delay calculations in cmos circuits.
- To be able to design digital VLSI circuits

UNIT I: MOS TRANSISTOR THEORY 9

NMOS and PMOS transistors, CMOS logic, MOS transistor theory – Introduction, Enhancement mode transistor action, Ideal I-V characteristics, DC transfer characteristics, Threshold voltage- Body effect- Design equations- Second order effects. MOS models and small signal AC characteristics, Simple MOS capacitance Models, Detailed MOS gate capacitance model, Detailed MOS Diffusion capacitance mode.

UNIT II: CMOS TECHNOLOGY AND DESIGN RULE 9

CMOS fabrication and Layout, CMOS technologies, P -Well process, N -Well process, twin –tub process, MOS layers stick diagrams and Layout diagram, Layout design rules, Latch up in CMOS circuits, CMOS process enhancements, Technology – related CAD issues, Fabrication and packaging.

UNIT III:INVERTERS AND LOGIC GATES 9

NMOS and CMOS Inverters, Inverter ratio, DC and transient characteristics , switching times, Super buffers, Driving large capacitance loads, CMOS logic structures , Transmission gates, Static CMOS design, dynamic CMOS design.

UNIT IV: CIRCUIT CHARACTERISATION AND PERFORMANCE ESTIMATION 9

Resistance estimation, Capacitance estimation, Inductance, switching characteristics, transistor sizing, power dissipation and design margining. Charge sharing .Scaling.

UNIT V:VLSI SYSTEM COMPONENTS CIRCUITS AND SYSTEM LEVEL PHYSICAL DESIGN 9

Multiplexers, Decoders, comparators, priority encoders, Shift registers. Arithmetic circuits – Ripple carry adders, Carry look ahead adders, High-speed adders, Multipliers. Physical design – Delay modeling, cross talk, floor planning, power distribution. Clock distribution. Basics of CMOS testing.

TOTAL: 45 Hours

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Neil H.E. Weste and Kamran Eshraghian	Principles of CMOS VLSI Design	Pearson Education ASIA, 2nd edition	2000
2.	John P.Uyemura	Introduction to VLSI Circuits and Systems	John Wiley & Sons, Inc.	2002
3.	Eugene D.Fabricius	Introduction to VLSI Design	McGraw Hill International Editions	1990

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4.	Pucknell	Basic VLSI Design	Prentice Hall of India Publication	1995
5.	Wayne Wolf	Modern VLSI Design System on chip	Pearson Education	2002

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19VLB03 **ANALOG VLSI CIRCUIT DESIGN**

L	T	P	C
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COURSE OBJECTIVES:

- To study the concepts of CMOS and BICMOS analog circuits.
- To understand the concepts of A/D convertors and analog integrated sensors.
- To understand the testing concepts in analog VLSI circuits and its statistical modeling.
- To understand the concepts of VLSI interconnects.
- To impart in-depth knowledge about switched capacitors, ADCs and DACs.
- To study the concepts of sampled-data analog filters

COURSE OUTCOMES:

- To be able to know the concepts of CMOS and BICMOS analog circuits.
- To be able to understand the concepts of A/D convertors and analog integrated sensors.
- To be able to understand the testing concepts in analog VLSI circuits and its statistical modeling.
- To be able to analyze VLSI interconnects.
- To be able to impart in-depth knowledge about switched capacitors, ADCs and DACs.
- To be able to know the concepts of sampled-data analog filters

UNIT I: BASIC CMOS CIRCUIT TECHNIQUES, CONTINUOUS TIME AND LOW VOLTAGE SIGNAL PROCESSING 9

Mixed-Signal VLSI Chips - Basic CMOS Circuits – Basic Gain Stage - Gain Boosting Techniques – Super MOS Transistor-Primitive Analog Cells-Linear Voltage-Current Converters –MOS Multipliers and Resistors-CMOS, Bipolar and Low-Voltage Bi CMOS Op-Amp Design-Instrumentation Amplifier Design-Low Voltage Filters.

UNIT II: BASIC BICMOS CIRCUIT TECHNIQUES, CURRENT -MODE SIGNAL PROCESSING AND NEURAL INFORMATION PROCESSING 9

Continuous-Time Signal Processing-Sampled-Data Signal Processing-Switched-Current Data Converters-Practical Considerations in SI Circuits Biologically-Inspired Neural Networks - Floating - Gate, Low-Power Neural Networks-CMOS Technology and Models-Design Methodology-Networks-Contrast Sensitive Silicon Retina.

UNIT III: SAMPLED-DATA ANALOG FILTERS, OVER SAMPLED A/D CONVERTERS AND ANALOG INTEGRATED SENSORS 9

First-order and Second SC Circuits-Bilinear Transformation - Cascade Design-Switched-Capacitor Ladder Filter-Synthesis of Switched-Current Filter- Nyquist rate A/D Converters-Modulators for Over sampled A/D Conversion-First and Second Order and Multibit Sigma-Delta Modulators-Interpolative Modulators –Cascaded Architecture-Decimation Filters ,mechanical,Thermal, Humidity and Magnetic Sensors-Sensor Interfaces.

UNIT IV: DESIGN FOR TESTABILITY AND ANALOG VLSI INTERCONNECTS 9

Fault modeling and Simulation - Testability-Analysis Technique-Ad Hoc Methods and General Guidelines-Scan Techniques-Boundary Scan-Built-in Self Test-Analog Test Buses- Design for Electron -Beam Testability-Physics of Interconnects in VLSI-Scaling of Interconnects-A Model for Estimating Wiring Density-A Configurable Architecture for Prototyping Analog Circuits.

UNIT V: STATISTICAL MODELING AND SIMULATION 9

Review of Statistical Concepts - Statistical Device Modeling- Statistical Circuit Simulation- Automation Analog Circuit Design-automatic Analog Layout-CMOS Transistor Layout- Resistor Layout-Capacitor Layout-Analog Cell Layout-Mixed Analog -Digital Layout.

TOTAL: 45 Hours

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication

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1.	Mohammed Ismail, Terri Fief	Analog VLSI signal and Information Processing	McGraw- Hill	1994
2.	Malcom R.Haskard, Lan C.May	Analog VLSI Design - NMOS and CMOS	Prentice Hall	1998
3.	Randall L Geiger. Phillip E. Allen Noel K.Strader	VLSI Design Techniques for Analog and Digital Circuits	Mc Graw Hill	1990
4.	Jose E.France, Yannis Tsividis	Design of Analog-Digital VLSI Circuits for Telecommunication and signal Processing	Prentice Hall	1994
5.	Philip Allen & D.Holberg	CMOS Analog Circuit Design	Oxford University Press	2002

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4. www.youtube.com/watch?v=4lt_j_Y944o
5. www.youtube.com/watch?v=jC0wMOehKqU

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19VLB04 **SOLID STATE DEVICE MODELING AND SIMULATION** **L T P C**
3 0 0 3

COURSE OBJECTIVES:

- To know the basic semiconductor physics
- To understand the basic concepts bipolar device modeling
- To know the operation of MOSFET modeling.
- To understand the Operation parameter measurement.
- To study the functions characteristics of optoelectronic device modeling
- To study the various parameter measurements

COURSE OUTCOMES:

- Able to know the fundamentals of semiconductor physics.
- Understand BJT modeling.
- Understand and design MOSFET modeling.
- Analyze optoelectronic device modeling methods
- Able to study the functions characteristics of optoelectronic device modeling
- Able to understand various parameter measurements

UNIT I: SEMICONDUCTOR PHYSICS **9**

Quantum Mechanical Concepts, Carrier Concentration, Transport Equation, Band gap, Mobility and Resistivity, Carrier Generation and Recombination, Avalanche Process, Noise Sources-Diodes : Forward and Reverse biased junctions –Reverse bias breakdown – Transient and AC conditions -Static and Dynamic behavior-Small and Large signal models –SPICE model for a Diode –Temperature and Area effects on Diode Model Parameters.

UNIT II:BIPOLAR DEVICE MODELING **9**

Transistor Models: BJT –Transistor Action –Minority carrier distribution and Terminal currents - Switching-Eber -Molls and Gummel Poon Model, SPICE modeling -temperature and area effects.

UNIT III:MOSFET MODELING **9**

OS Transistor –NMOS, PMOS –MOS Device equations -Threshold Voltage –Second order effects -Temperature Short Channel and Narrow Width Effect, Models for Enhancement, Depletion Type MOSFET, CMOS Models in SPICE.

UNIT IV: PARAMETER MEASUREMENT **9**

Bipolar Junction Transistor Parameter –Static Parameter Measurement Techniques – Large signal parameter Measurement Techniques, Gummel Plots, MOSFET: Long and Short Channel Parameters, Measurement of Capacitance.

UNIT V: OPTOELECTRONIC DEVICE MODELING **9**

Static and Dynamic Models, Rate Equations, Numerical Technique, Equivalent Circuits, Modeling of LEDs, Laser Diode and Photo detectors.

TOTAL: 45 Hours

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Ben.G.Streetman	Solid State Devices	Prentice Hall	1997
2.	Giuseppe Massobrio and Paolo Antogentti	Semiconductor Device Modeling with SPICE, Second Edition,	McGraw-Hill Inc, New York	1993
3.	Mohammed Ismail & Terri Fiez	Analog VLSI-Signal & Information Processing 1st Edition	Tata McGraw Hill Publishing Company Ltd	2001

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4.	Roulston E.J.,	Bipolar Semiconductor Devices	Mc-Graw Hill	1990
5.	Tor.A.Fijedly	Introduction to Device Modelling and Circuit Simulation	Wiley-interscience	1997

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4. http:// nptel.ac.in/courses/115102014/downloads/module3.pdf
5. http:// nptel.ac.in/courses/113104012/

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19VLB07 **CAD FOR VLSI CIRCUITS** **L T P C**
3 2 0 4

COURSE OBJECTIVES:

- To introduce the basic CAD algorithm
- To understand the Partitioning
- To study about Placement, Floor Planning
- To learn about Global, Detail routing
- To know the Modeling and synthesis in CAD flow.
- To understand the High level transformations

COURSE OUTCOMES:

- Learn the Fundamentals of basic algorithm in CAD.
- Study the different partitioning algorithm.
- Understand the floor planning and placement algorithm.
- Learn about different routing algorithms.
- Know about modeling and synthesis techniques of CAD.
- Able to analyze the local routing problems

UNIT I: VLSI DESIGN METHODOLOGIES **9**

Introduction to VLSI Design methodologies - Review of Data structures and algorithms - Review of VLSI Design automation tools - Algorithmic Graph Theory and Computational Complexity - Tractable and Intractable problems – general purpose methods for combinatorial optimization.

UNIT II:DESIGN RULES **9**

Layout Compaction - Design rules - problem formulation - algorithms for constraint graph compaction - placement and partitioning - Circuit representation – Placement algorithms – partitioning.

UNIT III:FLOOR PLANNING **9**

Floor planning concepts - shape functions and floor plan sizing - Types of local routing problems - Area routing - channel routing - global routing - algorithms for global routing.

UNIT IV:SIMULATION **9**

Simulation - Gate-level modeling and simulation - Switch-level modeling and simulation - Combinational Logic Synthesis - Binary Decision Diagrams – Two Level Logic Synthesis.

UNIT V:MODELLING AND SYNTHESIS **9**

High level Synthesis - Hardware models - Internal representation - Allocation - assignment and scheduling - Simple scheduling algorithm – Assignment problem - High level transformations.

TOTAL: 45 Hours

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	S.H. Gerez	Algorithms for VLSI Design Automation	John Wiley & Sons	2002
2.	N.A. Sherwani	Algorithms for VLSI Physical Design Automation	Kluwer Academic Publishers	2002
3.	Giovanni De Micheli	Synthesis and Optimization of Digital Circuits	Tata McGraw Hill	1994
4.	M. Sarrafzadeh and C.K. Wong	An Introduction to VLSI Physical Design	McGraw Hill	1996

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5.	Samir Palnitkar	Verilog HDL	Sun Microsystems Press A Prentice Hall Title	2001

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3. http:// nptel.ac.in/courses/Webcourse-contents/IIT.../VLSI%20Design/TOC-l13.html
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19VLB08 **LOW POWER VLSI DESIGN** **L T P C**
3 0 0 3

COURSE OBJECTIVES:

- To understand different sources of power dissipation in CMOS & MIS structure.
- To understand the different types of low power adders and multipliers
- To focus on synthesis of different level low power transforms.
- To gain knowledge on low power static RAM architecture & the source of power dissipation in SRAM
- To understand the various energy recovery techniques used in low power design
- To understand the Special techniques of low power VLSI design

COURSE OUTCOMES:

- An ability to analyze different source of power dissipation and the factors involved in.
- Able to understand the different techniques involved in low power adders and multipliers
- Understandings of the impact of various low power transform
- An ability to identify and analyze the different techniques involved in low power SRAM.
- Able to understand various energy recovery techniques.
- Able to analyze the adders and multipliers

UNIT I: POWER DISSIPATION **9**
Hierarchy of limits of power – Sources of power consumption – Physics of power dissipation in CMOS FET devices – Basic principle of low power design. (Add) Power dissipation in Domino CMOS- Low power VLSI design limits.

UNIT II:POWER OPTIMIZATION **9**
Logic level power optimization – Circuit level low power design – circuit techniques for reducing power consumption in adders and multipliers.

UNIT III:DESIGN OF LOW POWER CIRCUITS **9**
Computer arithmetic techniques for low power system – reducing power consumption in memories – low power clock, Inter connect and layout design – Advanced techniques –Special techniques.

UNIT IV:POWER ESTIMATION **9**
Power Estimation technique – logic power estimation – Simulation power analysis –Probabilistic power analysis, (Add) Modeling of signals- Signal probability calculation.

UNIT V: SYNTHESIS AND SOFTWARE DESIGN **9**
Synthesis for low power – Behavioral level transform – software design for low power overlap and digital correction.

TOTAL: 45 Hours

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Kaushik Roy and S.C.Prasad	Low power CMOS VLSI circuit design	Wiley	2000
2.	Dimitrios Soudris, Christians Pignet, Costas Goutis	Designing CMOS Circuits for Low Power	Kluwer	2002
3.	J.B.Kulo and J.H Lou	J.B.Kulo and J.H Lou	Wiley	1999
4.	A.P.Chandrasekaran and R.W.Broadersen	Low power digital CMOS design	Kluwer	1995

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5.	Gary Yeap	Practical low power digital VLSI design	Kluwer	1998

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3. nptel.ac.in/syllabus/106105034/
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19VLC01 **SIGNAL INTEGRITY FOR HIGH SPEED DEVICES** **L T P C**
3 0 0 3

COURSE OBJECTIVES:

- To learn the fundamental and importance of signal integrity.
- To analyze and minimize cross talk in unbounded conductive media.
- To study about differential signaling
- To study about the different types of Di-Electric materials.
- To learn about differential cross talk and CMOS based transmission line model
- To understand physical transmission line model

COURSE OUTCOMES:

- To learn the fundamental and importance of signal integrity.
- To analyze and minimize cross talk in unbounded conductive media.
- To study about the different types of Di-Electric materials.
- To study about differential signaling
- To learn about differential cross talk and CMOS based transmission line model
- Able to analyze the loosy dielectric and realistic conductors.

UNIT I: FUNDAMENTALS **9**

The importance of signal integrity-new realm of bus design-Electromagnetic fundamentals for signal integrity-maxwell equations common vector operators-wave propagations-Electro statics magneto statics-Power flow and the poynting vector-Reflections of electromagnetic waves.

UNIT II :CROSS TALK **9**

Introduction -mutual inductance and capacitance-coupled wave equation-coupled line analysis modal analysis-cross talk minimization signal propagation in unbounded conductive media-classic conductor model for transmission model.

UNIT III:DI-ELECTRIC MATERIALS **9**

Polarization of Dielectric-Classification of Di electric material-frequency dependent di electric material- Classification of Di electric material fiber-Weave effect-Environmental variation in di electric behaviour Transmission line parameters for loosy dielectric and realistic conductors.

UNIT IV:DIFFERENTIAL SIGNALING **9**

DC operating point and Load line-Q point-Bias Stability, Transistor biasing methods: Fixed bias-Collector to basebias-Self biasing, Bias compensation methods, Thermistor and sensistor compensation techniques, thermalrunaway ,thermal stability, FET biasing methods: Self bias-Source bias-Voltage divider bias-Biasing enhancement and depletion MOSFET.

UNIT V: PHYSICAL TRANSMISSION LINE MODEL **9**

Introduction- non ideal return paths-Vias-IO design consideration-Push-pull transmitter-CMOS receivers-ESSD protection circuits-On chip Termination.

TOTAL: 45 Hours

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Stephen H. Hall, Howard L. Heck	Advanced Signal Integrity for High-Speed Digital Designs	Wiley	2009
2.	James Edgar Buchanan	Signal and power integrity in digital systems: TTL, CMOS, and BiCMOS	Hardcover	1996
3.	Hanqiao Zhang Steven , Krooswyk,Jeffrey Ou	High Speed Digital Design: Design of High Speed Interconnects and Signaling	MK	2015

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4.	Stephen H. Hall Garrett W. Hall James A. McCall	High-Speed Digital System Design: A Handbook of Interconnect Theory and Design Practices	Kindly Edition	2000
5.	Eric Bogatin	Signal and Power Integrity - Simplified (Prentice Hall Modern Semiconductor Design Series)	Kindly Edition	Second Edition 2009

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3. nptel.ac.in/courses/108101089/downloads/Lecture%20notes/Lec2.pdf
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19VLC02 ADVANCED DIGITAL SYSTEM DESIGN

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COURSE OBJECTIVES:

- To understand the concepts of advanced Boolean algebra
- To understand the concepts of threshold logic
- To understand the concepts of symmetric functions
- To understand the concepts of sequential logic circuits.
- To study the concepts of Fault Diagnosis and Testability Algorithms.
- To understand the concept of test generation.

COURSE OUTCOMES:

- To apply knowledge of Boolean algebra to the analysis and design of digital logic circuits.
- To acquire the knowledge of threshold logic
- To acquire the knowledge of symmetric functions.
- To view advanced digital design from a hierarchical viewpoint.
- To acquire the knowledge of testability concepts.
- To analyze the Built-in Self Test.

UNIT I: ADVANCED TOPICS IN BOOLEAN ALGEBRA 9

Shannon's expansion theorem, Consensus theorem, Octal designation, Run measure, INHIBIT / INCLUSION / AOI / Driver / Buffer gates, Gate expander, Reed Muller expansion, Synthesis of multiple output combinational logic circuits by product map method, Design of static hazard free and dynamic hazard free logic circuits.

UNIT II: THRESHOLD LOGIC 9

Linear seperability, Unateness, Physical implementation, Dual comparability, Reduced functions, Various theorems in threshold logic, Synthesis of single gate and muitigate threshold Network.

UNIT III: SYMMETRIC FUNCTIONS 9

Elementary symmetric functions, Partially symmetric and total ly symmetric functions, McCluskey decomposition method, Unity ratio symmetric ratio functions, Synthesis of symmetric function by contact networks.

UNIT IV: SEQUENTIAL LOGIC CIRCUITS 9

Mealy machine, Moore machine, Trivial / Reversible / Isomorphic sequential machines, State diagrams, State table minimization, Incompletely specified sequential machines, State assignments, Design of synchronous and asynchronous sequential logic circuits working in the fundamental mode and pulse mode, Essential hazards Unger's theorem.

UNIT V: FAULT DIAGNOSIS AND TESTABILITY ALGORITHMS 9

Fault Table Method –Path Sensitization Method –Boolean Difference Method –Kohavi Algorithm –Tolerance Techniques –The Compact Algorithm –Fault in PLA –Test Generation –Masking Cycle –Built-in Self Test.

TOTAL: 45 Hours

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Charles H.Roth Jr	Fundamentals of Logic Design	Thomson Learning	2004
2	Nripendra N Biswas	Logic Design Theory	Prentice Hall of India	2001
3	Parag K.Lala	Digital system Design using PLD	B S Publications	2003
4	Lucien Ngalamou	Advanced Digital Systems Design with Rapid Prototyping on FPGAs Using	Springer	2012

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		VHDL		
5	Kuruvilla Varghese	Digital System Design with PLDs and FPGAs	Prentice Hall	2007

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4. extofvideo.nptel.iitm.ac.in/117106092/lec1.pdf
5. youtube.com/watch?v=CL3ups78jrs

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19VLC03 **SUBMICRON VLSI DESIGN** **L T P C**
3 0 0 3

COURSE OBJECTIVES:

- To introduce the concepts of Silicon realization of ASIC
- To introduce the concepts of CMOS devices at deep submicron level.
- To study and apply the deep submicron concepts to CMOS low power devices.
- To study and discuss about RF CMOS transistor sizing
- To study and discuss about RF CMOS transistor sizing limitations.
- To understand the scaling perspectives

COURSE OUTCOMES:

- Able to known the concepts of Silicon realization of ASIC
- Known the concepts of cmos devices at deep submicron level.
- Known the concepts to cmos low power devices.
- Importance of RF CMOS transistor sizing
- RF CMOS transistor sizing limitations.
- Able to analyze the package-Signal propagation

UNIT I: SILICON REALIZATION OF ASIC 9
Introduction-Handcrafted layout implementation-bit-slice layout implementation-Cell based layout implementation-gate array layout implementation - Hierchial design approach-The choice of layout implementation form

UNIT II: LOW POWER DESIGN 9
Sources of CMOS power consumption-technology options for low power-reduction of P-leak by technological measures Reduction of P-dyn by technology measures-reduction of P-dyn by reduced voltage process-design option for low power-computing power Vs chip power-scaling perspectives.

UNIT III : DESIGN FOR RELIABILITY 9
Introduction-latch up in CMOS circuits-Electrostatics discharge-and its protection-Electro migration-Hot carrier degradation design for signal integrity -clock distribution and critical timing issues-clock generation and synchronization in different domain on a chip-the influence of interconnection-design organization.

UNIT IV : DEEP SUB MICRON 9
RF CMOS Transistor downsizing limitations- RFbasic blocks layout implementation Submicron technology and layout dependent effects - input output interfacing, the bonding pad, the pad ring, electrostatic discharge prevention.

UNIT V :CMOS DEVICES 9
Clamp CMOS devices, zener diode-input structure-output structure-pull up-pull down-i/o pad, power clamp-core/pad limitation I/O Pad description using Ibis-Connecting to the package-Signal propagation between integrated circuits.

TOTAL: 45 Hours

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Harry J. M. Veendrick	Deep-Submicron Cmos Ics: From Basics to Asics	Thomson Learning	2004
2.	W. Nebel, Jean P. Mermet	Low Power Design in Deep Submicron Electronics	Prentice Hall of India	2001
3.	P.R.Van Der Meer, Arie van Staveren,	Low-Power Deep Sub-Micron CMOS Logic: Sub-threshold Current Reduction	Prentice Hall of India	2003

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	Arthur H. M. van Roermund			
4.	Philip E. Madrid	Device Design And Process Window Analysis Of A Deep Submicron CMOS VLSI Technology	Springer	2012
5.	Kuruvilla Varghese	Digital System Design with PLDs and FPGAs	Prentice Hall	2007

WEB URLs :

1. nptel.ac.in/courses/117101105/downloads/L1.pdf
2. nptel.ac.in/courses/117101058/downloads/Lec-12.pdf
3. nptel.ac.in/courses/117101105/1
4. nptel.ac.in/courses/117101105/2
5. youtube.com/watch?v=Q3WYZF5wzgU

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Programme Code & Name: RA & B.E-Robotics and Automation

19RAC04 **DIGITAL ELECTRONICS** **L T P C**

3 0 0 3

COURSE OBJECTIVES

- To understand the basic postulates of Boolean algebra and shows the correlation between Boolean expressions
- To impart the knowledge on procedures for the analysis and design of combinational circuits
- To understand the procedures for the analysis and design of sequential circuits
- To understand the principles of synchronous and asynchronous sequential circuits
- To understand the concept of VHDL and programmable logic devices.

COURSE OUTCOMES

19RAC04.CO1 Apply Boolean algebra, K-Map and Tabulation method for simplification of Boolean expression.
19RAC04.CO2 Design combinational logic circuits for various applications.
19RAC04.CO3 Design shift registers, Modulo-N asynchronous and synchronous counters.
19RAC04.CO4 Design and analyze state machines for the given specifications.
19RAC04.CO5 Design Logic Memories and built VHDL Program.

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19RAC04.CO1	X	X	X	-	X	-	-	-	-	-	-	-	X	-	-
19RAC04.CO2	X	X	X	-	X	-	-	-	-	-	-	-	X	X	-
19RAC04.CO3	X	X	X	-	X	-	-	-	-	-	-	-	X	X	-
19RAC04.CO4	X	X	X	-	X	-	-	-	-	-	-	-	X	X	-
19RAC04.CO5	X	X	X	-	X	-	-	-	-	-	-	-	X	X	-

UNIT I: BASIC CONCEPTS OF DIGITAL SYSTEMS AND LOGIC FAMILIES **9**

Review of Number systems, Number Representation, Boolean algebra, Boolean postulates and laws - De-Morgan 's Theorem - Principle of Duality, Simplification using Boolean algebra, Canonical forms - Sum of product and Product of sum - Minimization using Karnaugh map and Tabulation method, Digital Logic Families- TTL, ECL, CMOS

UNIT II: COMBINATIONAL CIRCUITS **9**

Realization of combinational logic using gates, Design of combinational circuits: Adder, Subtractor, Parallel adder Subtractor, carry look ahead adder, Magnitude Comparator, Parity generator and checker, Encoder, Decoder, Multiplexer, De-Multiplexer - Function realization using Multiplexer, Decoder - Code converters

UNITIII: SEQUENTIAL CIRCUITS **9**

Flip-flops - SR, JK, D and T- Master-Slave – Triggering - Characteristic table and equation – Application table – Asynchronous and synchronous counters - Shift registers - Types – Universal shift registers – Ring counter –Johnson Counters- Serial adder / Subtractor.

UNIT IV: SYNCHRONOUS AND ASYNCHRONOUS SEQUENTIAL CIRCUITS **9**

Mealy and Moore models – State diagram - State table – State minimization – State assignment - Excitation table - Design of Synchronous sequential circuits: Counters and Sequence generators- Circuit implementation - Asynchronous sequential circuits - Asynchronous sequential circuits, Hazard free combinational circuits.

UNIT V: PROGRAMMABLE LOGIC DEVICES MEMORY AND VHDL **9**

Memories: ROM, PROM, EPROM, PLA, PLD, FPGA – VHDL Programming: RTL Design – Combinational Logic – Types – Operators – Packages – Sequential Circuits – Sub Programs – Testbenches. (Examples: adders, counters, flip flops, FSM, Multiplexers / De-Multiplexers).

TOTAL: L: 45: = 45

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Programme Code & Name: RA & B.E-Robotics and Automation

19RAC26 **MICRO CONTROLLER LABORATORY** **L T P C**
0 0 2 1

COURSE OBJECTIVES

- To provide knowledge Microcontroller Kits.
- To provide knowledge on interfacing the stepper and D.C motors.
- To provide knowledge on interface the microcomputer port
- To provide knowledge to control the speeds.
- To provide hands-on PLC systems

COURSE OUTCOMES

19RAC26.CO1: Use Microcontroller Kits.
19RAC26.CO2: Interface the stepper and D.C motors.
19RAC26.CO3: Interface the microcomputer port lines, LED relays and LCD displays
19RAC26.CO4: Control the speed using Hydraulic actuators.
19RAC26.CO5: Control the various devices using PLC.

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19RAC27.CO1	X	-	-	X	X	-	-	-	-	-	-	X	X	-	-
19RAC27.CO2	X	-	-	X	X	-	-	-	-	-	-	X	X	X	X
19RAC27.CO3	X	-	-	X	X	-	-	-	-	-	-	X	X	X	X
19RAC27.CO4	X	-	-	X	X	-	-	-	-	-	-	X	X	X	X
19RAC27.CO5	X	-	-	X	X	-	-	-	-	-	-	X	X	-	-

LIST OF EXPERIMENTS

1. Study of Microcontroller Kits.
2. 8051 / 8031 Programming Exercises.
3. Stepper Motor interface.
4. D.C. motor controller interface.
5. Study of interrupt structure of 8051.
6. Interfacing high power devices to microcomputer port lines, LED relays and LCD displays.
7. Linear actuation of hydraulic cylinder with counter and speed control.
8. Hydraulic rotation with timer and speed control.
9. Sequential operation of pneumatic cylinders.
10. Traffic light controller.
11. Speed control of DC motor using PLC.
12. Testing of Relays using PLC.

TOTAL: P: 30: = 30

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19RAC17 POWER ELECTRONICS

L T P C
3 0 0 3

COURSE OBJECTIVES

- To get an overview of different types of power semiconductor devices and their switching characteristics.
- To understand the operation, characteristics and performance parameters of controlled rectifiers
- To study the operation, switching techniques and basics topologies of DC-DC switching regulators.
- To learn the different modulation techniques of pulse width modulated inverters and to understand harmonic reduction methods.
- To study the operation of AC voltage controller and various configurations.

COURSE OUTCOMES

19RAC17.CO1: Explain the working principles of various Power-semi-Conductor Devices
19RAC17.CO2: Understand the various Phase-Controlled Convertors.
19RAC17.CO3: Understand the various principles on DC to DC Converter.
19RAC17.CO4: Understand the various phase changing inverters
19RAC17.CO5: Understand the various principles on AC to AC Converter.

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19RAC17.CO1	X	X	-	X	X	X	-	-	-	-	-	-	X	-	-
19RAC17.CO2	X	X	-	X	X	-	-	-	-	-	-	-	X	X	-
19RAC17.CO3	X	X	-	X	X	-	-	-	-	-	-	-	X	X	-
19RAC17.CO4	X	X	-	X	X	-	-	-	-	-	-	-	X	X	-
19RAC17.CO5	X	X	-	X	X	-	-	-	-	-	-	-	X	-	-

UNIT I : POWERSEMI-CONDUCTOR DEVICES 9

Study of switching devices, Diode, SCR, TRIAC, GTO, BJT, MOSFET, IGBT-Static and Dynamic characteristics - Triggering and commutation circuit for SCR- Design of Driver and snubber circuit.

UNIT II: PHASE-CONTROLLED CONVERTERS 9

2- pulse,3-pulse and 6-pulseconverters– performance parameters –Effect of source inductance— Gate Circuit Schemes for Phase Control–Dual converters.

UNIT III: DC TO DC CONVERTER 9

Step-down and step-up chopper-control strategy–Forced commutated chopper–Voltage commutated, Current commutated, Load commutated, Switched mode regulators- Buck, boost, buck- boost converter, Introduction to Resonant Converters.

UNIT IV: INVERTERS 9

Single phase and three phase voltage source inverters(both 120^0 modeand 180^0 mode)–Voltage& harmonic control--PWM techniques: Sinusoidal PWM, modified sinusoidal PWM - multiple PWM – Introduction to space vector modulation –Current source inverter.

UNIT V: AC TO AC CONVERTERS 9

Single phase and Three phase AC voltage controllers–Control strategy- Power Factor Control – Multistage sequence control -single phase and three phase cyclo converters - Introduction to Matrix converters.

TOTAL: L: 45 = 45

TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	M.H.Rashid	Power Electronics: Circuits, Devices and Applications	Pearson Education, 3rd Edition New Delhi,	2004
2.	P.S.Bimbra	Power Electronics	Khanna Publishers	2003

REFERENCES:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	L. Umanand	Power Electronics Essentials and Applications	Wiley	2010

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2.	Daniel.W.Hart	Power Electronics	Indian Edition Mc Graw Hill	2013
3.	M.D. Singh and K.B. Khanchandani	Power Electronics	Mc Graw Hill India	2013
4.	Joseph Vithayathil	Power Electronics, Principles and Applications	McGraw Hill Series	2013
5.	Philip T. Krein	Elements of Power Electronics	Oxford University Press	2004

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Programme Code & Name: RA & B.E-Robotics and Automation

19RAC19 **PRINCIPLES OF ROBOTICS** **L T P C**
3 0 0 3

COURSE OBJECTIVES:

- To introduce the functional elements of Robotics
- To impart knowledge on the direct and inverse kinematics
- To introduce the manipulator differential motion and control
- To educate on various path planning techniques
- To introduce the dynamics and control of manipulators

COURSE OUTCOMES:

19RAC19.CO1: Understand basic concept of robotics.
19RAC19.CO1: Analyze Instrumentation systems and their applications to various
19RAC19.CO1: Explain differential motion add statics in robotics
19RAC19.CO1: Understand about the various path planning techniques.
19RAC19.CO1: Explain dynamics and control in robotics industries.

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19RAC19.CO1	X	X	X	X	X	-	-	-	-	-	-	-	X	X	X
19RAC19.CO2	X	X	X	X	X	-	-	-	-	-	-	-	X	X	X
19RAC19.CO3	X	X	X	X	X	-	-	-	-	-	-	-	X	X	X
19RAC19.CO4	X	X	X	X	X	-	-	-	-	-	-	-	X	X	X
19RAC19.CO5	X	X	X	X	X	-	-	-	-	-	-	-	X	X	X

UNIT I: BASIC CONCEPTS **9**

Brief history-Types of Robot–Technology-Robot classifications and specifications-Design and Control issues- Various manipulators – Sensors - work cell - Programming languages.

UNIT II: DIRECT AND INVERSE KINEMATICS **9**

Mathematical representation of Robots - Position and orientation – Homogeneous transformation Various joints-Representation using the Denavit Hattenberg parameters -Degrees of freedom-Direct kinematics-Inverse kinematics-SCARA robots- Solvability – Solution methods-Closed form solution.

UNIT III: MANIPULATOR DIFFERENTIAL MOTION AND STATICS **9**

Linear and angular velocities-Manipulator Jacobian-Prismatic and rotary joints–Inverse -Wrist and arm singularity - Static analysis – Force and moment Balance.

UNIT IV: PATH PLANNING **9**

Definition-Joint space technique-Use of p-degree polynomial-Cubic polynomial-Cartesian space technique - Parametric descriptions - Straight line and circular paths - Position and orientation planning.

UNIT V: DYNAMICS AND CONTROL **9**

Lagrangian mechanics-2DOF Manipulator-Lagrange Euler formulation-Dynamic model – Manipulator control problem-Linear control schemes-PID control scheme-Force control of robotic manipulator.

TOTAL: L: 45 = 45

TEXT BOOKS:

Sl. No.	Author(s)	Title of the Book	Publisher	Year of Publication
1	R.K.Mittal and I.J.Nagrath	Robotics and Control	Tata McGraw Hill, New Delhi,4th Reprint	2005
2	JohnJ.Craig	Introduction to Robotics Mechanics and Control	Third edition, Pearson Education,	2009.

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REFERENCES:

Sl. No.	Author(s)	Title of the Book	Publisher	Year of Publication
1	Ashitava Ghoshal	Robotics-Fundamental Concepts and Analysis	Oxford University Press, Sixth impression	2010
2	K. K.Appu Kuttan	Robotics	I K International	2007
3	Edwin Wise	Applied Robotics	Cengage Learning	2003
4	R.D.Klafter,T.A.Chimielewski and M.Negin	Robotic Engineering–An Integrated Approach	Prentice Hall of India, New Delhi	1994
5	S.Ghoshal	Embedded Systems & Robotics Projects using the 8051 Microcontroller	Cengage Learning	2009

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1.	Regional Institute of English	English for Engineers.	Cambridge University Press, New Delhi.	2006
2	Mindscapes	English For Technologists and Engineers	Department of English, Anna University, Chennai,	2012
3	Rutherford, Andrea.	J Basic Communication Skills for Technology	Pearson, New Delhi.	2001
4	Viswamohan, Aysha.	English for Technical Communication.	Tata McGraw-Hill, New Delhi.	2008
5	Raman, Meenakshi & Sangeetha Sharma.	Technical Communication: Principles and Practice. Oxford University	Press, New Delhi.	2011

19HSS05 COMMUNICATIVE ENGLISH FOR ENGINEERS **L T P C**
2 0 0 2

COURSE OBJECTIVES

- To understand the importance of listening and speaking in language acquisition process
- To engage in conversation intelligibly
- To use English accurately, appropriately and fluently in different situations (academic, social and professional) and familiarize themselves with all speech sounds in English
- To write academic, communicative and creative pieces of writing
- To devise different tasks / methods to enhance their learners' communication skills

COURSE OUTCOMES

- Speak clearly, confidently, comprehensibly, and communicate with one or many listeners using appropriate communicative strategies.
- Write cohesively and coherently and flawlessly avoiding grammatical errors, using a wide vocabulary range, organizing their ideas logically on a topic.
- Read different genres of texts adopting various reading strategies.
- listen/view and comprehend different spoken discourses/excerpts in different accents
- Communicate with others confidently

UNIT I GRAMMAR & VOCABULARY **6**

Phrases & Clauses- Kinds of Sentences - Types of sentences and sentence patterns – GRE Vocabulary - Word Formation- Error Spotting- Sentence Correction- Word Analogy- Idioms and Phrases- Direct and Indirect Speech- 'If' Conditionals

UNIT II LISTENING **6**

Listening processes: top-down and bottom-up skills - Listening strategies - Sounds of English: Consonants, vowels and diphthongs - Phonemic transcription, tongue twisters, words often mispronounced - Word stress and sentence stress: content words, structural words, strong forms, weak forms - Intonation patterns - Language functions : [Inviting-accepting/declining invitation - Offering /accepting/ refusing help - Thanking/ responding to thanks - Congratulating , Complimenting - Apologizing/ accepting an apology

UNIT III SPEAKING **6**

Greeting - Introducing Oneself -Invitation - Making Request - Expressing Gratitude - Complimenting and Congratulating - Expressing Sympathy - Apologizing - Asking for Information - Seeking Permission - Complaining and Expressing Regret - Using English in Real Life Situation [At the

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Bank/ post office/ College office - At the Green Grocer - At the Temple - At the College Canteen or Restaurant - At the Police station - At the Railway Station/ Bus Station - At the Medical Shop - At the Library

6

UNIT IV READING

Importance of Reading - Why develop reading habits among students and How - Reading techniques [Skimming , Scanning , Intensive reading , Extensive] Reading different text types [Menu ,Email , Letters , Cartoons , Advertisements, Recipe , Articles , Literary texts – stories, plays, poems, Biographies] – identifying lexical and Contextual meaning- Understanding Discourse Coherence – sequencing of sentences

6

UNIT V WRITING

Developing Proficiency in Writing - Writing for communicative purposes [Letters – official and personal , Messages / Notices, Reports , Emails , Advertisements ,Application for a job (covering letter and CV) - Creative Writing (Stories, Poems , Dialogues)

TOTAL HOURS: 30

TEXT BOOKS:

Sl. No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Raman, Meenakshi & Sangeetha Sharma.	Technical Communication: Principles and Practice.	Oxford University Press, New Delhi.	2011
2	Rizvi, Ashraf. M	Effective Technical Communication.	Tata McGraw-Hill New Delhi.	2005

REFERENCE BOOKS:

Sl. No	Author(s)	Title of the Book	Publisher	Year of Publication
1	Regional Institute of English	English for Engineers. Cambridge University Press	New Delhi.	2006.
2	Dr.Gunasekaran, Vishu "	Technical English Work Book.	Vishnu "Print Media, Krishna Publications	2011
3	Rutherford, Andrea.	J Basic Communication Skills for Technology.	Pearson, New Delhi.	2001
4	Viswamohan, Aysha.	English for Technical Communication.	Tata McGraw-Hill. New Delhi.	2008
5	Raman, Meenakshi & Sangeetha Sharma.	Technical Communication: Principles and Practice.	Oxford University Press, New Delhi	2011

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		L	T	P	C
19GES26	ENGINEERING DRAWING	1	0	3	3

COURSE OBJECTIVES

- To construct various curves in engineering applications.
- To draw the projection of three dimensional objects representing machine structure.
- To analyze the principles of projection of various planes by different angle to project points, lines and planes.
- To draw the projection of simple solid when axis is inclined to one reference plane by change of position method.
- To identify the interior components of machinery (or) buildings by sectioning the solid, and to study the development of simple solids for fabrication of sheet metals.
- To transform the manual drawings to CAD drawings.

COURSE OUTCOMES

- Construct various curves in engineering applications.
- Draw the projection of three dimensional objects representing machine structure.
- Analyze the principles of projection of various planes by different angle to project points, lines and planes.
- Draw the projection of simple solid when axis is inclined to one reference plane by change of position method.
- Identify the interior components of machinery (or) buildings by sectioning the solid, and to study the development of simple solids for fabrication of sheet metals.
- Transform the manual drawings to CAD drawings.

CONCEPTS AND CONVENTIONS (Not for Examination) 4

Importance of graphics in engineering applications, Use of drafting instrument, BIS conventions and specifications - Size, layout and folding of drawing sheets, Lettering and dimensioning.

COMPUTER AIDED DRAFTING (Not for Examination) 6

Importance 2d Drafting, sketching, modifying, transforming and dimensioning.

UNIT I: PLANE CURVES 13

Curves used in engineering practices, Conics, Construction of ellipse, Parabola and hyperbola by eccentricity method, Construction of cycloid, construction of involutes of square and circle, Drawing of tangents and normal to the above curves.

UNIT II: ISOMETRIC TO ORTHOGRAPHIC VIEWS 13

Representation of three dimensional objects, General Principles of Orthographic projection, Need for importance of multiple views and their placement, First angle projection, layout of views, Developing visualization skills through free hand sketching of multiple views from pictorial views of objects.

UNIT III: PROJECTION OF POINTS, LINES AND PLANE 13

(Free hand sketching) Projection of points, Projection of straight lines located in the first quadrant, Determination of true lengths and true inclinations, Projection of polygonal surface and circular lamina inclined to both reference planes.

UNIT IV: PROJECTION OF SOLIDS 13

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(Free hand sketching) Projection of simple solids like prisms, pyramids, cylinder and cone when the axis is inclined to one reference plane by change of position method.

UNIT V SECTION OF SOLIDS AND DEVELOPMENT OF SURFACES **13**

(Free hand sketching) Sectioning of simple solids like prisms, pyramids, cylinder and cone in simple vertical position by cutting planes inclined to one reference plane and perpendicular to the other, (Obtaining true shape of section is not required). Development of lateral surfaces of simple and truncated solids, Prisms, pyramids, cylinders and cones.

TOTAL: L: 15 + P: 60 = 7

TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Natrajan K.V	A text book of Engineering Graphics	Dhanalakshmi Publishers, Chennai	2015
2.	Basant Agrawal and C.M. Agrawal	Engineering Drawing	McGraw Hill Education; Second edition	2013

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Gopalakrishnan K.R	Engineering Drawing (Vol. I&II combined)	Subhas Stores Bangalore	2007
2	Luzzader, Warren.J. and Duff,John M	Fundamentals of Engineering Drawing with an introduction to Interactive Computer Graphics for Design and Production	Eastern Economy Edition, Prentice Hall of India Pvt. Ltd, New Delhi	2005
3	Shah M.B., and Rana B.C	Engineering Drawing	Pearson, 2nd Edition	2009
4	Venugopal K. and Prabhu Raja V	Engineering Graphics	New Age International (P) Limited	2008
5	Bhatt N.D. and Panchal V.M	Engineering Drawing	Charotar Publishing House, 50th Edition	2010

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19GES27	ENGINEERING GEOLOGY	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To impart the concepts of geological agents and their processes.
- To provide knowledge on various properties of minerals and their engineering significance.
- To give knowledge on various classifications of rocks.
- To understand the importance of geological investigations and mapping.
- To understand the applications of geological surveys in civil engineering structures.
- To give knowledge on various minerals.

COURSE OUTCOMES

- Understand the application of geology knowledge to Civil Engineering construction.
- Understand the concepts of various geological materials.
- Understand the properties, behaviour and engineering significance of different type of rocks and minerals.
- Learned the interpretation skills of geological maps having different type of geological features.
- Learned consideration and importance of geological aspects in civil engineering related infrastructure projects.
- Understand the concepts of various weathering processes.

UNIT I : PHYSICAL GEOLOGY 9

Role of Geology in civil engineering – Branches of geology – Earth structures and composition – Elementary knowledge on continental drift and plate tectonics – Earth processes – weathering – soils – Geological work of river, wind and sea – Engineering importance – Earthquake belts in India – Ground water – Mode of occurrence –Prospecting .

UNIT II : MINEROLOGY 9

Elementary knowledge on symmetry elements of important crystallographic systems – Physical properties of minerals – Study of the rock forming minerals – Quartz family – Feldspar family – Mica – Pyroxene family minerals – Fundamentals of process of formation of ore minerals – Properties, behaviour and engineering significance of clay minerals – Coal and petroleum – Their origin and occurrence in India.

UNIT III : PETROLOGY 9

Classification of rocks – Distinction between igneous, sedimentary and metamorphic rocks – Occurrence, Engineering properties and distribution – Igneous rocks – Granite, syenite, diorite, gabbro, pegmatite, dolerite and basalt – sedimentary rocks – Sandstone, limestone, shale, conglomerate and breccias – Metamorphic rocks –Quartzite, marble, slate, phyllite, gneiss and schist.

UNIT IV : STRUCTURAL GEOLOGY AND MAP 9

Attitude of beds – Outcrops – Contours – Introduction to geological maps – Folds – Faults and joints – Their bearing on engineering construction – Seismic and electrical methods for civil engineering investigations. Study of structures.

UNIT V : GEOLOGICAL INVESTIGATION 9

Remote sensing for civil engineering applications; Geological conditions necessary for design and construction of Dams, Reservoirs, Tunnels, and Road cuttings. Causes and preventions – Sea erosion and Coastal protection.

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TOTAL: (L:45):45

EXT BOOKS:

Sl. No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Parbin Singh.	A Text book of Engineering and General Geology	Katson publishing house, Ludhiana.	2010
2	Varghese, P.C	Engineering Geology for Civil Engineering	PHI Learning Private Limited, New Delhi	2012

REFERENCE BOOKS:

Sl. No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Muthiayya, V.D	A Text of Geology	Oxford IBH Publications, Calcutta.	2010
2	Blyth F.G.H. and De Freitas M.H	Geology for Engineers	Edward Arnold, London	2010
3	F.G.Bell.	Fundamentals of Engineering Geology	B.S. Publications. Hyderabad	2011
4	Dobrin, M.B	An introduction to geophysical prospecting	McGraw0Hill, New Delhi	2010
5	KVGK Gokhale	Principles of Engineering Geology	BS Publications, Hyderabad	2011

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Programme Code & Name: RA & B.E-Robotics and Automation

19RAC03 **MANUFACTURING TECHNOLOGY** **L T P C**
3 0 0 3

COURSE OBJECTIVES

- To impart knowledge on the concepts and basic mechanism of metal cutting.
- To understand the constructional features and working principle of centre lathe, and special purpose lathes.
- To familiarize the working principle of various machining operations such as milling, shaping, planning, slotting, drilling and broaching.
- To understand the various abrasive processes.
- To understand the concepts of computer numerical control (CNC) machine tool and CNC programming

COURSE OUTCOMES

19RAC03.CO1 Analysis the metal cutting tool parameters for various machine tool working conditions.
19RAC03.CO1 Suggest the suitable Lathe machine and its operations for various engineering applications.
19RAC03.CO1 Suggest the suitable shaper and milling machines and its operations for making gears.
19RAC03.CO1 Select the suitable machine operation in grinding and broaching machine tool for engineering applications.
19RAC03.CO1 Write the various CNC part programming produce the engineering components.

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19RAC03.CO1	X	X	X	-	-	X	-	-	-	-	-	X	-	-	X
19RAC03.CO2	X	X	-	X	X	X	-	-	-	-	-	X	-	-	X
19RAC03.CO3	X	-	X	X	X	-	-	-	-	-	-	X	-	-	X
19RAC03.CO4	X	X	-	-	-	-	-	-	-	-	-	X	-	-	X
19RAC03.CO5	X	X	-	-	-	-	-	-	-	-	-	X	-	-	X

UNIT I: THEORY OF METAL CUTTING 9

Mechanics of chip formation, single point cutting tool, forces in machining, Types of chip, cutting tools– nomenclature, orthogonal metal cutting, thermal aspects, cutting tool materials, tool wear, tool life, surface finish, cutting fluids and Machinability.

UNIT II: TURNING MACHINES 9

Centre lathe, constructional features, specification, operations – taper turning methods, thread cutting methods, special attachments, machining time and power estimation. Capstan and turret lathes- tool layout – automatic lathes: semi-automatic – single spindle: Swiss type, automatic screw type – multi spindle

UNITIII: SHAPER, MILLING AND GEAR CUTTING MACHINES 9

Shaper - Types of operations. Drilling, reaming, boring, Tapping. Milling operations-types of milling cutter. Gear cutting – forming and generation principle and construction of gear milling, hobbling and gear shaping processes – finishing of gears.

UNIT IV: ABRASIVE PROCESS AND BROACHING 9

Abrasive processes: grinding wheel – specifications and selection, types of grinding process– cylindrical grinding, surface grinding, centerless grinding and internal grinding- Typical applications – concepts of surface integrity, broaching machines: broach construction – push, pull, surface and continuous broaching machines

UNIT V: CNC MACHINING 9

Numerical Control (NC) machine tools – CNC types, constructional details, special features, machining center, part programming fundamentals CNC – manual part programming – micromachining – wafer machining

TOTAL: L: 45: = 45

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TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Hajra Choudhury	Elements of Workshop Technology	Media Promoters	2008
2	Rao. P. N	Manufacturing Technology - Metal Cutting and Machine Tools	Tata McGraw-Hill	2013

REFERENCE BOOKS:

S. No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Richerd R Kibbe, John E. Neely, Roland O. Merges and Warren J.White	Machine Tool Practices	Prentice Hall of India	2010
2	Jain.R.K	Production Technology: Manufacturing Processes, Technology and Automation	Khanna Publishers	2011
3	GeofreyBoothroyd	Fundamentals of Metal Machining and Machine Tools	McGraw Hill	2007
4	Roy. A.Lindberg	Manufacturing Technology - Metal Cutting and Machine Tools	PHI/Pearson Education	2006
5	Dr. B. Kumar	Manufacturing Technology	Khanna Publishers	2009

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19RAC06 MANUFACTURING TECHNOLOGY LABORATORY

L T P C
0 0 2 1

COURSE OBJECTIVES

- To train to operate the Lathe machine tool.
- To train to make the simple engineering components using Milling machine tool.
- To train to make the gears using Milling/ Gear Hobbing/ Gear Shaping machine tools.
- To train to make the simple engineering components using various grinding machine tools.
- To train to measure the cutting force on the Milling / Turning machine tools.

COURSE OUTCOMES

19RAC06.CO1 Make the simple components using Lathe Machine tool.
19RAC06.CO2 Make the simple components using Milling machine tool
19RAC06.CO3 Make the various Gear using Milling/ Gear Hobbing/ Gear Shaping machine tools.
19RAC06.CO4 Make the simple engineering components using different Grinding machine tools.
19RAC06.CO5 Analysis the various cutting forces in the Milling / Turning machine tools.

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19RAC06.CO1	-	-	-	X	-	-	-	-	-	-	-	X	-	-	X
19RAC06.CO2	-	-	-	X	-	-	-	-	-	-	-	X	-	-	X
19RAC06.CO3	-	-	-	X	-	-	-	-	-	-	-	X	-	-	X
19RAC06.CO4	-	-	-	X	-	-	-	-	-	-	-	X	-	-	X
19RAC06.CO5	-	-	-	X	-	-	-	-	-	-	-	X	-	-	X

LIST OF EXPERIMENTS

1. Eccentric Turning, Thread Cutting
2. Contour milling using vertical milling machine
3. Spur gear cutting in milling machine
4. Helical Gear Cutting in hobbing machine
5. Gear generation in hobbing machine
6. Gear generation in gear shaping machine
7. Plain Surface grinding
8. Cylindrical grinding
9. Tool angle grinding with tool and Cutter Grinder
10. Centreless grinding
11. Measurement of cutting forces in Milling / Turning Process

TOTAL: P : 30= 30

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UNIT – IV ALGEBRAIC STRUCTURES 9+3

Algebraic systems-Semi groups and monoids-Groups-Subgroups and homomorphisms- Cosets and Lagrange's
Theorem - Ring & Fields (Definitions and examples)

UNIT – V LATTICES AND BOOLEAN ALGEBRA 9+3

Partial ordering-Posets-Lattices as Posets- Properties of lattices-Lattices as Algebraic systems –Sub lattices –direct product and Homomorphism-Some Special lattices- Boolean Algebra

TOTAL: 45 + 15

TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Narsingh Deo	Graph Theory with Applications to Engineering and Computer Science, Reprint edition	Dover Publications Inc.	2016
2.	Tremblay J.P, Manohar R	Discrete Mathematical Structures with application to computer science,30th Reprint	Tata Mc Graw Hill Pub.Co.Ltd,New Delhi,	2011

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Bernard Kolman , Robert C.Busby, Sharan Culter Ross	Discrete Mathematical Structures, 6th Edition	Pearson Education Pvt Ltd. ,New Delhi	2015
2.	Richard Johnsonbaugh	Discrete Mathematics , 7th Edition	Pearson Education Asia, New Delhi	2014
3.	Seymour Lipschutz, Mark Lipson, Varsha H. Patil	Discrete Mathematics Schaum's Outlines , Revised 3rd Edition	Mc Graw Hil Pub.Co.Ltd.,New Delhi	2013
4.	Ralph. P.Grimaldi	Discrete and combinatorial Mathematics : An Applied Introduction, 5th Edition	Pearson Education Asia,Delhi	2012
5.	Kenneth H. Rosen	Discrete Mathematics and its Applications, 7th Edition	Tata Mc Graw Hill Pub . co.Ltd.,New Delhi,Special Indian Edition	2011

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19RAC18 **DESIGN OF MACHINE ELEMENTS** **L T P C**
3 0 0 3

(Use of approved Design Data book is permitted)

COURSE OBJECTIVES

- To select the materials based on mechanical properties, different types of loading, simple, steady and variable stresses.
- To know the design procedure for various types of shafts, keys and couplings.
- To design the threaded fasteners, bolted joints including eccentric loading and welded joints for pressure vessels and structures.
- To design the various types of springs like helical, leaf, disc and torsional springs.
- To state the design procedure for various types of bearings and flywheel

COURSE OUTCOMES

19RAC18.CO1: Select the materials based on mechanical properties, different types of loading and introduction about simple, steady and variable stresses.
19RAC18.CO2: Know the design procedure for various types of shafts, keys and couplings.
19RAC18.CO3: Design the threaded fasteners, bolted joints including eccentric loading and welded joints for pressure vessels and structures.
19RAC18.CO4: Design the various types of springs like helical, leaf, disc and torsional springs.
19RAC18.CO5: Design various types of bearings like sliding contact, rolling contact bearing and flywheels.

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19RAC18.CO1	X	X	-	-	-	X	-	-	-	-	-	-	X	-	-
19RAC18.CO2	X	X	X	-	-	X	-	-	-	-	-	-	X	-	-
19RAC18.CO3	X	-	X	-	-	X	-	-	-	-	-	-	X	-	-
19RAC18.CO4	X	X	X	-	-	X	-	-	-	-	-	-	X	-	-
19RAC18.CO5	X	-	X	-	-	X	-	-	-	-	-	-	X	-	-

UNIT I: STEADY AND VARIABLE STRESSES 9

Introduction to the design process - factor influencing machine design, selection of materials based on mechanical properties, preferred numbers – direct, bending and torsional stress equations – calculation of principle stresses for various load combinations, eccentric loading – design of curved beams – crane hook and 'c' frame - factor of safety - theories of failure – stress concentration – design for variable loading – Soderberg, Goodman and Gerber relations.

UNIT II: DESIGN OF SHAFTS AND COUPLINGS 9

Design of Solid And Hollow Shafts Based on Strength And Rigidity – Design Of Keys - Design Of Rigid And Flexible Couplings.

UNIT III: DESIGN OF FASTNERS AND WELDED JOINTS 9

Threaded fasteners - design of bolted joints including eccentric loading – design of welded joints for structures.

UNIT IV: DESIGN OF SPRINGS 9

Design of helical, leaf and torsional springs under constant loads and varying loads – concentric torsion springs - belleville springs introduction to modern spring like wave spring, constant force spring (theory only).

UNIT V: DESIGN OF BEARINGS AND FLYWHEELS 9

Design of bearings – sliding contact and rolling contact types. – cubic mean load – design of journal bearings – mckees equation – lubrication in journal bearings – calculation of bearing dimensions – design of flywheels involving stresses in rim and arm.

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TEXT BOOKS

Sl. No.	Author(s)	Title of the Book	Publisher	Year of Publication
1	Richard G Budynas J.Keith Nisbett	Shigley's Mechanical Engineering Design	Mc Graw Hill	2011
2	Khurmi R.S, Gupta J.K	Machine Design	Eurasia publishing house	2005

REFERENCE BOOKS

Sl. No.	Author(s)	Title of the Book	Publisher	Year of Publication
1	Norton R.L	Design of Machinery	Tata McGraw-hill book co	2002
2	Orthwein W	Machine Component Design	Jaico Publishing co	2003
3	Ugural A.C	Mechanical Design – An Integral Approach	Mcgraw-hill book co	2004
4	Spotts M.F., Shoup T.E	Design and Machine Elements	Pearson Education	2004
5	V B Bhandari	Design of Machine Elements	Tata Mcgraw-hill.	2007

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19RAC23 **MICROCONTROLLER AND PLC** **L T P C**
3 0 0 3

COURSE OBJECTIVES:

- To impart basics of varies microcontrollers.
- To impart the knowledge on 8051 microcontrollers Programme.
- To impart the knowledge on interfacing various microcontrollers.
- To impart the knowledge on PLC.
- To impart the knowledge on Applications of various PLC.

COURSE OUTCOMES

19RAC23.CO1: Familiarize varies microcontrollers.
19RAC23.CO2: Write the 8051 microcontrollers Programme.
19RAC23.CO3: Interface various microcontrollers.
19RAC23.CO4: Explain various PLC systems.
19RAC23.CO5: Illustrate the various applications of PLC.

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19RAC23.CO1	X	-	-	X	X	X	-	-	-	-	-	X	X	-	-
19RAC23.CO2	X	-	-	X	X	-	-	-	-	-	-	X	X	X	-
19RAC23.CO3	X	-	-	X	X	-	-	-	-	-	-	X	X	X	-
19RAC23.CO4	X	-	-	X	X	-	-	-	-	-	-	X	X	X	-
19RAC23.CO5	X	-	-	X	X	-	-	-	-	-	-	X	X	-	-

UNIT I: INTRODUCTION TO MICROCONTROLLER **9**

8051 Architecture: – Memory map - Addressing modes, I/O Ports –Counters and Timers – Serial data - I/O – Interrupts –Instruction set, Data transfer instructions, Arithmetic and Logical Instructions, Jump and Call Instructions, Assembly Language Programming tools.

UNIT II: MICROCONTROLLER PROGRAMMING **9**

8051 Assembly Language Programming- Block transfer, arithmetic operations, Code conversion, Time delay generation, Interrupt programming, Lookup table techniques

UNIT III: MICROCONTROLLER APPLICATIONS **8**

Interfacing of Keyboards – Interfacing of Display Devices – Pulse measurement – Analog to Digital and Digital to Analog Converter – Interfacing Hardware Circuit – Serial Data Communication – Network Configuration.

UNIT IV: PROGRAMMABLE LOGIC CONTROLLERS **9**

Introduction — Principles of operation – PLC Architecture and specifications – PLC hardware components Analog & digital I/O modules, CPU & memory module – Programming devices – PLC ladder diagram, Converting simple relay ladder diagram in to PLC relay ladder diagram. PLC programming Simple instructions – Manually operated switches – Mechanically operated a Proximity switches - Latching relays,

UNIT V: APPLICATIONS OF PROGRAMMABLE LOGIC CONTROLLERS. **9**

Timer instructions - On delay, Off delay, Cyclic and Retentive timers, Up /Down Counters, control instructions – Data manipulating instructions, math instructions; Applications of PLC – Simple materials handling applications, Automatic control of warehouse door, Automatic lubrication of supplier Conveyor belt, motor control, Automatic car washing machine, Bottle label detection and process control application.

TOTAL: L: 45: = 45

TEXT BOOKS:

Sl. No.	Author(s)	Title of the Book	Publisher	Year of Publication
1	Muhammad Ali Mazdi, J.G.Mazdi & R.D.McKinlay	The 8051 Microcontroller& Embedded systems Using assembly & C	2nd Edition Pearson Education	2006
2	Udayasankara.v & Mallikarjunaswamy .M.S	8051 Microcontroller, Hardware, Software & Applications	Tata McGraw Hill Education Pvt Limited. New Delhi	2009

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3	Gary Dunning	Introduction to Programmable Logic Controllers	Thomson Learning	2001

REFERENCES:

Sl. No.	Author(s)	Title of the Book	Publisher	Year of Publication
1	Singh. B.P	Microprocessors and Microcontrollers	Galcotia Publications (P) Ltd, First edition, New Delhi	1997
2	Parr	Programmable Controllers: An Engineers Guide	3rd Edition, Elsevier, Indian Reprint	2013
3	Valdes-Perez	Microcontrollers: Fundamentals and Applications with PIC	Taylor & Francis, Indian Reprint	2013
4	Bolton	Programmable Logic Controllers	5th Edition Newnes	2009

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Biomass direct combustion – Biomass gasifiers – Biogas plants – Digesters – Ethanol production – Bio diesel – Cogeneration - Biomass Applications.

UNIT V: OTHER RENEWABLE ENERGY SOURCES 9

Tidal energy – Wave Energy – Open and Closed OTEC Cycles – Small Hydro-Geothermal Energy Hydrogen and Storage - Fuel Cell Systems – Hybrid Systems.

TOTAL: L: 45 Hours

TEXT BOOKS:

Sl. No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	G.D. Rai	Non Conventional Energy Sources,	Khanna Publishers, New Delhi,	2011.
2.	Twidell, J.W. & Weir	A., Renewable Energy Sources	EFN Spon Ltd., UK,	2006

REFERENCE BOOKS:

Sl. No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	David M. Mousdale	Introduction to Biofuels,	CRC Press Taylor & Francis Group, USA	2010
2.	Chetan Singh Solanki	Solar Photovoltaic, Fundamentals, Technologies and Applications,	PHI Learning Private Limited, New Delhi	2009
3.	S.P. Sukhatme	Solar Energy	Tata McGraw Hill Publishing Company Ltd., New Delhi,	1997.
4.	Sinduja S	Renewable Energy Sources	Anuradha Publications	2012
5.	Tasneem abbasi and T.A Abbasi	Renewable Energy Sources: Their Impact on Global Warming and Pollution	Prentice Hall India Learning Private Limited	2010

19GES21 ELECTRICAL DRIVES AND CONTROLS **L T P C**
3 0 0 3

COURSE OBJECTIVES

- To understand the basics of electrical drives.
- To study the drive motor characteristics,
- To study the different methods of starting D.C motors and Induction Motors.
- To study the Conventional and Solid-State DC Drives.

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19CAC10 **NETWORK PROGRAMMING AND SECURITY** **L T P C**
3 0 0 3

COURSE OBJECTIVES:

- To understand the basics of Network Programming
- To be familiar with building network applications
- To design and implement client server Applications using TCP and UDP Sockets
- To expose with various socket options
- To get aware of Network security for Network Programming

COURSE OUTCOMES:

19CAC10.CO1 : Design and implement the client/server programs using variety of protocols
19CAC10.CO2 : Understand the key protocols which support Internet
19CAC10.CO3 : Demonstrate advanced knowledge of programming interfaces for network communication
19CAC10.CO4 : Use the basic tools for design and testing of network programs in Unix environment
19CAC10.CO5 : Identify some of the factors driving the need for network security

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19CAC10.CO1	x	x	x	-	-	-	-	-	-	x	-	x	x	-	-
19CAC10.CO2	x	x	x	-	-	x	-	-	x	x	-	x	x	-	-
19CAC10.CO3	x	x	x	-	-	x	-	-	x	x	-	x	x	-	-
19CAC10.CO4	x	x	x	-	-	x	-	-	x	x	-	x	x	-	-
19CAC10.CO5	x	x	x	-	-	x	-	-	x	x	-	x	x	-	-

UNIT I INTRODUCTION 9

TCP/IP Layer Model – Multicast, broadcast and Any cast - Socket address Structures – Byte ordering functions – address conversion functions – Elementary TCP Sockets – socket, connect, bind, listen, accept, read, write , close functions – Iterative Server – Concurrent Server.

UNIT II ELEMENTARY TCP SOCKETS 9

TCP Echo Server – TCP Echo Client – Posix Signal handling – Server with multiple clients –boundary conditions: Server process Crashes, Server host Crashes, Server Crashes andreboots, Server Shutdown.

UNIT III SOCKET OPTIONS AND MULTIPLEXING 9

Socket options – getsocket and setsocket functions – generic socket options – IP socket options – ICMP socket options – TCP socket options I/O multiplexing – I/O Models – select function – shutdown function – TCP echo Server (with multiplexing) – poll function – TCP echo Client (with Multiplexing).

UNIT IV ELEMENTARY UDP SOCKETS 9

UDP echo Server – UDP echo Client – Multiplexing TCP and UDP sockets – Domain name system – gethostbyname function – Ipv6 support in DNS – gethostbyadr function –getservbyname and getservbyport functions.

UNIT V NETWORK SECURITY 9

SSL - SSL Architecture, SSL Protocols, SSL Message , Secure Electronic Transaction(SET). TLS –TLS Protocols, DTLS Protocols, PKI – Fundamentals, Standards and Applications.

TOTAL: 45 Periods

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TEXT BOOKS:				
Sl.No	**Author(s)**	**Title of the Book**	**Publisher**	**Year of Publication**
1.	W. Richard Stevens, Bill Fenner, Andrew M. Rudoff	Unix Network Programming, Volume 1: The Sockets Networking API	Addison Wesley Pearson Education	2004
2.	Behrouz A Forouzan,Debdeep Mukhopadhyay	Cryptography and Network Security	Tata McGraw Hill Education Private Limited	2010
3.	William Stallings	Cryptographic and network security Principles and Practices	Prentice Hall	2005

REFERENCE BOOKS:				
Sl.No	**Author(s)**	**Title of the Book**	**Publisher**	**Year of Publication**
1.	Andre Perez	Network Security	Publisher John Wiley & Sons	2014
2.	Gary R. Wright , W. Richard Stevens	TCP/IP Illustrated: The Implementation	Addison Wesley Professional	2008
3.	Michael J. Donahoo, Kenneth L. Calvert	TCP/IP Sockets in C: Practical Guide for Programmers	Morgan Kaufmann Publishers	2009
4.	Lewis Van Winkle	Hands-On Network Programming with C: Learn socket programming in C and write secure and optimized network code	Packet Publishing	2019

WEB URLs:

1. https://www.tutorialspoint.com / unix_sockets
2. https://www.pearson.com / store/ unix-network-programming
3. https://ptec.epc-tracker.es / uploads / unix-network-programming
4. https://dl.acm.org / doi / book
5. https://www.tutorialspoint.com /network_security

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19CAC11 **CLOUD COMPUTING TECHNOLOGIES** **L T P C**
3 0 0 3

COURSE OBJECTIVES:

- To understand the basic concepts of Distributed system
- To learn about the current trend and basics of Cloud computing
- To be familiar with various Cloud concepts.
- To expose with the Server, Network and storage virtualization
- To be aware of Micro services and DevOps

COURSE OUTCOMES:

19CAC11.CO1 : Use Distributed systems in Cloud Environment
19CAC11.CO2 : Articulate the main concepts, key technologies, strengths and limitations of Cloud computing
19CAC11.CO3 : Identify the Architecture, Infrastructure and delivery models of Cloud computing
19CAC11.CO4 : Install, choose and use the appropriate current technology for the implementation of Cloud
19CAC11.CO5 : Adopt Microservices and DevOps in Cloud environment

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19CAC11.CO1	x	x	x	-	-	x	-	-	x	x	-	x	x	-	-
19CAC11.CO2	x	x	x	-	-	x	-	-	x	x	-	x	x	-	-
19CAC11.CO3	x	x	x	-	-	x	-	-	x	x	x	x	x	-	-
19CAC11.CO4	x	x	x	-	-	x	-	-	x	x	x	x	x	-	-
19CAC11.CO5	x	x	x	-	-	-	-	-	x	x	x	x	x	-	-

UNIT I DISTRIBUTED SYSTEMS **9**

Introduction to Distributed Systems – Characterization of Distributed Systems – Distributed Architectural Models –Remote Invocation – Request-Reply Protocols – Remote Procedure Call – Remote Method Invocation – Group Communication – Coordination in Group Communication – Ordered Multicast – Time Ordering – Physical Clock Synchronization –Logical Time and Logical Clocks.

UNIT II INTRODUCTION TO CLOUD COMPUTING **9**

Cloud Computing Basics – Desired features of Cloud Computing – Elasticity in Cloud – Ondemand provisioning - Applications – Benefits – Cloud Components: Clients, Data centers & Distributed Servers – Characterization of Distributed Systems – Distributed Architectural Models - Principles of Parallel and Distributed computing - Applications of Cloud computing– Benefits – Cloud services – Open source Cloud Software: Eucalyptus, Open Nebula, Openstack, Aneka, Cloudsim.

UNIT III CLOUD INFRASTRUCTURE **9**

Cloud Architecture and Design – Architectural design challenges – Technologies for Network based system - NIST Cloud computing Reference Architecture – Public, Private and Hybrid clouds – Cloud Models : IaaS, PaaS and SaaS – Cloud storage providers – Enabling Technologies for the Internet of Things – Innovative Applications of the Internet of Things.

UNIT IV CLOUD ENABLING TECHNOLOGIES **9**

Service Oriented Architecture – Web Services – Basics of Virtualization – Emulation – Types of Virtualization – Implementation levels of Virtualization – Virtualization structures – Tools &Mechanisms – Virtualization of CPU, Memory & I/O Devices – Desktop Virtualization –Server Virtualization – Google App Engine – Amazon AWS - Federation in the Cloud.

UNIT V MICROSERVICES AND DEVOPS **9**

Defining Microservices - Emergence of Microservice Architecture – Design patterns of Microservices – The Mini web service architecture – Microservice dependency tree –Challenges with Microservices - SOA vs Microservice – Microservice and API – Deployingand maintaining Microservices – Reason for having DevOps – Overview of DevOps –History of DevOps – Concepts and terminology in DevOps – Core elements of DevOps –Life cycle of DevOps – Adoption of DevOps - DevOps Tools – Build, Promotion and Deployment in DevOps - DevOps in Business Enterprises.

TOTAL: 45 Periods

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TEXT BOOKS:				
Sl.No	**Author(s)**	**Title of the Book**	**Publisher**	**Year of Publication**
1.	Kai Hwang, Geoffrey C. Fox & Jack G. Dongarra	Distributed and Cloud computing,From Parallel Processing to the Internet of Things	Morgan Kaufmann Publishers	2012
2.	Andrew S. Tanenbaum& Maarten Van Steen	Distributed Systems - Principles and paradigms	Second Edition, Pearson Prentice Hal	2006
3.	Thomas Erl, ZaighamMahood& Ricardo Puttin	Cloud Computing, Concept,Technology & Architecture	Prentice Hall, SecondEdition	2013

REFERENCE BOOKS:				
Sl.No	**Author(s)**	**Title of the Book**	**Publisher**	**Year of Publication**
1.	Richard Rodger	The Tao of Microservices	Manning Publications, First Edition,December	2017
2.	Magnus Larsson	Hands-On Microservices with Spring Boot and Spring Cloud: Buildand deploy microservices using spring cloud, Istio and kubernetes	Packt Publishing Ltd, First Edition,September	2019
3.	Jim Lewis	DEVOPS: A complete beginner's guide to DevOps best practices	ISBN-13:978-1673259148, ISBN-10: 1673259146, First Edition	2019
4.	Richard Rodger	The Tao of Microservices	Manning Publications, First Edition,December	2017

WEB URLs:

1. https://www.youtube.com/watch?v=dX2PSA0si5g
2. https://www.youtube.com/watch?v=RWgW-CgdIk0
3. https://www.youtube.com/watch?v=nRdNgMcKge8
4. https://www.youtube.com/watch?v=qEQqF7iqzYk
5. https://www.youtube.com/watch?v=L4aDJtPYI8M

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19CAC12

BIO INSPIRED COMPUTING

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To Learn bio-inspired theorem and algorithms
- To Understand random walk and simulated annealing
- To Learn genetic algorithm and differential evolution
- To Learn swarm optimization and ant colony for feature selection
- To understand bio-inspired application in various fields

COURSE OUTCOMES:

19CAC12.CO1 : Implement and apply bio-inspired algorithms
19CAC12.CO2 : Explain random walk and simulated annealing
19CAC12.CO3 : Implement and apply genetic algorithms
19CAC12.CO4 : Explain swarm intelligence and ant colony for feature selection
19CAC12.CO5 : Apply bio-inspired techniques in various fields

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19CAC12.CO1	x	x	x	-	x	x	-	-	x	-	-	x	x	-	-
19CAC12.CO2	x	x	x	-	x	x	-	-	x	-	-	x	x	-	-
19CAC12.CO3	x	x	x	-	x	x	-	-	x	-	-	x	x	-	-
19CAC12.CO4	x	x	x	-	x	x	-	-	x	-	-	x	x	-	-
19CAC12.CO5	x	x	x	-	x	x	-	-	x	-	-	x	x	-	-

UNIT I INTRODUCTION 9

Introduction to algorithm - Newton ' s method - optimization algorithm - No-Free-LunchTheorems - Nature-Inspired Metaheuristics -Analysis of Algorithms -Nature InspiresAlgorithms -Parameter tuning and parameter control.

UNIT II RANDOM WALK AND ANEALING 9

Random variables - Isotropic random walks - Levy distribution and flights - Markov chains -step sizes and search efficiency - Modality and intermittent search strategy - importance ofrandomization- Eagle strategy-Annealing and Boltzmann Distribution - parameters –SAalgorithm -Stochastic Tunneling.

UNIT III GENETIC ALGORITHMS AND DIFFERENTIAL EVOLUTION 9

Introduction to genetic algorithms and - role of genetic operators - choice of parameters – GAvarients - schema theorem - convergence analysis - introduction to differential evolution -varients - choice of parameters - convergence analysis - implementation.

UNIT IV SWARM OPTIMIZATION AND FIREFLY ALGORITHM 9

Swarm intelligence - PSO algorithm - accelerated PSO - implementation – convergenceanalysis - binary PSO - The Firefly algorithm - algorithm analysis - implementation - variants-Ant colony optimization toward feature selection.

UNIT V APPLICATIONS OF BIO INSPIRED COMPUTING 9

Improved Weighted Thresholded Histogram Equalization Algorithm for Digital ImageContrast Enhancement Using Bat Algorithm - Ground Glass Opacity Nodules Detection andSegmentation using Snake Model - Mobile Object Tracking Using Cuckoo Search- Bioinspired algorithms in cloud computing- Wireless Sensor Networks using Bio inspiredAlgorithms.

TOTAL: 45 Periods

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TEXT BOOKS:				
Sl.No	**Author(s)**	**Title of the Book**	**Publisher**	**Year of Publication**
1.	Eiben,A.E.Smith,James E	Introduction to Evolutionary Computing,	Springer	2015
2.	Helio J.C. Barbosa	Ant Colony Optimization - Techniques and Applications	Intech	2013

REFERENCE BOOKS:				
Sl.No	**Author(s)**	**Title of the Book**	**Publisher**	**Year of Publication**
1.	Xin-She Yang ,Jaao Paulo papa	Bio-Inspired Computing and Applications in ImageProcessing	Elsevier	2016
2.	Xin-She Yang	Nature Inspired Optimization Algorithm	Elsevier	2014
3.	Yang ,Cui,XIao,Gandomi,Karamanoglu	Swarm Intelligence and Bio-InspiredComputing	Elsevier	2013

WEB URLs:

1. https://en.wikipedia.org/wiki/Bio-inspired_computing
2. https://www.sciencedirect.com/topics/computer-science/random-walk-step
3. https://www.frontiersin.org/articles/10.3389/fbuil.2020.00102/full
4. https://www.sciencedirect.com/topics/engineering/firefly-algorithm
5. https://whatis.techtarget.com/definition/bio-inspired-computing

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19CAC13	**Information Retrieval Techniques**	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

To understand the basics of information retrieval with pertinence to modeling, query operations and indexing
To get an understanding of machine learning techniques for text classification and clustering.
To understand the various applications of information retrieval giving emphasis to multimedia IR, web search
To understand the concepts of digital libraries

COURSE OUTCOMES:

19CAC13.CO1 : Implement and apply bio-inspired algorithms
19CAC13.CO2 : Explain random walk and simulated annealing
19CAC13.CO3 : Implement and apply genetic algorithms
19CAC13.CO4 : Explain swarm intelligence and ant colony for feature selection
19CAC13.CO5 : Apply bio-inspired techniques in various fields

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19CAC13.CO1	x	x	x	-	x	x	-	-	x	-	-	x	x	-	-
19CAC13.CO2	x	x	x	-	x	x	-	-	x	-	-	x	x	-	-
19CAC13.CO3	x	x	x	-	x	-	-	-	x	-	-	x	x	-	-
19CAC13.CO4	x	x	x	-	x	-	-	-	x	-	-	x	x	-	-
19CAC13.CO5	x	x	x	-	x	x	-	-	x	-	-	x	x	-	-

UNIT I INTRODUCTION: MOTIVATION 9

Basic Concepts – Practical Issues - Retrieval Process – Architecture - Boolean Retrieval –Retrieval Evaluation – Open Source IR Systems–History of Web Search – Web Characteristics– The impact of the web on IR —IR Versus Web Search–Components of a Search engine.

UNIT II MODELING 9

Taxonomy and Characterization of IR Models – Boolean Model – Vector Model – Term Weighting – Scoring and Ranking –Language Models – Set Theoretic Models – Probabilistic Models – Algebraic Models -- Structured Text Retrieval Models – Models for Browsing.

UNIT III INDEXING 9

Static and Dynamic Inverted Indices – Index Construction and Index Compression. Searching-Sequential Searching and Pattern Matching. Query Operations –Query Languages – Query Processing - Relevance Feedback and Query Expansion – Automatic Local and Global Analysis – Measuring Effectiveness and Efficiency.

UNIT IV CLASSIFICATION AND CLUSTERING 9

Text Classification and Naïve Bayes – Vector Space Classification – Support vector machines and Machine learning on documents. Flat Clustering – Hierarchical Clustering –Matrix decompositions and latent semantic indexing – Fusion and Meta learning

UNIT V SEARCHING THE WEB 9

Searching the Web –Structure of the Web –IR and web search – Static and Dynamic Ranking – Web Crawling and Indexing – Link Analysis - XML Retrieval Multimedia IR: Models and Languages – Indexing and Searching Parallel and Distributed IR – Digital Libraries.

TOTAL: 45 Periods

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TEXT BOOKS:				
Sl.No	**Author(s)**	**Title of the Book**	**Publisher**	**Year of Publication**
1.	Cambridge, Massachusetts London	Implementing and Evaluating Search Engines	The MIT Press	2010
2.	Ricardo Baeza – Yates, Berthier Ribeiro – Neto	Modern Information Retrieval: The concepts and Technology behind Search	ACM Press Books	2011

REFERENCE BOOKS:				
Sl.No	**Author(s)**	**Title of the Book**	**Publisher**	**Year of Publication**
1.	Stefan Buttcher, Charles L. A. Clarke, Gordon V. Cormack	Information Retrieval	Elsevier	2010
2.	Manning ChristopherD., Raghavan Prabhakar& Schutze Hinrich	Introduction to Information Retrieval	University Press	2009

WEB URLs:

1. https://www.geeksforgeeks.org/what-is-information-retrieval/
2. https://aspoerri.comminfo.rutgers.edu/InfoCrystal/Ch_2.html
3. https://www.analyticsvidhya.com/blog/2021/07/indexing-in-natural-language-processing-for-information retrieval/
4. http://orion.lcg.ufrj.br/Dr.Dobbs/books/book5/chap16.htm
5. https://www.computer.org/csdl/magazine/cs/2004/04/c4043/13rRUxYrbPV

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19CAC14	SOFTWARE ARCHITECTURE	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- Understand Software Architectural requirements and drivers
- Be exposed to architectural styles and views
- Be familiar with architectures for emerging technologies

COURSE OUTCOMES:

19CAC14.CO1 : Explain influence of software architecture on business and technical activities
19CAC14.CO2 : Summarize quality attribute workshop
19CAC14.CO3 : Identify key architectural structures
19CAC14.CO4 : Use styles and views to specify architecture
19CAC14.CO5 : Design document for a given architecture

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19CAC14.CO1	x	x	x	-	-	-	-	-		-	-	x	x	-	-
19CAC14.CO2	x	x	x	-	-	-	-		x	x	-	x	x	-	-
19CAC14.CO3	x	x	x	-	-	x	-	x	x	x	-	x	x	-	-
19CAC14.CO4	x	x	x	-	-	x	-	x	x	x	-	x	x	-	-
19CAC14.CO5	x	x	x	-	-	x	-	x	x	x	-	x	x	-	-

UNIT I INTRODUCTION AND ARCHITECTURAL DRIVERS 9

Introduction – Software architecture - Architectural structures – Influence of software architecture on organization - both business and technical – Architecture Business Cycle Functional requirements – Technical constraints – Quality Attributes.

UNIT II QUALITY ATTRIBUTE WORKSHOP 9

Quality Attribute Workshop – Documenting Quality Attributes – Six part scenarios – Case studies.

UNIT III ARCHITECTURAL VIEWS 9

Introduction – Standard Definitions for views – Structures and views – Representing views available notations – Standard views – 4+1 view of RUP, Siemens 4 views, SEI's perspectives and views – Case studies.

UNIT IV ARCHITECTURAL STYLES 9

Introduction – Data flow styles – Call-return styles – Shared Information styles – Event styles – Case studies for each style.

UNIT V DOCUMENTING THE ARCHITECTURE 9

Good practices – Documenting the Views using UML – Merits and Demerits of using visual languages – Need for formal languages – Architectural Description Languages – ACME – Case studies. Special topics: SOA and Web services – Cloud Computing – Adaptive Structures.

TOTAL: 45 Periods

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TEXT BOOKS:				
Sl.No	**Author(s)**	**Title of the Book**	**Publisher**	**Year of Publication**
1.	Len Bass, Paul Clements, and Rick Kazman	Software Architectures Principles and Practices	Addison-Wesley	2003
2.	Anthony J Lattanze,	Architecting Software Intensive System	Auerbach Publications	2010

REFERENCE BOOKS:				
Sl.No	**Author(s)**	**Title of the Book**	**Publisher**	**Year of Publication**
1.	Paul Clements, Rick Kazman, and Mark Klein	Evaluating software architectures: Methods and case studies	Addison-Wesley	2001
2.	Mark Hansen	SOA Using Java Web Services	Prentice Hal	2007
3.	David Garlan, Bradley Schmerl, and Shang-Wen Cheng,	Software Architecture Based Self-Adaptation	Springer Verlag	2009

WEB URLs:

1. www.mdpi.com/journal/applsci/special_issues/Architectural_Structure
2. www.brainkart.com/article/Documenting-Quality-Attributes_11282/
3. www.slideshare.net/reejasr/architectural-structures-and-views
4. www.brainkart.com/article/Shared-Information-Style_11294/
5. www.todaysoftmag.com/article/2241/architecture-description-languages

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19CAC20	Organizational Behavior	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- The objective is to enable the students to understand the Organizational Behavior, and Organizational Change and dynamic of groups.
- To understand the human interactions in an organization,

COURSE OUTCOMES:

19CAC20.CO1 : Students will have a better understanding of human behavior in organization.
19CAC20.CO2 : They will know the framework for managing individual and group performance.
19CAC20.CO3 : Characteristics of attitudes and components of attitudes — A brief discussion
19CAC20.CO4 : List the determinants of personality
19CAC20.CO5 : List the characteristics of various leadership styles.

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19CAC20.CO1	x	x	x	-	-	-	-	-	-	x	-	x	x	-	-
19CAC20.CO2	x	x	x	-	-	x	x	-	x	x	-	x	x	-	-
19CAC20.CO3	x	x	x	-	-	x	x	x	x	x	-	x	x	-	-
19CAC20.CO4	x	x	x	-	-	x	-	x	x	x	-	x	x	-	-
19CAC20.CO5	x	x	x	-	-	x	-	x	x	x	-	x	x	-	-

UNIT I ORGANISATIONAL BEHAVIOUR 9

Organization Behaviour – Definition – Scope and Application in Management – Contributions of Other Disciplines to OB. Emerging Issues in Organizational Behaviour- Organizational behaviour models

UNIT II INDIVIDUAL PROCESSES 9

Personality – types – Factors influencing personality– Theories. Emotions - Theories – Emotional Intelligence- Learning – Types of learners – The learning process – Learning theories. Perceptions – Importance – Factors influencing perception- Attitudes – Nature of Attitudes Components of Attitudes Formation of Attitude Benefits of Positive Attitude Functions of Attitudes– Measurement-Motivation – Importance – Types – Theories.

UNIT III LEADERSHIP AND POWER 9

Meaning – Importance – Leadership styles – Theories – Leaders Vs Managers – Sources of power – Power centers – Power and Politics.

UNIT IV GROUP DYNAMICS 9

Meaning – Types of Groups – Functions of Small Groups – Group Size Status – Managerial Implications – Group Behaviour – Group Norms – Cohesiveness – Group Thinking

UNIT V ORGANISATIONAL CHANGE AND DEVELOPMENT 9

Organizational Change: Meaning – Nature of Work Change – Need for Change – Change Process – Types of Change – Factors Influencing Change – Resistance to Change – Overcoming Resistance – Organizational Development: Meaning and Different Types of OD Interventions.

TOTAL: 45 Periods

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TEXT BOOKS:				
Sl.No	**Author(s)**	**Title of the Book**	**Publisher**	**Year of Publication**
1.	K. Aswathappa	Organizational behaviour	Himalaya Publishing House Pvt. Ltd	2012
2.	Stephen P. Robins	Organizational behaviour	PHI Learning / Pearson Education. Edition 17	2016
3.	Fred Luthans	Organizational behaviour	McGraw Hill, 12th Edition	2013

REFERENCE BOOKS:				
Sl.No	**Author(s)**	**Title of the Book**	**Publisher**	**Year of Publication**
1.	Nelson, Quick, Khandelwal	ORGB – An innovative approach to learning and teaching	Cengage, 2nd edition	2012
2.	Ivancevich, Konopaske & Maheson,	Organizational Behaviour & Management	Tata McGraw Hill, 7th edition	2008
3.	Robert Kreitner and Angelo Kinicki	Organizational behaviour	Tata McGraw Hill, 10th Edition	2016

WEB URLs:

1. https://www.encyclopedia.com/social-sciences-and-law/economics-business-and-labor/businesses-and occupations/organizational-behavior
2. https://docs.oracle.com/database/121/HTMDB/concept_url.htm
3. https://www.futurelearn.com/info/courses/the-evolution-of-management/0/steps/90525
4. https://migration.trujay.com/help/find-url-microsoft-dynamics-365/
5. https://msmgf.org/files/msmgf/documents/Org_Dev/Organizational%20Change%20and%20Development.pdf

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19CAC21 **SOFTWARE TESTING AND QUALITY ASSURANCE** **L T P C**
3 0 0 3

COURSE OBJECTIVES:

- To know the behavior of the testing techniques and to design test cases to detect the errors in the software
- To get insight into the levels of testing in the user environment
- To understand standard principles to check the occurrence of defects and its removal.
- To learn the functionality of automated testing tools to apply in the specialized environment.
- To understand the models and metrics of software quality and reliability.

COURSE OUTCOMES:

19CAC21.CO1 : Able to test the software by applying various testing techniques.
19CAC21.CO2 : Able to debug the project and to test the entire computer based systems at all levels.
19CAC21.CO3 : Able to test the applications in the specialized environment using various automation tools.
19CAC21.CO4 : Able to evaluate the web applications using bug tracking tools.
19CAC21.CO5 : Able to apply quality and reliability metrics to ensure the performance of the software

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19CAC21.CO1	x	x	x	-	-	-	-	-	-	x	-	x	x	-	-
19CAC21.CO2	x	x	x	-	-	x	-	-	x	x	-	x	x	-	-
19CAC21.CO3	x	x	x	x	x	x	x	-	x	x	x	x	x	-	-
19CAC21.CO4	x	x	x	x	x	x	x	-	x	x	x	x	x	-	-
19CAC21.CO5	x	x	x	-	x	x	x	-	x	x	x	x	x	-	-

UNIT I TESTING TECHNIQUES & TEST CASE DESIGN **9**

Using White Box Approach to Test design - Test Adequacy Criteria – Static Testing Vs. Structural Testing – Code Functional Testing – Coverage and Control Flow Graphs – Covering Code Logic – Paths – Their Role in White box Based Test Design – Code Complexity Testing – Evaluating Test Adequacy Criteria. Test Case Design Strategies – Using Black Box Approach to Test Case Design – Random Testing – Requirements based testing – Boundary Value Analysis –Decision tables – Equivalence Class Partitioning – State-based testing – Cause-effect graphing – Error guessing – Compatibility testing – User documentation testing – Domain testing – Case study for Control Flow Graph and State-based Testing.

UNIT II LEVELS OF TESTING **9**

The Need for Levels of Testing- Unit Test Planning –Designing the Unit Tests – The Test Harness – Running the Unit tests and Recording Results – Integration Tests – Designing Integration Tests – Integration Test Planning – Scenario Testing – Defect Bash Elimination. System Testing – Acceptance testing – Performance testing – Regression Testing - Internationalization testing - Ad-hoc testing – Alpha, Beta Tests- Testing OO systems – Usability and Accessibility Testing – Configuration Testing - Compatibility Testing – Testing the documentation – Website Testing - Case Study for Unit and Integration Testing.

UNIT III TESTING FOR SPECIALIZED ENVIRONMENT **9**

Testing Client / Server Systems – Testing in a Multiplatform Environment - Testing Object-Oriented Software – Object Oriented Testing – Testing Web based systems – Web based system – Web Technology Evolution – Traditional Software and Web based Software – Challenges in Testing for Web-based Software – Quality Aspects – Web Engineering – Testing of Web based Systems. Case Study for Web Application Testing

UNIT IV TEST AUTOMATION **9**

Selecting and Installing Software Testing Tools - Software Test Automation – Skills needed for Automation – Scope of Automation – Design and Architecture for Automation – Requirements for a Test Tool – Challenges in Automation – Tracking the Bug – Debugging – Case study using Bug Tracking Tool.

UNIT V SOFTWARE TESTING AND QUALITY METRICS **9**

Six-Sigma – TQM - Complexity Metrics and Models – Quality Management Metrics - Availability Metrics - Defect Removal Effectiveness - FMEA - Quality Function Deployment – Taguchi Quality Loss Function – Cost of Quality. Case Study for Complexity and Object Oriented Metrics.

TOTAL: 45 Periods

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TEXT BOOKS:				
Sl.No	**Author(s)**	**Title of the Book**	**Publisher**	**Year of Publication**
1.	Adithya P. Mathur	Foundations of Software Testing – Fundamentals algorithms and techniques	Dorling Kindersley (India) Pvt. Ltd	2008
2.	Boris Beizer	Software Testing Techniques	Dream Tech Press	2009
3.	Dale H. Besterfiled	Total Quality Management	Pearson Education Asia, Third Edition	2011

REFERENCE BOOKS:				
Sl.No	**Author(s)**	**Title of the Book**	**Publisher**	**Year of Publication**
1.	Edward Kit	Software Testing in the Real World – Improving the Process	Pearson Education	1995
2.	Glenford J. Myers, Tom Badgett, Corey Sandler	The Art of Software Testing	3rd Edition, John Wiley & Sons Publication	2012
3.	Illene Burnstein	Practical Software Testing	Springer International Edition	2003
4.	Naresh Chauhan	Software Testing Principles and Practices	Oxford University Press	2010

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1. https://www.youtube.com/watch?v=BBmA5Qp6Ghk
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3. http://studymaterial.unipune.ac.in:8080/jspui/bitstream/123456789/3660/1/TYB.Voc%20Softw
4. https://www.youtube.com/watch?v=SfqF0CD0Mc4
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19CAC22 **ADVANCES IN NETWORKING** **L T P C**
3 0 0 3

COURSE OBJECTIVES:

- To understand the theme underlying IPv6 Structure and addressing methods.
- To understand and analyze the protocols for IPv6 implementation.
- To identify and provide solutions for QoS and security issues with IPv6.
- To learn about Software Defined concepts, architectures, protocols and applications.
- To explore the significance of Network Function Virtualization.

COURSE OUTCOMES:

19CAC22.CO1 : Understand the fundamentals of IPv6 and IPv6 Protocols
19CAC22.CO2 : Analyze the need for separation of data and control plan
19CAC22.CO3 : Understand the functionality of NFV
19CAC22.CO4 : Be Conversant with the latest networks and its architecture
19CAC22.CO5 : Gain an in-depth coverage of various networking technologies

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19CAC22.CO1	x	x	x	-	-	-	-	-	x	-	-	x	x	-	-
19CAC22.CO2	x	x	x	-	-	x	-	-	x	x	-	x	x	-	-
19CAC22.CO3	x	x	x	-	-	x	-	x	x	x	-	x	x	-	-
19CAC22.CO4	x	x	x	-	-	x	-	x	x	x	-	x	x	-	-
19CAC22.CO5	x	x	x	-	-	x	-	x	x	x	-	x	x	-	-

UNIT I IPv6 STRUCTURE AND ADDRESSING 9

IPv4 Address Depletion- IPv6 Transition Issues-IPv6 Structure: IPv6 Header, Extension Headers: Hop-by-Hop Options Header, Destination Options Header, Routing Header, Fragment Header, AH, ESP- IPv6 Addresses: Unicast, Anycast, Multicast – Address Autoconfiguration.

UNIT II IPv6 NETWORKING 9

IPv6 Internet Control Message Protocol (ICMPv6): ICMPv6 Messages, ragmentation and Path MTU- IPv6 Neighbor Discovery- IPv6 Routing: RIPng, EIGRP for IPv6, Fv3 - Mobile IPv6 .

UNIT III QoS PROVISIONING AND SECURITY WITH IPv6 9

QoS in IPv6 Protocols: Differentiated Services and IPv6, IPv6 Flows, Explicit Congestion Notification in IPv6 – Provisioning: Stateless DHCPv6,Stateful DHCPv6, DNS Extensions for IPv6- Security with IPv6: IP Security Protocol (IPsec)Basics, IPv6 Security Elements, Interaction of IPsec with IPv6 Elements.

UNIT IV SOFTWARE DEFINED NETWORKING 9

Genesis of SDN – Separation of Control Plane and Data Plane – Distributed Control Plane – IP and MPLS – Characteristics of SDN – Operation – Devices – Controller – OpenFlow Specification.

UNIT V NETWORK FUNCTION VIRTUALIZATION 9

Building SDN Framework – Network Functions Virtualization – Introduction –Virtualization and Data Plane I/O – Service Locations and Chaining – Applications – Use Cases of SDNs: Data Centers, Overlays, Big Data and Network Function Virtualization.

TOTAL: 45 Periods

TEXT BOOKS:				
Sl.No	**Author(s)**	**Title of the Book**	**Publisher**	**Year of Publication**
1.	Rick Grazian	IPv6 Fundamentals: A Straightforward Approach to Understanding IPv6	Cisco Press	2017
2.	Peter Loshin	IPv6:Theory,Protocol and Practice	Morgan Kaufmann Publishers	2004

REFERENCE BOOKS:				
Sl.No	**Author(s)**	**Title of the Book**	**Publisher**	**Year of Publication**
1.	William Stallings	Foundations of Modern Networking – SDN, NFC, QoE, IoT and Cloud	Pearson Education	2019
2.	Oswald Coker, Siamak Azodolmolky	Software-Defined Networking with Open Flow	Packet Publishing	2017
3.	Paul Goransson, Chuck Black	Software Defined Networks: A Comprehensive Approach	Morgan Kaufmann Publisher	2014

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2. www.geeksforgeeks.org/internet-control-message-protocol-icmp/
3. www.ibm.com/docs/en/i/7.1?topic=concepts-ip-security-protocols
4. www.researchgate.net/figure/Distributed-control-plane-architecture-implemented-Unlike the-distributed-control-plane_fig3_339889233
5. www.blueplanet.com/resources/What-is-NFV-prx.html

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19CAC23 **SOFTWARE COMPUTING TECHNIQUES** **L T P C**
3 0 0 3

COURSE OBJECTIVES:

- To gain knowledge of soft computing theories and its fundamentals.
- To design a soft computing system required to address a computational task.
- To learn and apply artificial neural networks, fuzzy sets and fuzzy logic and genetic algorithms in problem solving and use of heuristics based on human experience.
- To introduce the ideas of fuzzy sets, fuzzy logic and to become familiar with neural networks that can learn from available examples and generalize to form appropriate Rules for inferencing systems.
- To familiarize with genetic algorithms and other random search procedures while seeking global optimum in self – learning situations.

COURSE OUTCOMES:

19CAC23.CO1 : Identify and describe soft computing techniques and their roles in building intelligent

19CAC23.CO2 : Recognize the feasibility of applying a soft computing methodology for a particular problem.

19CAC23.CO3 : Apply fuzzy logic and reasoning to handle uncertainty and solve engineering problems.

19CAC23.CO4 : Apply genetic algorithms to optimization problems.

19CAC23.CO5 : Design neural networks to pattern classification and regression problems using soft computing approach.

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19CAC23.CO1	x	x	x	-	-	-	-	-	-	x	-	x	x	-	-
19CAC23.CO2	x	x	x	-	-	x	-	-	x	x	-	x	x	-	-
19CAC23.CO3	x	x	x	-	x	x	-	-	-	x	-	x	x	-	-
19CAC23.CO4	x	x	x	-	x	x	-	-	x	x	-	x	x	-	-
19CAC23.CO5	x	x	x	-	x	x	-	-	-	x	-	x	x	-	-

UNIT I FUZZY COMPUTING **9**

Basic Concepts of Fuzzy Logic, Fuzzy Sets and Crisp Sets, Fuzzy Set Theory and Operations, Properties of Fuzzy Sets, Fuzzy and Crisp Relations, Fuzzy to Crisp Conversion Membership Functions, Interference in Fuzzy Logic, Fuzzy If – Then Rules, Fuzzy Implications and Fuzzy Algorithms, Fuzzifications and Defuzzificataions, Fuzzy Controller, Industrial Applications.

UNIT II FUNDAMENTALS OF NEURAL NETWORKS **9**

Neuron, Nerve Structure and Synapse, Artificial Neuron and its Model, Activation Functions, Neural Network Architecture: Single Layer and Multi layer Feed Forward Networks, Recurrent Networks. Various Learning Techniques; Perception and Convergence Rule, Auto, Associative and Hetero-Associative Memory.

UNIT III BACKPROPAGATION NETWORKS **9**

Back Propagation Networks) Architecture: Perceptron Model, Solution, Single Layer Artificial Neural Network, Multi layer Perception Model; Back Propagation Learning Methods, Effect of Learning Rule Co – Efficient ;Back Propagation Algorithm, Factors Affecting Back Propagation Training, Applications.

UNIT IV COMPETETIVE NEURAL NETWORKS **9**

Kohenen's Self Organizing Map – SOM Architecture, learning procedure – Application; Learning Vector Quantization – learning by LVQ; Adaptive Resonance Theory – Learning procedure – Applications.

UNIT V GENETIC ALGORITHM **9**

Basic Concepts, Working Principle, Procedures of GA, Flow Chart of GA, Genetic Representations, (Encoding) Initialization and Selection, Genetic Operators, Mutation, Generational Cycle, Applications.

TOTAL: 45 Periods

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TEXT BOOKS:				
Sl.No	**Author(s)**	**Title of the Book**	**Publisher**	**Year of Publication**
1.	S. Rajasekaran and G.A. VijayalakshmiPai	Neural Networks, Fuzzy Logic and Genetic Algorithm: Synthesis and Applications	Prentice Hall of India	2003
2.	J.S.R. Jang, C.T. Sun and E. Mizutani	Neuro – Fuzzy and Soft Computing	Pearson Education	2004
3.	S. N. Sivanandam, S. N. Deepa	Principles of Soft Computing	Second Edition, Wileyn	2007

REFERENCE BOOKS:				
Sl.No	**Author(s)**	**Title of the Book**	**Publisher**	**Year of Publication**
1.	SimonHaykin.	Neural Networks	Prentice Hall, 2 nd Edition	1999
2.	Timothy Ross	Fuzzy Logic with Engineering Applications	Wiley Publications,4 thEdition	2016
3.	David E. Goldberg	Genetic Algorithms in Search, Optimization and Machine Learning	Pearson Education, First Edition	2008

WEB URLs:

1. https://www.techtarget.com/searchenterpriseai/definition/fuzzy-logic
2. https://www.analytixlabs.co.in/blog/fundamentals-of-neural-networks/
3. https://www.javatpoint.com/pytorch-backpropagation-process-in-deep-neural-network
4. https://towardsdatascience.com/funderstanding-competitive-neural-networks-f855bd7882e1
5. https://arxiv.org/pdf/1911.00490

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19CAC24	DEEP LEARNING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To understand how to represent the high-dimensional data, such as images, text and data.
- To explain convolution neural network
- To introduce major deep learning algorithms and their applications to solve real world problems.
- To explore about optimization and generalization in Deep learning
- To understand about deep reinforcement learning

COURSE OUTCOMES:

19CAC24.CO1 : Describe the fundamental concepts of Neural Networks

19CAC24.CO2 : Apply Convolution Neural Network techniques to solve problems in image

19CAC24.CO3 : Summarize the characteristics of deep Learning

19CAC24.CO4 : Comprehend the Optimization and Generalization in Deep Learning

19CAC24.CO5 : Interpret the concepts of Deep Reinforcement Learning to solve real world problems.

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19CAC24.CO1	x	x	x	-	-	-	-	-	-	x	-	x	x	-	-
19CAC24.CO2	x	x	x	-	-	x	-	-	x	x	-	x	x	-	-
19CAC24.CO3	x	x	x	-	x	-	-	-	x	x	-	x	x	-	-
19CAC24.CO4	x	x	x	-	-	x	-	-	x	x	-	x	x	-	-
19CAC24.CO5	x	x	x	-	x	-	-	-	x	x	-	x	x	-	-

UNIT I NEURAL NETWORK 9

Building Intelligence Machine-Expressing Linear Perceptron as Neurons-Feed Forward Neural Netwoks - Activation function. Supervised and Unsupervised Learning:Single Layer Perceptron – Perceptron Learning Algorithm – Least Mean Square Learning Algorithm - Multilayer Perceptron – Back Propagation Algorithm – XOR problem – Limitations of Back Propagation Algorithm - Implementing Neural Networks in TensorFlow.

UNIT II CONVOLUTION NEURAL NETWORK 9

Introduction-Filter and Feature Maps-Full Description of CNN-Max Pooling- Full Architectural Description of CNN-Image Preprocessing Pipeline Enable More Roburst Models,Accelerating Training with Batch Normalization-Visualizing Learning with Convolution Network-Leveraging and Learning Convolution Filters - Predefined Convolutional Filters Network (PCFNet)- Transfer Learning with Convolutional Neural Networks.

UNIT III DEEP NETWORKS 9

History of Deep Learning- A Probabilistic Theory of Deep Learning- Backpropagation and regularization, batch normalization- VC Dimension and Neural Nets-Deep Vs Shallow Networks - Convolutional Networks- Generative Adversarial Networks (GAN), Semisupervised Learning

UNIT IV OPTIMIZATION AND GENERALIZATION 9

Optimization in deep learning– Non-convex optimization for deep networks- Stochastic Optimization Generalization in neural networks- Spatial Transformer Networks- Recurrent networks, LSTM - Recurrent Neural Network Language Models- Word-Level RNNs & Deep Reinforcement Learning.

UNIT V DEEP REINFORCEMENT LEARNING 9

Markov Decision Processes-Explore versus Exploit-Policy versus Value Learning-Pole-Cart with Policy Gradients-Q Learning and Deep Q Networks-Improving and Moving Beyond DQN

TOTAL: 45 Periods

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TEXT BOOKS:				
Sl.No	**Author(s)**	**Title of the Book**	**Publisher**	**Year of Publication**
1.	Nikhil Buduma, Nicholas Locascio, .	Fundamentals of Deep Learning: Designing Next-Generation Machine Intelligence Algorithms	First Edition , O'ReillyMedia	2017
2.	Sudharsan Ravichandiran	Hands on Deep Learning Algorithms with Python	FirstEdition, Packt Publishing Limited	2019

REFERENCE BOOKS:				
Sl.No	**Author(s)**	**Title of the Book**	**Publisher**	**Year of Publication**
1.	François Chollet	Deep Learning with Python	First Edition.Manning Publications Company	2017
2.	Ian Goodfellow, YoshuaBengio and Aaron Courville	Deep Learning	First editionMIT Press, London	2016

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2. https://www.techtarget.com/searchenterpriseai/definition/convolutional-neural-network
3. https://www.bmc.com/blogs/deep-neural-network/
4. https://developers.google.com/machine-learning/crash-course/generalization/video-lecture
5. https://bernardmarr.com/what-is-deep-reinforcement-learning/

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TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	C.R.Kothari	Research Methodology	New Age Publishers	2012
2	Uma Sekaran	Research methods for Business	Oxford University Press, New Delhi	2012

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1	Donald R.Cooper Pamela S.Schindler and J.K.Sharma	Business research methods	Tata McGraw Hill	2012
2	Bhatacharaya	Research methodology	Excel books	2012
3	Paneerselvam	Research Methodology	Prentice Hall of India New Delhi	2012
4	William G.Zikmund	Business Research Methods	Thomson Learning	2012
5	Prasad	Corporate Governance	Prentice Hall Of India publications	2011

WEB URLs

1. https://www.youtube.com/watch?v=HTeFGOFqINw
2. https://www.youtube.com/watch?v=KE-45vg2PyI
3. https://www.youtube.com/watch?v=6xuVlje8cCc
4. https://www.youtube.com/watch?v=H2v9Xh2iQV8
5. https://www.youtube.com/watch?v=g9YUjTMpTjU

19MBB08 STRATEGIC MANAGEMENT

L	T	P	C
4	0	0	4

COURSE OBJECTIVES

- To know the major initiatives taken by a company's in Strategy Implementation
- To create an awareness about different types of strategies and its formulation.
- To give a clarity about Competitive Advantage.
- To enable the students to decide and implement the best strategy.
- To plan, evaluate and control over the implementation of strategies.

COURSE OUTCOMES

- Able to apply an appropriate strategy under different Circumstances.
- Application of appropriate strategy based on requirement.
- To find the opportunities for growth in the work place and enhance their skills to the requirement of the task.
- Analysis the strategies to attain a competitive advantage.
- Implementation of strategies based on strong competitive position.

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CourseOutcomes	ProgramOutcomes												PSOs			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
19MBA01.CO1	x	-	-	x	-	-	x	-	-	x	-	-	x	-	-	-
19MBA01.CO2	-	x	x	x	-	-	-	-	x	x	-	x	-	x	-	X
19MBA01.CO3	-	x	-	x	-	x	-	-	-	-	-	-	x	x	-	-
19MBA01.CO4	x	-	x	-	x	-	-	-	-	x	-	x	-	x	-	X
19MBA01.CO5	-	x	x	-	-	-	-	-	-	x	-	x	x	-	-	-

UNIT I INTRODUCTION **12**

Introduction to Strategic Management - Elements in strategic Management-Conceptual framework for strategic management-Strategic decision making – Issues in strategic decision making- Strategy formation process – Models of Strategic Management – Corporate Governance.

UNIT II STRATEGIC FORMULATION **12**

Business level strategy-meaning, Dynamics of business level strategy – Corporate level strategy –Expansion strategy – Stability strategy – Retrenchment strategies – Diversification and strategic alliances – Risks of diversification – Diversification strategies in the Indian context.

UNIT III COMPETITIVE ADVANTAGE **12**

Dynamics of internal environment – Porter's five force Model – Strategies for local companies competing with global companies-Capabilities and competencies – Distinctive Competencies – Resources and capabilities in relation to competitive advantage-Case study.

UNIT IV STRATEGIC ANALYSIS **12**

Tools & Techniques for strategic analysis- Corporate portfolio Analysis- SWOT Analysis – GAP analysis -Mc Kinsey's 7s Framework - GE 9 Cell Model - Distinctive competitiveness - Selection of matrix - Balance Score Card-Case study

UNIT V STRATEGY IMPLEMENTATION AND EVALUATION **12**

Nature of strategy implementation – Implementation process – Models of strategic implementation-Resource allocation- Factors affecting resource allocation – Structural Implementation- Structures for strategies –Techniques of strategic evaluation and control-Emerging trends and Analytical cases.

TOTAL HOURS: 60

TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1	Hill.	Strategic Management: An Integrated approach	Wiley Publications	2012
2	Azhar Kazmi	Strategic Management and Business Policy	Tata McGraw Hill	2013

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1	Adriau Haberberg and Alison Rieple	Strategic Management Theory & Application	Oxford University Press	2012
2	Gupta, Gollakota and Srinivasan	Business Policy and Strategic Management – Concepts and Application	Prentice Hall of India	2011
3	Lawrence G. Hrebiniak	Making strategy work	Pearson	2013
4	Dr.Dharma Bir Singh	Strategic Management & Business Policy	KoGent Learning Solutions Inc., Wiley	2012.
5	John A Pearce and Richard B Robinson	Strategic Management	New Delhi: Tata McGraw Hill	2013

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3. www.cakart.in/courses/ca-ipcc-group-2-strategic-management-niviya-ma.
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5. http://nptel.ac.in/courses/110108047/

19MBB09 INTERNATIONAL BUSINESS MANAGEMENT

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4	0	0	4

COURSE OBJECTIVES

- To enable the students to understand the fundamentals of International business.
- To provide the competence to the students on International business environment.
- To enable the students to understand the significance of MNC's and FDI
- To create an exposure about the International Marketing.
- Able to manage the conflict and ethical business management.

COURSE OUTCOMES

- Ability to take the business overseas having understood the intricacies of external market.
- Work on suitable external market entry strategies and choose the right market mix.
- Assessing the nations on different parameters and arrive at a decision on feasibility of entering that market.
- Strategically using the techniques in International Market.
- Familiar with conflicts situations and ethical issues in global business.

CourseOutcomes	ProgramOutcomes												PSOs			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
19MBA01.CO1	x	-	-	x	-	-	x	-	-	x	-	-	x	-	-	-
19MBA01.CO2	-	x	x	x	-	-	-	-	x	x	-	x	-	x	-	X
19MBA01.CO3	-	x	-	x	-	x	-	-	-	-	-	-	x	x	-	-
19MBA01.CO4	x	-	x	-	x	-	-	-	-	x	-	x	-	x	-	X
19MBA01.CO5	-	x	x	-	-	-	-	-	-	x	-	x	x	-	-	-

UNIT I INTRODUCTION 12

Nature and characteristics of International Business – Forms of International Business- Domestic versus International business – Drivers of International Business - International Theories – Goals of International Business-Advantages & Disadvantages of International Business.

UNIT II INTERNATIONAL BUSINESS ENVIRONMENT 12

Meaning- Environmental Factors – Socio cultural environment – Economic environment – Technological environment – Political environment – Strategies for dealing with cultural differences- Globalization & its Impact.

UNIT III MULTINATIONAL CORPORATION & FOREIGN DIRECT INVESTMENT 12

Definition & Concepts – Factors that contributed for growth of MNC's – Organizational Structure of MNC's – Classification of MNC's- Role of MNC's in developing Countries-Advantages & Disadvantages of MNC's – FDI –meaning, Factors influencing FDI – Reasons for FDI- FDI in India.

UNIT IV INTERNATIONAL MARKETING 12

Market entry Strategies - Globalization of markets & Brands – International pricing- International marketing strategies in different strategies of product life cycle- Market intelligence – International marketing system.

UNIT V CONFLICT MANAGEMENT AND ETHICS IN INTERNATIONAL BUSINESS MANAGEMENT 12

Meaning - Disadvantages of International Business – Conflict in International Business – Sources and types of Conflict – Conflict resolutions – Negotiation – the role of International Agencies – Ethical issues in International Business – Ethical Decision Making – Emerging Trends and Analytical Cases.

TOTAL HOURS: 60

TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1	Charles W.I. Hill and Arun Kumar Jain	International Business	Tata Hill, New Delhi	2011
2	John D. Daniels and Lee H. Radebaugh	International Business Environments and Operations	Pearson Education Asia, New Delhi	2000

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1	Michael R. Czinkota, Ilkka A. Ronkainen and Michael H. Moffet	International Business	Cengage Learning, New Delhi	2010
2	Rakesh Mohan Joshi	International Business	Oxford University Press, New Delhi	2009.
3	Vyuptakesh Sharan	International Business	Pearson Education in South Asia, New Delhi	2011
4	K. Aswathappa	International Business	Tata Mc Graw Hill, New Delhi	2012
5	Azhar Kazmi	Strategic Management and Business Policy	Tata McGraw Hill	2013

WEB URLs

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3. https://www.youtube.com/watch?v=GSyYo4ph3hM
4. https://www.youtube.com/watch?v=_Ebz48ZEPRE
5. https://www.youtube.com/watch?v=blHwi3S62ko

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REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1	William J. Stevenson, Ceyhun Ozgur	Introduction to Management Science with Spreadsheet	Tata McGraw Hill	2009
2	Wayne L. Winston	Microsoft Excel 2010: Data Analysis & Business Modeling	Microsoft Press	2012.
3	Kiran Pandya and Smriti Bulsari	SPSS in simple steps	Dreamtech	2011
4	Vikas Gupta, Comdex	Business Accounting with Ms Excel, 2010 and Tally ERP 9.0 Course	Kit, Wiley India	2012
5	G. Srinivasan	Operations Research – Principles and Applications	PHI, New Delhi	2012

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1. https://www.youtube.com/playlist?list=PL50F86BDF6873CED
2. https://www.youtube.com/watch?v=IiedOyglLn0
3. https://www.youtube.com/results?search_query=Rural+product+categories+
4. https://www.youtube.com/watch?v=fxVja3maAqo
5. https://www.youtube.com/watch?v=FHAoNKO8zg4

19MBC01 ADVERTISNG AND PROMOTIONS MANAGEMENT

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COURSE OBJECTIVES:

- To know the basic concepts of advertising functions and objectives
- To study the advertising media, types, strategies, copyrights and concepts
- To enrich the knowledge in types of advertisement.
- To learn about public relation concepts and advantages of public relations
- To study the concepts of publicity and knowing the meaning of Public relations

COURSE OUTCOMES:

- Students can able to know the concepts of advertising functions and objectives
- Students will learn the advertising media, types, strategies, copyrights and concepts
- Students will gain the knowledge in sales promotion, types and impact of promotion techniques
- They will get the benefits in public relations and advantages of public relations.
- They will get the knowledge in publicity and public relations.

CourseOutcomes	ProgramOutcomes												PSOs			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
19MBA01.CO1	x	-	-	x	-	-	x	-	-	x	-	-	x	-	-	-
19MBA01.CO2	-	x	x	x	-	-	-	-	x	x	-	x	-	X	-	x
19MBA01.CO3	-	x	-	x	-	x	-	-	-	-	-	-	x	X	-	-
19MBA01.CO4	x	-	x	-	x	-	-	-	-	x	-	x	-	X	-	x
19MBA01.CO5	-	x	x	-	-	-	-	-	-	x	-	x	x	-	-	-

UNIT I INTRODUCTION TO ADVERTISEMENT 12

Concept, Definition and Objectives -Social, Economic and Legal Implications of advertisements - Role of advertising in modern business world - Ethics in advertising - Advertising agency - Advertising campaign.

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UNIT II MEDIA MANAGEMENT 12

Media selection - Media plan - Reach and frequency of advertisement - Advertisement costs -Media Mix -Media strategy and Scheduling.

UNIT III DESIGN AND EXECUTION OF ADVERTISEMENTS 12

Message development – Different types of advertisements – Layout – Design appeal – Copy structure – Advertisement production – Print – Radio. T.V. and Web advertisements – Media Research – Testing validity and Reliability of ads – Measuring impact of advertisements.

UNIT IV SALES PROMOTION AND CAMPAIGN 12

Concept, Definition and Objectives -Scope and Role of sale promotion - Sales promotion techniques -Trade oriented and consumer oriented- Requirement identification -Designing of sales promotion campaign - Involvement of salesmen and dealers - Out sourcing sales promotion -Integrated promotion - Coordination within the various promotion techniques - Online sales promotion.

UNIT V PUBLIC RELATIONS 12

Introduction-Meaning – Objectives of Public Relations- Tools and techniques of public relations- Public relation Process- Advantages and Disadvantages of Public Relation- Effective Public Relations measures- Public Relation department Structure- Marketing Public Relations - Emerging Trends and Analytical Cases.

TOTAL HOURS: 60

TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1	George E Belch and Michel A Belch	Advertising & Promotion	Tata McGraw Hill	2012
2	Wells Williams, Moriarty & Burnett	Advertising, Principles & Practice	Pearson	2014

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1	Clow, Baack	Integrated Advertisements, Promotion and Marketing communication	PHI Learning	2012
2	Shah, D-Souza	Advertising and Promotions- An IMC perspective	Tata McGraw Hill	2013
3	Shimp	Advertising and Promotion: An IMC Approach	South Western Educational publishing	2012
4	Batra, Myers and Aaker	Advertising Management	PHI Learning	2014
5	Kazmi, Batra	Advertising & Sales Promotion	Excel Books	2013

WEB URLs

1. https://www.youtube.com/watch?v=NroY4SSrjL8
2. https://www.youtube,com/watch?v=P-6zmeVox54
3. https://www.youtube.com/watch?v=NcDOot_Mm6I
4. https://www.youtube.com/watch?v=BDcTSTMKfbE
5. www.sutjhally.com/courses/comm3872

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19MBC02 BRAND MANAGEMENT

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COURSE OBJECTIVES:

- To provide a basic knowledge about Branding, brand image & imagery Brand benefits and Brand value.
- To make the students learn about brand personality, brand identity and brand positioning.
- To make the students gaining knowledge in branding various commodities and services.
- Making the students know the value of branding and positioning it in the correct place and evaluate the success of a brand.
- Making the students gain the basic knowledge about brand performance.

COURSE OUTCOMES:

- Students will get the basic knowledge about branding, and brand image, types of branding.
- They able to know the brand positioning and brand vision
- Students will familiar in brand loyalty programmes and celebrities
- To successfully establish and sustain brands and lead to extensions
- They will gain the basic branding performance and role of brand manager.

CourseOutcomes	ProgramOutcomes												PSOs			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
19MBA01.CO1	x	-	-	x	-	-	x	-	-	x	-	-	x	-	-	-
19MBA01.CO2	-	x	x	x	-	-	-	-	x	x	-	x	-	x	-	x
19MBA01.CO3	-	x	-	x	-	x	-	-	-	-	-	-	x	x	-	-
19MBA01.CO4	x	-	x	-	x	-	-	-	-	x	-	x	-	x	-	x
19MBA01.CO5	-	x	x	-	-	-	-	-	-	x	-	x	x	-	-	-

UNIT I INTRODUCTION 9

Basics Understanding of Brands – Definitions - Branding Concepts – Functions of Brand - Significance of Brands – Different Types of Brands – Co branding – Store brands.

UNIT II BRAND STRATEGIES 9

Strategic Brand Management process – Building a strong brand – Brand positioning – Establishing Brand values – Brand vision – Brand Elements – Branding for Global Markets – Competing with foreign brands.

UNIT III BRAND COMMUNICATIONS 9

Brand image Building – Brand Loyalty programmes – Brand Promotion Methods – Role of Brand ambassadors, celebrities – On line Brand Promotions.

UNIT IV BRAND EXTENSION 9

Brand Adoption Practices – Different type of brand extension – Factors influencing Decision for extension – Re-branding and re-launching.

UNIT V BRAND PERFORMANCE 9

Measuring Brand Performance – Brand Equity Management – Global Branding strategies – Brand Audit – Brand Equity Measurement – Brand Leverage -Role of Brand Managers– Branding Challenges & Opportunities-Emerging Trends & Analytical Cases.

TOTAL HOURS: 45

TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1	Kevin Lane Keller	tegic Brand Management: Building, Measuring and Managing	Prentice Hall	2013
2	Moorthi YLR	nd Management	Vikas Publishing House	2012

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REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Lan Batey	Asain Branding – A Great way to fly	PHI, Singapore	2012
2	Paul Tmepoal	Branding in Asia	John Willy	2013
3	Ramesh Kumar	Managing Indian Brands	Vikas Publication, India	2012
4	Jagdeep Kapoor	Brandex	Biztranza, India	2015
5	Mahim Sagar, Deepali Singh, D.P.Agarwal Achintya Gupta	Brand Management	Ane Books Pvt.Ltd	2012

WEB URLs

1. https://www.youtube.com/watch?v=aHyC38rfrkI
2. https://www.youtube.com/watch?v=nwc68CNAxTM&list=PLP1K8RwG01
3. https://www.youtube.com/watch?v=sbjeOh9Eyqs
4. https://www.youtube.com/watch?v=uil8eL6etC0
5. https://www.youtube.com/watch?v=wSqv6cHcGqA

19MBC03 CONSUMER BEHAVIOUR

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COURSE OBJECTIVES:

- To provide basic knowledge about consumer behavior and its application of consumer behavior
- To know the various consumer behavior models and in implications
- To know the personal influences in consumer behavior
- To provide the external influences in consumer behavior
- To make the students to learn about the pre purchase and post purchase model

COURSE OUTCOMES:

- They will gain the knowledge about consumer behavior and its application of consumer behavior
- Students able to know the various consumer behavior models and in implications
- Students will gain the knowledge about personal influences in consumer behavior
- They can able to learn the external influences in consumer behavior
- Student will aware about the pre purchase and post purchase model

CourseOutcomes	ProgramOutcomes												PSOs			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
19MBA01.CO1	x	-	-	x	-	-	x	-	-	x	-	-	x	-	-	-
19MBA01.CO2	-	x	x	x	-	-	-	-	x	x	-	x	-	X	-	x
19MBA01.CO3	-	x	-	x	-	x	-	-	-	-	-	-	x	X	-	-
19MBA01.CO4	x	-	x	-	x	-	-	-	-	x	-	x	-	X	-	x
19MBA01.CO5	-	x	x	-	-	-	-	-	-	x	-	x	x	-	-	-

UNIT I INTRODUCTION 9

Concepts – Significance – Dimensions of Consumer Behavior – Application of knowledge of Consumer Behavior in marketing decisions.

UNIT II CONSUMER BEHAVIOR MODELS 9

Industrial and individual consumer behaviour models - Howared- Sheth, Engel – Kollat, Webstar and wind Consumer Behavior Models – Implications of the models on marketing decisions.

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UNIT III INTERNAL INFLUENCES AND EXTERNAL INFLUENCES 9

Psychological Influences on Consumer Behavior – Motivation – Perception – Personality Learning and Attitude-Self Image and Life styles – Consumer expectation and satisfaction. Socio-Cultural, Cross Culture - Family Group – Reference group – Communication – Factors Influencing Consumer behavior.

UNIT IV PURCHASE DECISION PROCESS 9

High and low involvement - Pre-purchase and post-purchase behavior – Online purchase decision process – Diffusion of Innovation – Managing Dissonance - Emerging Trends – Analytical cases.

UNIT V ORGANIZATIONAL BUYER BEHAVIOR 9

Organizational Buyer Behavior, consumer research, changing consumer research.

TOTAL HOURS: 45

TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1	Leon G.Schiffman and Leslie Lasar Kanuk	onsumer Behavior	Pearson Education, India	2013
2	Jay D. Lindquist and Joseph Sirgy, Shopper	uyer and Consumer Behavior	Biztranza	2014.

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1	Abbael	Consumer behavior: A strategic approach	Wiley	2012
2	Hed, Hoyer	Consumer behavior	Wiley	2012
3	Das Gupta	Consumer behavior	Wiley	2014
4	Shri Prakash	Theory of Consumer behavior	Vikas	2012
5	Srabanti Mukherjee	Consumer behavior	Cengage Learning	2013

WEB URLs

1. https://www.youtube.com/watch?v=jSrC-
2. https://www.youtube.com/watch?v=JmITufxTe7w
3. https://www.youtube.com/watch?v=LuK1dHcEjcQ
4. https://www.youtube.com/watch?v=CnxiSNWRdhA
5. https://www.youtube.com/watch?v=PnGaKYUAtQw

19MBC04 RETAIL MANAGEMENT

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COURSE OBJECTIVES:

- To understand the concepts of effective retailing in India.
- To know the role environment affecting Retail Business and the formats of retail
- To develop the students in application of various Retail Locations and Positioning of retails in India
- To know how to implement Retails shop Management and the Promotion Strategies.
- To know the process of Retail shopper behavior and challenges of retail n India.

COURSE OUTCOMES:

- Students will by benefited by knowing the basics of Retailing and evolution of retailing in India
- Students are familiar with the assessment of the Characteristics of retails formats and MNC role in retailing
- Students able to apply the process of how to implement the space management and inventory management
- Students are benefited by understanding of the role of retail shopper behavior and online retailing.
- To manage the retail chains and understand the retail customer's behavior

CourseOutcomes	ProgramOutcomes												PSOs			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
19MBA01.CO1	x	-	-	X	-	-	x	-	-	x	-	-	x	-	-	-
19MBA01.CO2	-	x	x	X	-	-	-	-	x	x	-	x	-	x	-	x
19MBA01.CO3	-	x	-	X	-	x	-	-	-	-	-	-	x	x	-	-
19MBA01.CO4	x	-	x	-	x	-	-	-	-	x	-	x	-	x	-	x
19MBA01.CO5	-	x	x	-	-	-	-	-	-	x	-	x	x	-	-	-

UNIT I INTRODUCTION 9

Definition & Scope - An overview of Retailing - Challenges and opportunities - Retail trends in India -Socio economic and technological influences -Government of India policy implications on retails – Key Divers of Retailing in India – Non Store format, Concept of Life cycle in Retail – Theories of Retail Development

UNIT II RETAIL FORMATS 9

Organized and unorganized formats - Different organized retail formats - Characteristics of each format - Emerging trends in retail formats - MNC's role in organized retail formats – Criteria for market evaluation – Selection of Promotional Mix – Customer profile market segmentation in India – Factors influencing Retail shoppers

UNIT III RETAILING DECISIONS 9

Choice of retail locations -internal and external atmospherics -Positioning of retail shops - Building retail store Image -Retail service quality management -Retail Supply Chain Management -Retail Pricing Decisions

UNIT IV RETAIL SHOP MANAGEMENT 9

Visual Merchandise management -Space management – Retail inventory management -Retail accounting and audits - Retail store brands -Retail advertising and promotions -Retail management information systems - Online retail - Integrated System – EDI (Electronic Data Interchange) and Bar coding – E-Retailing – Retail Audit.

UNIT V RETAIL SHOPPER BEHAVIOUR 9

Understanding of retail shopper behavior -Shopper profile analysis -Shopping decision process -Factors influencing retail shopper behavior -Complaints management -Retail sales force management—Emerging Trends & Analytical Cases.

TOTAL HOURS: 45

TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1	Pradhan	ailing Management, Text & Cases	McGraw Hill	2012
2	Berman	ail Management	Pearson	2012

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1	Nair	Retail Management	Himalaya Publishing House	2012
2	Madaan, Tata	Fundamentals of Retailing	Mcgraw Hill	2013
3	Gopal, Manjrekar	Retail Management	Excel Books	2014
4	Michael	Retail Management	HavyBiztantra, India	2012
5	Ogden	Integrated Retail Management	Tata McGrawhill	2014

WEB URLs

1. https://www.youtube.com/watch?v=eaMbGS0lOpk
2. https://www.youtube.com/watch?v=37_u6KMFGrk
3. https://www.youtube.com/watch?v=74GpekKO5iA
4. https://www.youtube.com/watch?v=Q7S-c0QZd8U
5. https://www.youtube.com/watch?v=2kVul9Oauf

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REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1	Stulz	Risk Management and Derivaties	Cengage Learning	2012
2	David	Option and Financial Futures – Valuation and Uses	McGraw Hill	2013
3	S.L.Gupta	Financial Derivatives- Theory, Concepts and Practice	Prentice Hall Of India	2014
4	Sundaram Janakiramanan	Derivatives and Risk Management	Pearson India	2013
5	S. S. S. KUMAR	Financial Derivatives	PHI Learning	2014

WEB URLs

1. https://www.youtube.com/watch?v=Wjlw7ZpZVK4
2. https://www.youtube.com/watch?v=btzU4eVHD2E
3. https://www.youtube.com/watch?v=Pz9TJUwa6DM
4. https://www.youtube.com/watch?v=uVq384nqWqg
5. https://www.youtube.com/watch?v=wNa-8IoWNRE

19MBC12 MERCHANT BANKING AND FINANCIAL SERVICES

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COURSE OBJECTIVES:

- To provide the basic idea about Merchant banking and what are the Legal aspects and Differentiations.
- To teach the issuing methods of financial instruments in stock exchanges.
- To understand the basic idea about fee based services provided by merchant bankers.
- To provide the basic idea about Leasing & Hire purchasing and Legal aspects and its differences.
- To teach the inputs of mutual funds which may be contributed towards the NSE and BSE & Credit rating

COURSE OUTCOMES:

- Ability to analyze the functions of the Indian financial system.
- Ability to analyze investments in stock exchanges and understand the modes of issuing securities.
- Acquire the knowledge on fee based services provided by merchant bankers.
- Acquire financial evaluation technique of leasing and hire purchase.
- Good knowledge on fund based financial services.

CourseOutcomes	ProgramOutcomes												PSOs			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
19MBA01.CO1	x	-	-	x	-	-	x	-	-	x	-	-	x	-	-	-
19MBA01.CO2	-	x	x	x	-	-	-	-	x	x	-	x	-	x	-	x
19MBA01.CO3	-	x	-	x	-	x	-	-	-	-	-	-	x	x	-	-
19MBA01.CO4	x	-	x	-	x	-	-	-	-	x	-	x	-	x	-	x
19MBA01.CO5	-	x	x	-	-	-	-	-	-	x	-	x	x	-	-	-

UNIT I OVERVIEW OF MERCHANT BANKING 12

Merchant Banking: Origin, growth and services rendered by merchant bankers – Problems and scope of merchant banking in India – Functions of Merchant Bank - Legal and Regulatory Framework – Relevant Provisions of Companies Act- SERA- SEBI guidelines- FEMA, etc. - Relation with Stock Exchanges and OTCEI.

UNIT II ISSUES MANAGEMENT 12

Role of Merchant Banker in appraisal of projects, Designing Capital Structure and Instruments – Issue Pricing – Participants – Methods: Book Building and Prospectus – Offer for Sale and Green Shoe Option-IPO and Private placement – Bought deals – Post Issue Activities.

UNIT III FEE BASED SERVICES 12

Mergers and Acquisitions: Motives, Merger Analysis, Terms of Exchange, Cash purchase, Stock Exchange Acquisitions, Leverage Buyouts and Management Buyouts.– Portfolio Management Services – Accounts and Audit – Credit Syndication – Credit Rating – Mutual Funds –Forms – Financial Evaluation – Regulation.

UNIT IV LEASING AND HIRE PURCHASING 12

Leasing: Concept, Types, Lease Agreements – Potentiality of Leasing as a means of financing – Advantages and Disadvantages – Accounting Treatment and sales tax provisions – Lease Financing in India – Hire Purchasing: Rights of Hirer- Accounting for Hire purchase – Methods.

UNIT V FUND BASED FINANCIAL SERVICES 12

Other Financial Services: Hire Purchase, Commercial paper, Credit Cards, Credit Rating, Recent trends in marketing financial services – Real estate Financing – Bills Discounting - Factoring: Meaning, Modus operandi, types, functions – Factoring in India – Forfeiting – Venture Capital-. Emerging Trends and Analytical cases.

TOTAL HOURS: 60

TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1	M.Y.Khan	nancial Services	Tata McGraw-Hill	2012
2	Dr.S.Gurusamy	erchant Banking and Financial Services	McGraw Hill Education	2014

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1	Machiraju	Indian Financial System	Vikas Publishing House	2012
2	J.C.Verma	A Manual of Merchant Banking	Bharath Publishing House	2013
3	Varshney P.N. & Mittal D.K	Indian Financial System	Sultan Chand & Sons	2013
4	Sasidharan	Financial Services and System	Tata McGraw Hill	2012
5	Nalini Prava Tripathy	Financial Services	PHI Learning	2012

WEB URLs

1. https://www.youtube.com/watch?v=d3WiHjWOTE8
2. http://www.academia.edu/4069475/MBA_II
3. http://www.corporater.com/ProjectPortfolio
4. http://www.investopedia.com/terms/h/hire-purchase.as
5. https://www.youtube.com/watch?v=U6rt-XSdlGk

19MBC13 SECURITY ANALYSIS AND PORTFOLIO MANAGEMENT

L	T	P	C
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COURSE OBJECTIVES

- To understand the basic concept of Investment, functions of Stock Exchanges, legal and regulatory framework of SEBI and its guidelines.
- To make them to understand the trading system and settlement in stock exchanges.
- To provide basic knowledge about the fundamental analysis and industrial analysis.
- To make them to understand the technical analysis using charts, market indicators, patterns, trends and oscillators.
- To make them to understand the process in portfolio management and the concept of mutual funds.

COURSE OUTCOMES

- The students will be able to analyse the investment avenues.
- They will become familiar in operations of stock exchanges.
- They will be able to know the different analysis techniques used to evaluate the Investments.
- Ability to do the Fundamental Analysis.
- Ability to design a suitable Portfolio for the different risk bearing investments.

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CourseOutcomes	ProgramOutcomes												PSOs			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
19MBA01.CO1	x	-	-	x	-	-	x	-	-	x	-	-	x	-	-	-
19MBA01.CO2	-	x	x	x	-	-	-	-	x	x	-	x	-	x	-	x
19MBA01.CO3	-	x	-	x	-	x	-	-	-	-	-	-	x	x	-	-
19MBA01.CO4	x	-	x	-	x	-	-	-	-	x	-	x	-	x	-	x
19MBA01.CO5	-	x	x	-	-	-	-	-	-	x	-	x	x	-	-	-

UNIT I OVERVIEW OF INVESTMENT **12**

Investments – Financial and Economical Meaning – Investment Process – Characteristics and Objectives - Investment Vs. Speculation – Investment categories – Risk and return – Factors Influencing Risk – Measuring Risk and Return, Valuation of Equity: Dividend Models, Price/Earnings Approach.

UNIT II STOCK MARKETS **12**

Financial Market - Types - Participants in financial Market – Regulatory Environment, Primary Market – Methods of floating new issues – Role of primary market – Stock Exchanges in India - BSE,OTCEI,NSE, ISE, and Regulations of stock exchanges – Trading system in stock exchanges.

UNIT III FUNDAMENTAL ANALYSIS **12**

Economic analysis: Key Macroeconomic Factors. Industry analysis: Industry Life Cycle Analysis. Analyzing the Structure and Characteristics of an Industry – Profit Potential of Industries. Company Analysis: Analyzing the Financial Statements, The Chemistry of Earnings, Market Share/Profit Margin Approach - Forecasting Earnings – Applied Valuation Techniques – Graham and Dodds investor ratios.

UNIT IV TECHNICAL ANALYSIS **12**

Technical Analysis – Charting methods – Market Indicators. Trend – Trend reversals – Patterns - Moving Average – Exponential moving Average – Oscillators – Market Indicators – Forecasting Individual Stock Performance - Random Walk Efficient Market theory.

UNIT V PORTFOLIO MANAGEMENT **12**

Portfolio Construction – Portfolio Analysis: Effects of combining securities – Markowitz's Mean-Variance model. Portfolio selection: Risk and investor Preferences – Constructing the portfolio – Significance of beta in the Portfolio- Capital Asset Pricing Model – Portfolio Revision – Portfolio Evaluation – Mutual Funds – Types - Regulatory Environment - Emerging Trends and Analytical cases.

TOTAL HOURS: 60

TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1	Donald E.Fischer & Ronald J.Jordan	ecurity Analysis & Portfolio Management	PHI Learning	2012
2	Punithavathy Pandian	curity Analysis and Portfolio Management	Vikas Publishing House Private Limited,	2012

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1	Reilly & Brown,	Investment Analysis and Portfolio Management	Cengage Learning	2012
2	S. Kevin	Securities Analysis and Portfolio Management	PHI Learning	2012
3	Prasannachandra	Investment analysis and Portfolio Management	Tata McGraw Hill	2011
4	V.A.Avadhan	Securities Analysis and Portfolio Management	Himalaya Publishing House	2013
5	V.K.Bhalla	Investment Management	S.Chand & Company Ltd.	2012

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WEB URLs

1. https://www.youtube.com/watch?v=wcN_lctOIGw
2. https://www.youtube.com/watch?v=uOVdcn-NvYQ
3. https://www.youtube.com/watch?v=OYSpvehtePU
4. https://www.youtube.com/watch?v=kXIFtQvKzPA
5. https://www.youtube.com/watch?v=8TJQhQ2GZ0Y

19MBC14 BANKING AND INDIAN FINANCIAL SYSTEM

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To study the concept of Banking and its growth in India.
- To understand the various types of deposits & advances.
- To create awareness on the rural banks for helping and promoting industrial and agricultural activities.
- To create awareness on the broad contours of export & import credit and recent developments in banking in India.
- To understand the working of e-banking services provided by banks.
-

COURSE OUTCOMES:

- Ability to understand the Banking operations in India.
- Ability to plan the sources of funding for their business operations.
- Ability to acquire expertise in the area of operations of Industrial and Agricultural Banks.
- Ability to evaluate the performance of banks in association with the evaluation of risks in securities market.
- Gain knowledge about the Electronic Payment System, Net Banking and Mobile Banking

CourseOutcomes	ProgramOutcomes												PSOs			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
19MBA01.CO1	x	-	-	x	-	-	x	-	-	x	-	-	x	-	-	-
19MBA01.CO2	-	x	x	x	-	-	-	-	x	x	-	x	-	x	-	x
19MBA01.CO3	-	x	-	x	-	x	-	-	-	-	-	-	x	x	-	-
19MBA01.CO4	x	-	x	-	x	-	-	-	-	x	-	x	-	x	-	x
19MBA01.CO5	-	x	x	-	-	-	-	-	-	x	-	x	x	-	-	-

UNIT I INDIAN BANKING SYSTEMS 9

Definition- Functions- Types- Central Banking-Structure of Banking System- Rural Financing - Acts governing the functioning of Indian banking system – RBI Act 1934, Negotiable Instruments Act 1881, Banking Regulations Act 1949 – Rights and obligations of a banker, Overview of Financial statement of banks.

UNIT II SOURCES AND MOBILIZATION OF FUNDS 9

Deposit Mobilization- Assets and Liabilities Management- Secured Advances - Endorsement and Crossing of Cheques- Payment of Cheques- Collection of Cheques - Different types of loans and their features, Major components of a typical loan policy document, Steps involved in Credit analysis, Credit delivery and administration, Pricing of loans, Customer profitability analysis.

UNIT III INDUSTRIAL AND AGRICULTURAL BANKING SYSTEMS 9

Development Banks- Investment Institutions- State Level Institutions- Specialized Financial Institutions- International Finance Institutions- IBRD- IFC- IDA- NABARD-NHB- Micro Financing Institutions.

UNIT IV CREDIT MONITORING AND RISK MANAGEMENT 9

Need for credit monitoring, Signals of borrowers' financial sickness, Financial distress prediction models – Rehabilitation process, Risk management – Interest rate, liquidity, forex, credit, market, operational and solvency risks – risk measurement process and mitigation, Basic understanding of NPAs and ALM – Performance analysis of banks; ratio analysis and CAMELS.

UNIT V VIRTUAL BANKING 9

Electronic Banking - advantages – Plastic money, E-money – Forecasting of cash demand at ATMs – Security threats in e-banking and RBI's initiatives – Mobile banking – Mobile banking services – challenges for mobile banking solution – SMS banking – typical push and pull service offered under mobile banking – Quality of service in SMS banking- Emerging Trends and Analytical cases.

TOTAL HOURS: 45

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TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1	Padmalatha Suresh and Justin Paul	anagement of Banking and Financial Services	Pearson	2012
2	Meera Sharma	anagement of Financial Institutions – with emphasis on Bank and Risk Management	PHI Learning Pvt Ltd	2013

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1	Peter S. Rose and Sylvia C. and Hudgins	Bank Management and Financial Services	Tata McGraw Hill	2012
2	H.R. Machiraju	Indian Financial System	Vikas Publishing House	2014
3	SriVastava	Management of Financial Institutions	Himalaya Publications	2013
4	Varshney	Banking and Financial Systems	S Chand	2014
5	Meera Sharma	Management of Financial Institutions – with emphasis on Bank and Risk Management	PHI Learning Pvt Ltd	2015

WEB URLs

1. https://www.youtube.com/watch?v=Qxl3br09Cf8
2. https://www.youtube.com/watch?v=Xsd5A-aMG4A
3. https://www.youtube.com/watch?v=0vb1uhwzkus
4. https://www.youtube.com/watch?v=VCmn1YH8eDc
5. https://www.youtube.com/watch?v=oADxUX4STjE

19MBC15 RISK MANAGEMENT AND INSURANCE

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To understand the risk management.
- To understand the management techniques for avoidance of risk.
- To understand the concept of Forward and Futures Contract, Options and Swaps.
- To understand the basics of insurance.
- To study the risk aversion and management.

COURSE OUTCOMES:

- To analyze the sources of risk in Insurance policies.
- To apply the management techniques for avoidance of risk.
- Use Forward Contract and Futures Contract to hedge the unsystematic Risk.
- Gain insight knowledge on types of insurance to be needed in an hour for an individual.
- To evaluate the factors of business risk and contractual provisions.

CourseOutcomes	ProgramOutcomes												PSOs			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
19MBA01.CO1	x	-	-	x	-	-	x	-	-	x	-	-	x	-	-	-
19MBA01.CO2	-	x	x	x	-	-	-	-	x	x	-	x	-	x	-	x
19MBA01.CO3	-	x	-	x	-	x	-	-	-	-	-	-	x	x	-	-
19MBA01.CO4	x	-	x	-	x	-	-	-	-	x	-	x	-	x	-	x
19MBA01.CO5	-	x	x	-	-	-	-	-	-	-	-	x	x	-	-	-

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UNIT I INTRODUCTION TO RISK MANAGEMENT 9

Risk and Uncertainty- Types of Risk – Objectives of risk management – Sources of risk – Risk Identification – Measurement of risk – Rationale for Risk Management in organizations.

UNIT II RISK ASSESSMENT 9

Risk identification – Risk analysis – Exposures – Physical assets – Financial assets – legal liability – Risk control Tools – Risk financing techniques – Risk Management Decisions- Options – Data Organization and Analysis - Risk Avoidance – Loss Control – Risk retention – Risk transfer – Value of risk Management – Pooling and diversification of risk.

UNIT III INTRODUCTION TO INSURANCE 9

Risk and Insurance- Definition and basic characteristics of Insurance – Insurance vs Gambling Insurance – Types of Insurance – Indian Insurance Industry - Historical framework – Major Players of Insurance - Insurance Regulation (IRDA)

UNIT IV LIFE INSURANCE 9

Basics of life Insurance – Features – Contract – Classifications – Annuities – General Insurance – Health Care Insurance- Fire Insurance - Marine Insurance- Vehicles Insurance.

UNIT V RISK AVERSION AND RISK MANAGEMENT 9

Risk aversion and demand for insurance – Factors that limit the insurability of Risk – Business risk management and demand for insurance – Contractual provisions that limit coverage –Case Analysis

TOTAL HOURS: 45

TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1	Harrington and Niehaus,	isk management and Insurance	Tata Mcgraw Hill Publishing	2012
2	Trieschman, Hoyt, Sommer	isk management and Insurance	Cengage Learning	2013

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1	Mark S. Dorfman	Introduction to Risk management and Insurance	Prentice hall of India	2012
2	Skipper and Kwon	Risk management and Insurance	Blackwell Publishing	2013
3	Nalini Prave Tripathy, and Prabir Pal	Insurance – Theory and Practice	Prentice hall of India	2014
4	George E Rejda	Principles of Risk Management and Insurance	Pearson Education	2013
5	Mishra, M.N	Insurance – Principles, and practices	S. Chand & Co IRDA Publications	2013

WEB URLs

1. https://www.youtube.com/watch?v=iCYYN_s25Hw
2. https://www.youtube.com/watch?v=1kU4pvdIdT4
3. https://www.youtube.com/watch?v=P0DnP7hFASg
4. https://www.youtube.com/watch?v=r0sRDUYgC-E
5. https://www.youtube.com/watch?v=CAI63OAP3xw

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19MBC16 CORPORATE FINANCE

L	T	P	C
4	0	0	4

COURSE OBJECTIVES:

- To provide the basic concepts of sources of raising finance from capital market.
- To teach the short term financial requirements.
- To educate the students regarding the techniques of analyzing cash flows.
- To teach the financing decision to solve the cash inadequacy and insolvency.
- To know about the corporate social responsibility.

COURSE OUTCOMES:

- To apply the knowledge on raising finance from capital market.
- To estimate the short term financial requirements.
- To appraise the risky investments.
- To apply the financing decision to solve the cash inadequacy and insolvency.
- To become a Good ethical corporate manage.

CourseOutcomes	ProgramOutcomes												PSOs			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
19MBA01.CO1	x	-	-	x	-	-	x	-	-	x	-	-	x	-	-	-
19MBA01.CO2	-	x	x	x	-	-	-	-	x	x	-	x	-	x	-	x
19MBA01.CO3	-	x	-	x	-	x	-	-	-	-	-	-	x	x	-	-
19MBA01.CO4	x	-	x	-	x	-	-	-	-	x	-	x	-	x	-	x
19MBA01.CO5	-	x	x	-	-	-	-	-	-	x	-	x	x	-	-	-

UNIT I INTRODUCTION 12

Definition of Corporate Finance – Importance of Corporate Finance – Functions of Corporate Finance – Scope of Corporate financing – Financial Planning – Financial Forecasting – Demand Forecasting – forecasting Techniques – Profit Planning – Marginal cost decision making, Standard cost and techniques.

UNIT II INDUSTRIAL FINANCE 12

Indian Capital Market – Problems of Industrial Finance - Equity financing – Debenture financing – SEBI Guidelines - International sources of finance, financing of exports – Role of EXIM bank and commercial banks– Finance for rehabilitation of sick units.

UNIT III WORKING CAPITAL FINANCE 12

Estimating working capital requirements – Approach adopted by Commercial banks, Commercial paper- Public deposits and inter corporate investments – Meaning – Advantages – Excess or Inadequate Working Capital – Factors – Working Capital Analysis.

UNIT IV FINANCING AND DIVIDEND DECISIONS 12

Appraisal of risky Investments- DCF methods – Sensitivity Analysis- Simulation – Decision tree Approach – Cash inadequacy and Cash insolvency – Financing decision in the context of Option pricing model and Agency costs.

UNIT V CORPORATE GOVERNANCE 12

Corporate Governance – SEBI Guidelines – Corporate Social Responsibility – Corporate disasters – Corporate Ethics – Stakeholders – Corporate Ethics for Managers and Professionals- Emerging Trends and Analytical cases..

TOTAL HOURS: 60

TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1	Richard A.Brealey, Stewat C.Myers and Mohanthy	ciples of Corporate Finance	Tata McGraw Hill	2013
2	I.M.Pandey	ancial Management	Vikas Publishing House Pvt Ltd	2012

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REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1	Brigham and Ehrhardt, 2nd Edition	Corporate Finance - A focused Approach	Cengage Learning	2012
2	M.Y Khan	Indian Financial System	Tata McGraw Hill	2012
3	Megginson, and Gitman	Corporate Finance	Smart	2012
4	Aswath Damodaran	Corporate Finance	John Wiley and Sons, Inc	2013
5	Krishnamurthy and Viswanathan	Advanced Corporate Finance	PHI Learning	2011

WEB URLs

1. https://www.youtube.com/watch?v=OY9yh8h_Ql8
2. https://www.youtube.com/watch?v=oHoVH-IO4Wo
3. https://www.youtube.com/watch?v=oHoVH-IO4Wo
4. https://www.youtube.com/watch?v=LSptY8XuGqk
5. https://www.youtube.com/watch?v=B7vSsD7LLrM

19MBC21 TRAINING AND DEVELOPMENT

L	T	P	C
4	0	0	4

COURSE OBJECTIVES:

- To familiarize students with training needs and analysis
- To focus on the factors affecting training design.
- To understand the training process and methods.
- To help them to know the implementation and evaluation of training.
- To manage and cope up with the management development.

COURSE OUTCOMES:

- Ability to know the training needs and analysis.
- Ability to understand the training design.
- Adopt different styles of training methods & process.
- Ability to initiate, manage & implementation of training.
- Able to know special need for technical managers.

CourseOutcomes	ProgramOutcomes												PSOs			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
19MBA01.CO1	x	-	-	x	-	-	x	-	-	x	-	-	x	-	-	-
19MBA01.CO2	-	x	x	x	-	-	-	-	x	x	-	x	-	x	-	x
19MBA01.CO3	-	x	-	x	-	x	-	-	-	-	-	-	x	x	-	-
19MBA01.CO4	x	-	x	-	x	-	-	-	-	x	-	x	-	x	-	x
19MBA01.CO5	-	x	x	-	-	-	-	-	-	x	-	x	x	-	-	-

UNIT I INTRODUCTION 12

Training Objective and Concepts of Training – Scope – process of training – Training and HRD – How training benefits the organization – Requisites of Effective Training – Role of External Agencies in Training and Development.

UNIT II TRAINING NEEDS ASSESMENT 12

Meaning And Purpose Of Training Needs Assessment, Training Needs Assessment At Different Levels-Approaches For Training Needs Assesment, Output Of Training Needs Assesment, Methods Used In Training Need Assessment

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TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1	Prem Chadha	rformance Management	Macmillan	2012
2	T.V.Rao	rformance Management & Appraisal Systems	Response Books	2013

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1	Herman Aguinis	Performance Management	Pearson education	2014
2	Varsha Dixit	Performance Management	Vrinda publication	2010
3	Srinivas R.Kandla	Performance Management, Strategies and Interventions Drives	Prentice Hall of India	2007
4	B.D.Singh	Compenstion & Reward Management	Excel Books	2013
5	R.K.Sahu	Performance Management System	Excel Books	2015

Web URL

1. https://www.youtube.com/watch?v=6GufMa-J8cI
2. https://www.youtube.com/watch?v=J_Qe9MMDAms
3. https://www.youtube.com/watch?v=8ijBfprUNuQ
4. https://www.youtube.com/watch?v=IHpAacOQTk0
5. https://www.youtube.com/watch?v=EK1pio8jnko

19MBC26 CROSS CULTURE MANAGEMENT

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To provide conceptual framework of global business environment
- To understand the cross cultural and its effect on organizations.
- To highlight the culture – communication link and understand negotiation skills.
- To learn about developing international and global strategies.
- To understand the operation of global management teams.

COURSE OUTCOMES:

- Ability to know the conceptual framework of global business environment
- Adopt to understand the cross cultural and its effect on organizations.
- Adopt different communication link and understand negotiation skills.
- Ability to learn about developing international and global strategies.
- Able to know operation of global management teams.

CourseOutcomes	ProgramOutcomes												PSOs			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
19MBA01.CO1	x	-	-	x	-	-	x	-	-	x	-	-	x	-	-	-
19MBA01.CO2	-	x	x	x	-	-	-	-	x	x	-	x	-	x	-	x
19MBA01.CO3	-	x	-	x	-	x	-	-	-	-	-	-	x	x	-	-
19MBA01.CO4	x	-	x	-	x	-	-	-	-	x	-	x	-	x	-	x
19MBA01.CO5	-	x	x	-	-	-	-	-	-	x	-	x	x	-	-	-

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UNIT I INTRODUCTION 9

Introduction to Cross cultural management – Understanding culture and culture differences among the globe – Cross border business development – Components of cultural intelligence – Key cultural values and concepts – Significance of Cross cultural management to managerial personnel.

UNIT II CULTURAL AND GLOBAL MANAGEMENT 9

Developing Cultural Intelligence – Decision Making Modules Across Culture – Cross Cultural Communication Process, Working In Multi – Cultural Teams, Concepts and performance, High performance winning Teams And Cultures – Culture Implications for Team Providing.

UNIT III CROSS CULTURE NEGOTIATION 9

Cross Culture negotiation and Decision Making – Process of Negotiation and Needed Skills and Knowledge Base – International and Global business operations – Strategy formulation and implementation – Aligning strategy, Structure and culture in an organizational context.

UNIT IV GLOBAL HUMAN RESOURCE MANAGEMENT 9

Global Human Resource Management – Staffing and Training for global operation – Developing a global management cadre – motivating and leading – Developing values and behavioral necessary to build high performance organizational personnel.

UNIT V CORPORATE CULTURE 9

Corporate culture – One Nature Of Organizational Culture – Quality And Cross Culture – Designing the strategy for a Culture Change Building – Stages Of Cultural Adjustment – Culture Shock – Successful Implementation Of Culture Change Phase – Measurement Of Ongoing Improvement-Emerging Trends and Analytical cases.

TOTAL HOURS : 45

TEXT BOOK(S):

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1	Jerome Dumetz, Fons Trompenaars, Meredith Belbin	ross-Cultural Management	GreateSpace	2012
2	Mark P.Peterson	ross-Cultural Management	Greatespace	2014

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1	David .C. Thomas	Cross cultural management	Sage publication	2014
2	Mark F.Peterson	Cross cultural Research	Sage publication	2015
3	Jerome Dumetz	Cross cultural management	Greate Space	2012
4	Neal .M.Ashnesay	Organisation culture and mamagement	Greate Space	2010
5	Geert hofstede	Cultures and organizations	Sage	2010

Web URL

1. www.prenhall.com/deresky
2. http:// globaledge. Msu .edu
3. www. Geert. hofstede .com
4. http:// www. Franchise – international .net/
5. http: // www. Astd. Org

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19MBC31 PROJECT MANAGEMENT

L	T	P	C
4	0	0	4

COURSE OBJECTIVES

- To understand the Project Selection Methods.
- To enable the student to understand the concept Work Break down Structure.
- To familiarize them with the implementation of PERT & CPM Networks.
- To gain insights about the importance of Data Collecting and reporting.
- To enable the student to Develop Types of project organizations.

COURSE OUTCOMES

- Ability to prepare Project Formulation.
- Ability to apply Budget uncertainty and risk management.
- Ability to implement scheduling & resource allocation.
- The student would be able to relate the tools and techniques in designing the control
- Ability to implement Organization Design.

CourseOutcomes	ProgramOutcomes												PSOs			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
19MBA01.CO1	x	-	-	x	-	-	x	-	-	x	-	-	x	-	-	-
19MBA01.CO2	-	x	x	x	-	-	-	-	x	x	-	x	-	x	-	x
19MBA01.CO3	-	x	-	x	-	x	-	-	-	-	-	-	x	x	-	-
19MBA01.CO4	x	-	x	-	x	-	-	-	-	x	-	x	-	x	-	x
19MBA01.CO5	-	x	x	-	-	-	-	-	-	x	-	x	x	-	-	-

UNIT I INTRODUCTION TO PROJECT MANAGEMENT 12

Project Management – Definition –Goal - Lifecycles. Project Selection Methods. Project Portfolio Process– Project Formulation. Project Manager – Roles- Responsibilities and Selection – Project Teams.

UNIT II PLANNING AND BUDGETING 12

The Planning Process – Work Break down Structure – Role of Multidisciplinary teams. Budget the Project – Methods. Cost Estimating and Improvement. Budget uncertainty and risk management.

UNIT III SCHEDULING & RESOURCE ALLOCATION 12

PERT & CPM Networks - Crashing – Project Uncertainty and Risk Management – Simulation – Gantt Charts – Expediting a project – Resource loading and leveling. Allocating scarce resources – Goldratt" s Critical Chain.

UNIT IV CONTROL AND COMPLETION 12

The Plan-Monitor-Control cycle – Data Collecting and reporting – Project Control – Designing the control

UNIT V PROJECT ORGANISATION & CONFLICT MANAGEMENT 12

Formal Organisation Structure – Organisation Design – Types of project organizations. Conflict – Origin & Consequences. Managing conflict – Team methods for resolving conflict- Emerging Trends and Analytical Cases.

TOTAL HOURS: 60

TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1	Clifford Gray and Erik Larson	Project Management	Tata McGraw Hill	2013
2	John M. Nicholas	Project Management for Business and Technology- Principles and Practice	Pearson Education Hill	2012

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3	M. Heinke J	Managing Services, New Delhi	Tata McGraw	2013
4	Hacksever, Render, Russell and Murdick	Service Management and Operations	Prentice Hall of India	2013
5	Zeithaml and Bitner	Service Marketing: Integrating Customer Focus Across the Firm	Tata McGraw	2012

WEB URLs

1. https://www.youtube.com/watch?v=E0PSAlqeigg
2. https://www.youtube.com/watch?v=Fno84qdMLAM
3. https://www.youtube.com/watch?v=tO0jbEjvWYU
4. https://www.youtube.com/watch?v=w0cD26CLBA0
5. https://www.youtube.com/watch?v=a2QgdDk4Xjw

19MBC34 SUPPLY CHAIN AND LOGISTICS MANAGEMENT

L	T	P	C
3	0	0	3

COURSE OBJECTIVES

- To introduce the concept of supply chain and logistics.
- To familiarize the key drivers of supply chain performance.
- To enable the students to understand the analytical tools necessary to solve supply chain
- To Use supply chain models and modeling system
- To Understand the scope and practice of business logistics and supply chain management

COURSE OUTCOMES

- Ability to explain the strategic role of a supply chain in the business process.
- Ability to use key strategic drivers of supply chain performance for effective results.
- Ability to analyze the analytic methodologies for supply chain.
- Develop Network design and supply chain network optimization models.
- Student gains knowledge on effective management of the logistics and supply chain

CourseOutcomes	ProgramOutcomes												PSOs			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
19MBA01.CO1	x	-	-	x	-	-	x	-	-	x	-	-	x	-	-	-
19MBA01.CO2	-	x	x	x	-	-	-	-	x	x	-	x	-	x	-	x
19MBA01.CO3	-	x	-	x	-	x	-	-	-	-	-	-	x	x	-	-
19MBA01.CO4	x	-	x	-	x	-	-	-	-	x	-	x	-	x	-	x
19MBA01.CO5	-	x	x	-	-	-	-	-	-	x	-	x	x	-	-	-

UNIT I SUPPLY CHAIN 9

Fundamentals, Importance, Decision Phases, Process view, Supplier- Manufacturer-Customer chain, Supply chain performance: Drivers, Structuring supply chain.

UNIT II OVERVIEW OF DEMAND FORECASTING IN THE SUPPLY CHAIN 9

Aggregate planning, Managing predictable variability. Managing supply chain cycle inventory, Uncertainty, safety inventory, Determination of optimal level of product availability

UNIT III DISTRIBUTION NETWORK DESIGN 9

Role, factors influencing network, options, Value Addition. Models for facility location and capacity planning. Network design: Impact of uncertainty, decisions using decision trees. Distribution center location models. Supply chain network optimization models.

UNIT IV LOGISTIC SYSTEM 9

Evolution, Infrastructure and Networks. Freight management, route planning, and Containerization. Model characteristics, inter-model operators and transport economies. Ocean carrier management, import-export logistics management. Logistics outsourcing, 3PL / 4PL - Insurance.

UNIT V TRANSACTIONAL LOGISTICS 9

Framework and role of supply chain in e- business and b2b practices. Supply Chain IT Framework. International supply chain, GPS, Tracking system. Emerging Trends – Analytical cases

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19MBC43 KNOWLEDGE MANAGEMENT

L	T	P	C
3	0	0	3

COURSE OBJECTIVES

- To enable the students to understand the fundamental concepts in Knowledge Management.
- To learn the Methods, Techniques and Tools of Knowledge Management.
- To understand the Ethical and legal issues in Knowledge Management
- To create an awareness about Disaster and Eco system.
- To enable the students to know the various styles of leadership.

COURSE OUTCOMES

- Ability to face the challenges in Building a Knowledge Management System.
- Ability to do the Knowledge Codification.
- Ability to use the Neural Networks as Learning Model.
- Able to manage the disaster
- To adopt different techniques of leading the people.

CourseOutcomes	ProgramOutcomes												PSOs			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
19MBA01.CO1	x	-	-	x	-	-	x	-	-	x	-	-	x	-	-	-
19MBA01.CO2	-	x	x	x	-	-	-	-	x	x	-	x	-	x	-	x
19MBA01.CO3	-	x	-	x	-	x	-	-	-	-	-	-	x	x	-	-
19MBA01.CO4	x	-	x	-	x	-	-	-	-	x	-	x	-	x	-	x
19MBA01.CO5	-	x	x	-	-	-	-	-	-	x	-	x	x	-	-	-

UNIT I INTRODUCTION 9

Understanding Knowledge: Data, Information and Knowledge, Types of Knowledge, Human thinking and Learning, Knowledge Management, System Life Cycle, Conventional vs. KM System Life Cycle, Challenges in Building KM System.

UNIT II KNOWLEDGE CREATION AND CAPTURE 9

Knowledge Transfer and Knowledge Sharing: Transfer as a Step in the Process, Transfer Methods, Role of Internet in Knowledge Transfer, and Knowledge Transfer in the e-world.

UNIT III KNOWLEDGE CODIFICATION 9

Knowledge Codification: Meaning, Reasoning for Codifying, Codification Tools and Procedures. Knowledge Developer's Skill Set, System Testing and Deployment: Knowledge Testing, Approaches to Logical Testing, Approaches to user Acceptance Testing, Managing the testing phase, KM System Deployment: Issues, User Training, Post Implementation Review.

UNIT IV KM SYSTEM TOOLS AND PORTALS 9

Role of NGO, Community based organization & Media, Disaster response, Police and other organization – Environment – Ecosystem & disasters –Aspects of environmental management for disaster risk reduction –Environmental Impact Assessment (EIA).

UNIT V KNOWLEDGE LEADERSHIP 9

Knowledge Leadership styles, Knowledge alignment with business strategies, Pragmatic knowledge development, Balancing knowledge and business management systems, Constructing knowledge infrastructure- Emerging Trends & Analytical Cases.

TOTAL HOURS: 45

TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1	Kimiz Dalkir	nowledge Management in Theory and Practice	Butterworth – Heinemann	2012
2	J. Becker; M.J. Shaw	formation Systems and e-Business Management	Springer	2010

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REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1	Stuart Barnes	Knowledge Management Systems – Theory and Practice	Cengage Learning	2012
2	Steven Cavaleri and Sharon Seivert with Lee W. Lee	Knowledge Leadership – The Art and Science of Knowledge based organisation	Butterworth – Heinemann	2013
3	Shelda Debowski	Knowledge Management	Wiley India	2012
4	Stuart Barnes	Knowledge Management Systems – Theory and Practice	Cengage Learning	2012
5	Yogesh Malhotra	Knowledge Management and Virtual Organizations	deal Group Inc (IGI)	2012

WEB URLs

1. https://www.youtube.com/watch?v=JUZxaHj0FEI
2. https://www.youtube.com/watch?v=KYdg5whlEvY
3. https://www.youtube.com/watch?v=uKbL8IxiVuQ
4. https://www.youtube.com/watch?v=ZHpcOx7LBkc
5. https://www.youtube.com/watch?v=skCEiEAzslM

19MBC44 RELATIONAL DATABASE MANAGEMENT SYSTEM

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COURSE OBJECTIVES

- To enable the students to understand the concepts database.
- To enhance the knowledge of students in Relational Model.
- To help the students understand the issues involved in the operation of SQL,DML,DDL,DCL
- To enhance the Application of RDBMS Design and other SQL Functions.
- To Using the Hash Structure appropriately.

COURSE OUTCOMES

- Ability to choose appropriate Database Systems.
- Ability to structure Complex Queries.
- Leverage RAID System.
- Ability to Modeling analysis.
- Ability to Implement Hash Structure.

CourseO utcomes	ProgramOutcomes												PSOs			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
19MBA01.CO1	x	-	-	x	-	-	x	-	-	x	-	-	x	-	-	-
19MBA01.CO2	-	x	x	x	-	-	-	-	x	x	-	x	-	x	-	x
19MBA01.CO3	-	x	-	x	-	x	-	-	-	-	-	-	x	x	-	-
19MBA01.CO4	x	-	x	-	x	-	-	-	-	x	-	x	-	x	-	x
19MBA01.CO5	-	x	x	-	-	-	-	-	-	x	-	x	x	-	-	-

UNIT I INTRODUCTORY CONCEPTS OF DBMS 12

Introduction and application of DBMS – Purpose of database- Database System Architecture –Levels – Mapping –Database System Architecture – Levels –Mapping, Database Users and DBA-Difference between DBMS & RDMS.

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REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Pascal Dennis	Lean Production Simplified: A Plain-Language Guide to the World's MostPowerful Production System	Second edition, Productivity Press, New York	2016
2	Groover M.P	Automation, Production Systems and Computer Integrated Manufacturing	Third Edition, Prentice-Hall	2014
3	Jha, N.K	Handbook of Flexible Manufacturing Systems	Academic Press Inc	2012
4	Wilson	How to Implement Lean Manufacturing	McGraw-Hill Publishing Company	2015
5	Allen N. Mendl	Just in Time	Solution Tree	2005

19CMB03 DESIGN OF MANUFACTURE AND ASSEMBLY

L T P C
3 0 0 3

COURSE OBJECTIVES

- To understand the selection of materials, methods, fits and tolerance concepts to design a Product.
- To familiarize the basic concept of design for castings, forming andmachining.
- To understand the factors influencing the manufacturingprocesses.
- To comprehend the factors influencing the designing of cast and machinedcomponents.
- To understand the basic procedure of design for assembly andenvironments.
- To familiarize the tools required in various manufacturingprocesses..

COURSE OUTCOMES

1. Understand the basic principles formanufacturability.
2. Understand and explain the factors influencing the form designsystems
3. Demonstrate the design considerations required for machinedcomponents
4. Comprehend and explain the design consideration for castcomponents.
5. Demonstrate the need for designing forenvironment
6. Explain life cycleassessment.

UNIT I: BASICS OF DESIGNING PRINCIPLES 9

General design principles for manufacturability - strength and mechanical factors, mechanisms selection, evaluation method, Process capability - Feature tolerances Geometric tolerances - Assembly limits -Datum features - Tolerance stacks.

UNIT II: FACTORS INFLUENCING FORM DESIGN SYSTEMS 9

Material, Manufacture, Design- Possible solutions - Materials choice - Influence of materials on form design - form design of welded members, forgings and castings.

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UNIT III: COMPONENT DESIGN –MACHINING CONSIDERATION 9

Design features to facilitate machining - drills - milling cutters - keyways - Doweling procedures, counter sunk screws - Reduction of machined area- simplification by separation - simplification by amalgamation - Design for machinability - Design for economy - Design for clampability - Design for accessibility - Design for assembly.

UNIT IV: COMPONENT DESIGN –CASTING CONSIDERATION 9

Castings based on parting line considerations - Minimizing core requirements, machined holes, redesign of cast members to obviate cores. Identification of uneconomical design - Modifying the design - group technology - Computer Applications for DFMA.

UNIT V: DESIGN FOR THE ENVIRONMENT 9

Introduction - Environmental objectives -Global issues - Regional and local issues - Basic DFE methods - Design guide lines - Example application - Lifecycle assessment - Basic method - AT&T's environmentally responsible product assessment - Weighted sum assessment method - Lifecycle assessment method -Techniques to reduce environmental impact - Design to minimize material usage - Design for disassembly - Design for recyclability - Design for remanufacture - Design for energy efficiency - Design to regulations andstandards.

TOTAL: L: 45= 45

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Kevien Otto and Kristin Wood	Product Design	Pearson Publication	2011
2	Boothroyd, G, Heartz and Nike	Product Design for Manufacture	Marcel Dekker	2010
3	A. K. Chitale and R. C. Gupta	Product Design and Manufacturing	Prentice Hall Inc	2007
4	Fixel, J	Design for the Environment	McGraw hill	1996
5	Dickson, John. R, and Corroda Poly	Engineering Design and Design for Manufacture and Structural Approach	Field Stone Publisher, USA.	1995

19CMB04 CNC MACHINES AND ROBOTICS

L T P C
3 0 0 3

COURSE OBJECTIVES

- To familiarize in the field of automated machines like computer numerical control and robotics.
- To understand the construction principles of CNCmachines.
- To comprehend and explain the elements of control systems in CNCmachines
- To understand and develop a computer numerical control program for lathe and milling machine.
- To be able to write programs for robotmotion.
- To understand the anatomy of robots and itsapplications.

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COURSE OUTCOMES

1. Understand and explain the CNC lathe and millingmachines
2. Identify and explain the types of feedback and control systems in CNCmachines
3. Construct and experiment various part programming of CNC lathe andmilling
4. Apply and practice basic principles of roboticdesign.
5. Understand and write programs for various robot motioncontrols.
6. Understand and explain robot working principles for variousapplications.

UNIT I: CONSTRUCTIONAL FEATURES OF CNC MACHINES **9**

CNC Machines - Concept, Classifications, working principle, advantages and limitation - Constructional features - Machine structure – Friction and Antifriction LM guide ways - Recirculating ball bearings, Linear motion bearings - Feed and spindle drives - Tool turret - Tool changer - ATC, APC - Chip conveyors.

UNIT II: FEEDBACK AND CONTROL SYSTEMS **9**

Open loop and closed loop systems - Interpolator - Feedback devices - Digital absolute and incremental measuring system - Incremental rotary encoder, Moiré fringes and absolute rotary encoders - Configuration of CNC system and Interfacing.

UNIT III: PART PROGRAMMING OF CNC LATHE AND MILLING **9**

Tooling - Preset, semi-qualified and qualified tooling - Absolute and incremental programming – G and M codes for Lathe and Milling machine - CNC Lathe - Single and multi-pass canned cycle programming - Turning, profile turning, grooving, threading and drilling cycle programming - Tool offset - Tool nose radius compensation CNC Milling - Profile and pocket milling, drilling, boring cycle programming - Cutter diameter compensation CNC Lathe - Single and multi-pass canned cycle programming - Turning, profile turning, grooving, threading and drilling cycle programming - Tool offset - Tool nose radius compensation CNC Milling - Profile and pocket milling, drilling, boring cycle programming - Cutter diameter compensation.

UNIT IV: FUNDAMENTAL CONCEPT OF ROBOTICS **9**

History, Robot Anatomy - work volume - drive system - Control system and Dynamic performance - End effector, Gripper - Mechanical, hydraulic and Pneumatic gripper and Tool as end effector - Robotic sensor, Tactile and Proximity sensors - Robot applications in material handling system, processing and itsassembly.

UNIT V: ROBOT MOTION CONTROL AND PROGRAMMING **9**

Introduction to manipulator kinematics - Homogeneous co-ordinates and Homogeneous transformations for the manipulator - Manipulator path control, motion types - Robot dynamics - Methods of robot programming - Lead through and Robot programming languages - Simple commands in VAL- Working and configurations of five axis CNC machines - Latest CNC tool materials - Applications of robots in automotiveindustry

TOTAL: L: 45 = 45

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	PM Agarwal and VJ Patel	CNC Fundamentals and Programming	Charotar Publishing House	2014
2	P Radhakrishnan	Computer Numerical Control CNCmachines	New central book agency	2013
3	A. K. Chitale and R. C. Gupta	Mechatronics	Tata McGraw Hill Publications	2009
4	Mikell P Groover, Mitchell weiss, Roger N Nagel G Odrey	Industrial Robotics	TATA Mc-Graw Hill	2012
5	KhushdeepGoyal	CNC Machines and Automation	S.K. Kataria& Sons	2014

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19CMB05 ADVANCED STRENGTH OF MATERIALS

L T P C
2 1 0 3

COURSE OBJECTIVES

- To understand the basic concepts of stress, strain, displacement andtransformations
- To be able to estimate strength and predict failure ofmaterials
- To able to find the shear stress and shear straincentre.
- To understand and use energy methods to find force, stress and displacement in simple structures.
- To understand stresses in open and closed sections in torsion andbending
- Tounderstandstressfunctions,andunderstandstressesinplatesandshells,thickcircular cylinders and discs, contact stresses and stressconcentration.

COURSE OUTCOMES

1. Understand the basic concepts of elasticity and stress strainrelationship
2. Locate the shear centre and understand the shear flows for varioussections.
3. Solve stress related problems in curved flexible members andplates
4. Examine the torsion forces in non- circularsections
5. Analyze the stress in rotatingmembers
6. Analyze the contact stresses and explain the methods of computingthem.

UNITI: ELASTICITY **9**

Stress - Strain relations and equilibrium equations of elasticity in Cartesian, Polar and Spherical coordinates-Differential equations of equilibrium-Compatibility-Boundary conditions -Airy's stress - Representation of three-dimensional stress of a tension-Generalized Hook's law.

UNIT II: SHEAR CENTRE AND UNSYMMETRICAL BENDING **9**

Location of shear center for various sections - Shear flows - Stresses and deflections in beams subjected to unsymmetrical loading - Kern of asection.

UNIT III: CURVED FLEXIBLE MEMBERS AND STRESSES IN PLATES **9**

Circumference and radial stresses - Deflections-Curved beam with restrained ends-Closed ring subjected to concentrated load and uniform load-Chain links and crane hooks-Stresses in circular and rectangular plates due to various types of loading and end conditions.

UNIT IV: TORSION OF NON-CIRCULAR SECTIONS **9**

Torsion of rectangular cross section-St.Venants theory-Elastic membrane analogy-Prandtl's stress function-Torsional stress in hollow thin walled tubes.

UNIT V: STRESSES IN ROTATING MEMBER AND CONTACT STRESSES **9**

Radial and tangential stresses in solid disc and ring of uniform thickness and varying thickness with allowable speeds-Methods of computing contact stress-Deflection of bodies in point and line contact applications.

TOTAL: L: 30+ T: 15=45

REFERENCE BOOKS:

Sl. No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Allan F. Bower	Applied Mechanics of Solids	CRC press – Special Indian Edition -2012	2010
2	Srinath. L.S	Advanced Mechanics of solids	Tata McGraw Hill	2009
3	K. Baskarand T.K.Varadan	Theory of Isotropic/Orthotropic Elasticity	Ane Books Pvt. Ltd	2009
4	Boresi, Arthur P. and Schmidt Richard J	Advanced Mechanics of Materials	6th Ed,." John Wiley & Sons	2003
5	G H Ryder	Strength of Materials	Macmillan, India Ltd	2007

19CMB06 FINITE ELEMENT ANALYSIS AND APPLICATIONS

L T PC
3 0 0 3

COURSE OBJECTIVES

- To obtain an understanding of the fundamental theory of the FEAmethod.
- To understand the application and use of the FE method for heat transferproblems.
- To understand the use of the basic finite elements for structural applications using truss, beam, frame, and planeelements.
- To be able to use the basic finite elements for structural applications using plane stress, plane strainproblems.
- To understand the overview of application packages such as ANSYS andDEFORM.
- To be a able to develop code for one dimensional analysis andvalidation.

COURSE OUTCOMES

1. Apply the procedure involved to solve a structural problem using Finite Element Methods.
2. Develop the element stiffness matrices using differentapproach.
3. Develop the global and natural co-ordinates, shape functions for one and two dimensional elements
4. Analyze a 2D problem using line, triangular, Axisymmetry, quadrilateral element, Tetrahedral and hexahedralelements.
5. Develop FEA/FEM general pre and post processingsolutions.
6. Develop code for one dimensional analysis andvalidation.

UNITI: INTRODUCTION 9

Basics of FEM - Initial value and boundary value problems - weighted residual Galerkin and Raleigh Ritzmethods-reviewofVariationalcalculus-Integrationbyparts-BasicsofVariationformulation.

UNIT II: ONE DIMENSIONAL ANALYSIS 9

Steps in FEA - Discretization, function - derivation of element characteristics matrix, shape function, assembly and imposition of boundary conditions - solution and post processing - One dimensional analysis in solid mechanics and heat transfer.

UNIT III: SHAPE FUNCTIONS AND HIGHER ORDER FORMULATIONS 9

Global and Natural Co-ordinates - Shape functions for one and two dimensional elements - Three Noded triangular and four Noded quadrilateral element - Nonlinear analysis -Isoparametric elements - Basics of two dimensional axis symmetric analyses

UNIT IV: TWO DIMENSIONAL VECTOR VARIABLE PROBLEMS 9

Equations of elasticity - Plane stress, plane strain and Axisymmetry problems - Body forces and temperature effects - Stress calculations - Plate and shell elements.

UNIT V:COMPUTER IMPLEMENTATION 9

Pre Processing, Mesh generation, elements connectivity, boundary conditions, input of material and processing characteristics - Solution and post processing - Overview of application packages such as ANSYS and DEFORM - Development of code for one dimensional analysis and validation.

TOTAL: L: 45 = 45

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	S. S. Rao	The Finite Element Method in Engineering	Elsevier Publishers,	2014
2	D. L .Logan	A First Course in the Finite Element Method	Cengage Learning	2012

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3	S. S. Bhavikati	Finite Element Analysis	New Age International Publishers	2010
4	Seshu, P	Text Book of Finite Element Analysis	Prentice-Hall of India Pvt. Ltd., New Delhi	2010
5	Reddy. J.N	An Introduction to the Finite Element Method	3rd Edition, Tata McGraw-Hill	2009

19CMB07 INTEGRATED PRODUCT AND PROCESS DEVELOPMENT

L T PC
3 0 0 3

COURSE OBJECTIVES

- To emphasize the need for integrated product developmentprocess
- To understand the significance of customer role in productdevelopment
- To be able to generate concepts and testthem.
- To know to design for industry requirement and establish the bestarchitecture
- To understand the factors influencing the productdevelopment.
- To understand the basics and need ofprototyping.

COURSE OUTCOMES

1. Understand the basic principles of productdevelopment
2. Identify and demonstrate the concept generation, selection and testingprocess
3. Demonstrate the establishment of productarchitecture
4. Apply various tools in industrial designprocess
5. Explain the elements involved in design formanufacturability.
6. Explain the principles involved inprototyping.

UNIT I: BASIC CONCEPTS OFP RODUCT DEVELOPMENT 9

Need for IPPD-Strategic importance of Product development - integration of customer, designer, material supplier and process planner, Competitor and customer - behavior analysis - Understanding customer-promoting customer understanding-involve customer in development and managing requirements - Organization process management.

UNIT II: CONCEPT GENERATION, SELECTION AND TESTING 9

Plan and establish product specifications. Task - Structured approaches - clarification - search externally and internally-Explore systematically - reflect on the solutions and processes - concept selection - methodology - benefits. Implications - Product change - variety - component standardization - product performance - manufacturability - Concept TestingMethodologies.

UNIT III:PRODUCT ARCHITECTURE 9

Product development management - establishing the architecture - creation - clustering - geometric layout development - Fundamental and incidental interactions - related system level design issues - secondary systems -architecture of the chunks - creating detailed interface specifications-Portfolio Architecture.

UNIT IV:INDUSTRIAL DESIGN 9

Integrate process design - Managing costs - Robust design - Integrating CAE, CAD, CAM tools - Simulating product performance and manufacturing processes electronically - Need for industrial design-impact - design process - investigation of customer needs - conceptualization - refinement - management of the industrial design process - technology driven products - user - driven products - assessing the quality of industrial design.

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UNIT V: DESIGN FOR MANUFACTURING AND PRODUCT DEVELOPMENT 9

Definition - Estimation of Manufacturing cost-reducing the component costs and assembly costs - Minimize system complexity - Prototype basics - Principles of prototyping - Planning for prototypes - Economic Analysis - Understanding and representing tasks-baseline project planning - accelerating the project-project execution.

TOTAL: L: 45 = 45

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Karl T.Ulrich and Steven D.Eppinger	Product Design and Development	McGraw –Hill International Edns	2012
2	G. Dieter and L. Schmidt	Engineering Design	4th ed., McGraw-Hill	2009
3	K Otto and K Wood	Product Design	Pearson Publication	2008
4	Stuart Pugh	Tool Design– Integrated Methods for successful Product Engineering	Addison Wesley Publishing,	2005
5	S Rosenthal	Effective Product Design and Development	Business One Orwin, Homewood	2004

19CMB08 INDUSTRIAL SAFETY MANAGEMENT

L T P C
3 0 0 3

COURSE OBJECTIVES

- To understand the modern safetyconcepts.
- To be able to understand the role of employee in safetymeasures
- To provide a structured management approach to control safety risks in variousoperations.
- To be able to integrate health & safety measures into alltasks.
- To understand the techniques involved in accidentprevention
- To know safety, health, welfare andlaws.

COURSE OUTCOMES

1. Explain the modern safety concepts and safety managementfunctions.
2. Acquire, articulate and apply specialized knowledge relevant to operationalsafety.
3. Demonstrate the safety measures in various types of workingplaces.
4. Explain the causes and costs ofaccidents
5. Illustrate the methods of accidentprevention.
6. Comprehend various laws and welfare activities related to safety andhealth.

UNIT I:SAFETY MANAGEMENT 9

Evaluation of modern safety concepts - Safety management functions - safety organization, safety department - safety committee, safety audit - performance measurements and motivation - employee participation in safety - safety and productivity.

UNIT II:OPERATIONALSAFETY 9

Hot metal Operation - Boiler, pressure vessels - heat treatment shop - gas furnace operation – electroplating-hotbendingpipes-Safetyinweldingandcutting.Cold-metalOperation-Safetyin

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Machine shop - Cold bending and chamfering of pipes - metal cutting - shot blasting, grinding, painting - Power press and othermachines.

UNIT III:SAFETYMEASURES **9**

Layout design and material handling - Use of electricity - Management of toxic gases and chemicals - Industrial fires and prevention - Road safety - highway and urban safety - Safety of sewage disposal and cleaning - Control of environmental pollution - Managing emergencies in Industries - planning, security and risk assessments, on-site and off site. Control ofmajor

UNIT IV:ACCIDENTPREVENTION **9**

Human side of safety - personal protective equipment - Causes and cost of accidents -Accident prevention programmer - Specific hazard control strategies - HAZOP - Training and development.

UNIT V: SAFETY, HEALTH, WELFARE& LAWS **9**

Safety and health standards - Industrial hygiene - occupational diseases prevention - Welfare facilities - History of legislations related to Safety-pressure vessel act-Indian boiler act - The environmental protection act - Electricity act - Explosive act.

TOTAL: L: 45= 45

REFERENCE BOOKS:

Sl. No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	BHEL	Occupational Safety Manual BHEL.	BHEL	2014
2	Singh U.K. and Dewan J.M.,	Safety, Security and risk management",	APH Publishing Company, New Delhi,	1996.
3	Krishnan N.V	Safety in Industry	Jaico Publisher House,	1996
4.	P M C Nair	Industrial safety and the law : an introduction	Attam Publishers, Thiruvananthapuram	1994
5	John V. Grimaldi and Rollin H. Simonds	Safety Management	All India Travellers bookseller, New Delhi	1989

19CMB09 APPLIED MATERIALS ENGINEERING

L T PC
3 0 0 3

COURSE OBJECTIVES

- To provide the knowledge about the behaviors and various strengthening mechanisms of materials.
- To impart knowledge on fracture mechanism and failure analysis ofmaterials.
- To provide the knowledge on material properties, material cost and factors to be considered while selecting materials for variousapplications.
- To study various cases in material selection for differentapplications.
- To educate the material processing concepts and various process induceddefects.
- To familiarize the modern materials and heat treatment ofmaterials.

COURSE OUTCOMES

1. Familiarize the fundamentals of material behaviour
2. Explain the various strengthening mechanisms ofmaterials
3. Comprehend fracture mechanism and discover the material failuredefects
4. Select the suitable material for differentapplications

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5. Propose the suitable process for materials and analyze the process induceddefects
6. Explain the characteristics of modernmaterials

UNIT I: ELASTIC AND PLASTIC BEHAVIOUR **9**

Mechanism of Elastic and Plastic deformation, An elasticity and viscoelasticity- role of dislocations, yield stress, shear strength of perfect and real crystals - Strengthening mechanism, work, hardening, solid solution, grain boundary strengthening, Poly phase mixture, precipitation, particle fiber and dispersion strengthening. Effect of temperature, strain and strain rate on plastic behavior- Super plasticity.

UNIT II:FRACTURE BEHAVIOUR **9**

Griffith's theory - stress intensity factor and fracture toughness-Toughening mechanisms - Ductile, brittle transition in steel-High temperature fracture, creep - Larson-Miller, Parameter - Deformation and fracture mechanism maps – Fatigue - Low and high cycle fatigue test, crack initiation and propagation mechanisms and Paris law - Residual Life Estimation- Effect of surface and metallurgical parameters on fatigue - fracture of non metallic materials - Failure analysis, sources of failure, procedure of failureanalysis.

UNIT III: SELECTION OF MATERIALS **9**

Motivation, cost basis and service requirements - selection for Mechanical properties, strength, toughness, fatigue and creep - Selection for surface durability corrosion and wear resistance - Relationship between materials selection and processing - Case studies in materials selection with Relevance to aero, auto, marine, machinery and nuclear applications.

UNIT IV:MATERIAL PROCESSING **9**

Processing of engineering materials - Primary and Secondary processes -stability, Weldability, forge ability and malleability Criteria - Process induced defects - Monitoring and control.

UNIT V MODERN MATERIALS AND TREATMENT **9**

Dual phase steels, high strength low alloy steel, transformation included plasticity steel, maraging steel, smart materials, properties and applications of engineering plastics and composites materials - advanced structural ceramics – WC, TiC, TaC, Al2O3, SiC, Si3N4, CBN, diamond – Plasma, PVD, CVD- thick and thin film deposition – Functionally Gradient Materials , Nanomaterials.

TOTAL: L: 45 = 45

REFERENCE BOOKS:

Sl. No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Norman E. Dowling	Mechanical Behaviour of Materials	McGraw-Hill	2012
2	Burakonsa, T.Z. and Wierzchan. T	Surface Engg of Meterials"-Principles of Equipment, Techniques. 5. Courtney, T.H.,"Mechanical Behavior of Materials	(2nd edition), McGraw Hill	2000
3	Dieter, G.E	Mechanical Metallurgy	McGraw Hill	1988
4	R.A.Flinn and P.K.Trojan	Engineering Materials and their Applications	Wiley	2006
5	James, K.W., Wiley, Intersam, John	The Hand book of Advance Materials	Wilson Publishers.	2004

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19CMC10 COMPUTATIONAL FLUID DYNAMICS

L T PC
2 1 0 3

COURSE OBJECTIVES

- Toemphasizetheknowledgeonboundaryconditions,finitedifferencemethod,and numericalerrors
- To understand the analysis of heat conduction in one dimensional and two dimensional method
- To understand the Governing equations and Boundary layer flow for Incompressible fluid
- To understand the basic concepts ofone dimensional and two dimensional convection problems.
- To understand the basics of analysis byFEM
- To understand the algebraic models and heat transfer using standardcodes

COURSE OUTCOMES

1. Understand the principles of governing differential equation and finite differencemethod.
2. Understand and explain heat conduction in various dimensionalmethod
3. Explain the equations for Incompressible fluid flow by differenceapproach.
4. Understand and explain the principles of convection heattransfer
5. Explain the FEM analysis of conduction and incompressibleflow
6. Explain the fundamentals involved in turbulencemodels

UNIT I: GOVERNING DIFFERENTIAL EQUATION AND FINITE DIFFERENCE METHOD 9

Classification, Initial and Boundary conditions - Initial and Boundary Value problems - Finite difference method, Central, Forward, Backward difference, Uniform and non-uniform Grids, Numerical Errors, Grid IndependenceTest.

UNIT II: CONDUCTION HEAT TRANSFER 9

Dimensional conduction, Two and three dimensional steady state problems, Transient one-dimensional problem, Two-dimensional Transient Problems

UNIT III: INCOMPRESSIBLE FLUID FLOW 9

Governing Equations, Stream Function -Verticity method, Determination of pressure for viscous flow, SIMPLE Procedure of Patankar and Spalding, Computation of Boundary layer flow, finite difference approach.

UNIT IV: CONVECTION HEAT TRANSFERAND FEM 9

Steady One-Dimensional and Two-Dimensional Convection - diffusion, Unsteady one-dimensional convection - diffusion, Unsteady two-dimensional convection - Diffusion - Introduction to finite element method - solution of steady heat conduction by FEM - Incompressible flow - simulation by FEM.

UNIT V:TURBULENCE MODELS 9

Algebraic Models - One equation model, K - ϵ Models, Standard and High and Low Reynolds number models, Prediction of fluid flow and heat transfer using standard codes.

TOTAL: L: 30+ T: 15 = 45

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REFERENCE BOOKS:

Sl. No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Jiri Blazek	Computational FluidDynamics: Principles and Applications	Butterworth-Heinemann	2015
2	John Wendt	Computational Fluid Dynamics: An Introduction	Springer Science & Business Media	2013
3	Wei Shyy, HS.Udaykumar, Madhukar M.Rao	Computational FluidDynamics with MovingBoundaries	Courier Corporation	2012
4	Ryoichi Amano, BengtSundén	Computational FluidDynamics and Heat Transfer: Emerging Topics	WIT Press	2011
5	Eduardo Ramos S	Computational FluidDynamics 2010: Proceedingsof the Sixth Edition	Springer Science & Business Media	2011

19CMB11 DATA COMMUNICATIONS IN CAD/CAM

L	T	P	C
3	0	0	3

COURSE OBJECTIVES

- To provide the knowledge on basic functions, operations and languages of digital computers and microprocessors
- To impart knowledge on operatingsystems.
- To familiarize the functions ofcompiler.
- To provide the knowledge on data communication, networking, transmissions of communications systems
- To educate the different types of networkingstructure.
- To familiarize the Internet services andProtocols

COURSE OUTCOMES

1. Explain the basic functions, operations and languages of digital computersand microprocessors
2. Describe various operatingsystems.
3. Describe the functioning of acompiler.
4. Illustrate various networking and communicationmodels
5. Choose suitable networkstructure
6. Explain the internet services andProtocols

UNIT I: DIGITAL COMPUTERS & MICRO PROCESSORS 9

Block diagram - register transfer language - arithmetic, logic and shift micro operations - instruction code - training and control instruction cycle - I/O and interrupt design of basic computer. Machine language-assemblylanguage–assembler.RegistersALUandBusSystems-timingandcontrol

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signals - machine cycle and timing diagram - functional block diagrams of 80 x 86 and modes of operation - Features of Pentium Processors

UNIT II: OPERATING SYSTEM & ENVIRONMENTS 9

Types - functions - UNIX & WINDOWS NT - Architecture - Graphical User Interfaces -Compilers - Analysis of the Source program - the phases of a compiler - cousins of the compiler, the grouping of phases - compiler construction tools.

UNIT III:COMMUNICATION MODEL 9

Data communication and networking - protocols and architecture - data transmission concepts and terminology - guided transmission media - wireless transmission - data encoding - asynchronous and synchronous communication - base band interface standards RS232C, RS449 interface

UNIT IV:COMPUTER NETWORKS 9

Network structure - network architecture - the OSI reference model services - network standardization - example - Managing remote systems in network - network file systems - net working in manufacturing.

UNITV: INTERNET 9

Internet services - Protocols - intranet information services - mail based service - system and network requirements - Internet tools - UseNet - e-mail - IRC - www - FTP - Telnet.

TOTAL: L: 45 = 45

REFERENCE BOOKS:

Sl. No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	William Stallings	Data of Computer Communications	Prentice Hall of India	2013
2	Alfred V. Aho, Ravi Setjhi, Jeffrey D Ullman	Compilers Principles Techniques and Tools	Addison Wesley	2011
3	Gaonkar R.S	Microprocessor Architecture, Programming and Applications of 8085	Penram International	2014
4	Andrew S. Tanenbanum	Computer Networks	Prentice Hall of India 3rd Edition	2012.
5	Morris Mano. M	Computer System Architecture",	Prentice Hall of India	2013

19CMB12 MECHANISMS DESIGN AND SIMULATION

L T P C
3 0 0 3

COURSE OBJECTIVES

- To understand the layout of linkages and kinematic analysis of variouslinks.
- To impart the knowledge of kinematics simulations of variousmechanisms.
- To learn the Path Curvature Theory used inmechanisms.
- To study the synthesis analysis of four barmechanisms.
- To comprehend synthesis of cam mechanisms

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- To understand coupler curve basedmechanisms.

COURSE OUTCOMES

1. Comprehend the basics of mechanismdesign
2. Determine and analyze the kinematics attributes of variouslinks.
3. Illustrate the path curvature theory and itsapplications
4. Design four bar based mechanisms of real timeapplications.
5. Analyze the cam mechanisms of real timeapplications
6. Describe the coupler curve basedmechanisms

UNITI: INTRODUCTION **9**

Introduction to kinematics and mechanisms-Mobility analysis-Formation of one degree of freedom Multi loop kinematic chains-Grass motion concepts-compliant and equivalent mechanisms.

UNIT II:KINEMATIC ANALYSIS **9**

Position Analysis-vector loop equations for four bar, slider crank, inverted slider crank, geared five bar and six bar links-Analytical and Graphical methods-displacement, velocity and acceleration analysis of simple mechanisms.

UNIT III: PATH CURVATURE THEORY **9**

Fixed and moving centrodes-Inflection points and inflection circle-Euler Savary equation- Bobillier's construction-Hartmann's construction-cubic of stationary curvature.

UNIT IV: SYNTHESIS OF FOUR BAR MECHANISMS **9**

Type and number synthesis- linkage concept-Dimensional synthesis-Function generation, path generation and motion generation-Graphical methods-Pole technique and inversion technique-Point position reduction-two, three and four position synthesis of four bar mechanisms-Analytical methods-Freudenstein's equation-Bloch's synthesis.

UNIT V: SYNTHESIS OF CAM AND COUPLER CURVE BASED MECHANISMS **9**

Cognate linkages-parallel motion linkages-design of six bar, Single dwell, double dwell and double stroke-multi dwell -CAM mechanisms - determination of optimum size of cams- mechanism defects - CaseStudy-Kinematicanalysisofspatialmechanisms-simulationmechanismsusingsoftwarepackage.

TOTAL: L: 45 = 45

REFERENCE BOOKS:

Sl. No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Kenneth J. Waldron, Gary L. Kinzel,Sunil K. Agrawal	Kinematics, Dynamics, and Design of Machinery	3rd Edition, John Wiley-Sons	2016
2	David H. Myszka,	Machines & Mechanisms: Applied Kinematic Analysis	Pearson Education, 4th revised edition	2011
3	J. J. Uicker, G. R. Pennock and J.E. Shigley	Theory of Machines and Mechanisms	Oxford University Press, NY, IInd Edition	2014
4	Robert L. Nortron	Kinematics and Design of Machinery	McGraw Hill Higher Education, 2nd revised edition	2012
5	A. Hernandez	Kinematic analysis of mechanisms via a velocity equation based in a geometric matrix	Mechanism and machine theory, vol. 38(12), pp 1413-1429	2013

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- To study the Speed Control of AC Drives.

COURSE OUTCOMES

1. Able to explain the basics of electrical drives.
2. Able to describe drive motor characteristics
3. Able to demonstrate the methods of starting D.C motors and Induction Motors.
4. Able to describe speed control of DC drives.
5. Able to explain the conventional and solid state speed control of AC drives.

UNIT I INTRODUCTION 9

Basic Elements - Types of Electric Drives - Factors are influencing the choice of Electrical Drives - Heating and Cooling Curves - Loading conditions and classes of duty - Selection of power rating for drive motors with regard to thermal overloading and Load variation factors.

UNIT II DRIVE MOTOR CHARACTERISTICS 9

Dynamics of Motor load system – Multiquadrant operation – DC Motor (Types, Torque Equation, Characteristics and Applications) - Single phase induction motor (Types and Applications) - Three phase induction motors(Types, Characteristics) - Braking of Electric motors.

UNIT III STARTING METHODS 9

Necessity of a starters – Types of DC Motor Starters – Types of 3 phase squirrel cage and slip ring Induction Motor Starters.

UNIT IV CONVENTIONAL AND SOLID STATE SPEED CONTROL OF DC DRIVES 9

Speed control of DC series and shunt motors - Armature and field control - Ward-Leonard control system using controlled rectifiers and DC choppers.

UNIT V CONVENTIONAL AND SOLID STATE SPEED CONTROL OF AC DRIVES 9

Speed control of three phase induction motor - Voltage control, voltage / frequency control and slip power recovery scheme using inverters and AC voltage regulators.

TOTAL: 45 Hours

TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	G. K. Dubey	Fundamentals of Electrical Drives	CRC press	2002
2.	Vedam Subrahmaniam	Electric Drives (Concepts and Applications)	Tata McGraw-Hill	2010

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication

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1.	Gnanavadivel J Karthikeyan J Chitra Selvi S	Electrical Drives and Controls	Anuradha Publishers	2004
2.	Thiyagarajan V	Electrical Drives and Controls	A.R. Publications	2015
3.	Pillai SK	A First Course on Electric Drives	New age international publishers	2013
4.	Jagadeesh Babu V	Electrical Drives and Controls	Scitech Publications	2015
5.	Austin Hughes and Bill Drury	Electric Motors and Drives	Newness Heinemann Publishers	2018

19GES22 ELECTRICAL DRIVES AND CONTROLS LABORATORY

L	T	P	C
3	0	0	1

OBJECTIVES:

- To study the conventional and solid-state drives
- To study the different methods of starting D.C motors and induction motors.
- To understand the basic concepts of different types of electrical machines and their performance.

LIST OF EXPERIMENTS:

1. Load test on DC Shunt & DC Series motor.
2. O.C.C & Load characteristics of DC Shunt and DC Series generator.
3. Speed control of DC shunt motor (Armature, Field control).
4. Load test on single phase transformer.
5. O.C & S.C Test on a single phase transformer.
6. V curves and inverted V curves of synchronous Motor.
7. Load test on three phase squirrel cage Induction motor.
8. Speed control of three phase slip ring Induction Motor.
9. Load test on single phase Induction Motor.
10. Study of DC & AC Starters.

TOTAL: 45 Hours

19GES23 ANALOG AND DIGITAL COMMUNICATION

L	T	P	C
3	0	0	3

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Programme Code & Name: RA & B.E-Robotics and Automation

COURSE OBJECTIVES

1. To Understand basic elements of a communication system
2. To Conduct analysis of baseband signals in time domain and in frequency domain
3. To Demonstrate understanding of various analog and digital modulation and demodulation techniques technique
4. To Analyses the performance of modulation and demodulation techniques in various transmission environments
5. To appreciate the importance of synchronization in communication systems

COURSE OUTCOMES

1. Explain and apply various types of modulation and demodulation in analog and digital Communication.
2. Describe the concept of digital communicationtechniques.
3. Describe the concept of various digital transmissiontechniques.
4. Comprehend the Cellular communicationtechniques.
5. Explain the concepts of Satellite communication and Optical communication

UNIT I FUNDAMENTALS OF ANALOG COMMUNICATION 9

Principles of amplitude modulation - AM envelope - frequency spectrum and bandwidth - modulation index andpercent modulation - AM Voltage distribution - AM power distribution - Angle modulation - FM and PM waveforms - phase deviation and modulation index - frequency deviation and percent modulation - Frequency analysis of angle modulated waves - Bandwidth requirements for Angle modulated waves.

UNIT II DIGITAL COMMUNICATION 9

Shannon limit for information capacity - Digital amplitude modulation - Frequency Shift Keying - FSK bit rateand baud - FSK transmitter - BW consideration of FSK - FSK receiver - Phase Shift Keying – BPSK, QPSK8- PSK - Quadrature Amplitude modulation – 8-QAM - bandwidth efficiency - Carrier recovery – squaring loop, Costas loop - DPSK.

UNIT III DIGITAL TRANSMISSION 9

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Pulse modulation - PCM – PCM sampling - Sampling rate - Signal to Quantization noise rate - Commanding-analog and digital - Delta modulation PCM - Adaptive Delta modulation PCM - Differential PCM – Inter symbol interference - Eye patterns.

UNIT IV **CELLULAR COMMUNICATION** **9**

Fundamental concept of Cellular telephone - Frequency reuse, Interference - Co-channel Interference, Adjacent channel Interference - Cell splitting - Cell sectoring - Segmentation and Dualization - Roaming and Handoff.

UNIT V **SATELLITE AND OPTICAL COMMUNICATION** **9**

Kepler's Law - Satellite Orbits - Geo synchronous satellites - satellite system link models -Optical Fiber Communication system - Optical Fiber configurations - Optical Fiber classification Losses in Optical fiber cables - Optical sources - LED , Injection laser diode - Light detector - PIN diodes, Avalanche photo diode.

TEXT BOOK

Sl.No	AUTHOR(s)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	Wayne Tomasi,	Electronic Communication Systems Fundamentals through Advanced	Pearson Education	2008
2.	H.Taub,D L Schilling,G Saha	Principles of Communication	Pearson Education	2008

REFERENCE BOOK

Sl.No	AUTHOR(s)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	B.P.Lathi	Modern Analog and Digital Communication	Oxford	2008

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		systems	University Press	
2.	Blake	Electronic Communication Systems	Thomson Delmar Publications	2002
3.	Martin S.Roden	Analog and Digital Communication System	PHI	2002
4.	B.Sklar	Digital Communication Fundamentals and Applications	Pearson Education	2007
5.	Simon Haykin	Communication Systems	John Wiley & Sons	2010.

19GES24 DIGITAL PRINCIPLES AND SYSTEM DESIGN **L T P C**
3 0 0 3

COURSE OBJECTIVES:

- To know about the basics of Boolean Algebra and Logic Gates.
- To Design and Implement Combinational Logic.
- To Design and Implement Synchronous Sequential Logic.
- To Design and Implement of Asynchronous Sequential Logic.
- Be familiar with the theory, construction, and operation of Basic Memory And Programmable Logic.

COURSE OUTCOMES:

- To Learn about the basics of Boolean Algebra and Logic Gates.
- To Learn about the basics Combinational Logic.
- To Learn about the basics Synchronous Sequential Logic.
- To Learn about the basics of Asynchronous Sequential Logic.
- Be familiar with the theory, construction, and operation of Basic Memory and Programmable Logic.

UNIT I: BOOLEAN ALGEBRA AND LOGIC GATES 6

Review of Number Systems –Arithmetic Operations -Binary Codes–Boolean Algebra and Theorems – Boolean Functions–Simplification of Boolean Functions using Karnaugh Map and \Tabulation Methods – Logic Gates–NAND and NOR Implementations.

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UNIT II :COMBINATIONAL LOGIC 6

Combinational Circuits –Analysis and Design Procedures–Circuits for Arithmetic Operations, Code Conversion –Decoders and Encoders –Multiplexers and Demultiplexers –Introduction to HDL –HDL Models of Combinational circuits.

UNIT III:SYNCHRONOUS SEQUENTIAL LOGIC 6

Sequential Circuits –Latches and Flip Flops –Analysis and Design Procedures –State Reduction and State Assignment –Shift Registers–Counters –HDL for Sequential Logic Circuits.

UNIT IV:ASYNCHRONOUS SEQUENTIAL LOGIC 6

Analysis and Design of Asynchronous Sequential Circuits–Reduction of State and Flow Tables –Race-free State Assignment–Hazards.

UNIT V:MEMORY AND PROGRAMMABLE LOGIC 6

RAM and ROM –Memory Decoding –Error Detection and Correction –Programmable Logic Array – Programmable Array Logic –Sequential Programmable Devices –Application Specific Integrated Circuits.

TOTAL: 30 Hours

TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Morris Mano M. and Michael D. Ciletti	Digital Design	Pearson Education	IV Edition, 2008.
2.	John F. Wakerly,	Digital Design Principles and Practices	Pearson Education	IV Edition, 2007

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Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication

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1.	Charles H. Roth Jr,	Fundamentals of Logic Design	Jaico Publishing House	Fifth Edition–, Mumbai, 2003
2.	Donald D. Givone	Digital Principles and Design	Tata Mcgraw Hill	2003
3.	Kharate G. K	Digital Electronics	Oxford University Press	2010
4.	Thomas L. Floyd	Digital Fundamentals	Pearson Education Inc	10th Edition, 2011
5.	Donald D.Givone	Digital Principles and Design	TMH	2003

19GES25 DIGITAL PRINCIPLES AND SYSTEM DESIGN LABORATORY

L	T	P	C
3	0	0	3

LIST OF EXPERIMENTS

1. Verification of Boolean theorems using digital logic gates
2. Design and implementation of combinational circuits using basic gates
3. Design and implementation of 4-bit binary adder / subtractor using basic gates and MSI devices.
4. Design and implementation of parity generator / checker using basic gates and MSI devices
5. Design and implementation of magnitude comparator.
6. Design and implementation of application using multiplexers/ Demultiplexers.
7. Design and implementation of Shift registers
8. Design and implementation of Synchronous and Asynchronous counters
9. Design and implementation of Coding combinational / sequential circuits using HDL

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Programme Code & Name: RA & B.E-Robotics and Automation

		L	T	P	C
19GES26	ENGINEERING DRAWING	1	0	3	3

COURSE OBJECTIVES

- To construct various curves in engineering applications.
- To draw the projection of three dimensional objects representing machine structure.
- To analyze the principles of projection of various planes by different angle to project points, lines and planes.
- To draw the projection of simple solid when axis is inclined to one reference plane by change of position method.
- To identify the interior components of machinery (or) buildings by sectioning the solid, and to study the development of simple solids for fabrication of sheet metals.
- To transform the manual drawings to CAD drawings.

COURSE OUTCOMES

- Construct various curves in engineering applications.
- Draw the projection of three dimensional objects representing machine structure.
- Analyze the principles of projection of various planes by different angle to project points, lines and planes.
- Draw the projection of simple solid when axis is inclined to one reference plane by change of position method.
- Identify the interior components of machinery (or) buildings by sectioning the solid, and to study the development of simple solids for fabrication of sheet metals.
- Transform the manual drawings to CAD drawings.

CONCEPTS AND CONVENTIONS (Not for Examination) 4

Importance of graphics in engineering applications, Use of drafting instrument, BIS conventions and specifications - Size, layout and folding of drawing sheets, Lettering and dimensioning.

COMPUTER AIDED DRAFTING (Not for Examination) 6

Importance 2d Drafting, sketching, modifying, transforming and dimensioning.

UNIT I: PLANE CURVES 13

Curves used in engineering practices, Conics, Construction of ellipse, Parabola and hyperbola by eccentricity method, Construction of cycloid, construction of involutes of square and circle, Drawing of tangents and normal to the above curves.

UNIT II: ISOMETRIC TO ORTHOGRAPHIC VIEWS 13

Representation of three dimensional objects, General Principles of Orthographic projection, Need for importance of multiple views and their placement, First angle projection, layout of views, Developing visualization skills through free hand sketching of multiple views from pictorial views of objects.

UNIT III: PROJECTION OF POINTS, LINES AND PLANE 13

(Free hand sketching) Projection of points, Projection of straight lines located in the first quadrant, Determination of true lengths and true inclinations, Projection of polygonal surface and circular lamina inclined to both reference planes.

UNIT IV: PROJECTION OF SOLIDS 13

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(Free hand sketching) Projection of simple solids like prisms, pyramids, cylinder and cone when the axis is inclined to one reference plane by change of position method.

UNIT V SECTION OF SOLIDS AND DEVELOPMENT OF SURFACES **13**

(Free hand sketching) Sectioning of simple solids like prisms, pyramids, cylinder and cone in simple vertical position by cutting planes inclined to one reference plane and perpendicular to the other, (Obtaining true shape of section is not required). Development of lateral surfaces of simple and truncated solids, Prisms, pyramids, cylinders and cones.

TOTAL: L: 15 + P: 60 = 7

TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Natrajan K.V	A text book of Engineering Graphics	Dhanalakshmi Publishers, Chennai	2015
2.	Basant Agrawal and C.M. Agrawal	Engineering Drawing	McGraw Hill Education; Second edition	2013

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Gopalakrishnan K.R	Engineering Drawing (Vol. I&II combined)	Subhas Stores Bangalore	2007
2	Luzzader, Warren.J. and Duff,John M	Fundamentals of Engineering Drawing with an introduction to Interactive Computer Graphics for Design and Production	Eastern Economy Edition, Prentice Hall of India Pvt. Ltd, New Delhi	2005
3	Shah M.B., and Rana B.C	Engineering Drawing	Pearson, 2nd Edition	2009
4	Venugopal K. and Prabhu Raja V	Engineering Graphics	New Age International (P) Limited	2008
5	Bhatt N.D. and Panchal V.M	Engineering Drawing	Charotar Publishing House, 50th Edition	2010

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Programme Code & Name: RA & B.E-Robotics and Automation

19GES27 **ENGINEERING GEOLOGY** **L T P C**
3 0 0 3

COURSE OBJECTIVES

- To impart the concepts of geological agents and their processes.
- To provide knowledge on various properties of minerals and their engineering significance.
- To give knowledge on various classifications of rocks.
- To understand the importance of geological investigations and mapping.
- To understand the applications of geological surveys in civil engineering structures.
- To give knowledge on various minerals.

COURSE OUTCOMES

- Understand the application of geology knowledge to Civil Engineering construction.
- Understand the concepts of various geological materials.
- Understand the properties, behaviour and engineering significance of different type of rocks and minerals.
- Learned the interpretation skills of geological maps having different type of geological features.
- Learned consideration and importance of geological aspects in civil engineering related infrastructure projects.
- Understand the concepts of various weathering processes.

UNIT I: PHYSICAL GEOLOGY **9**

Role of Geology in civil engineering – Branches of geology – Earth structures and composition – Elementary knowledge on continental drift and plate tectonics – Earth processes – weathering – soils – Geological work of river, wind and sea – Engineering importance – Earthquake belts in India – Ground water – Mode of occurrence –Prospecting .

UNIT II : MINEROLOGY

9 Elementary knowledge on symmetry elements of important crystallographic systems – Physical properties of minerals – Study of the rock forming minerals – Quartz family – Feldspar family – Mica – Pyroxene family minerals – Fundamentals of process of formation of ore minerals – Properties, behaviour and engineering significance of clay minerals – Coal and petroleum – Their origin and occurrence in India.

UNIT III : PETROLOGY **9**

Classification of rocks – Distinction between igneous, sedimentary and metamorphic rocks – Occurrence, Engineering properties and distribution – Igneous rocks – Granite, syenite, diorite, gabbro, pegmatite, dolerite and basalt – sedimentary rocks – Sandstone, limestone, shale, conglomerate and breccias – Metamorphic rocks –Quartzite, marble, slate, phyllite, gneiss and schist.

UNIT IV : STRUCTURAL GEOLOGY AND MAP **9**

Attitude of beds – Outcrops – Contours – Introduction to geological maps – Folds – Faults and joints – Their bearing on engineering construction – Seismic and electrical methods for civil engineering investigations. Study of structures.

UNIT V : GEOLOGICAL INVESTIGATION **9**

Remote sensing for civil engineering applications; Geological conditions necessary for design and construction of Dams, Reservoirs, Tunnels, and Road cuttings. Causes and preventions – Sea erosion and Coastal protection.

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TOTAL: (L:45):45

EXT BOOKS:

Sl. No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Parbin Singh.	A Text book of Engineering and General Geology	Katson publishing house, Ludhiana.	2010
2	Varghese, P.C	Engineering Geology for Civil Engineering	PHI Learning Private Limited, New Delhi	2012

REFERENCE BOOKS:

Sl. No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Muthiayya, V.D	A Text of Geology	Oxford IBH Publications, Calcutta.	2010
2	Blyth F.G.H. and De Freitas M.H	Geology for Engineers	Edward Arnold, London	2010
3	F.G.Bell.	Fundamentals of Engineering Geology	B.S. Publications. Hyderabad	2011
4	Dobrin, M.B	An introduction to geophysical prospecting	McGraw0Hill, New Delhi	2010
5	KVGK Gokhale	Principles of Engineering Geology	BS Publications, Hyderabad	2011

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Programme Code & Name: RA & B.E-Robotics and Automation

19GES28 **ENGINEERING MECHANICS** **L T P C**
3 1 0 3

COURSE OBJECTIVES

- To generalize the scalar and vector representation of forces and moments.
- To explore truss, beam, frame and cable problems and respond to the distributed force systems.
- To predict Centroid and Moment of Inertia.
- To realize the Laws of Motion, Principle of Work and Energy, Kinematics & Kinetics of Motion and the interrelationship.
- To recognize the effect of impact of elastic bodies.
- To comprehend the effect of friction on equilibrium.

COURSE OUTCOMES

- Generalize the scalar and vector representation of forces and moments.
- Explore truss, beam, frame and cable problems and respond to the distributed force systems.
- Predict Centroid and Moment of Inertia.
- Realize the Laws of Motion, Principle of Work and Energy, Kinematics & Kinetics of Motion and the interrelationship.
- Recognize the effect of impact of elastic bodies.
- Comprehend the effect of friction on equilibrium.

UNIT I: BASICS AND STATICS OF PARTICLES **15**

Introduction – Units and Dimensions – Laws of Mechanics – Lami's theorem, Parallelogram and triangular Law of forces – Vectorial representation of forces – Vector operations of forces – additions, subtraction, dot product, cross product – Coplanar Forces – rectangular components – Equilibrium of a particle – Forces in space – Equilibrium of a particle in space – Equivalent systems of forces – Principle of transmissibility .

UNIT II: EQUILIBRIUM OF RIGID BODIES **15**

Free body diagram – Types of supports – Action and reaction forces –stable equilibrium – Moments and Couples – Moment of a force about a point and about an axis – Vectorial representation of moments and couples – Scalar components of a moment – Varignon's theorem – Single equivalent force -Equilibrium of Rigid bodies in two dimensions – Equilibrium of Rigid bodies in three dimensions

UNIT III: PROPERTIES OF SURFACES AND SOLIDS **15**

Centroids and centre of mass – Centroids of lines and areas – Rectangular, circular, triangular areas by integration – T section, I section, Angle section, Hollow section by using standard formula – Theorems of Pappus – Area moments of inertia of plane areas – Rectangular, circular, triangular areas by integration – T section, I section, Angle section, Hollow section by using standard formula – Parallel axis theorem and perpendicular axis theorem –Principal moments of inertia of plane areas – Principal axes of inertia-Mass moment of inertia

UNIT IV: DYNAMICS OF PARTICLES **15**

Displacements, Velocity and acceleration, their relationship – Relative motion – Curvilinear motion – Newton's laws of motion – Work Energy Equation – Impulse and Momentum – Impact of elastic bodies.

UNIT V: FRICTION **15**

Friction force – Laws of sliding friction – equilibrium analysis of simple systems with sliding friction – wedge friction – Rolling – resistance.

TOTAL:L : 45 + T :30 = 75

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TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Beer, F.P and Johnston. E.R.,	Vector Mechanics for Engineers: Statics and Dynamics	Tata McGraw-Hill Publishing company, New Delhi	2013
2.	S. Timoshenko, D.H. Young, J.V. Rao and Sukumar Pati	Engineering Mechanics	McGraw Hill Education; 5 edition	2013

REFERENCE BOOKS:

Sl. No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Hibbeller, R.C and Ashok Gupta	Engineering Mechanics: Statics and Dynamics	Pearson Education	2010
2	Irving H. Shames and Krishna Mohana Rao. G	Engineering Mechanics – Statics and Dynamics	Pearson Education	2006
3	Meriam J.L. and Kraige L.G	Engineering Mechanics	John Wiley & Sons	2013
4	Rajasekaran S and Sankarasubramanian G	Engineering Mechanics	Vikas Publishing House Pvt. Ltd	2005
5	Bhavikatti, S.S	Engineering Mechanics	New Age International (P) Limited Publishers	2015

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Programme Code & Name: RA & B.E-Robotics and Automation

19RAC01 APPLIED HYDRAULICS AND PNEUMATICS **L T P C**
3 0 0 3

COURSE OBJECTIVES

- To impart the knowledge on applications of Fluid Power Engineering in Power transmission system.
- To familiarize hydraulic system and its components.
- To design hydraulic circuits for various application.
- To understand pneumatic systems, related components used in a system.
- To design the pneumatic system circuits.

COURSE OUTCOMES

19RAC01.CO1 Apply the fundamental laws of fluid power systems on real time applications.
19RAC01.CO2 Select the hydraulic pumps and actuators to the various engineering applications.
19RAC01.CO3 Design the hydraulic circuits for engineering applications.
19RAC01.CO4 Design the basic pneumatic circuits using various pneumatic components.
19RAC01.CO5 Design the hydro-pneumatic circuits using advanced fluid power techniques.

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19RAC01.CO1	X	X	X	X	-	X	X	-	-	X	-	X	X	-	-
19RAC01.CO2	X	X	X	-	-	X	X	-	-	X	-	X	X	-	-
19RAC01.CO3	X	X	X	-	-	-	X	-	X	X	-	-	X	-	-
19RAC01.CO4	X	X	X	-	-	X	X	-	-	X	-	-	X	-	-
19RAC01.CO5	X	X	X	-	-	-	X	-	X	X	-	-	X	-	-

UNIT I: FLUID POWER SYSTEMS AND FUNDAMENTALS 9

Introduction to fluid power, Advantages of fluid power, Application of fluid power system. Types of fluid power systems, Properties of hydraulic fluids – General types of fluids –Fluid power symbols. Basics of Hydraulics-Applications of Pascal's Law- Laminar and Turbulent flow – Reynold's number – Darcy's equation – Losses in pipe, valves and fittings.

UNIT II: HYDRAULIC SYSTEM & COMPONENTS 9

Sources of Hydraulic Power: Pumping theory – Pump classification – Gear pump, Vane Pump, piston pump, construction and working of pumps – pump performance – Variable displacement pumps. Fluid Power Actuators: Linear hydraulic actuators – Types of hydraulic cylinders – Single acting, Double acting special cylinders like tanden, Rodless, Telescopic, Cushioning mechanism, Construction of double acting cylinder, Rotary actuators – Fluid motors, Gear, Vane and Piston motors.

UNIT III: DESIGN OF HYDRAULIC CIRCUITS 9

Construction of Control Components: Directional control valve – 3/2-way valve – 4/2-way valve – Shuttle valve – check valve – pressure control valve – pressure reducing valve, sequence valve, Flow control valve – Fixed and adjustable, electrical control solenoid valves, Relays, ladder diagram. Accumulators and Intensifiers: Types of accumulators – Accumulators circuits, sizing of accumulators, intensifier – Applications of Intensifier – Intensifier circuit.

UNIT IV: PNEUMATIC SYSTEMS AND COMPONENTS 9

Pneumatic Components: Properties of air – Compressors – Filter, Regulator, and Lubricator Unit – Air control valves, Quick exhaust valves, and pneumatic actuators. Fluid Power Circuit Design, Speed control circuits, synchronizing circuit, Pneumatic hydraulic circuit. Sequential circuit design for simple applications using cascade method.

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UNIT V: DESIGN OF PNEUMATIC CIRCUITS 9

Servo systems – Hydro Mechanical servo systems, Electro hydraulic servo systems and proportional valves. Fluidics – Introduction to fluidic devices, simple circuits, Introduction to Electro Hydraulic Pneumatic logic circuits, ladder diagrams, PLC applications in fluid power control. Fluid power circuits; failure and troubleshooting.

TOTAL: L: 45

TEXT BOOKS

Sl. No.	Author(s)	Title of the Book	Publisher	Year of Publication
1	Anthony Esposito	Fluid Power with Applications	Pearson Education	2013
2	Majumdar S.R	Oil Hydraulics Systems-Principles and Maintenance	Tata McGraw-Hill	2001

REFERENCE BOOKS

Sl. No.	Author(s)	Title of the Book	Publisher	Year of Publication
1	Srinivasan.R	Hydraulic and Pneumatic controls	Vijay Nicole	2006
2	Shanmugasundaram.K	Hydraulic and Pneumatic controls	Chand & Co.	2006
3	Majumdar S. R	Pneumatic systems– Principles and maintenance	Tata McGraw Hill	2001
4	Anthony Lal	Oil hydraulics in the service of industry	Allied publishers	1982
5	Harry L. Stevart D.B	Practical guide to fluid power	Taraoeala sons and Port Ltd.	1976

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Programme Code & Name: RA & B.E-Robotics and Automation

19RAC02 FLUID MECHANICS AND MACHINERY

L T P C
3 0 0 3

COURSE OBJECTIVES

- To understand the applications of fluid in various engineering requirements.
- To explain the various losses in pipes.
- To understand the importance of dimensional analysis.
- To interpret the various types of pumps and its principles.
- To comprehend the types of flow in turbines.

COURSE OUTCOMES

19RAC02.CO1 Interpret the concepts of fluid properties and its characteristics
19RAC02.CO2 Analyze major and minor losses that can be applied in Engineering applications.
19RAC02.CO3 Identify the nature of physical quantities with dimensional analysis
19RAC02.CO4 Demonstrate the performance characteristics of hydraulic pumps
19RAC02.CO5 Demonstrate the performance characteristics of hydraulic turbines

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19RAC02.CO1	X	X	X	-	-	X	X	X	-	X	-	X	X	-	-
19RAC02.CO2	X	X	X	X	-	-	X	X	-	X	-	X	X	-	-
19RAC02.CO3	X	X	X	X	-	-	X	X	-	X	-	X	X	-	-
19RAC02.CO4	X	X	X	X	-	-	X	X	-	X	-	X	X	-	-
19RAC02.CO5	X	X	X	X	-	-	X	X	-	X	-	X	X	-	-

UNIT I: FLUID PROPERTIES AND FLOW CHARACTERISTICS 9

Units and dimensions- Properties of fluids- mass density, specific weight, specific volume, specific gravity, viscosity, compressibility, vapor pressure, surface tension and capillarity. Flow characteristics concept of control volume - application of continuity equation, energy equation and momentum equation

UNIT II: FLOW THROUGH CIRCULAR CONDUITS 9

Hydraulic and energy gradient - Laminar flow through circular conduits and circular annuli-Boundary layer concepts – types of boundary layer thickness – Darcy Weisbach equation –friction factor- Moody diagram- commercial pipes- minor losses – Flow through pipes in series and parallel.

UNIT III: DIMENSIONAL ANALYSIS 9

Need for dimensional analysis – methods of dimensional analysis – Similitude –types of similitude Dimensionless parameters- application of dimensionless parameters – Model analysis.

UNIT IV: PUMPS 9

Impact of jets - Euler"s equation - Theory of roto-dynamic machines – various efficiencies– velocity components at entry and exit of the rotor- velocity triangles - Centrifugal pumps– working principle -work done by the impeller - performance curves - Reciprocating pump- working principle – Rotary pumps classification.

UNIT V: TURBINES 9

Classification of turbines – heads and efficiencies – velocity triangles, axial, radial and mixed flow turbines, Pelton wheel, Francis turbine and Kaplan turbines- working principles - work done by water on the runner – draft tube. Specific speed - unit quantities – performance curves for turbines – governing of turbines.

TOTAL: L: 45: = 45

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TEXT BOOKS

S.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Dr. P.N. Modi& Dr. S.M. Seth	Hydraulics and Fluid Mechanics Including Hydraulics Machines	Rajsons Publications Pvt. Ltd. 20th edition	2015
2.	Dr. R. K. Bansal	A Textbook of Fluid Mechanics and Hydraulic Machines	Laxmi Publications, Ninth edition	2017

REFERENCE BOOKS

S. No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Streeter, V. L. and Wylie E. B.	Fluid Mechanics	McGraw Hill Publishing Co.	2010
2	Kumar K. L.	Engineering Fluid Mechanics	Eurasia Publishing House(p) Ltd., New Delhi	2004
3	Robert W.Fox, Alan T. McDonald, Philip J.Pritchard.	Fluid Mechanics	Wiley, 9th Edition	2015
4	Graebel. W.P.	Engineering Fluid Mechanics	Taylor & Francis, Indian Reprint	2011
5	R.K.Rajput	A text book of Fluid Mechanics	S.Chand & co, New Delhi	2007

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1.	Glyn James	Advanced Modern Engineering Mathematics, 4th Edition	Pearson Education	2016
2.	Bali N. P Manish Goyal	A Text book of Engineering Mathematics, 9th edition	Laxmi Publications Pvt Ltd.	2016
3.	Datta.K.B.	Mathematical Methods of Science and Engineering	Cengage Learning India Pvt Ltd, Delhi	2013
4.	Ray Wylie. C, Barrett.L.C	Advanced Engineering Mathematics, 6th Edition	Tata Mc Graw Hill Education Pvt Ltd, New Delhi	2012
5.	Ramana.B.V.	Higher Engineering Mathematics	Tata Mc Graw Hill Publishing Company, New Delhi	2008

19BSS24 DISCRETE MATHEMATICS

L	T	P	C
3	1	0	4

COURSE OBJECTIVES

- To extend student's Logical and Mathematical maturity.
- To deal with abstraction and the counting principles.
- To identify the basic properties of graphs and model simple applications.
- To study the concepts and properties of algebraic structures.
- To learn discrete objects and their properties.

COURSE OUTCOMES

- Have knowledge of the concepts needed to test the logic of a program.
- Ability to distinguish between the notion of discrete and continuous mathematical structures
- Have an understanding in identifying structures on many levels.
- Be aware of the counting principles.
- Be exposed to concepts and properties of algebraic structures such as groups, rings and fields.

UNIT - I LOGIC AND PROOFS 9+3

Propositional Logic – Propositional equivalences-Predicates and quantifiers- Rules of inference-introduction to Proofs-Proof Methods and strategy.

UNIT – II COMBINATORICS 9+3

Mathematical inductions-Strong induction and well ordering-.The basics of counting-The pigeonhole principle –Permutations and combinations-Recurrence relations-Solving Linear recurrence relations-generating functions-inclusion and exclusion and applications.

UNIT – III GRAPHS 9+3

Graphs and graph models-Graph terminology and special types of graphs-Representing graphs and graph isomorphism - connectivity-Euler and Hamilton paths.

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UNIT – IV ALGEBRAIC STRUCTURES 9+3

Algebraic systems-Semi groups and monoids-Groups-Subgroups and homomorphisms- Cosets and Lagrange's
Theorem - Ring & Fields (Definitions and examples)

UNIT – V LATTICES AND BOOLEAN ALGEBRA 9+3

Partial ordering-Posets-Lattices as Posets- Properties of lattices-Lattices as Algebraic systems –Sub lattices –direct product and Homomorphism-Some Special lattices- Boolean Algebra

TOTAL: 45 + 15

TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Narsingh Deo	Graph Theory with Applications to Engineering and Computer Science, Reprint edition	Dover Publications Inc.	2016
2.	Tremblay J.P, Manohar R	Discrete Mathematical Structures with application to computer science,30th Reprint	Tata Mc Graw Hill Pub.Co.Ltd,New Delhi,	2011

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Bernard Kolman , Robert C.Busby, Sharan Culter Ross	Discrete Mathematical Structures, 6th Edition	Pearson Education Pvt Ltd. ,New Delhi	2015
2.	Richard Johnsonbaugh	Discrete Mathematics , 7th Edition	Pearson Education Asia, New Delhi	2014
3.	Seymour Lipschutz, Mark Lipson, Varsha H. Patil	Discrete Mathematics Schaum's Outlines , Revised 3rd Edition	Mc Graw Hil Pub.Co.Ltd.,New Delhi	2013
4.	Ralph. P.Grimaldi	Discrete and combinatorial Mathematics : An Applied Introduction, 5th Edition	Pearson Education Asia,Delhi	2012
5.	Kenneth H. Rosen	Discrete Mathematics and its Applications, 7th Edition	Tata Mc Graw Hill Pub . co.Ltd.,New Delhi,Special Indian Edition	2011

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3	S.Salivahanan, N.Sureshkumar and A.Vallavaraj	Electronic Devices and Circuits	Tata McGraw Hill	2nd Edition, , 2008
4	Donald A. Neamen	Semiconductor Physics and Devices	Tata McGraw Hill	Third Edition
5	S. M. Sze	Semiconductor Devices: Physics and Technology	Wiley	Second Edition

19GES12 ELECTRONIC SIMULATION LABORATORY

L	T	P	C
0	0	3	1

COURSE OBJECTIVES:

The objectives of this laboratory course are,

- To understand the operation of semiconductor devices using laboratory equipments and simulation software.
- To design and test the electronic circuits using laboratory devices, equipments and simulation software.

COURSE OUTCOMES:

After the completion of the course, the students can able to

- Measure and interpret the parameters of diodes and transistors
- Construct and analyze the amplifier using BJT.
- Construct and analyze the voltage regulator.
- Design and measure various wave shaping circuits using diodes.
- Measure and interpret the parameters of different special diodes.

LIST OF EXPERIMENTS:

1. Analyze the Device Behaviour of Semiconductor Diodes.
2. Analyze the Characteristics of Bipolar Junction Transistors.
3. Design and Analysis of BJT as an amplifier.
4. Analyze the Device Behaviour of FETs.
5. Design and Analysis of Voltage Regulators.
6. Design and Analysis of Rectifiers.
7. Design and Analysis of Clippers and Clampers.
8. Analyze the device Behaviour of UJT.
9. Analyze the device Behaviour of SCR.
10. Analyze the characteristics of LED, LDR and Photodiode.

19GES13 ELECTRIC CIRCUITS

L	T	P	C
2	1	0	3

COURSE OBJECTIVES

- To communicate the knowledge on DC circuits and its analysis.
- To impart knowledge on AC circuits and its analysis.

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- To impart knowledge on solving circuits equations using network theorems.
- To introduce the concept of resonance circuits and transient response in circuits.
- To impart knowledge on balanced and unbalanced in three phase circuits.

COURSE OUTCOMES

- Able to analyze DC circuits
- Able to give details on the AC circuits and analyze.
- Able to solve the different type of network problems
- Able to implement the resonance condition in the power circuits.
- Able to analyze the different type of load in three phase circuits.

UNIT I DC CIRCUITS **6+3**

Basic circuit elements - Ohm's law - Resistors in series and parallel circuits - Voltage division and current division - Kirchhoff's laws - Source transformation - Star-Delta conversion - Mesh and nodal analysis.

UNIT II AC CIRCUITS **6+3**

Introduction to AC circuits- Form Factor - Phase and phase difference - Sinusoidal Voltage and Current - Single phase AC circuits - Series and parallel RL, RC and RLC circuits - Power - Power factor.

UNIT III NETWORK THEOREMS FOR DC AND AC CIRCUITS **6+3**

Superposition theorem - Thevenin's theorem - Norton's theorem - Maximum power transfer theorem - Reciprocity theorem- Compensation theorem

UNIT IV RESONANCE CIRCUITS AND TRANSIENT RESPONSE **6+3**

Series and parallel resonance - Quality factor and bandwidth - Transient response of RL, RC and RLC Circuits using Laplace transform for DC input.

UNIT V THREE PHASE CIRCUITS **6+3**

Three phase balanced / unbalanced voltage sources - Analysis of three phase 3-wire and 4-wire circuits with star and delta connected loads, balanced & un balanced loads - Phasor diagram of voltages and currents - Power and Power factor measurements in three phase circuits.

TOTAL: 45 Hours

TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Charles K. Alexander, Mathew N.O. Sadiku	Fundamentals of Electric Circuits	McGraw Hill	2013
2.	William H. Hayt Jr, Jack E. Kemmerly and Steven M. Durbin	Engineering Circuits Analysis	McGraw Hill publishers New Delhi	2013

REFERENCE BOOKS:

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Course Name	:	19CYC14 -DIGITAL FORENSICS	L	T	P	C
			3	0	0	3

Course Objectives

1	The fundamentals and importance of digital forensics.
2	Digital investigation in an organized and systematic way.
3	Analysis the data acquisition methods.
4	Discriminate on Digital Forensics.
5	Develop computer forensic tools.

Course Outcomes

1	Understand the concepts of digital forensics.
2	Analyze investigation process.
3	Interpret the inner workings of file systems.
4	Design data acquisition methods
5	Apply various forensic tools

Course Outcomes	Program Outcomes												PSOs		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO1 2	PSO 1	PSO 2	PSO 3
19CYC14.CO1	X	X	X	X	-	-	-	-	-	-	X	X	X	-	-
19CYC14.CO2	X	X	X	X	-	-	-	-	-	-	X	X	X	-	-
19CYC14.CO3	X	X	X	X	-	-	-	-	-	-	X	X	X	-	-
19CYC14.CO4	X	X	X	X	-	-	-	-	-	-	X	X	X	-	-
19CYC14.CO5	X	X	X	X	-	-	-	-	-	-	X	X	X	-	-

Unit-I : Introduction

Computer forensics fundamentals- Benefits of forensics-computer crimes-computer forensics evidence and courts- legal concerns and private issues.	9

Unit-II : Computing Investigations

Understanding Computing Investigations – Procedure for corporate High-Tech investigations-understanding data recovery work station and software- conducting and investigations.	9

Unit-III : Data Acquisition

Data acquisition- understanding storage formats and digital evidence- determining the best acquisition method, acquisition tools- validating data acquisitions-performing RAID data acquisitions- remote network acquisition tools- other forensics acquisitions tools	9

Unit-IV : Processing Crimes

Processing crimes and incident scenes-securing a computer incident or crime-seizing digital evidence at scene-storing digital evidence-obtaining digital hash-reviewing case.	9

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Unit-V : Current Computer Forensic Tools		
Current computer forensics tools- software, hardware tools, validating and testing forensic software, addressing data-hiding techniques, performing remote acquisitions, E-Mail investigations- investigating email crime and violations, understanding E-Mail servers, specialized E-Mail forensics tool.		9
	:	45

Text Books:

S.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	**Karlstad**, Joakim	Fundamentals of Digital Forensics	Springer	2018
2.	Anders Flaglien, Inger Marie Sunde,AusraDilijonaite	Digital Forensics	John Wiley & Sons,	2017

REFERENCE BOOK

SI.NO	Author(s)	Title of the Book	Publisher	Year of Publications
1.	**Michael Hale Ligh, Andrew Case**	The Art of Memory Forensics	Wiley	2014
2.	Jack Wiles Anthony Reyes	The best damn cybercrime and digital forensics	Syngress	2007
3	Sharma, S.R	Dimensions Of Cyber Crime	Annual Publications Pvt. Ltd., 1st Edition	2004

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Course Name	:	19CYC15 -INTRODUCTION TO CYBER LAWS	L	T	P	C
			3	0	0	3

Course Objectives

1	The basics concepts of Cyber evolution and computer technology
2	Illustrate the Information Technology in current trends
3	Understand of concepts of Cyber Law
4	Develop the security in business
5	Formulate cybercrime concepts

Course Outcomes

1	Explain the concepts of Cyberspace.
2	Analyze the various Information Technology Act
3	To Understand basics of Cyber Law related with legislation
4	Design Security in cyber space
5	Apply Various Case Studies on Real Time Crimes.

Course Outcomes	Program Outcomes												PSOs		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO1 2	PSO 1	PSO 2	PSO 3
19CYC15.CO1	X	X	X	X	-	-	-	-	-	-	X	X	X	X	-
19CYC15.CO2	X	X	X	X	-	-	-	-	-	-	X	X	X	X	-
19CYC15.CO3	X	X	X	X	-	-	-	-	-	-	X	X	X	X	-
19CYC15.CO4	X	X	X	X	-	-	-	-	-	-	X	X	X	X	-
19CYC15.CO5	X	X	X	X	-	-	-	-	-	-	X	X	X	X	-

Unit-I : Introduction To Cyber Law Evolution Of Computer Technology

Emergence of Cyber space. Cyber Jurisprudence, Jurisprudence and law, Doctrinal approach, Consensual approach, Real Approach, Cyber Ethics, Cyber Jurisdiction, Hierarchy of courts, Civil and criminal jurisdictions, Cyberspace-Web space, Web hosting and web Development agreement, Legal and Technological Significance of domain Names, Internet as a tool for global access.	9

Unit-II :Information Technology Act

Overview of IT Act, 2000, Amendments and Limitations of IT Act, Digital Signatures, Cryptographic Algorithm, Public Cryptography, Private Cryptography, Electronic Governance, Legal Recognition of Electronic Records, Legal Recognition of Digital Signature Certifying Authorities, Cyber Crime and Offences, Network Service Providers Liability, Cyber Regulations Appellate Tribunal, Penalties and Adjudication	9

Unit-III :Cyber Law And Related Legislation

Patent Law, Trademark Law, Copyright, Software - Copyright or Patented, Domain Names and Copyright disputes, Electronic Data Base and its Protection, IT Act and Civil Procedure Code, IT Act and Criminal Procedural Code, Relevant Sections of Indian Evidence Act, Relevant Sections of Bankers Book Evidence Act, Relevant Sections of Indian Penal Code, Relevant Sections of Reserve Bank of India Act, Law Relating To Employees And Internet, Alternative Dispute Resolution, Online Dispute Resolution (ODR).	9

Unit-IV :Electronic Business And Legal Issues		
Evolution and development in Ecommerce, paper vs paper less contracts E-Commerce models- B2B, B2C,E security. Application area: Business, taxation, electronic payments, supply chain, EDI, E-markets, Emerging Trends.		9
Unit-V :Case Study On Cyber Crimes		
Harassment Via E-Mails, Email Spoofing (Online A Method Of Sending E-Mail Using A False Name Or E-Mail Address To Make It Appear That The E-Mail Comes From Somebody Other Than The True Sender, Cyber Pornography (Exm.MMS),Cyber-Stalking		9
	:	45

Text Books:

S.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	K.Kumar	Cyber Laws: Intellectual property & E Commerce, Security"	, Dominant Publisher,	2011
2.	Rodney D. Ryder	Guide To Cyber Laws	Second Edition, Wadhwa And Company,	2007

REFERENCE BOOK

SI.NO	Author(s)	Title of the Book	Publisher	Year of Publications
1.	Vakul Sharma,	Handbook Of Cyber Laws	Macmillan India Ltd, 2 ndEdition,PHI,	2003
2.	Justice Yatindra Singh,	Cyber Laws	Universal Law Publishing, 1 stEdition,New Delhi	2003
3	Sharma, S.R	Dimensions Of Cyber Crime	Annual Publications Pvt. Ltd., 1st Edition	2004

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Course Code & Course Name	:	19CYC43 - DATA WAREHOUSING AND DATA MINING	L	T	P	C
			3	0	0	3

Course Objectives

1.	Tostudythe conceptsofdatawarehousingarchitecture
2.	To understand data mining principles andtechniques
3.	Tolearntouseassociationruleminingforhandlinglargedata
4.	Tostudyclassificationandclusteringforbetterorganizationandretrievalofdata
5.	To exposebusinessapplicationsandrecenttrendsofDatamining

Course Outcomes

1.	Identify the components of data warehousingarchitecture
2.	Implement data preprocessing for miningapplications
3.	Apply the association rules for miningthe data
4.	Deployappropriateclassificationtechniques
5.	Analyzeclusteringtechniques

Course Outcomes	Program Outcomes												PSOs		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO1 2	PSO 1	PSO 2	PSO 3
19CYC43.CO1	X	X	X	X	-	-	-	-	-	-	X	X	X	-	-
19CYC43.CO2	X	X	X	X	-	-	-	-	-	-	X	X	X	-	-
19CYC43.CO3	X	X	X	X	-	-	-	-	-	-	X	X	X	-	-
19CYC43.CO4	X	X	X	X	-	-	-	-	-	-	X	X	X	-	-
19CYC43.CO5	X	X	X	X	-	-	-	-	-	-	X	X	X	-	-

Unit-I : DataWarehousing — 9

Introduction to Data warehousing - Data warehousing Components - Building a Data Warehouse - Mapping the Data Warehouse to Multiprocessor Architecture - DBMS Schemas for Decision Support - Data Extraction, Cleanup, and Transformation Tools - Multidimensional Data Model-On Line Analytical Processing and tools - Need for OLAP- OLAP Operations – Types ofOLAP servers.

Unit-II : DataMining — 9

Data Mining-Motivation and Importance of Data mining – Evolution of Database systems – Data mining functionalities – Steps in KDD process- Architecture of a typical data mining system - Classification of data mining systems – Data mining task primitives - Major issues in data mining

Unit-III :Association Rule Mining — 9

Introduction - Association rule mining - Mining frequent item sets with and without candidate generation – Pattern evaluation methods - Mining various kinds of association rules: Pattern mining - Mining multilevel association - Mining multidimensional association - Constraint based mining.

Unit-IV :Classification — 9

Basic concepts - Decision tree induction - Bayesian classification - Rule based classification - Classification by back propagation - Model Evaluation and Selection - Techniques to improve classification – Case study

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Unit-V :Cluster		9
Cluster analysis - Clustering techniques: Partitioning methods - Hierarchical methods - Evaluation of clustering Outlier detection: Outliers and Outlier analysis - Outlier detection methods- Case study		
Total	**:**	**45**

Text Books:

S.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Jiawei Han and Micheline Kamber,	Data Mining: Concepts and Techniques	Morgan Kaufmann Publishers	2011.
2.	Alex Berson and Stephen J. Smith	Data Warehousing, Data Mining & OLAP	Tata McGraw Hill Edition	2011

Reference Books:

S.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	G. K. Gupta	Introduction to Data Mining with Case Studies	Prentice Hall of India	2014
2.	Ian Witten, Eibe Frank	Data Mining: Practical Machine Learning Tools and Techniques	Morgan Kaufmann	2011
3.	Alex Berson and Stephen J. Smith	Data Warehousing, Data Mining & OLAP	Tata McGraw – Hill Edition	2007
4.	K.P. Soman, ShyamDiwakarand V. Ajay	Insight into Data mining Theory and Practice	Prentice Hall of India	2006
5.	George M Marakas	ModernData Warehousing, Miningand Visualization	Prentice Hall	2003

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19CYP06 **PROFESSIONALPRACTICES** **L T P C**
0 0 6 3

COURSE OBJECTIVES

1. Toexamineimportantprofessionalissuesincontemporarypracticeandtohelpstudentsbecomean effective participant in a team of ITprofessionals.
2. Tohavegainedathoroughunderstandingofthevariousissues/factorsanIT professionalfacesandhow one shouldrespond.
3. To have learned what are considered professional behavior in the ITfield
4. To have learned about the currentITpractices.
5. To Develop professional attitude from the perspectives of experienced ITpractitioners

COURSE OUTCOMES

1. Describethevariousissues/factorsaninformationtechnologyprofessional
2. Describe professional behavior in the informationtechnology.
3. Recognizewhatarethecurrentissuesin ITandtheemergingtechnology
4. Write properly formatted and organized technicalreports
5. Acquireandintegrateknowledgetoappreciateindustrypractices

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19CYP06.CO1	X	X	X	X	-	-	-	-	-	-	X	X	X	X	-
19CYP06.CO2	X	X	X	X	-	-	-	-	-	-	X	X	X	X	-
19CYP06.CO3	X	X	X	X	-	-	-	-	-	-	X	X	X	X	-
19CYP06.CO4	X	X	X	X	-	-	-	-	-	-	X	X	X	X	-
19CYP06.CO5	X	X	X	X	-	-	-	-	-	-	X	X	X	X	-

CONTENT:

1. **Discipline-specificknowledgeandcapabilities**:appropriatetothelevelofstudyrelatedtoanInformation Technologyprofession.
2. **Communication**:usingoral,writtenandinterpersonalcommunicationtoinform,motivateandeffect change
3. **Digitalliteracy**:usingtechnologiestofind,useanddisseminateinformation
4. **Criticalthinking**:evaluatinginformationusingcriticalandanalyticalthinkingandjudgment
5. **Problemsolving**:creatingsolutionstoauthentic(realworldandill-defined)problems
6. **Self-management:** working and learning independently, and taking responsibility for personalactions.
7. **Teamwork**:workingandlearningwithothersfromdifferentdisciplinesandbackgrounds
8. **Globalcitizenship:**engagingethicallyandproductivelyintheprofessionalcontextandwithdiverse communities and cultures in a globalcontext

I. Information TechnologyProfessionalism

A. Privacy andconfidentiality
B. Computerethics
C. Intellectual propertyissues
D. Computer crime andfraud
E. Professionalbodies
F. Impact of information technology onsociety

II. Information TechnologyPractices

A. Effects ofstandardization
B. Effectiveness vsefficiency
C. Distributed systemsissues
D. Emergingtechnologies
E. Qualityissues
F. Currentissues

TOTAL HOURS: 90

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TEXT BOOKS:

S.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Schultz, Robert A	Contemporary Issues in Ethics and Information Technology	IRM Press	2006
2.	Baase S	A Gift of Fire, Social, Legal and Ethical Issues for Computers and the Internet	Prentice Hall	2003

REFERENCE BOOKS:

S.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1	Johnson DG	Computer Ethics	Prentice Hall	2001
2	Spinello RA	CyberEthics: Morality and Law in Cyberspace	Jones and Bartlett	2000

WEB URLs

1. www.infosec.gov.hk
2. www.pcpd.org.hk
3. www.ipd.gov.hk
4. www.ogcio.gov.hk
5. www.hkcs.org.h

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19ADE06 **SOFTWARE ARCHITECTURE** L T P C 3 0 0 3

COURSE OBJECTIVES:

1. Understand the fundamentals of software architecture.
2. Study the various software development methodologies.
3. Learn the importance of architectural documentation and evaluation.
4. Learn the various software architecture design components.
5. Relate software architecture and software quality.

COURSE OUTCOMES

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

19ADE06.CO1 Develop Software applications starting from software architecture and design.
19ADE06.CO2 Learn and evaluate existing software architectures.
19ADE06.CO3 Realize importance of architectural documentation and document them.
19ADE06.CO4 Employ various software architecture design components.
19ADE06.CO5 Design methods for improving software quality from the perspective of softwarearchitecture.

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19ADE06.CO1	x	x	-	x	x	-	x	-	-	x	x	x	-	x	-
19ADE06.CO2	x	-	x	-	-	x	-	x	x	x	-	-	x	-	-
19ADE06.CO3	x	x	x	x	x	x	-	x	x	x	-	-	-	x	-
19ADE06.CO4	x	-	x	-	-	-	x	-	x	x	x	x	-	x	x
19ADE06.CO5	x	x	x	x	x	-	x	-	x	-	x	x	-	-	x

UNIT- I INTRODUCTION 9

Basic concepts of software architecture – Context of Software Architecture – ABC cycle – What software architecture is and what it isn't – Architectural patterns – Good Architecture- Reference models – Architectural structures and views-Introduction to styles – Decentralized Architectures

UNIT- II DESIGN METHODOLOGIES 9

Structured design- Design practices-Stepwise refinement – Incremental design- Structured system analysis and design –Jackson structured programming – Jackson system Development.

UNIT- III ARCHITECTURAL DESCRIPTION DOCUMENTATION AND EVALUATION 9

Early architecture description languages-Domain and style specific ADL's- Extensible ADL's – Documenting software architecture – Uses and Audiences for Architecture Documentation – Views – Choosing Views – Combining Views –Architecture evaluation – Evaluation Factors – Architecture Tradeoff Analysis Method – Lightweight Architecture Evaluation – ATAM.

UNIT- IV ARCHITECTURE DESIGN 9

Typical architectural design-Dataflow-Independent components-Call and return – Using styles in design – Architectural design space-Design space of architectural elements – Design space of architectural styles.

UNIT- V IMPLEMENTATION AND CONFORMANCE TOARCHITECTURE 9

Understanding quality attributes- Implementation of Quality attributes in Architecture – Architecture and requirements conformance –Functionality– Quality attribute considerations – System quality attributes- Introduction to tactics – Achieving Quality Attributes through Tactics – Tactics types –Architectural patterns and styles – Architecture and Quality Attributes – Quality attribute scenarios in practice.

TOTAL HOURS 45

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Text Books:				
S.No.	**Author(s)**	**Title of the Book**	**Publisher**	**Year of Publication**
1.	Len Bass, Paul Clements, Rick Kazman	Software Architecture in Practice	Third Edition, Addison, Wesley	2012
2.	David Budgen	Software Design	Second Edition, Pearson Education	2004

Reference Books:				
S.No.	**Author(s)**	**Title of the Book**	**Publisher**	**Year of Publication**
1.	Richard N.Taylor, NenadMedvidovic and Eric M.Dashofy	Software Architecture, Foundations, Theory and Practice	Wiley	2010
2.	Hong Zhu	Software Design Methodology from Principles to Architectural Styles	Elsevier	2005
3.	Mary Shaw and David Garlan	Software Architecture –Perspectives on an emergingDiscipline	Pearson Education	2008

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19ADE07	INTERNET OF THINGS	L T P C 3 0 0 3

COURSE OBJECTIVES:

1. To understand Smart Objects and IoT Architectures
2. To learn about various IOT-related protocols
3. To build simple IoT Systems using Arduino and Raspberry Pi.
4. To understand data analytics and cloud in the context of IoT
5. To develop IoT infrastructure for popular applications

COURSE OUTCOMES

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

19ADE07.CO1 Explain the concept of IoT.
19ADE07.CO2 Analyze various protocols for IoT.
19ADE07.CO3 Design a PoC of an IoT system using Rasperry Pi/Arduino
19ADE07.CO4 Apply data analytics and use cloud offerings related to IoT.
19ADE07.CO5 Analyze applications of IoT in real time scenario

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19ADE07.CO1	x	-	-	-	x	-	x	-	-	-	x	x	-	x	-
19ADE07.CO2	x	-	x	x	-	x	-	x	x	x	-	-	x	-	-
19ADE07.CO3	x	x	-	-	x	x	-	x	x	x	-	-	-	x	-
19ADE07.CO4	x	-	x	-	-	-	x	-	x	x	x	-	-	x	-
19ADE07.CO5	x	x	x	x	x	-	x	-	x	-	x	x	-	-	x

UNIT- I FUNDAMENTALS OF IoT 9

Evolution of Internet of Things - Enabling Technologies – IoT Architectures: oneM2M, IoT World Forum (IoTWF) and Alternative IoT models – Simplified IoT Architecture and Core IoT Functional Stack — Fog, Edge and Cloud in IoT – Functional blocks of an IoT ecosystem – Sensors, Actuators, Smart Objects and Connecting Smart Objects

UNIT- II IoT PROTOCOLS 9

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

UNIT- III DESIGN AND DEVELOPMENT 9

Design Methodology - Embedded computing logic - Microcontroller, System on Chips - IoT system building blocks - Arduino - Board details, IDE programming - Raspberry Pi - Interfaces and Raspberry Pi with Python Programming.

UNIT- IV DATA ANALYTICS AND SUPPORTING SERVICES 9

Structured Vs Unstructured Data and Data in Motion Vs Data in Rest – Role of Machine Learning – No SQL Databases – Hadoop Ecosystem – Apache Kafka, Apache Spark – Edge Streaming Analytics and Network Analytics – Xively Cloud for IoT, Python Web Application Framework – Django – AWS for IoT – System Management with NETCONF-YANG

UNIT- V CASE STUDIES/INDUSTRIAL APPLICATIONS 9

Cisco IoT system - IBM Watson IoT platform - Manufacturing - Converged Plantwide Ethernet Model (CPwE) – Power Utility Industry – GridBlocks Reference Model - Smart and Connected Cities: Layered architecture, Smart Lighting, Smart Parking Architecture and Smart Traffic Control

TOTAL HOURS 45

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Text Books:

S.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton and Jerome Henry	IoT Fundamentals: Networking Technologies, Protocols and Use Cases for Internet of Things	CiscoPress	2017
2.	Arshdeep Bahga, Vijay Madisetti	Internet of Things – A hands-on approach	Universities Press	2015

Reference Books:

S.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Olivier Hersent, David Boswarthick, Omar Elloumi	The Internet of Things – Key applications and Protocols	Wiley	2012
2.	Jan Ho¨ ller, Vlasios Tsiatsis , Catherine Mulligan, Stamatis . Karnouskos, Stefan Avesand. David Boyle	From Machine-to-Machine to the Internet of Things - Introduction to a New Age of Intelligence	Elsevier	2014
3.	Dieter Uckelmann, Mark Harrison, Michahelles, Florian (Eds)	Architecting the Internet of Things	Springer	2011
4.	Michael Margolis, Arduino Cookbook	Recipes to Begin, Expand, and Enhance Your Projects	2nd Edition, O'Reilly Media	2011

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19ADE18 **WEB SERVICES AND API DESIGN** **L T P C**
3 0 0 3

COURSE OBJECTIVES:

1. To understand the types of web services, resources, APIs and their architectures
2. To analyze the web service / API design patterns
3. To understand the design principles and best practices
4. To develop, deploy RESTful web service APIs in JAVA
5. To understand the security concerns.

COURSE OUTCOMES

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

19ADE18.CO1 Use a suitable architecture for a given design problem
19ADE18.CO2 Analyze the types of resources and suitable design patterns for development and deployment
19ADE18.CO3 Create and Analyze front-end and Back end designs
19ADE18.CO4 Deploy RESTful API web services using JAVA
19ADE18.CO5 Implement security best practices for preventing security attacks

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19ADE18.CO1	x	-	-	-	x	x	x	-	x	-	x	x	x	-	-
19ADE18.CO2	x	-	x	x	-	x	-	x	x	x	-	-	-	-	x
19ADE18.CO3	x	x	-	-	x	-	-	x	-	x	-	-	-	x	-
19ADE18.CO4	x	-	x	-	-	x	x	-	x	x	x	-	-	-	-
19ADE18.CO5	x	x	-	x	-	-	-	-	x	-	x	x	x	x	-

UNIT- I INTRODUCTION 9

Web Services - Building Blocks, Types; Service Oriented architectures - resource oriented architectures, API architectures, Micro services and architectures, HATEOAS, REST, URI, Code on Demand.

UNIT- II RESOURCES AND DESIGN PATTERNS 9

Resources - Identification, Resource Relations, Representations, Parameters, types, methods, Requirements for APIs, Architectural Patterns. Basic and Advanced RESTful API patterns.

UNIT- III RESTFUL API DESIGN PRINCIPLES 9

API front End Design, API back end Design, Identifier Design, Interaction Design with HTTP, Metadata Design, Representation Design, URI design, REST constraints, Best Practices.

UNIT- IV DEVELOPMENT AND DEPOLYMENT 9

Frameworks, Standard Languages, API Description Languages, Handover points, Development and Deployment of RESTful web service applications in Java, microservice API, Best Practices.

UNIT- V PERFORMANCE AND SECURITY 9

Performance and availability - caching - Traffic shaping - Evolution and versioning, Security concerns - Mechanisms, Authentication, Validation, Access Control, Token Based Authentication, Authorization.

TOTAL HOURS 45

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Text Books:

S.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Matthias Biehl	RESTful API Design, API University Series	1st Edition, CreateSpace Independent Publishing Platform	2016
2.	Mark Masse	REST API Design Rulebook: Designing Consistent RESTful Web ServiceInterfaces	1st Edition, O' Reilly	2011

Reference Books:

S.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Harihara Subramanian, Pethuru Raj	Hands-On RESTful API Design Patterns and BestPractices: Design, develop, and deploy highly adaptable, scalable, and secure "RESTful web APIs	Packt Publishing	2019
2.	JJ Geewax	API Design Patterns	1st Edition, Manning Publications	2021
3.	Bogunuva Mohanram Balachandar	Restful Java Web Services: A pragmatic guide to designing and building RESTful APIs using Java	3rd Edition, Ingram Short Title	2017

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19ADE19	NONLINEAR OPTIMIZATION	L T P C 3 0 0 3

COURSE OBJECTIVES:

1. To understand the role of optimization techniques and its importance in engineering
2. To introduce the concept of nonlinear optimization methods.
3. To realize the application of non-traditional optimization algorithms
4. To choose appropriate optimization method and solve real world problems.
5. To understand the concept of Advanced Non-Linear Optimization

COURSE OUTCOMES

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

19ADE19.CO1	Comprehend the need and applications of the optimization methods
19ADE19.CO2	understand basic theoretical principles for formulation of optimization models and its solution.
19ADE19.CO3	learn the unified and exact mathematical basis as well as the general principles of various soft computing techniques
19ADE19.CO4	Apply detailed theoretical and practical aspects of intelligent modelling
19ADE19.CO5	Apply detailed aspects of optimization andcontrol of non-linear systems.

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19ADE19.CO1	x	-	-	-	x	x	x	-	x	-	x	x	x	-	-
19ADE19.CO2	x	-	x	x	-	x	-	x	x	x	-	-	-	-	x
19ADE19.CO3	x	x	-	-	x	-	-	x	-	x	-	-	-	x	-
19ADE19.CO4	x	-	x	-	-	x	x	-	x	x	x	-	-	-	-
19ADE19.CO5	x	x	-	x	-	-	-	-	x	-	x	x	x	x	-

UNIT- I CLASSICAL OPTIMIZATION TECHNIQUES 9

Single variable optimization, Constrained and unconstrained multi-variable optimization, Direct substitution method, Lagrange's method of multipliers,Karush-Kuhn-Tucker conditions

UNIT- II NON-LINEAR PROGRAMMING: ONE-DIMENSIONAL MINIMIZATIONMETHOD 9

Unimodal function, Unrestricted search, Exhaustive search, Dichotomous search, Interval halving method, Fibonacci method, Golden section method, Direct root methods

UNIT- III NON-LINEAR PROGRAMMING: UNCONSTRAINED OPTIMIZATION TECHNIQUES 9

Direct Search Methods: Random search methods, Grid search method, Univariate method, Hookes and Jeeves' method, Powell's method Indirect Search Methods: Steepest descent method, Fletcher-Reeves method, Newton's method

UNIT- IV NON-LINEAR PROGRAMMING: CONSTRAINED OPTIMIZATION TECHNIQUES 9

Direct Methods: Random search method, Sequential linear programming. Indirect methods: Transformation techniques, Exterior penalty function method, Interior penalty function method

UNIT- V ADVANCED NON-LINEAR OPTIMIZATION 9

Genetic Algorithms -Working principle-Genetic operators-Numerical problem-Simulated Annealing – Numerical problem - Neural network based optimization-Optimization of fuzzy systems-fuzzy set theory-computational procedure

TOTAL HOURS 45

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Text Books:

S.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	S.S.Rao	Engineering Optimization Theory and Practice	New Age International (P),5th edition	2019
2.	C. B Gupta	Optimization Techniques in Operation Research	I.K.International House Pvt.Ltd	2007

Reference Books:

S.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Godfrey C. Onwubolu, B. V. Babu	New Optimization Techniques in Engineering		2004
2.	Cesar Lopez	MATLAB Optimization Techniques		2014

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19ADE21 **ENGINEERING ECONOMICS** L T P C 3 0 0 3

COURSE OBJECTIVES:

1. To Learn the fundamental of Economics.
2. To Understand different methods of depreciation use for calculation
3. To know the various method of comparison used in economic
4. To Understand how funds are managed in an organization.
5. Different methods of production and marketing adopted in an industry.

COURSE OUTCOMES

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

19ADE21.CO1 The basic concepts of economics are learned
19ADE21.CO2 Understand the various types depreciation used
19ADE21.CO3 Learn the different comparison technique used in industries.
19ADE21.CO4 The fund flow in the industries are learned
19ADE21.CO5 Understand the different Production and Marketing techniques used in the industries.

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19ADE21.CO1	x	-	-	-	x	x	x	-	x	-	x	x	x	-	-
19ADE21.CO2	x	-	x	x	-	x	-	x	x	x	-	-	-	-	x
19ADE21.CO3	x	x	-	-	x	-	-	x	-	x	-	-	-	x	-
19ADE21.CO4	x	-	x	-	-	x	x	-	x	x	x	-	-	-	-
19ADE21.CO5	x	x	-	x	-	-	-	-	x	-	x	x	x	x	-

UNIT- I MICRO AND MACRO ECONOMICS AND ITSAPPLICATIONS 9

Introduction – Micro Economics – Macro Economics – Economic decisions and Technical Decisions – Demand and Supply Concepts – Elasticity of Demand – Cost of Products – Price of products – Break-Even Analysis – Nature of Functioning of Money –Notional Income – GNPand Savings – Inflation and Deflation Concepts

UNIT- II METHODS OF DEPRECIATION 9

Straight line method of Depreciation- Declining Balance Method of Depreciation-Sum of the Years Digits Method of Depreciation-Sinking Fund Method of Depreciation- Service-output Method of Depreciation.

UNIT- III METHODS OF COMPARISON OF ALTERNATIVES 9

Introduction – Elementary Economic Analysis – Interest Formulas and their Applications Comparisons – Present Worth Method – Future Worth Method – Annual Equivalent Method – Rate of Return Method.

UNIT- IV FINANCIAL MANAGEMENT 9

Sources of finance, internal and external-preparation of balance sheet and profit and loss statements, Types of accounting and significance of each type, interest formulas and their applications.

UNIT- V PRODUCTION & MARKETING MANAGEMENT 9

Types of Production; process of planning, scheduling, Routing, material control: product concept concepts of productivity. Core concepts of Marketing- Needs, Wants, Demand- Marketing Vs Selling- Products and Markets- Pricing and its related factors- Channels of Distribution- Promotion- Advertising- Market Research- Sales Forecasting.

TOTAL HOURS 45

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Text Books:

S.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	O.P. Khanna	Industrial Engineering and Management	Dhanpat Rai and Sons	-
2.	R. Pannerselvam	Engineering Economics	Prentice Hall of India Pvt	2014

Reference Books:

S.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	S.K. Jain	Applied Economics for Engineers and Managers	Vikas Publications House, New Delhi	1997
2.	Mote Paul, Gupta	Managerial Economics	Tata Mc Graw Hill	1987
3.	Joseph L. Massie	Essentials of Management	Prentice-Hall of India, Third edition	1979

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19CHC03 **CHEMICAL PROCESS INDUSTRIES** **L T P C**
2 0 0 2

COURSE OBJECTIVES:

- To acquire knowledge on chemical industries
- To develop skills in oil and allied industries
- To understand the concepts in fermentation industries.
- To provide knowledge on pulp and leather industries.
- To provide knowledge on cement industries.

COURSE OUTCOMES:

19CHC03.CO1 : Ability to identifies the contemporary technologies in water treatment and label the process economics in sulphur based industries.

19CHC03.CO2 : Ability to design the production methodology of oil industries and analyse the efficiency of the products.

19CHC03.CO3 : Ability to analyze and formulate the chemical processes and economics involved in the carbohydrate industries.

19CHC03.CO4 : Ability to describe the flow sheets of manufacture process of pulp based, leather industries and engineering problems faced in the industries.

19CHC03.CO5 : Ability to evaluate the surface coating and cement industry processes to justify their appropriate production techniques and their handling processes.

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19CHC03.CO1	x	x	-	-	x	-	-	-	-	x	-	x	x	-	x
19CHC03.CO2	x	x	x	x	x	-	-	-	-	x	-	x	x	x	x
19CHC03.CO3	x	x	x	x	x	-	-	-	-	x	-	x	x	x	x
19CHC03.CO4	x	x	x	x	x	-	-	-	-	x	-	x	x	x	x
19CHC03.CO5	x	x	x	x	x	-	-	-	-	x	-	x	x	x	x

UNIT I NITROGEN, PHOSPHOROUS AND SULPHUR BASED INDUSTRIES **11**

Nitrogen, Ammonium nitrate, Ammonium sulphate and Urea. Phosphorus, Phosphoric acid, Ammonium phosphates, Sodium phosphates, Nitrophosphate & Phosphate esters. Mixed fertilizers (NPK Mixtures). Manufacture of Sulphur and Sulphuric acid. Materials for handling, storage and transportation.

UNIT II OIL AND ALLIED INDUSTRIES **7**

Vegetable oil extraction methods. Refining of vegetable oils. Hydrogenation of Oils. Soaps and Candle. Detergents and Glycerine. Materials for handling, storage and transportation.

UNIT III CARBOHYDRATES AND FERMENTATION INDUSTRIES **9**

Manufacture of Starch, Dextrin, Glucose and sucrose and manufacture of Ethyl alcohol, Acetic acid, Citric acid, Oxalic acid and Antibiotics (Penicillin). Materials for handling, storage and transportation.

UNIT IV PULP AND LEATHER INDUSTRIES **9**

Production of Pulp. Conversion to paper. Production of Viscose, Acetate and Cuprammoniumrayons and Cellulose acetate. Production of Dimethyl sulphite and Dimethyl sulphoxide from wood liquor. Manufacture of leather from hides and skins. Manufacture of Glue and Gelatin. Materials for handling, storage and transportation.

UNIT V SURFACE COATING AND CEMENT INDUSTRIES **9**

Constituents of paints & varnishes and their functions. Paint mixing process. Manufacture of pigments such as White lead, Zinc oxide and Titanium dioxide. Cements: Introduction, types of cements, properties and applications. Manufacture of Portland cement.

TOTAL: 45 Periods

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TEXT BOOKS:				
Sl.No	**Author(s)**	**Title of the Book**	**Publisher**	**Year of Publication**
1	Gopala Rao, M. & Marshall Sittig	Dryden's Outlines of Chemical Technology	Affiliated East-West Press, New Delhi	2004
2	Austin, G.T	Shreve's Chemical Process Industries	McGraw Hill	1984

REFERENCE BOOKS:				
Sl.No	**Author(s)**	**Title of the Book**	**Publisher**	**Year of Publication**
1	Shukla, S.D. Pandey, G.N	A Text Book of Chemical Technology, Vol. I	Vikas, New Delhi	1994
2	Venkateswaralu, D., Upadrashta, K.R. & Chandrasekaran, K.D.	Chemtech - I	Chand & Co., New Delhi	1975
3	Kent, A.J. Van Nostrand	Riegel's Handbook of Industrial Chemistry	Reinhold, New York	1974
4	Stephenson, R.M	Introduction to Chemical Process Industries	Van Nostrand, New Jersy	1966
5	Lowenheim, F.A. & Moran, M.K. : Faith	Keyes and Clark's Industrial Chemicals	John Wiley, New York	1975

WEB URLs:

1. https://www.chemicalprocessing.com/
2. https://chemical-materials.elsevier.com/chemical-manufacturing-excellence/chemical-processing-industries-in-spotlight/
3. https://www.accessengineeringlibrary.com/content/book/9780071410373/chapter/chapter1
4. https://www.youtube.com/watch?v=HdknvtO2x3s
5. https://www.youtube.com/watch?v=az8n64NweAE

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19CHC04 **INSTRUMENTAL METHODS OF ANALYSIS** **L T P C**
3 0 0 3

COURSE OBJECTIVES:

- To enable the students to have a fundamental knowledge about the Light spectrum, Absorption
- To expose students with electrical and electronic components used in the analytical instruments
- To learn and understand the principles and operation of different instrumentation techniques
- To acquire knowledge on the different chromatographic methods for separation of biological products
- To know the different molecular spectroscopic techniques and their analytical applications

COURSE OUTCOMES:

19CHC04.CO1 : Ability to analyze the function of electrical and optical component in analytical instruments and their calibration
19CHC04.CO2 : Ability to apply the spectroscopic techniques to identify, estimate and characterize analytes
19CHC04.CO3 : Ability to analyze the thermal behavior of materials using thermal analysis
19CHC04.CO4 : Ability to apply chromatographic and electrophoretic techniques to separate, purify and quantify molecules
19CHC04.CO5 : Ability to analyze different types of electrodes and electroanalytical techniques for sensing and quantifying analytes.

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19CHC04.CO1	x	x	-	-	x	-	-	-	-	x	-	x	x	-	x
19CHC04.CO2	x	x	x	x	x	-	-	-	-	x	-	x	x	x	x
19CHC04.CO3	x	x	x	x	x	-	-	-	-	x	-	x	x	x	x
19CHC04.CO4	x	x	x	x	x	-	-	-	-	x	-	x	x	x	x
19CHC04.CO5	x	x	x	x	x	-	-	-	-	x	-	x	x	x	x

UNIT I INTRODUCTION TO SPECTROMETRY 9

Properties of electromagnetic radiation- wave properties – components of optical instruments – Sources of radiation – wavelength selectors – sample containers – radiation transducers – Signal process and read outs – signal to noise ratio - sources of noise – Enhancement of signal to noise - types of optical instruments – Principle of Fourier Transform optical Measurements.

UNIT II MOLECULAR SPECTROSCOPY 9

Molecular absorption spectrometry – Measurement of Transmittance and Absorbance – Beer's law – Instrumentation - Applications -Theory of fluorescence and Phosphorescence – Instrumentation – Applications – Theory of Infrared absorption spectrometry – IR instrumentation – Applications – Theory of Raman spectroscopy – Instrumentation – applications.

UNIT III MAGNETIC RESONANCE SPECTROSCOPY AND MASS SPECTROMETRY 9

Manufacture of Starch, Dextrin, Glucose and sucrose and manufacture of Ethyl alcohol, Acetic acid, Citric acid, Oxalic acid and Antibiotics (Penicillin). Materials for handling, storage and transportation.

UNIT IV SEPARATION METHODS 9

General description of chromatography – Band broadening and optimization of column performance- Liquid chromatography – Partition chromatography – Adsorption chromatography – Ion exchange chromatography -size exclusion chromatography- Affinity chromatography principles of GC and applications – HPLC- Capillary electrophoresis – Applications

UNIT V ELECTRO ANALYSIS AND SURFACE MICROSCOPY 9

Electrochemical cells- Electrode potential cell potentials – potentiometry- reference electrode – ion selective and molecular selective electrodes – Instrument for potentiometric studies – Voltametry – Cyclic and pulse voltametry- Applications of voltametry . Study of surfaces – Scanning probe microscopes – AFM and STM.

TOTAL: 45 Periods

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TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1	Skoog, D.A. F. James Holler, and Stanky, R.Crouch	Instrumental Methods of Analysis	Cengage Learning	2007
2	Willard, Hobart	Instrumental Methods of Analysis	CBS	1986

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1	Braun, Robert D	Introduction to Instrumental Analysis	Pharma Book Syndicate	1987
2	Ewing,G.W	Instrumental Methods of Chemical Analysis	McGraw-Hill	1985
3	Sharma, B.K	Instrumental Methods of Chemical Analysis: Analytical Chemistry	Goel Publishing House	1972
4	Haven, Mary C	Laboratory Instrumentation	John Wiley	1995
5	Arthur I. Vogel	Quantitative Inorganic Analysis including Elementary Instrumental Analysis	ELBS, Group	1989

WEB URLs:

1. http://nptel.ac.in/courses.php
2. http://nptel.ac.in/downloads/102103044/
3. http://nptel.ac.in/courses.php?disciplineId=102
4. https://www.youtube.com/watch?v=dAM0CVa8IkQ
5. https://www.youtube.com/watch?v=vrlR4oBslV8

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19CHE03 **FOOD TECHNOLOGY** **L T P C**
3 0 0 3

COURSE OBJECTIVES:

- To acquire knowledge about food and energy
- To know about the general aspects in food.
- To gain knowledge about the production of food products
- To know the fundamentals of preservation methods.
- To know different packing materials for the preservation of foods.

COURSE OUTCOMES:

19CHE03.CO1 : Ability to differentiate the constituents present in food
19CHE03.CO2 : Ability to understand the processing methods
19CHE03.CO3 : Ability to distinguish the production and utilization of food.
19CHE03.CO4 : Ability to know the preservation methods
19CHE03.CO5 : Ability to understand the concept of food packing materials.

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19CHE03.CO1	x	-	-	-	-	-	-	-	x	x	-	x	x	-	-
19CHE03.CO2	x	x	x	x	-	-	-	-	x	x	-	x	x	x	-
19CHE03.CO3	x	-	-	-	-	-	-	-	x	x	-	x	x	-	-
19CHE03.CO4	x	x	x	x	-	-	-	-	x	x	-	x	x	x	-
19CHE03.CO5	x	x	x	x	-	-	-	-	x	x	-	x	x	x	-

UNIT I FOOD CONSTITUENTS AND DERIVATIVE FACTORS 9

Constituents of food – carbohydrates, lipids, proteins, vitamins and minerals, food additives; deteriorative factors and their control.

UNIT II GENERAL ENGINEERING ASPECTS AND PROCESSING METHODS 9

Preliminary processing methods; conversion and preservation operations

UNIT III PRODUCTION AND UTILISATION OF FOOD PRODUCTS 9

Cereal grains; pulses; vegetables; fruits; spices; fats and oils; bakery; confectionery and chocolate products; soft and alcoholic beverages; dairy products; meat; poultry and fish products.

UNIT IV PRESERVATION METHODS 9

Preservation by heat and cold; Dehydration; Frying; Drying; Irradiation; Microwave heating sterilization and pasteurization; fermentation and pickling

UNIT V FOOD PACKAGING 9

Basic packaging materials, types of packaging materials used for different kinds of foods, HACCP Introduction and Principles, Introduction to Food Labeling.

TOTAL: 45 Periods

TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1	B. Sivasanker	Food Processing & Preservation	Prentice-Hall Of India Pvt. Ltd.	2002
2	Potter N.N.	Food Science	The AVI Publishing Co., Westport	2006

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REFERENCE BOOKS:				
Sl.No	**Author(s)**	**Title of the Book**	**Publisher**	**Year of Publication**
1	W.C. Frazier & D.C. Westhoff	Food Microbiology	Mcgraw-Hill Book Co.,	1988
2	J.M. Jay	Modern Food Microbiology	Cbs Publications	1987
3	Barbosa-Canovas, G. V., & Ibarz, A	Introduction to food process engineering	CRC Press	2014
4	Sahu, J. K	Introduction to advanced food process engineering	CRC Press	2014
5	P. Coultate	Food – The Chemistry Of Its Components	Royal Society, London	1992

WEB URLs:

1. www.fao.org/wairdocs/x5434e/x5434e00.htm
2. https://www.mooclist.com/course/food-security-and-sustainability-crop-production-edx?static=true
3. https://www.mooclist.com/course/nutrition-and-health-part-3-food-safety-edx?static=true
4. https://www.youtube.com/watch?v=1JbnRA-Hpwg
5. https://www.youtube.com/watch?v=fr1nzF9AMXs

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19CHE04 **POLYMER TECHNOLOGY** **L T P C**
3 0 0 3

COURSE OBJECTIVES:

- To gain familiarity on polymers.
- To provide knowledge on addition polymerization.
- To provide knowledge on condensation polymerization.
- To have knowledge on molecular weights of polymers
- To understand the transitions in polymers.

COURSE OUTCOMES:

19CHE04.CO1 : Ability to emphasize about polymers.
19CHE04.CO2 : Ability to analyze the free radicals.
19CHE04.CO3 : Ability to differentiate the polycondensation.
19CHE04.CO4 : Ability to determine molecular weights of polymers.
19CHE04.CO5 : Ability to comprehend the crystallization in polymers.

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19CHE04.CO1	x	x	x	x	x	x	-	-	x	x	-	x	x	x	-
19CHE04.CO2	x	x	x	x	x	x	-	-	x	x	-	-	x	x	-
19CHE04.CO3	x	x	x	x	x	x	-	-	x	x	-	-	x	x	-
19CHE04.CO4	x	x	x	x	x	x	-	-	x	x	-	-	x	x	-
19CHE04.CO5	x	x	x	x	x	x	-	-	x	x	-	x	x	x	-

UNIT I INTRODUCTION **6**

History of Macromolecules – structure of natural products like cellulose, rubber,proteins – concepts of macro molecules – Staudinger's theory of macromolecules – difference between simple organic molecules and macromolecules.

UNIT II ADDITION POLYMERIZATION **12**

Chemistry of Olefins and Dienes – double bonds – Chemistry of free radicals – monomers – functionality – Polymerization: Initiation – types of initiation – free radical polymerization – cationic polymerization – anionic polymerization – coordination polymerization – industrial polymerization – bulk, emulsion, suspension and solution polymerization techniques – Kinetics – Copolymerization concepts.

UNIT III CONDENSATION POLYMERIZATION **9**

Simple condensation reactions – Extension of condensation reactions to polymer synthesis – functional group reactivity – polycondensation – kinetics of polycondensation- Carother's equation – Linear polymers by polycondensation – Interfacial polymerization – crosslinked polymers by condensation – gel point.

UNIT IV MOLECULAR WEIGHTS OF POLYMERS **9**

Difference in molecular weights between simple molecules and polymers – number average and weight average molecular weights – Degree of polymerization and molecular weight – molecular weight distribution – Polydispersity – molecular weight determination. Different methods – Gel Permeation Chromatography – Osmometry, Light Scattering.

UNIT V TRANSITIONS IN POLYMERS **9**

First and second order transitions – Glass transition, Tg – multiple transitions in polymers – experimental study – significance of transition temperatures – crystallinity in polymers – effect of crystallization – in polymers – factors affecting crystallization crystal nucleation and growth – relationship between Tg and Tm – Relationship between properties and crystalline structure.

TOTAL: 45 Periods

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TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1	Billmeyer.F.W.,Jr	Text Book of Polymer Science	Wiley-Interscience	1984
2	Seymour. R.B., and Carraher.C.E., Jr	Polymer Chemistry	Marcel Dekker	1988

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1	Gowariker.V.T., Viswanathan.N.V., and Sreedar.J	Polymer Science	Wiley Eastern Ltd.,	1988
2	Joel,R.F	Polymer Science and Technology	Eastern Economy Edition	1999
3	Rodriguez, F., Cohen.C., Oberic.K and Arches, L.A	Principles of Polymer Systems	Taylor and Francis	2001
4	Belov P.S	Fundamentals of Petroleum Chemicals Technology	, Mir Publishers, Moscow	1970
5	Wiseman P	Petrochemicals	Ellis Horwood	1986

WEB URLs:

1. https://www.dupont.com/knowledge/polymer-technology.html
2. https://www.youtube.com/watch?v=p6QPFKwylnU
3. https://www.youtube.com/watch?v=4lKVZpJI0Oo
4. https://www.youtube.com/watch?v=icj_5yF-GV8
5. https://www.youtube.com/watch?v=b_XZKangA8Y

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19CHC06 **CHEMICAL ENGINEERING THERMODYNAMICS I** **L T P C 3 0 0 3**

COURSE OBJECTIVES:

- To learn PVT behavior of fluids
- To understand laws of thermodynamics
- To provide knowledge on thermodynamic property relations and their application to fluid flow
- To have knowledge on thermodynamic formulations
- To understand the compression and expansion of fluids.

COURSE OUTCOMES:

19CHC06.CO1 : Ability to outline the terminology associated with engineering thermodynamics, apply the concepts of heat, work and energy conversion to calculate heat and work quantities for industrial processes and predict the properties of ideal and real mixtures based on thermodynamic principles.

19CHC06.CO2 : Ability to apply the basic concepts of first and second laws of thermodynamics for the design and analyze of the open and closed system in chemical process plants.

19CHC06.CO3 : Ability to predict the changes in the properties of real fluids undergoing changes in process plant equipments.

19CHC06.CO4 : Ability to use empirical correlations and experimental date to evaluate thermodynamic quantities that relate to the vapour - liquid or liquid-liquid equilibrium of ideal and non-ideal chemical mixtures.

19CHC06.CO5 : Ability to determine equilibrium constants, standard enthalpy, Gibbs free Energy and equilibrium compositions for single and multiple reaction systems.

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19CHC06.CO1	x	-	x	-	-	-	-	-	-	x	-	x	-	-	-
19CHC06.CO2	x	x	x	-	-	-	-	-	-	x	-	x	x	-	-
19CHC06.CO3	x	-	x	-	-	-	-	-	-	x	-	x	-	-	-
19CHC06.CO4	x	-	x	-	-	x	x	-	-	x	-	x	x	-	-
19CHC06.CO5	x	x	x	-	-	-	-	-	-	x	-	x	x	-	-

UNIT I Basic Concept of Thermodynamics **6**

Scope of thermodynamics; Definition of system, control volume, state and path function, equilibrium, reversibility, energy, work and heat, zeroth law, temperature scales.

UNIT II PVT behavior of Pure Substances **7**

PVT behavior of fluids; Mathematical representation of PVT behavior; Generalized compressibility factor correlation; Generalized equations of state.

UNIT III First and Second law of Thermodynamics **12**

Joule's experiment, internal energy, first law, energy balance for closed systems, mass and energy balance for open systems, Statements of the second law of thermodynamics, heat engine and refrigerator, Carnot cycle and Carnot theorems, thermodynamic temperature scale, entropy and its calculation, second law of thermodynamics for a control volume.

UNIT IV Thermodynamic Formulations **12**

Third law of thermodynamics, entropy from a microscopic point of view. Thermodynamic potentials – internal energy, Helmholtz free energy, Gibbs free energy, thermodynamic property relations – Maxwell relations – partial derivatives and Jacobian method, residual properties, thermodynamic property tables and diagrams.

UNIT V Compression, Expansion of Fluids **8**

Thermodynamic aspects and classification of compression process, equation for change of state of gases, work done calculation for different situations, factors affecting compressor performance, multistage compression, convergent divergent flow in nozzles, Ejectors.

TOTAL: 45 Periods

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TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1	Smith, J.M., Van Ness, H.C and Abbot M.M	Introduction to Chemical Engineering Thermodynamics	McGraw Hill	2003
2	Narayanan, K.V	A Textbook of Chemical Engineering Thermodynamics	Prentice Hall	2004

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1	Kyle, B.G	Chemical and Process Thermodynamics	Prentice Hall	1990
2	Hougen, O.A., Watson, K.M., and Ragatz, R.A	Chemical Process Principles Part - II: Thermodynamics	John Wiley & Sons	1970
3	Sandler, S.I	Chemical and Engineering Thermodynamics	John Wiley International	1989
4	Rao .Y.V.C	Chemical Engineering Thermodynamics	United press (India) ltd.	1997
5	Merle Potter, Craig Somerton	Schaum's outline of Thermodynamics for Engineers	McGraw Hill	2009

WEB URLs:

1. https://nptel.ac.in/courses/103/101/103101004/
2. https://nptel.ac.in/courses/103/104/103104151/
3. https://www.classcentral.com/course/swayam-chemical-engineering-thermodynamics-12898
4. https://www.youtube.com/watch?v=aDXBo0FtALA&list=PLwdnzlV3ogoVnCnIfjDHng_8biZSUEYtK
5. https://www.youtube.com/watch?v=yVOzgBfsQI0&list=PLFW6lRTa1g80QsuYcFQZWrsn_PB987gn5

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19CHC17 **FLUID MECHANICS LABORAROTRY** **L T P C**
0 0 3 1

COURSE OBJECTIVES:

- To develop understanding of the non Newtonian fluids.
- To provide knowledge on weir and notches.
- To provide knowledge on flow through pipes.
- To have knowledge on pumps
- To understand the effect of pressure drop.

COURSE OUTCOMES:

19CHC17.CO1 : Ability to realize the nature of non Newtonian fluids
19CHC17.CO2 : Ability to comprehend the weir and notches.
19CHC17.CO3 : Ability to analyze the flow through pipes.
19CHC17.CO4 : Ability to determine various pumps.
19CHC17.CO5 : Ability to analyze the pressure drop.

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19CHC17.CO1	x	x	x	x	-	-	-	-	-	x	-	x	x	x	-
19CHC17.CO2	x	x	x	x	-	-	-	-	-	x	-	x	x	x	-
19CHC17.CO3	x	x	x	x	-	-	-	-	-	x	-	x	x	x	-
19CHC17.CO4	x	x	x	x	-	-	-	-	-	x	-	x	x	x	-
19CHC17.CO5	x	x	x	x	-	-	-	-	-	x	-	x	x	x	-

LIST OF EXPERIMENTS

1. Viscosity measurement of non Newtonian fluids
2. Calibration of constant and variable head meters
3. Calibration of weirs and notches
4. Open drum orifice and draining time
5. Flow through straight pipe
6. Flow through annular pipe
7. Flow through helical coil and spiral coil
8. Losses in pipe fittings and valves
9. Characteristic curves of pumps (Centrifugal / Gear / Reciprocating)
10. Pressure drop studies in packed column
11. Hydrodynamics of fluidized bed
12. Drag coefficient of solid particle

TOTAL: 30 Periods

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19CHC18 INSTRUMENTAL METHODS OF ANALYSIS LABORATORY

L	T	P	C
0	0	3	1

COURSE OBJECTIVES:

- To provide students an exposure to spectroscopic methods.
- To have a practical hands on experience on Absorption Spectroscopic methods
- To acquire experience in the purification by performing thin layer chromatography
- To validate and analysis using spectrometric and microscopic techniques
- To enhance the knowledge on column chromatography

COURSE OUTCOMES:

19CHC18.CO1 : Ability to differentiate the spectroscopic methods.
19CHC18.CO2 : Ability to assess absorption spectroscopic methods.
19CHC18.CO3 : Ability to analyze the thin layer chromatography.
19CHC18.CO4 : Ability to emphasize the spectrometric and microscopic techniques.
19CHC18.CO5 : Ability to analyze the column chromatography.

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19CHC18.CO1	x	x	x	x	-	-	-	-	-	x	-	x	x	x	-
19CHC18.CO2	x	x	x	x	-	-	-	-	-	x	-	x	x	x	-
19CHC18.CO3	x	x	x	x	-	-	-	-	-	x	-	x	x	x	-
19CHC18.CO4	x	x	x	x	-	-	-	-	-	x	-	x	x	x	-
19CHC18.CO5	x	x	x	x	-	-	-	-	-	x	-	x	x	x	-

LIST OF EXPERIMENTS

1. Precision and validity in an experiment using absorption spectroscopy.
2. Validating Lambert-Beer's law using KMnO4
3. Finding the molar absorbtivity and stoichiometry of the Fe (1,10 phenanthroline) using absorption spectrometry.
4. Finding the pKa of 4-nitrophenol using absorption spectroscopy.
5. UV spectra of nucleic acids.
6. Chemical actinometry using potassium ferrioxolate.
7. Estimation of SO4-- by nephelometry.
8. Estimation of Al3+ by Flourimetry.
9. Limits of detection using aluminium alizarin complex.
10. Chromatography analysis using TLC.
11. Chromatography analysis using column chromatography.

TOTAL: 30 Periods

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19CHE01 **ENZYME ENGINEERING** **L T P C**
3 0 0 3

COURSE OBJECTIVES:

- To understand the basics of microorganisms and enzymes.
- To provide knowledge on fermentation.
- To provide knowledge on bioreactor design.
- To have knowledge on biochemical aspects of enzyme
- To understand the working of bioreactors.

COURSE OUTCOMES:

19CHE01.CO1 : Ability to acquire knowledge on microbes.
19CHE01.CO2 : Ability to identify the fermentation process
19CHE01.CO3 : Ability to analyze the bioreactor design
19CHE01.CO4 : Ability to comprehend the function and applications of enzymes
19CHE01.CO5 : Ability to explore the industrial applications of enzymes

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19CHE01.CO1	x	-	x	-	x	-	-	-	x	x	x	x	-	-	x
19CHE01.CO2	x	-	x	-	x	-	-	-	x	x	x	x	-	-	x
19CHE01.CO3	x	x	x	-	x	-	-	-	x	x	x	x	-	-	x
19CHE01.CO4	x	x	x	-	x	-	-	-	x	x	x	x	-	-	x
19CHE01.CO5	x	x	x	-	x	-	-	-	x	x	x	x	-	-	x

UNIT I 9

Types of Microorganism: Structure and function of microbial cells. Fundamentals of microbial growth, batch and continuous culture. Isolation and purification of enzymes from cells. Cell and Enzyme Immobilization.

UNIT II 9

Fermentation – Types of mechanisms, Continuous fermentation – aeration and agitation, kinetics of fermentation – Processes

UNIT III 9

Introduction of Bioreactor design: Continuously stirred aerated tank bioreactors. Mixing power correlation. Determination of volumetric mass transfer rate of oxygen from air bubbles and effect of mechanical mixing and aeration on oxygen transfer rate, heat transfer and power.

UNIT IV 9

Introduction to Biochemistry, Function and applications. Nature and function of enzyme. Coenzyme / Cofactor. Classification of enzymes. Assay methods and units. Examples of applications of enzymes in industry, analytical technique medicine and Pharmaceuticals.

UNIT V 9

Industrial Bioreactors Utilizing Isolated enzymes and biosensors development and applications. Designs of reactor, Batch and continue type; analysis for immobilized enzyme reactors. Sterile and non sterile operations; reactors in series with and without recycle.

TOTAL: 45 Periods

TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1	Wiseman. A and Blakeborough N and Dunnill P	Enzymic and nonenzymic catalysis	Ellis and Harwood, U.K	1981
2	Cornish. A -Bowden	Analysis of Enzyme Kinetic Data	Oxford University Press	1996

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REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1	Wiseman A	Topics in enzyme and fermentation Bio-technology	Ellis and Harwood, U.K	1990
2	Shuler M.L., Kargi F	Bioprocess Engineering Basic Concepts	Prentice Hall of India	2002
3	Bailey J.E., Ollis D.F	Biochemical Engineering Fundamentals	McGraw-Hill, International Edition	2010
4	Lee J.M	Biochemical Engineering	Prentice Hall	1992
5	Blanch H.W., Clark D.S	Biochemical Engineering	Marcel Dekker	1997

WEB URLs:

1. https://www.cell.com/trends/biotechnology/fulltext/0167-7799(83)90057-4
2. https://onlinelibrary.wiley.com/doi/abs/10.1002/bit.27329
3. https://eng.au.dk/en/research/biological-and-chemical-engineering/industrial-biotechnology/enzyme-engineering/
4. https://www.youtube.com/watch?v=ruifWn_7hVk
5. https://www.youtube.com/watch?v=rckx6a1KwJk

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19CHE02 **PETROLEUM REFINING AND PETROCHEMICALS** **L T P C**
3 0 0 3

COURSE OBJECTIVES:

- To understand the basics of crude oil .
- To provide knowledge on refining techniques.
- To provide knowledge on treatment techniques.
- To have knowledge on petroleum products
- To understand the petrochemicals production.

COURSE OUTCOMES:

19CHE02.CO1 : Ability to emphasize the petroleum products.
19CHE02.CO2 : Ability to determine the various refining techniques.
19CHE02.CO3 : Ability to analyze treatment methods.
19CHE02.CO4 : Ability to determine extraction process.
19CHE02.CO5 : Ability to Apply the knowledge of treatment processes to develop the manufacture of petroleum products.

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19CHE02.CO1	x	x	x	x	-	-	-	-	-	x	-	x	x	x	-
19CHE02.CO2	x	x	x	x	-	-	-	-	-	x	-	x	x	x	-
19CHE02.CO3	x	x	x	x	-	-	-	-	-	x	-	x	x	x	-
19CHE02.CO4	x	x	x	x	-	-	-	-	-	x	-	x	x	x	-
19CHE02.CO5	x	x	x	x	-	-	-	-	-	x	-	x	x	x	-

UNIT I 9

Origin, Formation and Evaluation of Crude Oil. Testing of Petroleum Products. Refining of Petroleum – Atmospheric and Vaccum Distillation.

UNIT II 9

Cracking, Thermal Cracking, Vis-breaking, Catalytic Cracking (FCC), Hydro Cracking, Coking and Air Blowing of Bitumen.

UNIT III 9

Treatment Techniques: Removal of Sulphur Compounds in all Petroleum Fractions to improve performance, Solvent Treatment Processes, Dewaxing, Clay Treatment and Hydrofining.

UNIT IV 9

Cracking of Naphtha and Feed stock gas for the production of Ethylene, Propylene, Isobutylene and Butadiene. Production of Acetylene from Methane, Catalytic Reforming of Petroleum Feed Stocks and Extraction of Aromatics.

UNIT V 9

Production of Petrochemicals like Dimethyl Terephathalate (DMT), Ethylene Glycol, Synthetic Glycerine, Linear Alkyl Benzene (LAB), Acrylonitrile, Methyl Methacrylate (MMA), Vinyl Acetate Monomer, Phthalic Anhydride, Maleic Anhydride, Phenol and Acetone, Methanol, Formaldehyde, Acetaldehyde, Pentaerythritol and Production of Carbon Black.

TOTAL: 45 Periods

TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1	Nelson, W. L	Petroleum Refinery Engineering	McGraw Hill, New York	1985
2	Bhaskara Rao, B. K	Modern Petroleum Refining Processes	Oxford and IBH Publishing Company	1990

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REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1	Bhaskara Rao, B. K	A Text on Petrochemicals	Khanna Publishers	1987
2	Wiseman. P	Petrochemicals	UMIST Series in Science and Technology	2001
3	H. Steiner	Introduction to petrochemicals Industry	Pergamon	1961
4	Chauvel A., Lefebvre G	Petrochemical Processes	McGraw Hill, New York	1989
5	Onohue D., Lang K	A First Course in Petroleum Technology	Prentice Hall, New Jersy	1989

WEB URLs:

1. https://www.total.com/energy-expertise/transformation-development/refining-petrochemical
2. https://www.fkit.unizg.hr/_download/repository/PRPP_2013_Crude_oil_composition.pdf
3. https://www.youtube.com/watch?v=yvqSR3KeDt4
4. https://www.youtube.com/watch?v=xhT8w54E8OA
5. https://www.youtube.com/watch?v=In3Slgka8gc

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19BTC18 **BIOCHEMISTRY LABORATORY** **L T P C**
0 0 3 1

COURSE OBJECTIVES:

- To provide knowledge on qualitative analysis of biomolecules.
- To understand the concept of quantitative estimation of biomelcules.
- To gain a preliminary understanding of preparation of standard buffer solution.
- To enhance awareness of estimation of amino acids
- To develop rudimentary ability to quantitative analysis of lipids.

COURSE OUTCOMES:

1. Ability to differentiate qualitative analysis of biomolecules.
2. Ability to assess quantitative estimation of biomolecules.
3. Ability to analyze the relation between buffer solutions
4. Ability to estimate the amino acids
5. Ability to analyze the lipids.

LIST OF EXPERIMENTS

1. General guidelines for working in biochemistry lab (theory)
2. Units of volume, weight, density and concentration measurements and their range in biological measurements. Demonstration of proper use of volume and weight measurement devices.
3. Accuracy, precision, sensitivity and specificity (theory)
4. Preparation of buffer –titration of a weak acid and a weak base.
5. Qualitative tests for carbohydrates – distinguishing reducing from non-reducing sugars andketo from aldo sugars.
6. Quantitative method for amino acid estimation using ninhydrin – distinguishing amino from imino acid.
7. Protein estimation by Biuret and Lowry's methods.
8. Protein estimation by Bradford and spectroscopic methods.
9. Extraction of lipids and analysis by TLC.
10. Estimation of nucleic acids by absorbance at 260 nm and hyperchromic effect (demo).
11. Enzymatic assay: phosphatase from potato.
12. Enzymatic assay: estimation of glucose by GOD-POD method after hydrolysis of starch with acid and specificity of the enzymatic method.

TOTAL: 30 PERIODS

Equipment Needed for 30 Students

Autocalve 1
Hot Air Oven 1
Incubators 2
Light Microscopes 4
Incubator Shaker 1
Colorimeter 2
Laminar Flow Chamber 1
Glassware, Chemicals, Media as required

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19BTC19	MICROBIOLOGY LABORATORY	L	T	P	C
		0	0	3	1

COURSE OBJECTIVES:

- To provide knowledge on laboratory safety and sterilization techniques.
- To understand the concept of culture media.
- To gain a preliminary understanding of staining techniques.
- To enhance awareness of isolation of microorganism from various sources
- To develop rudimentary ability to parameters of microbial growth.

COURSE OUTCOMES:

1. Ability to differentiate the microroganisms.
2. Ability to assess culture medias.
3. Ability to analyze the staining techniques
4. Ability to emphasize the isolation of microorganisms
5. Ability to analyze the parameters for the microbial growth.

LIST OF EXPERIMENTS

1. Laboratory safety and sterilization techniques-Dry heat sterilization (Autoclave, hot air oven)
2. Microscopic methods in the identification of microorganisms
3. Preparation of culture media – nutrient broth and nutrient agar
4. culturing of microorganisms – in broth and in plates (pour plates, streak plates, spread plates isolation and preservation of bacterial cultures)
5. Staining techniques – Grams' and differential, lactophenol cotton blue
6. Quantification of microorganisms-serial dilution and plating
7. Effect of disinfectants on microbial flora
8. Isolation of microorganisms from different sources – soil, water and milk
9. Antibiotic sensitivity assay
10. Growth curve – observation and growth characteristics of bacteria.
11. Effect of different parameters on bacterial growth (pH, temperature, and substrate concentration)

TOTAL: 30 PERIODS

Equipment Needed for 30 Students

Autoclave 1
Hot Air Oven 1
Incubators 2
Light Microscopes 4
Incubator Shaker 1
Colorimeter 2
Lamina Flow Chamber 1
Glassware, Chemicals, Media as required

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19BTC20 INSTRUMENTAL METHODS OF ANALYSIS LABORATORY

L	T	P	C
0	0	3	1

COURSE OBJECTIVES:

- To provide students an exposure to spectroscopic methods.
- To have a practical hands on experience on Absorption Spectroscopic methods
- To acquire experience in the purification by performing thin layer chromatography
- To validate and analysis using spectrometric and microscopic techniques
- To enhance the knowledge on column chromatography

COURSE OUTCOMES:

1. Ability to differentiate the spectroscopic methods.
2. Ability to assess absorption spectroscopic methods.
3. Ability to analyze the thin layer chromatography.
4. Ability to emphasize the spectrometric and microscopic techniques.
5. Ability to analyze the column chromatography.

LIST OF EXPERIMENTS

1. Precision and validity in an experiment using absorption spectroscopy.
2. Validating Lambert-Beer's law using KMnO4
3. Finding the molar absorbtivity and stoichiometry of the Fe (1,10 phenanthroline) using absorption spectrometry.
4. Finding the pKa of 4-nitrophenol using absorption spectroscopy.
5. UV spectra of nucleic acids.
6. Chemical actinometry using potassium ferrioxolate.
7. Estimation of SO4-- by nephelometry.
8. Estimation of Al3+ by Flourimetry.
9. Limits of detection using aluminium alizarin complex.
10. Chromatography analysis using TLC.
11. Chromatography analysis using column chromatography.

TOTAL: 30 PERIODS

Equipment Needed for 20 Students

Colorimeter -2

Glassware, Chemicals, Media as required

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19BTC21 MOLECULAR BIOLOGY LABORATORY

L	T	P	C
0	0	3	1

COURSE OBJECTIVES:

- To provide hands-on experience in performing basic molecular biology techniques.
- To introduce students to the theory behind in each technique
- To describe common applications of each methodology in biological research.
- To take up specialized project in Molecular biology
- To develop pre-requisite knowledge for research work.

COURSE OUTCOMES:

1. Ability to demonstrate knowledge and understanding of the principles underpinning important techniques in molecular biology.
2. Ability to demonstrate knowledge and understanding of applications of these techniques.
3. Ability to demonstrate the ability to carry out laboratory experiments and interpret the results.
4. Ability to aware of the hazardous chemicals and safety precautions in case of emergency.
5. Ability to perform electrophoresis techniques

LIST OF EXPERIMENTS:

1 Electrophoresis -Agarose and Polyacrylamide Gel
2 Isolation of microbial DNA
3 Isolation of genomic DNA
4 Quantification of DNA (UV/ Vis) and analysis of purity
5 Restriction enzyme digestion & Ligation
6 Competent cells preparation
7 Transformation
8 Selection of recombinants – Antibiotic sensitivity assay
9 Plating of λ phage
10 Lamda phage lysis of liquid cultures

Total Hours 30

Equipment Needed for 30 Students

Electrophoresis Kit 1
Incubators 2
Light Microscopes 2
Incubator Shaker 1
Spectrophotometer 1
Laminar Flow Chamber 1
Glassware, Chemicals, Media as required

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19BTC05 **MOLECULAR BIOLOGY** **L T P C**
3 0 0 3

COURSE OBJECTIVES:

- To familiarize with the molecular biology of both Prokaryotes and Eukaryotes.
- To understand the replication process
- To familiarize students on macromolecule's properties, structures and functions
- To expose students to various molecular events in prokaryotes
- To create deeper understanding on regulation of genes activities

COURSE OUTCOMES:

1. Analyze three major macromolecules and their properties in living organisms.
2. Organize the mechanism of DNA replication.
3. Analyze the mechanism of transcription and universal genetic.
4. Analyze the process of translation and DNA repair system.
5. Apply the concept of gene regulation and its significance

UNIT I CHEMISTRY OF NUCLEIC ACIDS 9

Introduction to nucleic acids: Nucleic acids as genetic material, Structure and physicochemical properties of elements in DNA and RNA, Biological significance of differences in DNA and RNA. Primary structure of DNA: Chemical and structural qualities of 3',5'-Phosphodiester bond. Secondary Structure of DNA: Watson & Crick model, Chargaff's rule, X–ray diffraction analysis of DNA, Forces stabilizes DNA structure, Conformational variants of double helical DNA, Hogsteen base pairing, Triple helix, Quadruple helix, Reversible denaturation and hyperchromic effect. Tertiary structure of DNA: DNA supercoiling

UNIT II DNA REPLICATION & REPAIR 9

Overview of Central dogma. Organization of prokaryotic and eukaryotic chromosomes. DNA replication: Meselson & Stahl experiment, bi–directional DNA replication, Okazaki fragments, Proteomics of DNA replication, Fidelity of DNA replication, Inhibitors of DNA replication, Overview of differences in prokaryotic and eukaryotic DNA replication, Telomere replication in eukaryotes. D-loop and rolling circle mode of replication. Mutagens, DNA mutations and their mechanism, various types of repair mechanisms.

UNIT III TRANSCRIPTION 9

Structure and function of mRNA, rRNA and tRNA. Characteristics of promoter and enhancer sequences. RNA synthesis: Initiation, elongation and termination of RNA synthesis, Proteins of RNA synthesis, Fidelity of RNA synthesis, Inhibitors of transcription, Differences in prokaryotic and eukaryotic transcription. Basic concepts in RNA world: Ribozymes, RNA processing: 5'-Capping, Splicing-Alternative splicing, Poly 'A' tail addition and base modification.

UNIT IV TRANSLATION 9

Introduction to Genetic code: Elucidation of genetic code, Codon degeneracy, Wobble hypothesis and its importance, Prokaryotic and eukaryotic ribosomes. Steps in translation: Initiation, Elongation and termination of protein synthesis. Inhibitors of protein synthesis. Posttranslational modifications and its importance.

UNIT V REGULATION OF GENE EXPRESSION 9

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Organization of genes in prokaryotic and eukaryotic chromosomes, Hierarchical levels of gene regulation, Prokaryotic gene regulation –lac and trp operon. Regulation of gene expression with reference to λ phage life cycle.

Total Hours 45

TEXT BOOKS:

Sl. No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Friefelder, David	Molecular Biology	Narosa Publications	1999
2.	Weaver, Robert F	Molecular Biology	Tata McGraw-Hill	2003

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Karp, Gerald	Cell and Molecular Biology: Concepts and Experiments	John Wiley	2005
2.	Friefelder, David and George M. Malacinski	Essentials of Molecular Biology	Panima Publishing	1993
3.	Tropp, Burton E	Molecular Biology: Genes to Proteins	Jones and Bartlett	2008
4.	Glick, B.R. and J.J. Pasternak	Molecular Biotechnology: Principles and Applications of Recombinant DNA	ASM	2010
5.	Harvey Lodish, Arnold Berk, S.L Zipursky, Paul Matsudaira, David Baltimore and James Danell	Molecular Cell Biology	W.H Freeman	2016

WEB URLs

1. http://leadingstrand.cshl.edu/Course/Keynote/2013/A-MEMBRANE/93
2. http://leadingstrand.cshl.edu/Course/Keynote/2012/A-SYSTEM/83
3. https://www.youtube.com/watch?v=HgTXc4ZESB8&list=PLyjWMictIvv2D2gV4bknO8D-HLkqjG-Jr
4. https://www.youtube.com/watch?v=ZYhQZXtRCks
5. https://www.youtube.com/watch?v=tJVIFTS1YN0&list=PLrl4F_rRUyHuxM3NyTlyvHiK4IK9F_glj

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19BTC06 **FUNTAMENTALS OF BIOPROCESS** **L T P C**
3 0 0 3

COURSE OBJECTIVES:

- To study the historical development of bio process technology, design of fermenter and types of fermentation process
- To gain knowledge about formulation, optimization of medium.
- To study the principles of sterilization and their kinetics
- To inculcate the stoichiometry and energetics of cell growth and product formation
- To evaluate the kinetics and mechanism of microbial growth

COURSE OUTCOMES:

1. Ability to develop skills of the students in the area of bio process technology with emphasis an bioprocess principles
2. Ability to discuss and distinguish the medium requirements and optimization methods
3. Ability to explain the sterilization kinetics of medium and equipments
4. Ability to learn about fermentation processes, metabolic stoichiometry, energetics, kinetics of microbial growth etc
5. Ability to understand the kinetics of microbial growth that plays a vital role in the fermentation process

UNIT I OVERVIEW OF FERMENTATION PROCESSES **9**

Overview of fermentation industry, general requirements of fermentation processes, basic configuration of fermentor and ancillaries, main parameters to be monitored and controlled in fermentation processes.

UNIT II RAW MATERIALS AND MEDIA DESIGN FOR FERMENTATION PROCESS **9**

Criteria for good medium, medium requirements for fermentation processes, carbon, nitrogen, minerals, vitamins and other complex nutrients, oxygen requirements, medium formulation of optimal growth and product formation, examples of simple and complex media, design of various commercial media for industrial fermentations – medium optimization methods

UNIT III STERILIZATION KINETICS **9**

Thermal death kinetics of microorganisms, batch and continuous heat sterilization of liquid media, filter sterilization of liquid media, air sterilization and design of sterilization equipment - batch and continuous

UNIT IV METABOLIC STOICHIOMETRY AND ENERGETICS **9**

Stoichiometry of cell growth and product formation, elemental balances, degrees of reduction of substrate and biomass, available electron balances, yield coefficients of biomass and product formation, maintenance coefficients energetic analysis of microbial growth and product formation, oxygen consumption and heat evolution in aerobic cultures, thermodynamic efficiency of growth.

UNIT V KINETICS OF MICROBIAL GROWTH AND PRODUCT FORMATION **9**

Batch cultivation and continuous cultivation. Simple unstructured models for microbial growth, Monod model, growth of filamentous organisms, product formation kinetics - Leudeking- Piret models, substrate and product inhibition on cell growth and product formation.

Total Hours **45**

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TEXT BOOKS:

Sl. No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Shuler, Michael L. and Fikret Kargi	Bioprocess Engineering	Prentice Hall	1992
2.	Doran, Pauline	Bioprocess Engineering Principles	Elsevier	1995

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Lydersen, Bjorn K	Bioprocess Engineering Systems, Equipment and Facilities	John Wiley	1994
2.	Bailey, James E. and David F. Ollis	Biochemical Engineering Fundamentals	McGraw Hill	1986
3.	Peter F. Stanbury, Stephen J. Hall & A. Whitaker	Principles of Fermentation Technology	Science & Technology Books	1995
4.	Harvey W. Blanch, Douglas S. Clark	Biochemical Engineering	Marcel Dekker, Inc	1997
5.	P. A. Belter, E. L. Cussler and Wei-Shou Hu	Bioseparations - Downstream Processing for Biotechnology	Wiley Interscience	1988

WEB URLs

1. https://nptel.ac.in/courses/113104060/4
2. https://nptel.ac.in/courses/103101004/
3. https://nptel.ac.in/courses/103104043/
4. https://www.youtube.com/watch?v=5eKdZ0dVCCo
5. https://www.youtube.com/watch?v=-BFRwlgB2QQ

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19MDC04 **DIGITAL ELECTRONICS** L T P C 3 0 0 3

COURSE OBJECTIVES

1. To introduce basic postulates of Boolean algebra and shows the correlation between Boolean expressions
2. To outline the formal procedures for the analysis and design of combinational circuits
3. To outline the formal procedures for the analysis and design of sequential circuits
4. To illustrate the concept of synchronous and asynchronous sequential circuits
5. To introduce the concept of Different Logic Families and programmable logic devices.

COURSE OUTCOMES

1. Apply Boolean algebra, Karnaugh map and Tabulation method for simplification of Boolean expressions
2. Design combinational logic circuits for various applications
3. Design shift registers, Modulo-N asynchronous and synchronous counters
4. Design and analyze state machines for the given specifications
5. Discuss different logic families and Implement digital circuit in programmable logic devices

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19MDC04.CO1	x	x	x	-	-	-	-	-	-	x	-	x	x	-	-
19MDC04.CO2	x	x	x	-	-	x	-	-	x	x	-	x	x	-	-
19MDC04.CO3	x	x	x	-	-	x	-	-	x	x	-	x	x	-	-
19MDC04.CO4	x	x	x	-	-	x	-	-	x	x	-	x	x	-	-
19MDC04.CO5	x	x	x	-	-	x	-	-	x	x	-	x	x	-	-

UNIT I **BASIC CONCEPTS OF DIGITAL SYSTEMS** 9

Review of Number systems, Number Representation, Boolean algebra, Boolean postulates and laws - De-Morgan's Theorem - Principle of Duality, Simplification using Boolean algebra, Canonical forms - Sum of product and Product of sum - Minimization using Karnaugh map and Tabulation method.

UNIT II **COMBINATIONAL CIRCUITS** 9

Realization of combinational logic using gates , Design of combinational circuits : Adder , Subtractor, Parallel adder Subtractor, Carry look ahead adder, Magnitude Comparator, Parity generator and checker, Encoder, Decoder, Multiplexer, Demultiplexer - Function realization using Multiplexer, Decoder - Code converters.

UNIT III **SEQUENTIAL CIRCUITS** 9

Flip-flops - SR, JK, D and T- Master-Slave – Triggering - Characteristic table and equation – Application table – Asynchronous and synchronous counters - Shift registers - Types – Universal shift registers – Ring counter – Johnson Counters- Serial adder / Subtractor.

UNIT IV **SYNCHRONOUS AND ASYNCHRONOUS SEQUENTIAL CIRCUITS** 9

Mealy and Moore models – State diagram - State table – State minimization – State assignment - Excitation table - Design of Synchronous sequential circuits: Counters and Sequence generators- Circuit implementation - Asynchronous sequential circuits - Hazards and Races, Hazard free combinational circuits

UNIT V **LOGIC FAMILIES AND PROGRAMMABLE DEVICES** 9

Introduction to Logic families – TTL & CMOS Logic and their characteristics – Tristate gates - Programmable Logic Devices – Programmable LogicArray (PLA) - Programmable Array Logic (PAL) ,Field Programmable Gate Arrays (FPGA) – Implementation of combinational logic circuits using PLA,PAL

LIST OF EXPERIMENTS

1. Design and implementation of Combinational logic functions
2. Design and implementation of Adders and Subtractors
3. Design and implementation of Code Converters
4. Design and implementation of Parity Generator and Checker

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5. Design and implementation of Magnitude Comparator
6. Design and implementation of Multiplexer and De-multiplexer
7. Design and implementation of Encoders and Decoders
8. Design and implementation of Asynchronous Counters
9. Design and implementation of Synchronous Counters
10. Design and implementation of Shift registers

Total:30 Hrs

REFERENCE BOOK

Sl.No	AUTHOR(s)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	Morris Mano M. and Michael D. Ciletti	Digital Design	Pearson Education	V Edition, 2013.
2.	Donald D.Givone,	Digital Principles and Design	Tata Mc-Graw Hill Publishing company limited, New Delhi	2002
3.	Thomas L. Floyd	Digital Fundamentals	Pearson Education Inc	10th Edition, 2011
4.	Charles H. Roth Jr,	Fundamentals of Logic Design	Jaico Publishing House	Fifth Edition–, Mumbai, 2003
5.	Leach D, Malvino A P & Saha	Digital Principles and Applications	Tata McGraw-Hill Publishing Company	8th Edition, , 2014

WEB REFERENCE(s)

1. www.nptel.ac.in/courses/117105080/7
2. www.nptel.ac.in/video.php?subjectId=117105080
3. www.nptelvideos.in/2012/12/digital-systems-design.html
4. www.allabout circuits.com
5. www.electronicsforu.com

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19MDC18 **DIGITAL ELECTRONICS** L T P C 3 0 2 4

COURSE OBJECTIVES

1. To introduce basic postulates of Boolean algebra and shows the correlation between Boolean expressions
2. To outline the formal procedures for the analysis and design of combinational circuits
3. To outline the formal procedures for the analysis and design of sequential circuits
4. To illustrate the concept of synchronous and asynchronous sequential circuits
5. To introduce the concept of Different Logic Families and programmable logic devices.

COURSE OUTCOMES

1. Apply Boolean algebra, Karnaugh map and Tabulation method for simplification of Boolean expressions
2. Design combinational logic circuits for various applications
3. Design shift registers, Modulo-N asynchronous and synchronous counters
4. Design and analyze state machines for the given specifications
5. Discuss different logic families and Implement digital circuit in programmable logic devices

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19MDC18.CO1	x	x	x	x	x	-	-	-	-	-	-	x	x	x	x
19MDC18.CO2	x	x	x	x	x	-	-	-	x	-	-	x	x	x	x
19MDC18.CO3	x	x	x	x	x	-	-	-	x	-	-	x	x	x	x
19MDC18.CO4	x	x	x	x	x	-	-	-	x	-	-	x	x	x	x
19MDC18.CO5	x	x	x	x	x	-	-	-	x	-	-	x	x	x	x

UNIT I **BASIC CONCEPTS OF DIGITAL SYSTEMS** 9

Review of Number systems, Number Representation, Boolean algebra, Boolean postulates and laws - De-Morgan's Theorem - Principle of Duality, Simplification using Boolean algebra, Canonical forms - Sum of product and Product of sum - Minimization using Karnaugh map and Tabulation method.

UNIT II **COMBINATIONAL CIRCUITS** 9

Realization of combinational logic using gates , Design of combinational circuits : Adder , Subtractor, Parallel adder Subtractor, Carry look ahead adder, Magnitude Comparator, Parity generator and checker, Encoder, Decoder, Multiplexer, Demultiplexer - Function realization using Multiplexer, Decoder - Code converters.

UNIT III **SEQUENTIAL CIRCUITS** 9

Flip-flops - SR, JK, D and T- Master-Slave – Triggering - Characteristic table and equation – Application table – Asynchronous and synchronous counters - Shift registers - Types – Universal shift registers – Ring counter – Johnson Counters- Serial adder / Subtractor.

UNIT IV **SYNCHRONOUS AND ASYNCHRONOUS SEQUENTIAL CIRCUITS** 9

Mealy and Moore models – State diagram - State table – State minimization – State assignment - Excitation table - Design of Synchronous sequential circuits: Counters and Sequence generators- Circuit implementation - Asynchronous sequential circuits - Hazards and Races, Hazard free combinational circuits

UNIT V **LOGIC FAMILIES AND PROGRAMMABLE DEVICES** 9

Introduction to Logic families – TTL & CMOS Logic and their characteristics – Tristate gates - Programmable Logic Devices – Programmable LogicArray (PLA) - Programmable Array Logic (PAL) ,Field Programmable Gate Arrays (FPGA) – Implementation of combinational logic circuits using PLA,PAL

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REFERENCE BOOK

Sl.No	AUTHOR(s)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	Morris Mano M. and Michael D. Ciletti	Digital Design	Pearson Education	V Edition, 2013.
2.	Donald D.Givone,	Digital Principles and Design	Tata Mc-Graw Hill Publishing company limited, New Delhi	2002
3.	Thomas L. Floyd	Digital Fundamentals	Pearson Education Inc	10th Edition, 2011
4.	Charles H. Roth Jr,	Fundamentals of Logic Design	Jaico Publishing House	Fifth Edition–, Mumbai, 2003
5.	Leach D, Malvino A P & Saha	Digital Principles and Applications	Tata McGraw-Hill Publishing Company	8th Edition, , 2014

WEB REFERENCE(s)

1. www.nptel.ac.in/courses/117105080/7
2. www.nptel.ac.in/video.php?subjectId=117105080
3. www.nptelvideos.in/2012/12/digital-systems-design.html
4. www.allabout circuits.com
5. www.electroniesforu.com

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19MDC07	PATHOLOGY AND MICROBIOLOGY	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

1. Gain knowledge on the structural and functional aspects of living organisms.
2. Know the etiology and remedy in treating the pathological diseases.
3. Empower the importance of public health.
4. To study identification of bacteria
5. To study Antibodies and its types

COURSE OUTCOMES

1. Analyze structural and functional aspects of living organisms.
2. Explain the function of microscope
3. Discuss the importance of public health.
4. Describe methods involved in treating the pathological diseases.
5. Able to know study Antibodies and its types

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19MDC07.CO1	x	x	x	-	-	-	-	-	-	x	-	x	x	-	-
19MDC07.CO2	x	x	x	-	-	x	-	-	x	x	-	x	x	-	-
19MDC07.CO3	x	x	x	-	-	x	-	-	x	x	-	x	x	-	-
19MDC07.CO4	x	x	x	-	-	x	-	-	x	x	-	x	x	-	-
19MDC07.CO5	x	x	x	-	-	x	-	-	x	x	-	x	x	-	-

UNIT I **CELL DEGENERATION, REPAIR AND NEOPLASIA** 9

Cell injury - Reversible cell injury and Irreversible cell injury and Necrosis, Apoptosis, Intracellular accumulations, Pathological calcification- Dystrophic and Metastatic, cellular adaptations of growth and differentiation, Inflammation and Repair including fracture healing, Neoplasia, Classification, Benign and Malignant tumours, carcinogenesis, spread of tumours Autopsy and biopsy.

UNIT II **FLUID AND HEMODYNAMIC DERANGEMENTS** 9

Edema, Hyperemia/Ischemia, normal hemostasis, thrombosis, disseminated intravascular coagulation, embolism, infarction, shock, Chronic venous congestion. Hematological disorders-Bleeding disorders, Leukaemias, Lymphomas Haemorrhage.

UNIT III **MICROBIOLOGY** 9

Structure of Bacteria and Virus. Routes of infection and spread; endogenous and exogenous infections, Morphological features and structural organization of bacteria and virus, growth curve, identification of bacteria , culture media and its types , culture techniques and observation of culture. Disease caused by bacteria, fungi, protozoal, virus and helminthes.

UNIT IV **MICROSCOPES** 9

Light microscope – bright field, dark field, phase contrast, fluorescence, Electron microscope (TEM & SEM). Preparation of samples for electron microscope. Staining methods – simple, gram staining and AFB staining.

UNIT V **IMMUNOPATHOLOGY** 9

Natural and artificial immunity, types of Hypersensitivity, antibody and cell mediated tissue injury: opsonization, phagocytosis, inflammation, Secondary immunodeficiency including HIV infection. Auto-immune disorders: Basic concepts and classification, SLE.Antibodies and its types, antigen and antibody reactions, immunological techniques: immune diffusion, immuno electrophoresis, RIA and ELISA, monoclonal antibodies

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REFERENCE BOOK

Sl.No	AUTHOR(s)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	Ramzi S Cotran, Vinay Kumar & Stanley L Robbins,	Pathologic Basis of Diseases.	7th edition, WB Saunders Co	2005 (Units I & II).
2.	Ananthanarayanan & Panicker,	Microbiology.	Orientblackswan, 10th edition. (Units III, IV and V).	2017
3.	Underwood JCE	General and Systematic Pathology	Churchill Livingstone, 3rd edition,	: 2000.
4.	Dubey RC and Maheswari DK.	A Text Book of Microbiology &	Chand Company Ltd,	2007
5.	Prescott, Harley and Klein	Microbiology.	10th edition, McGraw Hill	2017

WEB REFERENCE(s)

1. https://nptel.ac.in/courses/102106025/36
2. https://nptel.ac.in/courses/112104118/43
3. https://nptel.ac.in/courses/102103015/
4. https://nptel.ac.in/courses/115103030/9
5. https://nptel.ac.in/courses/102103038/

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		L	T	P	C
19MDE02	TISSUE ENGINEERING	3	0	0	3

COURSE OBJECTIVES

1. Expose to Tissue Engineering
2. Understand the Cell cycle and differentiation
3. Be familiar with stem cells.
4. Understand different synthetic and biomaterials

COURSE OUTCOMES

1. Explain the components of Tissue Engineering
2. Use appropriate materials in tissue engineering
3. Apply Tissue Engineering in different fields
4. Understand diffcrent synthetic and biomaterials
5. Understand the Cell cycle and differentiation

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19MDE02.CO1	x	x	x	-	-	-	-	-	-	x	-	x	x	-	-
19MDE02.CO2	x	x	x	-	-	x	-	-	x	x	-	x	x	-	-
19MDE02.CO3	x	x	x	-	-	x	-	-	x	x	-	x	x	-	-
19MDE02.CO4	x	x	x	-	-	x	-	-	x	x	-	x	x	-	-
19MDE02.CO5	x	x	x	-	-	x	-	-	x	x	-	x	x	-	-

UNIT I FUNDAMENTALS OF TISSUE ENGINEERING 9

Tissue exchange and tissue development - Objectives of tissue engineering - Laboratory set up for tissue engineering. Cell cycle and differentiation - cell adhesion - cell adhesion molecules - cell migration - cell aggregation and tissue equivalent.

UNIT II STEM CELLS 9

Definition of stem cells – types of stem cells – differentiation, dedifferentiation maturation, proliferation, pluripotency and immortalization. Sources of stem cells: haematopoetic – fetal - cord blood – placenta - bone marrow - primordial germ cells - cancer stem cells - induced pleuripotent stem cells.

UNIT III COMPONENTS OF TISSUE ENGINEERING 9

Cell and Drug delivery systems - Transplantation – Implantation - Synthetic components – nanotechnology in tissue engineering – Imaging methods: SEM, TEM, Fluorescent and Confocal microscopy.

UNIT IV MATERIALS IN TISSUE ENGINEERING 9

Biological materials – degradable and non degradable – extra cellular matrix – decellularization - Polymers: synthetic and natural – cell interaction with polymers – applications of polymer.

UNIT V APPLICATION OF TISSUE ENGINEERING 9

Replacement Engineering: Artificial organs – cartilage, skin blood, pancreas, kidney and liver. Regenerative engineering: Nerve regeneration – cardiac tissue regeneration – muscle regeneration.

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REFERENCE BOOK

Sl.No	AUTHOR(s)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	CS Potten,	Stem cells .(Unit I &II).	Elsevier	1997
2.	W.Mark Saltzman	Tissue Engineering – Engineering principles for design of replacement organs and tissue (Units I,III,IV&V)	Oxford University Press Inc New York	2004
3.	Gray E. Wnek, Gray L Browlin	Encyclopedia of Biomaterials and Biomedical Engineering	Marcel Dekker Inc New York	2004
4.	R. Lanza,J. Gearhart et al(Eds),	Essential of Stem Cell Biology	Elsevier Academic press	2006
5.	R.Lanza,I.Weissman, J. Thomson, and R. Pedersen	Handbook of Stem Cells", Two Volume, Volume 12: Volume 1.Embryonic Stem Cells Volume 2.Adult & Fetal Stem Cells	Academic Press.	2004

WEB REFERENCE(s)

1. ocw.mit.edu › Courses › Health Sciences and Technology MIT Open Course War http://ocw.mit.edu
2. https://nptel.ac.in/courses/102/106/102106036/
3. https://ocw.mit.edu/courses/mechanical-engineering/2-782j-design-of-medical-devices-and-implants-spring-2006/lecture-notes/ch5_tel.pdf
4. https://www.biologydiscussion.com/biotechnology/tissue-engineering/tissue-engineering-4-aspects-with-diagram/10577
5. https://www.nibib.nih.gov/science-education/science-topics/tissue-engineering-and-regenerative-medicine

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		L	T	P	C
19MDC22	PATHOLOGY AND MICROBIOLOGY LABOTATORY	0	2	0	1

LIST OF EXPERIMENTS

1. Urine physical and chemical examination (protein, reducing substances, ketones, bilirubin and blood)
2. Study of parts of compound microscope
3. Histopathological slides of benign and malignant tumours.
4. Manual paraffin tissue processing and section cutting (demonstration)
5. Cryo processing of tissue and cryosectioning (demonstration)
6. Basic staining – Hematoxylin and eosin staining.
7. Special stains – cresyl fast Blue (CFV)- Trichrome – oil red O – PAS
8. Capsule stain
9. Simple stain.
10. Gram stain.
11. AFB stain.

		L	T	P	C
19MDC23	BIOMEDICAL SENSORS AND MEASUREMENTS LABOTATORY	0	2	0	1

LIST OF EXPERIMENTS

1. Real Time data Acquisition and Analysis of the following physiological parameters ECGs (EKGs), EMGs, and EEGs
2. Measurement of Blood Pressure using Sphygmomanometer & Digital meter.
3. Recording of Electromyogram/ nerve conduction velocity.
4. The Galvanic Skin Response Amplifier
5. Study of lung and cardiovascular models
6. Bridge Amplifier: Testing of various transducers including commonly available i)force, ii)pressure, and iii)displacement transducers, iv)temperature probes, v)light meters,
7. Study and usage of Automatic defibrillators.
8. Measurement of pH of a given solution using pH meter.
9. Determination of solution concentration using Colorimeter/Spectrophotometer.

		L	T	P	C
19MDC24	MEDICAL IMAGE PROCESSING LABOTATORY	0	2	0	1

LIST OF EXPERIMENTS

1. Color image segmentation algorithm development
2. wavelet/vector quantization compression
3. Deformable templates applied to skin tumor border finding
4. Helicopter image enhancement
5. High-speed film image enhancement
6. Computer vision for skin tumor image evaluation
7. New border images

Mini Project (Select One):

8. Take a hand written document, Perform preprocessing and try to segment into characters
   Take an image, design fuzzy rules for content based image retrieval.
   Take an image, design a neural network for content based image retrieval.

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		L	T	P	C
19MDC02	BIOMEDICAL SENSORS &MEASUREMENT DEVICES	3	0	0	3

COURSE OBJECTIVES

1. To introduce the relevance of this course to the existing technology through demonstrations, case studies, simulations, contributions of scientist, national/international policies with a futuristic vision along with socio-economic impact and issues
2. To understand the purpose of measurement, the methods of measurements, errors associated with measurements.
3. To know the principle of transduction, classifications and the characteristics of different transducers and study its biomedical applications.
4. To know the different display and recording devices.
5. To study signal conditioning & signal analyser

OUTCOMES

1. Comprehend and appreciate the significance and role of this course in the present contemporary world
2. Describe the purpose and methods of measurements
3. Analyze the characteristics of different transducers
4. Explain different display and recording devices for various applications.
5. To study signal conditioning & signal analyser

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19MDC02.CO1	x	x	x	-	-	-	-	-	-	x	-	x	x	-	-
19MDC02.CO2	x	x	x	-	-	x	-	-	x	x	-	x	x	-	-
19MDC02.CO3	x	x	x	-	-	x	-	-	x	x	-	x	x	-	-
19MDC02.CO4	x	x	x	-	-	x	-	-	x	x	-	x	x	-	-
19MDC02.CO5	x	x	x	-	-	x	-	-	x	x	-	x	x	-	-

UNIT I SCIENCE OF MEASUREMENT 7

Measurement System – Instrumentation – Classification and Characteristics of Transducers – Static and Dynamic – Errors in Measurements – Calibration – Primary and secondary standards.

UNIT II DISPLACEMENT, PRESSURE, TEMPERATURE SENSORS 11

Resistive Transducers: Strain Gauge: Gauge factor, sensing elements, configuration, biomedical applications; strain gauge as displacement & pressure transducers, RTD materials & range, Characteristics, thermistor characteristics, biomedical applications of Temperature sensors Capacitive transducer, Inductive transducer, LVDT, Active type: Thermocouple – characteristics.

UNIT III PHOTOELECTRIC AND PIEZO ELECTRIC SENSORS 9

Phototube, scintillation counter, Photo Multiplier Tube (PMT), photovoltaic, Photo conductive cells, photo diodes, phototransistor, comparison of photoelectric transducers, spectrophotometric applications of photo electric transducers. Piezoelectric active transducer and biomedical applications as pressure & Ultrasound transducer.

UNIT IV SIGNAL CONDITIONING & SIGNAL ANALYSER 9

AC and DC Bridges –wheat stone bridge, Kelvin, Maxwell, Hay, Schering – Concepts of filters, Pre-amplifier – impedance matching circuits – isolation amplifier. Spectrum analyzer.

UNIT V DISPLAY AND RECORDING DEVICES 9

Digital voltmeter – Multi meter – CRO – block diagram, CRT – vertical & horizontal deflection system, DSO, LCD monitor, PMMC writing systems, servo recorders, photographic recorder, magnetic tape recorder, Inkjet recorder, thermal recorder. Demonstration of the display and recording devices.

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REFERENCE BOOK

Sl.No	AUTHOR(s)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	L.A Geddes and L.E.Baker.	Principles of Applied Biomedical Instrumentation	Third Edition, – John Wiley and sons,	Reprint 2008
2.	Albert D.Helfrick	Modern Electronic Instrumentation and Measurement Techniques	William D.Cooper. Prentice Hall of India,	2007
3.	A.K.Sawhney	Electrical & Electronics Measurement and Instrumentation	10th Edition, Dhanpat Rai&Co,New Delhi	2000
4.	Ernest o Doebelin and dhanesh N manik	Measuremet systems, Application and design	5th Edition, Mc Graw-Hill	2007.
5.	Khandpur R.S	Handbook of Biomedical Instrumentation	Tata McGraw Hill, New Delhi, 3rd Edition	2014.

WEB REFERENCE(s)

1. https://nptel.ac.in/courses/112106139/
2. https://nptel.ac.in/courses/112103174/3
3. https://nptel.ac.in/courses/108105064/24
4. https://nptel.ac.in/courses/108105062/8
5. https://nptel.ac.in/courses/Webcourse-contents/IIT-Delhi/.../mod1/10.htm

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19MDC25 **ANALOG ELECTRONICS** L T P C 3 0 0 3

COURSE OBJECTIVES

1. Design and construct amplifiers
2. Construct JFET and MOSFET amplifiers
3. Study rectifiers and power supplies
4. Learn about feedback amplifiers
5. Learn about oscillators

COURSE OUTCOMES

1. To learn about Design and construct amplifiers
2. To Construct JFET and MOSFET amplifiers
3. To Study rectifiers and power supplies
4. ToLearn about feedback amplifiers
5. To Learn about oscillators

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19MDC25.CO1	x	x	x	-	-	-	-	-	-	x	-	x	x	-	-
19MDC25.CO2	x	x	x	-	-	x	-	-	x	x	-	x	x	-	-
19MDC25.CO3	x	x	x	-	-	x	-	-	x	x	-	x	x	-	-
19MDC25.CO4	x	x	x	-	-	x	-	-	x	x	-	x	x	-	-
19MDC25.CO5	x	x	x	-	-	x	-	-	x	x	-	x	x	-	-

UNIT I **BJT AMPLIFIERS** 9

CE, CB and CC amplifiers - Method of drawing small-signal equivalent circuit- Analysis of transistor amplifier Configurations-current and voltage gain, input and output impedance -Differential amplifiers- CMRR- Darlington Amplifier- Bootstrap technique - Multistage amplifiers -Cascaded stages - Cascode Amplifier. Large signal Amplifiers – Class A, Class B and Class C Power Amplifiers

UNIT II **JFET AND MOSFET AMPLIFIERS** 9

Small signal analysis of JFET amplifiers- Small signal Analysis of MOSFET and JFET, Common source amplifier, Voltage swing limitations, Small signal analysis of MOSFET and JFET Source follower and Common Gate amplifiers, - BiCMOS,Cascode amplifier.

UNIT III **RECTIFIERS AND POWER SUPPLIES** 9

Rectifiers - Half-wave, full-wave and bridge rectifiers – Rectifiers with filters- C, L, and CLC filters Voltage regulators - Zener diode regulator- regulator with current limiting, Over voltage protection, Switched mode power supply (SMPS).

UNIT IV **FEEDBACK AMPLIFIERS** 9

General Feedback Structure – Properties of negative feedback – Basic Feedback Topologies –Feedback amplifiers – Series – Shunt, Series – Series, Shunt – Shunt and Shunt – Series Feedback – Determining the Loop Gain – Stability Problem.

UNIT V **OSCILLATORS** 9

Classification, Barkhausen Criterion - Mechanism for start of oscillation and stabilization of amplitude, General form of an Oscillator, Analysis of LC oscillators - Hartley, Colpitts,Clapp, Tuned collector oscillators, RC oscillators - phase shift –Wienbridge - Twin-T Oscillators, Frequency range of RC and LC Oscillators, Quartz Crystal Construction, Electrical equivalent circuit of Crystal, Miller and Pierce Crystal Oscillators, frequency stability of oscillators.

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REFERENCE BOOK

Sl.No	AUTHOR(s)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	Donald .A. Neamen	Electronic Circuit Analysis and Design	Tata Mc Graw Hill	2nd Edition, 2009
2.	Robert L. Boylestad and Louis Nashеresky	Electronic Devices and Circuit Theory	Pearson Education / PHI	10th Edition 2008
3.	Adel .S. Sedra, Kenneth C. Smith	Micro Electronic Circuits	Oxford University Press	6th Edition, 2010
4.	Behzad Razavi	Design of Analog CMOS Integrated Circuits	Tata Mc Graw Hill,	2007
5.	Paul Gray, Hurst, Lewis, Meyer	Analysis and Design of Analog Integrated Circuits	John Willey & Sons	4th Edition 2005

WEB REFERENCE(s)

1. www.nptel.ac.in/courses/117101106/7
2. www.nptel.ac.in/courses/117101106/9
3. www.nptel.ac.in/courses/117101106/8
4. www.nptel.ac.in/courses/117106088/1
5. www.nptel.ac.in/courses/117106088/14

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		L	T	P	C
19MDC26	ANALOG ELECTRONICS LABOTATORY	0	2	0	1

LIST OF EXPERIMENTS

1. Frequency Response of CE amplifier 2.
2. Frequency Response of CS amplifier
3. Frequency response of feedback amplifier circuit-current series
4. Frequency response of feedback amplifier circuit- voltage shunt
5. Transistor based design of RC phase Shift Oscillator circuit
6. Transistor based design of Wein Bridge Oscillator circuit
7. Power Supply circuit - Half wave rectifier and Full wave rectifier with simple capacitor filter
8. Mini Project

		L	T	P	C
19MDC27	MICROPROCESSOR AND MICROCONTROLLER LABORATORY	0	2	0	1

LIST OF EXPERIMENTS

1. Addition, subtraction, multiplication, division using 8086 processor
2. Sorting of numbers in ascending order using 8086 processor
3. Sorting of numbers in descending order using 8086 processor
4. Palindrome and Fibonacci series using 8086 processor
5. Sorting of even numbers in an array using 8086 processor
6. Finding the largest and smallest number in an array using 8086 processor
7. Addition of two numbers using 8051 processor
8. Subtraction of two numbers using 8051 processor
9. Multiplication of two numbers using 8051 processor
10. Sorting of numbers in ascending order using 8051 processor
11. Sorting of numbers in descending order using 8051 processor
12. Palindrome and fibonacci series using 8051 processor
13. Sorting of even numbers in an array using 8051 processor
14. Basic programs using ARM controller

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19ITC02 **DATA STRUCTURES LABORATRORY** **L T P C**
0 0 2 1

COURSE OBJECTIVES

The students should be made to:

1. Be familiar with C programming
2. Be exposed to implementing abstract data types
3. Learn to use files
4. Learn to implement sorting algorithms
5. Learn to implement searching algorithms

COURSE OUTCOMES

At the end of the course, the student should be able to:

1. Design and implement C programs for implementing stacks, queues and linked lists.
2. Apply good programming design methods for program development.
3. Apply the different data structures for implementing solutions to practical problems.
4. Develop searching programs.
5. Create and analyze sorting programs

Course Outcomes	Program Outcomes												PSOs			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
19ITC02.CO1	X	X	X	X	-	-	-	-	-	-	X	X	X	-	-	-
19ITC02.CO2	X	X	X	X	-	-	-	-	-	-	X	X	X	-	-	-
19ITC02.CO3	X	X	X	X	-	-	-	-	-	-	X	X	X	-	-	-
19ITC02.CO4	X	X	X	X	-	-	-	-	-	-	X	X	X	-	-	-
19ITC02.CO5	X	X	X	X	-	-	-	-	-	-	X	X	X	-	-	-

LIST OF EXPERIMENTS:

1. Implement a menu driven program to implement operations on the singly linked list.
2. Implement a menu driven program to implement operations on the doubly linked list
3. Implement a menu driven program to implement operations on the circular linked list
4. Implement a program for stack that performs operations using array
5. Implement a program to convert infix notation to postfix notation using stack.
6. Implement a program to QUEUE using arrays that performs operations
7. Implement a program to stack using linked list.
8. Implement a program to queue using linked list.
9. Implement recursive and non-recursive tree traversing methods inorder, preorder and post-order traversal
10. Implement a program to create and operation on binary search tree.
11. Implement a program to QueueSort.
12. Implement a program to MergeSort.
13. Implement a program to Bubble Sort.
14. Implement a program to Binary Search and sequential search.
15. Implement a program to Breadth First search using linked representation of graph
16. Implement a program to Depth first search using linked representation of graph.

LIST OF EQUIPMENTS FOR A BATCH OF 30 STUDENTS:

Standalone desktops with C compiler 30 Nos.

(Or)

Server with C compiler supporting 30 terminals or more.

TOTAL HOURS: 30

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19ITC03 **DATABASE MANAGEMENT SYSTEMS** **L T P C**
3 0 0 3

COURSE OBJECTIVES

1 Analyze database requirements and determine the entities involved in the system and their relationships.
2 Formulate solutions to a broad range of query and data update problems using SQL.
3 Understand the basic issues of transaction processing and concurrency control.
4 Explain and implement the fundamental concepts of a relational database system.
5 Understand the database security and access techniques.

COURSE OUTCOMES

1 Design ER diagrams for new databases and apply for database applications.
2 Implement a database schema for a given problem-domain.
3 Normalize a database with non-loss decomposition.
4 Apply concurrency control techniques for database transactions.
5 Implement different database access techniques.

Course Outcomes	Program Outcomes												PSOs			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
19ITC03.CO1	X	X	X	X	-	-	-	-	-	-	X	X	X	-	X	-
19ITC03.CO2	X	X	X	X	-	-	-	-	-	-	X	X	X	-	X	-
19ITC03.CO3	X	X	X	X	-	-	-	-	-	-	X	X	X	-	X	-
19ITC03.CO4	X	X	X	X	-	-	-	-	-	-	X	X	X	-	X	-
19ITC03.CO5	X	X	X	X	-	-	-	-	-	-	X	X	X	-	X	-

UNIT I INTRODUCTION TO DBMS

9

Database System Applications-Purpose of Database Systems -View of data- Database Languages - Database System Architecture - Data models - Entity-Relationship model - Extended E-R Features - Introduction to relational databases- Keys - Integrity Constraints - Relational Algebra - Fundamental Operations - Additional Operations- Domain Relational Calculus - Tuple Relational Calculus.

UNIT II SQL & QUERY OPTIMIZATION

9

SQL Standards - Data types - Basic Structure of SQL Queries - DDL-DML-DCL-TCL - Views- Advanced SQL - Embedded SQL - Static Vs Dynamic SQL - Query Processing - Query Optimization- Heuristic and Cost based Query Optimization.

UNIT III RELATIONAL DATABASE DESIGN AND TRANSACTIONS

9

Functional Dependencies - Codd's Rule - Normalization - Non-loss decomposition- 1NF to 5NF - Domain Key Normal Form – Denormalization - Transaction Concepts - ACID Properties – Serializability- Concurrency Control - Locking Mechanisms - Two Phase Commit Protocol - Dead lock.

UNIT IV SYSTEM ARCHITECTURE

9

Overview of Physical Storage Media - RAID - Tertiary storage - File Organization - Organization of Records in Files - Indexing and Hashing - Ordered Indices - B+ Tree Index Files - B Tree Index Files - Static Hashing - Dynamic Hashing - Distributed Databases - Distributed Data Storage - DistributedTransactions.

UNIT V DATABASE SECURITY

9

Database Security - Data Classification - Threats and risks - Database Access Control - Types of Privileges - Security of Statistical Databases Parallel Databases- Spatial and Multimedia Databases - Mobile and Web databases - Object Oriented Databases- XML Databases.

TOTAL HOURS: 45

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TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Abraham Silberschatz, Henry F. Korth	Database System Concepts	Tata McGraw-Hill	2013
2.	Ramez Elmasri Shamkant	Fundamentals of Database Systems	Pearson Education	2011

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Raghu Ramakrishnan Johannes Gehrke	Database Management Systems	Tata McGraw-Hill	2014
2.	Hector Garcia-Molina Jeffrey D. Ullman Jennifer	Database Systems: The Complete book	Pearson Education	2013
3.	Shefali Naik	Concepts of Database Management Systems	Pearson Education	2013
4.	G.K.Gupta	Database Management Systems	Tata McGraw Hill	2011
5.	Rob Cornell	Database Systems Design and	Cengage Learning	2011

WEB URLs

1. www.w3schools.in/dbms/l
2. www.tutorialspoint.com/sql/sql_tutorial.pdf
3. tutorialink.com/dbms/introduction-to-transaction-concepts.dbms
4. https://www.cse.iitb.ac.in/~sudarsha/db-book/slide-dir/ch12.pdf
5. www.edutechlearners.com/advance-database-management-system-notes/

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19ITC09	OPERATING SYSTEMS	L T P C 3 0 0 3

COURSE OBJECTIVES

1. To understand the basic concepts Operating System.
2. To understand the fundamental Operating System abstractions such as processes, process scheduling
3. To understand the principles of concurrency and synchronization, and apply them to write concurrent programs/software
4. To Implement basic resource management techniques (scheduling or time management, space management) and principles
5. To describe the types of I/O management, disk scheduling, disk management and swap space management

COURSE OUTCOMES

1. Explain structures of Operating System.
2. Apply fundamental Operating System abstractions such as processes, process scheduling, Semaphores, IPC abstractions, shared memory regions, deadlock and threads.
3. Explain the principles of concurrency and synchronization and apply them to write concurrent programs/software.
4. Implement basic resource management techniques (scheduling or time management, space management) and principles.
5. Describe the types of I/O management, disk scheduling, disk management and swap space management

Course Outcomes	Program Outcomes												PSOs			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
19ITC09.CO1	X	X	X	X	-	-	-	-	-	-	X	X	X	-	-	X
19ITC09.CO2	X	X	X	X	-	-	-	-	-	-	X	X	X	-	-	X
19ITC09.CO3	X	X	X	X	-	-	-	-	-	-	X	X	X	-	-	X
19ITC09.CO4	X	X	X	X	-	-	-	-	-	-	X	X	X	-	-	X
19ITC09.CO5	X	X	X	X	-	-	-	-	-	-	X	X	X	-	-	X

UNIT I INTRODUCTION 9

Introduction – What Operating System Do – Operating System Structure – Operating system Operations – Operating System Components: Process Management – Memory Management – Storage Management – I/O Management – Network Management - Protection and Security.

Classes of Operating Systems: Mainframe Systems – Single Processor System - Multiprocessor Systems - Desktop Systems — Distributed Systems – Clustered Systems – Real-Time Systems – Handheld Systems - Open Source Operating Systems.

Operating System Structures: Operating System Services – User and Operating System Interface – System Calls– Types of System Calls.

UNIT II PROCESS MANAGEMENT AND THREADING 9

Processes: Process concept – Process scheduling – Operation on Processes - Inter-process Communication: Shared Memory Systems - Message Passing Systems.

Process Scheduling: Basic Concepts – Scheduling Criteria – Scheduling Algorithms: First-Come, First-Served – Priority – Round-Robin – Multilevel Queue – Multilevel Feedback Queue.

Threads: Overview – Multithreading models - Threading issues.

UNIT III PROCESS SYNCHRONIZATION AND DEADLOCKS 9

Process Synchronization: Background - The critical-section problem (Software based solution and hardware based solution) – Semaphores – Classic Problems of Synchronization – Monitors.

Deadlocks: System model - Deadlock Characterization – Methods for Handling Deadlocks -Deadlock Prevention Deadlock Avoidance – Deadlock Detection – Recovery from Deadlocks.

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UNIT IV MEMORY MANAGEMENT 9

Management Strategies: Background – Swapping – Memory allocation: Contiguous Memory Allocation –Non- Contiguous Memory Allocation: Segmentation - Paging – Segmentation with Paging - Structure of the Page Table.

Virtual Memory: Background - Demand Paging – Page Replacement – Allocation of Frames – Thrashing.

UNIT V FILE SYSTEM AND STORAGE MANGEMENT 9

System Interface: File Concept – Access Methods – Directory and Disk Structure – Protection.

File System Implementation: File System Structure – File System Implementation – Directory Implementation

- Allocation Methods – Free Space Management.

Mass Storage Structure: Overview of Mass Storage Structure – Disk Structure - Disk Scheduling – Disk Management - Swap Space Management.

Case Study: Windows, Linux and Android operating Systems.

TOTAL HOURS:45

TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Abraham Silberschatz, Peter Baer Galvin and Greg Gagne,	Operating System Concepts	John Wiley & Sons (ASIA) Pvt. Ltd, 9th Edition	2015
2	Harvey M. Deitel	Operating Systems	Pearson Education, 3rd Edition.	2007

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Andrew S. Tanenbaum	Modern Operating Systems	Prentice Hall of India, 3rd Edition	2009
2	William Stallings	Operating Systems: Internals and Design Principles	Prentice Hall of India, 6th Edition	2009
3	D M Dhamdhere	Operating Systems: A Concept-Based Approach	Tata Mc-graw Hill Publishing3rd Edition	2012
4	Charles Crowley	Operating System: A Design-Oriented Approach	Tata Mc-graw Hill Publishing, 1st edition	2009
5	Evi Nemeth , Garth Snyder, Trent R. Hein , Ben Whaley , Dan Mackin	UNIX and Linux System Administration Handbook	Prentice Hall of India, 4th Edition	2010

WEB URLs:

1. www.onlinecourses.nptel.ac.in/noc16_cs10
2. www.udacity.com/course/introduction-to-operating-systems--ud923
3. www.cs140.stanford.edu/
4. www.ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-828-operating- system- engineering-fall-2012/
5. www.tutorialspoint.com/operating_system/

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19ITC06 COMPUTER ORGANIZATION AND ARCHITECTURE **L T P C 3 0 0 3**

COURSE OBJECTIVES

1. To understand the basic hardware and software issues of computer organization
2. To understand the arithmetic and logic unit and implementation of fixed point and floating-point arithmetic operations
3. To provide the concept of pipelining and hazards
4. To familiarize the students with memory system including virtual memories and cache memories
5. To exposé the students with I/O devices and standard I/O interfaces

COURSE OUTCOMES

1. Analyze the abstraction of various components of a computer.
2. Design arithmetic and logical unit.
3. Analyze pipelined control units.
4. Evaluate the performance of memory systems.
5. Understanding the I/O devices and interfaces

Course Outcomes	Program Outcomes												PSOs			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
19ITC06.CO1	X	X	X	X	-	-	-	-	-	-	X	X	X	-	-	-
19ITC06.CO2	X	X	X	X	-	-	-	-	-	-	X	X	X	-	-	-
19ITC06.CO3	X	X	X	X	-	-	-	-	-	-	X	X	X	-	-	-
19ITC06.CO4	X	X	X	X	-	-	-	-	-	-	X	X	X	-	-	-
19ITC06.CO5	X	X	X	X	-	-	-	-	-	-	X	X	X	-	-	-

UNIT I INTRODUCTION 9

Introduction-Technologies for building Processors and Memory-Performance-The Power Wall-Operations of the Computer Hardware-Operands Signed and Unsigned numbers, Representing Instructions, Logical Operations, Instructions for Making Decisions

UNIT II ARITHMETIC OPERATIONS 9

MIPS Addressing for 32-Bit Immediate and Addresses-Parallelism and Instructions: Synchronization, Translating and Starting a Program, Addition and Subtraction, Multiplication, Division, Floating Point, Parallelism and Computer Arithmetic: Subword Parallelism, Streaming SIMD Extensions

UNIT III PIPELINING AND HAZARDS 9

Building a Datapath-A Simple Implementation Scheme-Overview of Pipelining-Pipelined Datapath-Data Hazards: Control Hazards, Exceptions-Parallelism via Instructions-Instruction Level Parallelism and Matrix Multiply Hardware Design language

UNIT IV MEMORY SYSTEM 9

Memory Technologies-Basics of Caches-Measuring and Improving Cache Performance-Memory hierarchy-Virtual Memory-Secondary storage-Redundant Arrays of Inexpensive Disks-Implementing Cache Controllers

UNIT V INPUT&OUTPUT ORGANIZATION 9

Accessing I/O Devices-Interrupts-Interrupt Hardware-Enabling and Disabling Interrupts-Handling Multiple Devices-Controlling Device Requests-Exceptions-Direct Memory Access-Buses -Standard I/O Inter faces – PCI Bus, SCSI Bus, USB

TOTAL HOURS: 45

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TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	David A. Patterson and John L. Hennessey	Computer Organization and design	Morgan auffman / lsevier	2014
2.	Smruti Ranjan Sarangi	Computer Organization and Architecture	Tata McGraw Hill	2015

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	V.Carl Hamacher, Zvonko G. Varanesic and Safat G. Zaky	Computer Organisation	McGraw-Hill Inc	2012
2.	William Stallings	Computer Organization and Architecture	Pearson Education	2010
3.	Vincent P. Heuring, Harry F. Jordan	Computer System Architecture	Pearson Education	2011
4.	Carl Hamacher, Zvonko Vranesic, Safwat Zaky, and Naraig Manjikian	Computer Organization and Embedded Systems	McGraw Hill Higher Education	2011
5.	John P. Hayes	Computer Architecture and Organization	Tata McGraw Hill	2014

WEB URLs:

1.www.ics.p.lodz.pl/~dpuchala/CompArch/Lecture_6.pdf
2.www.dauniv.ac.in/downloads/CArch_PPTs/
3. www.nptel.ac.in/Computer organization
4. www.cse.iitk.ac.in/users/karkare/courses/2011/cs220/html/notes.html
5. www.freevideolectures.com/Course/2277/Computer-Organization

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19ITC07 **OBJECT ORIENTED PROGRAMMING** **L T P C**
3 0 0 3

COURSE OBJECTIVES

1. Understand the basic Object Oriented Programming concepts.
2. Develop solutions to problems by using of Data Abstraction, Encapsulation and Inheritance.
3. Ability to implement one or more patterns involving realization of an abstract interface.
4. Utilization of polymorphism in the solution of problems which can take advantage of dynamic dispatching.
5. To comprehend the art of programming, the structure and the meaning of basic Java programs.

COURSE OUTCOMES

1. Classify basic concepts and structure of object-oriented programming.
2. Implement real time applications by using constructor, operator over loading and function overloading in C++ Programming language.
3. Demonstrate of Inheritance and polymorphism techniques in C++ Programming language.
4. Able to write simple programs in JAVA Programming language.
5. Implement real time application by using exception handling and multithreaded techniques in JAVA programming language.

Course Outcomes	Program Outcomes												PSOs			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
19ITC07.CO1	X	X	X	X	-	-	-	-	-	-	X	X	X	-	-	-
19ITC07.CO2	X	X	X	X	-	-	-	-	-	-	X	X	X	-	-	-
19ITC07.CO3	X	X	X	X	-	-	-	-	-	-	X	X	X	-	-	-
19ITC07.CO4	X	X	X	X	-	-	-	-	-	-	X	X	X	-	-	-
19ITC07.CO5	X	X	X	X	-	-	-	-	-	-	X	X	X	-	-	-

UNIT I BASIC CONCEPTS OF OOP 9

Introduction OOP: Principles of OOP, Benefits and applications of OOP - Overview of C++: Program Structure-Namespace- Identifiers-Declaration of variables-Constants-Operators- Reference Variables - Functions in C++: Inline Functions-Friend Functions - Objects and classes: Basics of object and class in C++-Private and Public Members-Static Data and Function Members-Class Scope and Accessing Class Members

UNIT II CONSTRUCTORS AND OVERLOADING 9

Constructors: Types of Constructors-Destructors - Overloading: Operator Overloading: Overloading Unary and Binary Operators-Rules for Overloading Operators - Function Overloading

UNIT III INHERITANCE AND POLYMORPHISM 9

Base Class and Derived Class-Types of Inheritance: Single-Multiple-Multilevel-Hierarchical-Protected Members. Derived Class Constructors –Overriding, Member Functions - Virtual Base Class - Abstract Class - Polymorphism: this pointer - Virtual Functions.

UNIT IV INTRODUCTION TO JAVA 9

Basic Java Concepts: Objects – Classes – Methods and Messages –Abstraction and Encapsulation – Inheritance – Abstract Classes – Polymorphism - Access specifiers – Static Members –Constructors – Finalize Method

UNIT V JAVA PROGRAMMING 9

Arrays – Strings - Packages and Interfaces - Exception Handling – Multithreaded Programming- Dynamic Binding – Final Keyword – Abstract classes

TOTAL HOURS: 45

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TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	E Balagurusamy	Object Oriented Programming with C++	Tata McGraw Hill	2012
2.	Herbert Schlitz	JAVA -The Compete Reference	Tata McGraw-Hill	2014

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Bjarne Stroustrup	The C++ Programming Language	Pearson Education	2012
2.	Deitel and Deitel	C++ : How to Program	PHI	2014
3.	Herbert Schlitz	The Compete Reference C++	Tata McGraw Hill Wesley	2014
4.	Cay S. Horstmann and Gary Cornell	Core Java: Volume I – Fundamentals	Sun Microsystems Press	2008
5.	C. Thomas Wu	An introduction to Object-oriented programming with Java	Tata McGraw-Hill Publishing company Ltd	2006

WEB URLs

1. www.tutorialspoint.com/cplusplus/cpp_object_oriented.html
2. www.codecademy.com/courses/intro-to-object-oriented-programming
3. www.wiziq.com/tutorials/object-oriented-programming docs
4. www.java2s.com/Tutorial/Java/CatalogJava.html
5. www.docs.oracle.com/javase/tutorial/java/TOC.html

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19ITC08 **OBJECT ORIENTED PROGRAMMING LABORATORY** **L T P C**
0 0 2 1

COURSE OBJECTIVES

The student should be made to:

1. Understand the basic Object Oriented Programming concepts.
2. Develop solutions to problems by using of Data Abstraction, Encapsulation and Inheritance.
3. Ability to implement one or more patterns involving realization of an abstract interface.
4. Utilization of polymorphism to solve problems which can take advantage of dynamic dispatching.
5. To comprehend the art of programming, the structure and the meaning of basic Java programs.

COURSE OUTCOMES

At the end of the course, the student should be able to:

1. Classify basic concepts and structure of object-oriented programming.
2. Implement real time applications by using constructor, operator over loading and function overloading
3. Demonstrate Inheritance and polymorphism techniques in C++ Programming language.
4. Able to write simple programs in JAVA Programming language.
5. Implement real time application by using exception handling and multithreaded techniques in JAVA programming language.

Course Outcomes	Program Outcomes												PSOs			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
19ITC08.CO1	X	X	X	X	-	-	-	-	-	-	X	X	X	-	-	-
19ITC08.CO2	X	X	X	X	-	-	-	-	-	-	X	X	X	-	-	-
19ITC08.CO3	X	X	X	X	-	-	-	-	-	-	X	X	X	-	-	-
19ITC08.CO4	X	X	X	X	-	-	-	-	-	-	X	X	X	-	-	-
19ITC08.CO5	X	X	X	X	-	-	-	-	-	-	X	X	X	-	-	-

LIST OF EXPERIMENTS:

IMPLEMENTATION IN THE FOLLOWING TOPICS:

1. Pass by value, Pass by reference and Pass by address.
2. Constructors & Destructors, Copy Constructor.
3. Friend Function & Friend Class.
4. Inheritance.
5. Polymorphism & Function Overloading.
6. Virtual Functions.
7. Overload Unary & Binary Operators Both as Member Function & Non Member Function.
8. Class Templates & Function Templates.
9. Exception Handling Mechanism.
10. Standard Template Library concept.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

Standalone desktops with C++ compiler 30 Nos.

(or)

Server with C++ compiler supporting 30 terminals or more.

TOTAL HOURS: 30

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19ITC10 **OPERATING SYSTEMS LABORATORY** **L T P C**
0 0 2 1

COURSE OBJECTIVES

The student should be made to:

1. Learn shell programming and the use of filters in the UNIX environment.
2. Be exposed to programming in C using system calls.
3. Learn to use the file system related system calls.
4. Be exposed to process creation and inter process communication.
5. Be familiar with implementation of CPU Scheduling Algorithms, page replacement algorithms and Deadlock avoidance

COURSE OUTCOMES

At the end of the course, the student should be able to

1. Implement deadlock avoidance, and Detection Algorithms
2. Compare the performance of various CPU Scheduling Algorithm
3. Critically analyze the performance of the various page replacement algorithms
4. Create processes and implement IPC
5. Develop various algorithms for CPU scheduling and for deadlock avoidance

Course Outcomes	Program Outcomes												PSOs			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
19ITC10.CO1	X	X	X	X	-	-	-	-	-	-	X	X	X	-	-	X
19ITC10.CO2	X	X	X	X	-	-	-	-	-	-	X	X	X	-	-	X
19ITC10.CO3	X	X	X	X	-	-	-	-	-	-	X	X	X	-	-	X
19ITC10.CO4	X	X	X	X	-	-	-	-	-	-	X	X	X	-	-	X
19ITC10.CO5	X	X	X	X	-	-	-	-	-	-	X	X	X	-	-	X

LIST OF EXPERIMENTS:

1. File exploring basic commands under Linux Operating systems
2. Program using Shell scripts.
3. Basic process management algorithms.
4. Process synchronization algorithms.
5. Implementing various memory allocation methods.
6. Implementing paging and segmentation.
7. Implementing various page replacement policies.
8. Implementation of file system calls.
9. Implementation of Pattern matching.
10. Implementation of disk scheduling algorithms.

LAB EQUIPMENT FOR A BATCH OF 30 STUDENTS:

Standalone desktops with C / C++ / Java / Equivalent complier 30 Nos.
(Or)
Server with C / C++ / Java / Equivalent complier supporting 30 terminals or more.

TOTAL HOURS: 30

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19ITC11 **DESIGN AND ANALYSIS OF ALGORITHMS** **L T P C**
3 0 0 3

COURSE OBJECTIVES

1. To learn how to develop efficient algorithms for simple computational tasks.
2. To learn reasoning and correctness of algorithms.
3. To learn the complexity measures, different range of behaviors of algorithms and the notion of tractable and intractable problems will be understood.
4. To design the algorithms for real time problems.
5. To solve the problems by using different types of algorithms techniques.

COURSE OUTCOMES

1. Design algorithms for various computing problems.
2. Analyze the time and space complexity of algorithms.
3. Critically analyze the different algorithm design techniques for a given problem.
4. Modify existing algorithms to improve efficiency
5. Solve the real time problems by using backtracking and branch and bound techniques.

Course Outcomes	Program Outcomes												PSOs			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
19ITC11.CO1	X	X	X	X	-	-	-	-	-	-	X	X	X	-	-	-
19ITC11.CO2	X	X	X	X	-	-	-	-	-	-	X	X	X	-	-	-
19ITC11.CO3	X	X	X	X	-	-	-	-	-	-	X	X	X	-	-	-
19ITC11.CO4	X	X	X	X	-	-	-	-	-	-	X	X	X	-	-	-
19ITC11.CO5	X	X	X	X	-	-	-	-	-	-	X	X	X	-	-	-

UNIT I INTRODUCTION 9

Notion of an Algorithm – Fundamentals of Algorithmic Problem Solving – Important Problem Types – Fundamentals of the Analysis of Algorithm Efficiency – Analysis Framework – Asymptotic Notations and its properties – Mathematical analysis for Recursive and Non-recursive algorithms.

UNIT II BRUTE FORCE AND DIVIDE-AND-CONQUER 9

Brute Force - Closest-Pair and Convex-Hull Problems-Exhaustive Search - Traveling Salesman Problem - Knapsack Problem - Assignment problem. Divide and conquer methodology – Merge sort – Quick sort – Binary search – Multiplication of Large Integers – Strassen's Matrix Multiplication-Closest-Pair and Convex-Hull Problems.

UNIT III DYNAMIC PROGRAMMINGAND GREEDY TECHNIQUE 9

Computing a Binomial Coefficient – Warshall's and Floyd' algorithm – Optimal Binary Search Trees – Knapsack Problem and Memory functions. Greedy Technique– Prim's algorithm- Kruskal's Algorithm- Dijkstra's Algorithm- Huffman Trees.

UNIT IV ITERATIVE IMPROVEMENT AND LIMITATION OF ALGORITHM 9

The Simplex Method-The Maximum-Flow Problem – Maximm Matching in Bipartite Graphs- the Stable marriage Problem. Limitations of Algorithm Power-Lower-Bound Arguments-Decision Trees-P, NP and NP Complete Problems.

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UNITV BACKTRACKING, BRANCH AND BOUND AND APPROXIMATION ALGORITHM 9

Backtracking – n-Queens problem – Hamiltonian Circuit Problem – Subset Sum Problem-Branch and Bound – Assignment problem – Knapsack Problem – Traveling Salesman Problem- Approximation Algorithms for NP – Hard Problems – Traveling Salesman problem – Knapsack problem.

TOTAL HOURS: 45

TEXT BOOKS:

S.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Anany Levitin	Introduction to the Design and Analysis of Algorithms	Third Edition, Pearson Education,.	2012
2.	Bogdan Ciubotaru & Gabriel-Miro Muntean	Advanced Network Programming Principles & Techniques, Network Application Programming with Java	Springer Verlag	2013

REFERENCE BOOKS:

S.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Alfred V. Aho, John E. Hopcroft and Jeffrey D. Ullman	Data Structures and Algorithms	Pearson Education Reprint	2006
2	Donald E. Knuth,	The Art of Computer Programming	Volumes 1& 3 Pearson Education,	2009
3	A I. Chandra Mohan	Design and Analysis of Algorithms	PHI Learning Pvt. Ltd, 2nd Edition	2012
4	Steven S. Skiena	The Algorithm Design Manual	Second Edition Springer	2008
5	Manas Ranjan Kabat	Design And Analysis Of Algorithms	PHI Learning Pvt. Ltd, 2nd Edition	2013

WEB URLs:

1. www.nptel.ac.in/ algorithms
2. www.tutorialspoint.com/design_and_analysis_of_algorithms/index.htm
3. www.personal.kent.edu/~rmuhamma/Algorithms/algorithm.html
4. www.ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-046j-design-and-analysis-of-algorithms-spring-2015/lecture-videos/
5. www.khanacademy.org/computing/computer-science/algorithms

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