SRM UNIVERSITY
(Under section 3 of UGC Act 1956)

Volume - II
B.TECH (Full Time) 2013 - 2014
Open Electives Syllabus
(Common to all B.Tech Programmes)

FACULTY OF ENGINEERING AND TECHNOLOGY
SRM UNIVERSITY
SRM NAGAR, KATTANKULATHUR – 603 203

STUDENT OUTCOMES

The curriculum and syllabus for B.Tech programs (2013) conform to outcome based teaching learning process. In general, ELEVEN STUDENT OUTCOMES (a-k) have been identified and the curriculum and syllabus have been structured in such a way that each of the courses meets one or more of these outcomes. Student outcomes describe what students are expected to know and be able to do by the time of graduation. These relate to the skills, knowledge, and behaviors that students acquire as they progress through the program. Further each course in the program spells out clear instructional objectives which are mapped to the student outcomes.

The student outcomes are:

(a) an ability to apply knowledge of mathematics, science, and engineering

(b) an ability to design and conduct experiments, as well as to analyze and interpret data

(c) an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability

(d) an ability to function on multidisciplinary teams

(e) an ability to identify, formulate, and solve engineering problems

(f) an understanding of professional and ethical responsibility

(g) an ability to communicate effectively

(h) the broad education necessary to understand the impact of engineering solutions in global, economic, environmental, and societal context

(i) a recognition of the need for, and an ability to engage in life-long learning

(j) a knowledge of contemporary issues

(k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

OPEN ELECTIVES

Every student shall earn 9 credits by choosing three of the open elective courses from the following list. While choosing the electives, students shall ensure that they do not opt for the courses syllabus contents of which are similar to that of departmental core/elective courses. Further students from a program, say Mechanical Engg., shall not opt for open electives offered by their own program, that is, open elective courses of code numbers starting with ME. Courses with code numbers starting with GE /LE may be opted for by students of all programs. Students shall consult their faculty advisors before opting for an open elective course. The open elective courses on offer will be subject to availability of time table slot, faculty members, class rooms and minimum class strength specified from time to time.

Legend:

L - Number of lecture hours per week
T - Number of tutorial hours per week
P - Number of practical hours per week
C - Number of credits for the course

Category of courses:

G - General
B - Basic Sciences
E - Engineering Sciences and Technical Arts
P - Professional Subjects

Course Code	Category	Course Name	L	T	P	C
AE1201	P	AUTOMOTIVE ENGINEERING	3	0	0	3
AE1202	P	ELECTRIC AND HYBRID VEHICLES	3	0	0	3
AS1201	P	BOUNDARY LAYER THEORY	3	0	0	3
AS1202	P	COMPUTATIONAL FLUID DYNAMICS	3	0	0	3
AS1203	P	THEORY OF ELASTICITY	3	0	0	3
AS1204	P	FINITE ELEMENT ANALYSIS	3	0	0	3
AS1205	P	EXPERIMENTAL STRESS ANALYSIS	3	0	0	3
AS1206	P	ARTIFICIAL INTELLIGENCE/EXPERT SYSTEMS IN DESIGN AND MANUFACTURING	3	0	0	3
AS1207	P	AVIONICS	3	0	0	3
AS1208	P	CREATIVITY, INNOVATION AND NEW PRODUCT DEVELOPMENT	3	0	0	3
AS1209	P	COMPOSITE MATERIALS AND STRUCTURES	3	0	0	3
BI1201	P	MACHINE LEARNING IN BIOINFORMATICS	3	0	0	3
BI1202	P	PRINCIPLES AND APPLICATIONS OF BIOINFORMATICS	3	0	0	3
BI1203	P	BIOSIMULATIONS USING MATLAB	3	0	0	3
BI1204	P	DATA MINING IN BIOINFORMATICS	3	0	0	3
BI1205	P	BIOINFORMATICS FOR BIOENGINEERS	3	0	0	3
BM1201	P	INTRODUCTION TO BIOMEDICAL DEVICES	3	0	0	3
BM1202	P	INTRODUCTION TO BIOMECHANICS	3	0	0	3
BM1203	P	FUNDAMENTALS OF BIOSIGNAL PROCESSING	3	0	0	3
BT1201	P	NEUROBIOLOGY	3	0	0	3
BT1202	P	IMMUNOTECHNOLOGY	3	0	0	3
BT1203	P	TISSUE ENGINEERING	3	0	0	3
BT1204	P	MARINE-BASED PHARMACEUTICALS	3	0	0	3
BT1205	P	BIOREFINERY	3	0	0	3
BT1206	P	COMPREHENSIVE BIOPROCESS ENGINEERING	3	0	0	3
BT1207	P	ACTIVATED CARBON TECHNOLOGY	3	0	0	3
CE1202	P	DIGITAL IMAGE PROCESSING	3	0	0	3
CE1203	P	SOIL CHEMISTRY AND ITS IMPACT	3	0	0	3
CE1204	P	WATER POLLUTION AND ITS MANAGEMENT	3	0	0	3
CE1205	P	GLOBAL WARMING AND CLIMATE CHANGE	3	0	0	3
CE1206	P	DISASTER MANAGEMENT AND MITIGATION	3	0	0	3
CH1201	P	ENERGY ENGINEERING TECHNOLOGY AND MANAGEMENT	3	0	0	3
CH1202	P	RENEWABLE ENERGY TECHNOLOGY	3	0	0	3

Course Code	Category	Course Name	L	T	P	C
CH1203	P	INDUSTRIAL POLLUTION PREVENTION AND CONTROL	3	0	0	3
CH1204	P	PETROLEUM TECHNOLOGY	3	0	0	3
CH1205	P	INTRODUCTION TO TRANSPORT PROCESSES	3	0	0	3
CS1201	P	DATA STRUCTURES	3	0	0	3
CS1202	P	DATABASE CONCEPTS	3	0	0	3
CS1203	P	SOFT COMPUTING	3	0	0	3
CS1204	P	WEB DESIGN	3	0	0	3
EC1201	P	ELECTRONIC CIRCUITS AND SYSTEMS	3	0	0	3
EC1202	P	TELECOMMUNICATION SYSTEMS	3	0	0	3
EC1203	P	MODERN WIRELESS COMMUNICATION SYSTEMS	3	0	0	3
EE1201	P	POWER PLANT INSTRUMENTATION	3	0	0	3
EE1202	P	BIOMEDICAL INSTRUMENTATION	3	0	0	3
EE1203	P	RENEWABLE ENERGY RESOURCES	3	0	0	3
EE1204	P	SOFT COMPUTING	3	0	0	3
EE1205	P	PRINCIPLES OF CONTROL SYSTEMS	3	0	0	3
EE1206	P	MICROCONTROLLERS AND THEIR APPLICATIONS	3	0	0	3
EE1207	P	ELECTRICAL MACHINES AND DRIVES	3	0	0	3
EE1208	P	FUNDAMENTALS OF ELECTRIC POWER UTILIZATION	3	0	0	3
EE1209	P	INDUSTRIAL ELECTRONICS	3	0	0	3
EE1210	P	DSP CONTROL OF ELECTRIC DRIVES	3	0	0	3
EI1201	P	REAL-TIME EMBEDDED SYSTEMS	3	0	0	3
EI1202	P	INSTRUMENTATION IN AEROSPACE AND NAVIGATION	3	0	0	3
EI1203	P	MICRO CONTROLLER BASED SYSTEM DESIGN	3	0	0	3
EI1204	P	FIBER OPTICS AND LASER INSTRUMENTS	3	0	0	3
EI1205	P	INSTRUMENTATION ENGINEERING	3	0	0	3
FP1201	P	HUMAN NUTRITION AND HEALTH	3	0	0	3
FP1202	P	FOOD PRODUCTS DEVELOPMENT	0	2	3	3
FP1203	P	TECHNOLOGY OF BAKERY AND CONFECTIONERY PRODUCTS	0	2	3	3
FP1204	P	TECHNOLOGY OF FERMENTED FOODS	0	2	3	3
FP1205	P	FOOD PROCESSING AND PRESERVATION TECHNOLOGY	3	0	0	3

Course Code	Category	Course Name	L	T	P	C
GE1201	P	DISASTER MANAGEMENT	2	0	1	3
GE1202	P	CYBER SECURITY	3	0	0	3
GE1203	P	PROFESSIONAL ETHICS	3	0	0	3
GN1202	P	INSTRUMENTS IN BIOENGINEERING RESEARCH	3	0	0	3
GN1203	P	DAY-TO-DAY BIOLOGY	3	0	0	3
GN1204	P	GENETICS AND INHERITED DISEASES	3	0	0	3
IC1201	P	INTRODUCTION TO AUTOMATION	3	0	0	3
IC1202	P	VIRTUAL INSTRUMENTATION	3	0	0	3
IC1203	P	FUNDAMENTALS OF MEMS	3	0	0	3
IC1204	P	CONTROL THEORY	3	0	0	3
IT1201	P	INFORMATION SECURITY	3	0	0	3
IT1202	P	INTRODUCTION TO DATABASE MANAGEMENT SYSTEM	3	0	0	3
IT1203	P	WEB DESIGN	3	0	0	3
LE1201	P	COMMUNICATION SKILLS AND LANGUAGE LABORATORY	2	0	2	3
LE1202	P	PROFICIENCY IN ENGLISH AND ACCENT TRAINING	2	0	2	3
LE1203	P	CREATIVE WRITING	2	2	0	3
LE1204	P	INDIAN WRITING IN ENGLISH	3	0	0	3
LE1205	P	SCIENCE FICTION	3	0	0	3
MB1201	P	INTELLECTUAL PROPERTY RIGHTS , INNOVATION AND TECHNOLOGY	3	0	0	3
MB1202	P	TOTAL ENGINEERING QUALITY MANAGEMENT	3	0	0	3
MB1203	P	PRINCIPLES OF TECHNOLOGY AND INNOVATION MANAGEMENT	3	0	0	3
MB1204	P	MARKETING MANAGEMENT	3	0	0	3
MB1205	P	INDUSTRIAL MARKETING	3	0	0	3
MB1206	P	STRESS MANAGEMENT	3	0	0	3
MB1207	P	BASICS OF BANKING AND CAPITAL MARKETS	3	0	0	3
MB1208	P	FINANCE FOR NON FINANCE EXECUTIVES	3	0	0	3
MB1209	P	FUNDAMENTALS OF ENTREPRENEURSHIP	3	0	0	3
MB1210	P	OPERATIONS RESEARCH	3	0	0	3
MB1211	P	ETHICAL VALUES FOR BUSINESS	3	0	0	3
MB1212	P	INFORMATION SYSTEMS FOR ENGINEERS	3	0	0	3
MB1213	P	DATA WAREHOUSING AND DATA MINING	3	0	0	3
MB1214	P	COMPUTER NETWORKS AND SECURITIES	3	0	0	3

Course Code	Category	Course Name	L	T	P	C
MB1215	P	LEGAL ASPECTS OF BUSINESS	3	0	0	3
MB1216	P	INDUSTRIAL ENGINEERING AND MANAGEMENT	3	0	0	3
MB1217	P	BUSINESS ENVIRONMENT	3	0	0	3
MB1218	P	PRODUCT DESIGN, MANAGEMENT TECHNIQUES AND ENTREPRENEURSHIP	3	0	0	3
ME1202	P	PRODUCT DESIGN AND DEVELOPMENT	3	0	0	3
ME1203	P	CONCURRENT ENGINEERING	3	0	0	3
ME1205	P	MEMS AND NANO MANUFACTURING	3	0	0	3
ME1208	P	NON DESTRUCTIVE TESTING	3	0	0	3
ME1209	P	NANO PROCESSING	3	0	0	3
ME1211	P	LOW COST AUTOMATION	3	0	0	3
ME1213	P	MANUFACTURING COST ESTIMATION	3	0	0	3
ME1214	P	MICRO ELECTRO MECHANICAL SYSTEMS	3	0	0	3
ME1215	P	INTRODUCTION TO HYDRAULICS AND PNEUMATICS	3	0	0	3
ME1216	P	PLASTIC ENGINEERING	3	0	0	3
ME1217	P	INTRODUCTION TO ROBOTICS	3	0	0	3
ME1220	P	BASIC THERMODYNAMICS AND HEAT TRANSFER	2	2	0	3
ME1225	P	RENEWABLE AND SUSTAINABLE ENERGY	3	0	0	3
ME1226	P	ENERGY AUDITING	3	0	0	3
ME1227	P	ENERGY CONSERVATION	3	0	0	3
ME1228	P	SOLAR ENERGY UTILIZATION	3	0	0	3
MH1201	P	HUMAN COMPUTER INTERFACE	3	0	0	3
MH1202	P	ARTIFICIAL INTELLIGENCE AND NEURAL NETWORKS	3	0	0	3
MH1203	P	BIOMEDICAL INSTRUMENTATION	3	0	0	3
MH1204	P	SOFTWARE ENGINEERING	3	0	0	3
MH1205	P	PRODUCTION AND OPERATIONS MANAGEMENT	3	0	0	3
MH1207	P	MATERIAL HANDLING SYSTEMS	3	0	0	3
NT1201	P	APPLICATIONS OF NANOTECHNOLOGY	3	0	0	3
NT1202	P	INTRODUCTION TO NANOELECTRONICS	3	0	0	3
NT1203	P	ENVIRONMENTAL NANOTECHNOLOGY	3	0	0	3
NT1204	P	MEDICAL NANOTECHNOLOGY	3	0	0	3
NT1205	P	NANO SCALE SURFACE ENGINEERING	3	0	0	3

Course Code	Category	Course Name	L	T	P	C
NT1206	P	NANOTECHNOLOGY FOR ADVANCED COMPUTING	3	0	0	3
SE1201	P	SOFTWARE TESTING AND REUSE	3	0	0	3
SE1202	P	SOFTWARE DEVELOPMENT AND MANAGEMENT	3	0	0	3
SE1203	P	OBJECT ORIENTED PROGRAMMING	3	0	0	3
SE1204	P	SOFTWARE ENGINEERING PRACTICES	3	0	0	3
TE1201	P	WIRELESS COMMUNICATION NETWORKS	3	0	0	3
TE1202	P	DIGITAL LOGIC CIRCUITS	3	0	0	3
TE1203	P	TELECOM BILLING	3	0	0	3

SYLLABUS

AE1201	**AUTOMOTIVE ENGINEERING**	**L**	**T**	**P**	**C**
	Total contact hours - 45	**3**	**0**	**0**	**3**
	Prerequisite				
	Nil				

PURPOSE	
To impart knowledge to students in about an overall understanding of Automobile Engineering.	
INSTRUCTIONAL OBJECTIVES	
To understand,	
1.	Classification and layouts of different vehicles
2.	Different types of Engines in use
3.	Different types of clutch, gear box and transmission used
4.	Different types of brakes, drivelines and wheels and tyres

UNIT I - VEHICLE CLASSIFICATION AND LAYOUTS (9 hours)

Study various vehicle layouts as front engine & front wheel drive, front engine & rear wheel drive, rear engine & rear wheel drive. Classification based on controls positioning. Types of Chassis frames & construction of Chassis frame and vehicular Body

UNIT II - ENGINE TYPES (BASED ON FUEL USED) (9 hours)

Gasoline, Diesel, LPG, CNG, Bio-Diesel (Basic study)

UNIT III - CLUTCH, TRANSMISSION AND BRAKES (9 hours)

Functions and type of clutches, single plate, multiple plates, centrifugal. Vehicle motion, resistances during motion, accelerated and constant velocity motions, tractive force, gradeabilty, power required and engine characteristics, gear ratio requirement. Manual Gear Boxes - Sliding mesh, constant mesh, synchromesh, epicyclical gear boxes, gear ratios, Automatic transmission. Service Brakes - Function, Internal expanding brakes, shoes and lining material, properties, hydraulic braking system, brake oil, bleeding of brakes, pneumatic braking system and vacuum brakes. Auxiliary Brakes - Exhaust brakes, parking brake.

UNIT IV - STEERING, FRONT AXLE AND SUSPENSION (9 hours)

Steering requirements, steering gears box types, steering system and linkages, steering geometry, wheel alignment, toe-in, toe-out, caster, camber, power

steering. Purpose of front and rear suspension, types of suspension system, coil spring, leaf spring, torsion bars, shock absorbers, air suspensions, independent suspension and McPherson strut .

UNIT V - DRIVE LINE, REAR AXLES AND WHEELS AND TYRES (9 hours)

Propellers shaft, final drive types, Bevel, hypoid, Drive axles & differential, fully or semi-floating and three quarter floating, dead axle. Types of wheel, rims, tread patterns of tyre, tubeless tyres, specifications of tyres.

TEXT BOOKS

1. Dr. Kirpal Singh, "*Automobile Engineering (Volume – 1&2)",* 12th Edition, Standard Publishers Distributors, 2011.
2. Rajput.R.K, *"A Text Book of Automobile Engineering*", Laxmi Publications (P) Ltd, 2007.
3. Kamaraju Ramakrishna, *"Automobile Engineering*", Printice Hall of India, 2012
4. Donald L Anglin, William H Crouse, "*Automotive Mechanics 10 Edition",* TATA McGraw Hill Education, 2006

AE1201 – AUTOMOTIVE ENGINEERING												
Course Designed by		Department of Automobile Engineering										
1	Student Outcome	a	b	C	d	e	f	g	h	i	j	k
		x				x						
2	Mapping of instructional objectives with student outcome	1-4				1-4						
3	Category	General(G)		Basic Sciences(B)		Engineering Sciences and Technical Art (E)				Professional Subjects (P)		
		--		--		--				x		
4	Approval	23rd meeting of Academic Council, May 2013										

AE1202	ELECTRIC AND HYBRID VEHICLES	L	T	P	C
	Total contact hours - 45	3	0	0	3
	Prerequisite				
	Nil				

PURPOSE

This course introduces the fundamental concepts, principles, analysis and design of hybrid, electric and fuel cell vehicles.

INSTRUCTIONAL OBJECTIVES

1.	To understand working of different configurations of electric vehicles, and its components, hybrid vehicle configuration and performance analysis.

UNIT I - ELECTRIC VEHICLES **(9 hours)**

Introduction, Components, vehicle mechanics – Roadway fundamentals, vehicle kinetics, Dynamics of vehicle motion - Propulsion System Design.

UNIT II - BATTERY **(9 hours)**

Basics – Types, Parameters – Capacity, Discharge rate, State of charge, state of Discharge, Depth of Discharge, Technical characteristics, Battery pack Design, Properties of Batteries.

UNIT III - DC & AC ELECTRICAL MACHINES **(9 hours)**

Motor and Engine rating, Requirements, DC machines, Three phase A/c machines, Induction machines, permanent magnet machines, switched reluctance machines.

UNIT IV - ELECTRIC VEHICLE DRIVE TRAIN **(9 hours)**

Transmission configuration, Components – gears, differential, clutch, brakes regenerative braking, motor sizing.

UNIT V - HYBRID ELECTRIC VEHICLES **(9 hours)**

Types – series, parallel and series, parallel configuration – Design – Drive train, sizing of components.

REFERENCES

1. Iqbal Hussain, "*Electric & Hybrid Vechicles – Design Fundamentals*", Second Edition, CRC Press, 2011.
2. James Larminie, "*Electric Vehicle Technology Explained",* John Wiley & Sons, 2003.
3. Mehrdad Ehsani, Yimin Gao, Ali Emadi, *"Modern Electric, Hybrid Electric, and Fuel Cell Vehicles: Fundamentals"*, CRC Press, 2010.
4. Sandeep Dhameja, "*Electric Vehicle Battery Systems*", Newnes, 2001

AE1202 – ELECTRIC AND HYBRID VEHICLES												
Course Designed by		**Department of Automobile Engineering**										
1	Student Outcome	a	b	C	d	e	f	g	h	i	j	k
		x				x					x	
2	Mapping of instructional objectives with student outcome	1				1					1	
3	Category	General(G)		Basic Sciences(B)		Engineering Sciences and Technical Art(E)					Professional Subjects(P)	
		--		--		--					x	
4	Approval	23rd meeting of Academic Council, May 2013										

AS1201	**BOUNDARY LAYER THEORY**	**L**	**T**	**P**	**C**
	Total Contact Hours-45	**3**	**0**	**0**	**3**
	Prerequisite				
AS1003	**AERO-FLUID MECHANICS**				

PURPOSE	
To study all aspects in boundary layer theory in fluid motions.	
INSTRUCTIONAL OBJECTIVES	
1.	To become familiar with viscous fluid flow.
2.	To study the development of boundary layer for two-dimensional Flow.
3.	To study the Analysis of flow by laminar and turbulent boundary layer equation

UNIT I - BASICS **(9 hours)**

Basic laws of fluid flow - Continuity, momentum and energy equations as applied to system and control volume. Concept of flow fields - Viscous fluid flow – Boundary conditions - hotwire and Laser - Doppler anemometry.

UNIT II - INTRODUDTION TO BOUNDARY LAYER **(9 hours)**

Development of boundary - Estimation of boundary layer thickness- Displacement thickness, momentum and energy thickness for two-dimensional flows.

UNIT III - LAMINAR BOUNDARY LAYER **(9 hours)**

Analysis of flow past of flat plate and a cylinder - Integral relation of Karman - Integral analysis of energy equation - Laminar boundary layer equations - flow separation - Blasius solution for flat-plate flow — Boundary layer temperature profiles for constant plate temperature - Falkner Skan Wedge flows - Integral equation of Boundary layer - Pohlhausen method - Thermal boundary layer calculations - Ono parameter and two parameter integral methods.

UNIT IV - TURBULENT BOUNDARY LAYER **(9 hours)**

Two-dimensional turbulent boundary layer equations - Integral relations - Eddy-Viscosity theories — Velocity profiles -The law of the wall - The law of the wake - Turbulent flow in pipes and channels - Turbulent boundary layer on a flat plate - 'Boundary layers with pressure gradient.

UNIT V - COMPRESSIBLE BOUNDRY LAYER **(9 hours)**

Compressible boundary layer equation, recovery factor, similarity solutions, laminar supersonic cone rule, shock-boundary layer interaction

TEXTBOOKS

1. White.F.M, "*Viscous Fluid Flow*, McGraw" Hill Book Co., Inc., New York, 1985
2. Reynolds.A.J, "*Turbulent Flows in Engineering"*, John Wiley & Sons, 1980.

REFERENCES

1. Panton.R.L, "*Incompressible Flow"*, John Wiley and Sons, 1984.
2. Anderson.J.D, "*Fundamentals of Aerodynamics"*, McGraw Hill Book Co., Inc., New York, 1985.
3. Schlichting.H, "*Boundary Layer Theory"*, McGraw Hill New York, 1979.

AS1201 – BOUNDARY LAYER THEORY												
Course Designed by		**Department of Aerospace engineering**										
1	Student Outcome	a	b	c	d	e	f	g	h	i	j	k
		x				x						
2	Mapping of instructional objectives with student outcome	1-3				1-3						
3	Category	General (G)		Basic Sciences(B)		Engineering Sciences and Technical Arts (E)			Professional Subjects (P)			
		--		--		--			x			
4	Broad Area	Aerodynamics		Propulsion		Aircraft Structures			General			
		x		--		--			--			
5	Approval	23rd meeting of Academic Council, May 2013										

AS1202	**COMPUTATIONAL FLUID DYNAMICS**	**L**	**T**	**P**	**C**
	Total Contact Hours-45	**3**	**0**	**0**	**3**
	Prerequisite				
AS1003	**AERO-FLUID MECHANICS**				
AS1017	**HEAT TRANSFER**				
MA1004	**NUMERICAL METHODS**				
MA1013	**FOURIER SERIES, PARTIAL DIFFERENTIAL EQUATIONS AND ITS APPLICATIONS**				
CS1001	**PROGRAMMING USING MATLAB**				
PURPOSE					
To impart knowledge about various computational methods for fluid flow and heat transfer problems so as to enable the students to write computer programs for solving elementary fluid dynamics/heat transfer problems.					

INSTRUCTIONAL OBJECTIVES	
1.	Students Will be exposed to governing equations required for CFD and their mathematical behavior.
2.	Students Will be exposed to modeling of Fluid flow and heat transfer problem.

UNIT I - GOVERNING EQUATIONS (9 hours)

Introduction — Various applications of CFD, Governing equations-continuity, momentum, energy equations, Boundary conditions

UNIT II - FUNDAMENTALS OF DISCRETISATION (9 hours)

Basics of FDM, FVM, FEM. Revision of Numerical Methods. Discretisation of Computational Domain

UNIT III - ONE DIMENSIONAL UNSTEADY STATE PROBLEMS (9 hours)

Explicit Vs Implicit and Semi- implicit Methods**.** Numerical Oscillations, Derivation of Stability Criterion. Guiding Principles Of FVM.

UNIT IV - INTRODUCTION TO CONVECTION (9 hours)

Upwind Differencing, False Diffusion, Significance of Peclet number.

UNIT V - ALGORITHMS IN CFD (9 hours)

Simple, Flow chart for Simple, Predictor- Corrector Methods, MAC Algorithm, TERM PROJECT.

TEXT BOOK

1. Anil Date: Introduction to CFD.

REFERENCES

1. Versteeg.H.K and Malalasekera.W, "*An Introduction to Computational Fluid Dynamics, the Finite Volume Method*", Addison Wesley Longmen Limited, 1995.
2. Patankar.S.V, "*Numerical Heat Transfer and Fluid Flow*", Hemisphere Publishing Corporation, 1980.

AS1202 – COMPUTATIONAL FLUID DYNAMICS												
Course Designed by		Department of Aerospace engineering										
1	Student Outcome	a	b	c	d	e	f	g	h	i	j	K
		x				x						
2	Mapping of instructional objectives with student outcome	1-2				1-2						
3	Category	General (G)		Basic Sciences(B)		Engineering Sciences and Technical Arts (E)		Professional Subjects(P)				
		--		--		--		x				
4	Broad Area	Aerodynamics		Propulsion		Aircraft Structures		General				
		x		x		--		--				
5	Approval	23rd meeting of Academic Council, May 2013										

	THEORY OF ELASTICITY	L	T	P	C
AS1203	Total Contact Hours-45	3	0	0	3
	Prerequisite				
ME1010	MECHANICS OF SOLIDS				

PURPOSE

This course is aimed at the theory and method of solution for problems involving linear elastic materials.

INSTRUCTIONAL OBJECTIVES

1.	To familiarize with the theory of elasticity, with emphasis on linear elasticity.
2.	To study about Linear and nonlinear strain measures, the boundary value problem for linear elasticity, plane problems in linear elasticity, and three dimensional problems in linear elasticity.
3.	Other topics will be selected from nonlinear elasticity, contact problems and fracture mechanics.

UNIT I - ASSUMPTIONS IN ELASTICITY (9 hours)

Definitions, notations and sign conventions for stress and strain, Equations of equilibrium.

UNIT II - BASIC EQUATIONS OF ELASTICITY (9 hours)

Strain-displacement relations, Stress-strain relations, Lame's constant-cubical dilatation, Compressibility of material, bulk modulus, Shear modulus, Compatibility equations for stresses and strains, Principal stresses and principal strains, Mohr's circle, Saint Venant's principle, Theories of failure.

UNIT III - PLANE STRESS AND PLANE STRAIN PROBLEMS (9 hours)

Airy's stress function, Biharmonic equations, Polynomial solutions, Simple two dimensional problems in Cartesian coordinates like bending of cantilever and simply supported beams etc.

UNIT IV - POLAR COORDINATES (9 hours)

Equations of equilibrium, Strain displacement relations, Stress-strain relations, AxiSymmetric problems, Kirch, Michell's and Boussinesque problems.

UNIT V - TORSION (9 hours)

Navier's theory, St.Venant's theory, Prandtl's theory on torsion, The semi-inverse method and applications of shafts to circular, elliptical, equilateral triangular and rectangular sections.

TEXT BOOKS

1. Timoshenko.S and Goodier.T.N, "*Theory of Elasticity"*, McGraw-Hill Ltd., Tokyo, 1990.
2. Enrico Voltorra and Caines.J.H, "*Advanced Strength of Materials"*, Printice Hall, New Jersey, 1991.

REFERENCES

1. Wang.C.T, "*Applied Elasticity",* Mc Graw-Hill Co., New York, 1993.
2. Sokolnlkoff.IS, "*Mathematical Theory of Elasticit"y*, McGraw-Hill New York, 1978

AS1203 – THEORY OF ELASTICITY												
Course Designed by		**Department of Aerospace engineering**										
1	Student Outcome	a	b	c	d	e	f	g	h	i	j	K
		x				x						
2	Mapping of instructional objectives with student outcome	1-3				1-3						
3	Category	General (G)		Basic Sciences(B)		Engineering Sciences and Technical Arts (E)		Professional Subjects(P)				
		--		--		--		x				
4	Broad Area	Aerodynamics		Propulsion		Aircraft Structures		General				
		--		--		x		--				
5	Approval	23rd meeting of Academic Council, May 2013										

	FINITE ELEMENT ANALYSIS	L	T	P	C
AS1204	Total Contact Hours-45	3	0	0	3
	Prerequisite				
ME1010	MECHANICS OF SOLIDS				
AS1017	HEAT TRANSFER				

PURPOSE

To understand the basics of finite element analysis and its applications in engineering

INSTRUCTIONAL OBJECTIVES

To familiarize the

1.	Basics of Finite Element analysis
2.	Rayleigh and Ritz methods for static analysis
3.	Different elements like truss, beam, triangular, quadrilateral and brick elements.
4.	Analysis of one dimensional and two dimensional problems with the help of software.

UNIT I - INTRODUCTION TO FINITE ELEMENT ANALYSIS (9 hours)

Basics of FEA, historical background, FEM applications. General field problems in engineering, Modeling — discrete and continuous models, difficulties involved in solution- relevance and place of FEM. Boundary and initial value problems.

UNIT II - CALCULUS OF VARIATIONS (9 hours)

Variational formulation in finite elements, Weighted residual methods — Galerkin method, sub domain method, method of least square and collocation method, numerical problems.

UNIT III - STATIC ANALYSIS (9 hours)

General procedure of FEM, skeletal and continuum structures, descritization of domain, basic types of elements- truss, beam, triangular, quadrilateral and brick elements- shape functions, Rayleigh and Ritz method, formulation of element stiffness matrices -Isoparametric elements.

UNITM IV - FINITE ELEMENT ANALYSIS OF ONE DIMENSIONAL PROBLEMS (9 hours)

One dimensional second order equations-generalized coordinate approach, derivation of element equation- assembly of element equation- imposition of boundary conditions- solution of equation- Cholesky method- extension of the

method to fourth order equation- time dependent problems from heat transfer and solid mechanics-heat transfer through simple fins, composite wall, bending of beams.

UNIT V - FINITE ELEMENT ANALYSIS OF TWO DIMENSIONAL PROBLEMS (9 hours)

Global and natural coordinates, second order equations involving scalar valued function- model equation - variational formulation - finite element formulation through generalized coordinate approach — convergence criteria for chosen models interpolation functions- element matrices-problems on bending of plates and heat transfer in two dimensions.

UNIT VI - INTRODUCTION TO ADVANCED TOPICS (9 hours)

(Only preliminaries to the covered. Not included for examination) Three dimensional problems, use of software packages.

TEXT BOOKS

1. Reddy.J.N, "*An Introduction to Finite Element Method"*, McGraw Hill International Editions,1 993
2. Chandrupatla and Bologundu., "*Finite Elements in Engineering"*, Prentice Hall of India Pvt. Ltd, 1997.

REFERENCES

1. Rao.S.S, "*Finite Element Methods in Engineering"*, Pregamon Press, 1989.
2. Krishnamoorthy.C .S, "*Finite Element Analysis - Theory and Programming"*, Tata McGraw Hill Publishing Co, 1987.
3. Zienkiewicz.O.C, "*The Finite Element Method in Engg. Science"*, McGraw Hill, London, 1977.

AS1204 – FINITE ELEMENT ANALYSIS												
Course Designed by		**Department of Aerospace engineering**										
1	Student Outcome	a	b	c	d	e	f	g	h	i	j	k
		x				x						
2	Mapping of instructional objectives with student outcome	1-4				1-4						
3	Category	General (G)		Basic Sciences(B)		Engineering Sciences and Technical Arts (E)			Professional Subjects(P)			
		--		--		--			x			
4	Broad Area	Aerodynamics		Propulsion		Aircraft Structures			General			
		--		--		x			--			
5	Approval	23rd meeting of Academic Council, May 2013										

	EXPERIMENTAL STRESS ANALYSIS	L	T	P	C
AS1205	Total Contact Hours-45	**3**	**0**	**0**	**3**
	Prerequisite				
ME1010	**MECHANICS OF SOLIDS**				
PURPOSE					
To familiarize the students with various strain measurements and Non-destructive testing techniques.					
INSTRUCTIONAL OBJECTIVES					
Upon completion of the course, the student will be able to appreciate					
1.	Use of strain gauges and its principles				
2.	Principle of photo elasticity and its use.				
3.	Non-destructive testing method.				

UNIT I - MEASUREMENTS **(9 hours)**

Principles of measurements-Accuracy, Sensitivity and Range of measurements.

UNIT II - EXTENSOMETERS **(9 hours)**

Mechanical, Optical, Acoustical and Electrical extensometers and their uses, advantages and disadvantages.

UNIT III - ELECTRICAL RESISTANCE STRAIN GAUGES **(9 hours)**

Principle of operation and requirements-Types and their uses-Materials for strain gauge. Calibration and temperature compensation-cross sensitivity, Rosette analysis- Wheatstone bridge and potentiometer circuits for static and dynamic strain measurements.

UNIT IV - PHOTOELASTICITY **(9 hours)**

Two dimensional photoelasticity- Concepts of light-photo-elastic effects- stress optic law-Interpretation of fringe pattern-Compensation and separation techniques-Photoelastic materials. Introduction to three dimensional photoelasticity.

UNIT V - NON-DESTRUCTIVE TESTING **(9 hours)**

Fundamentation of NDT-Radiography-ultrasonics -Magnetic particle inspection- Fluorescent penetrant technique- Eddy current testing-Acoustic Emission Technique-Fundamentals of brittle coating methods-Introduction to Moire techniques- Holography- Ultrasonic C-Scan-Thermography, Fibre-optic Sensors.

TEXT BOOKS

1. Dally.J.W and Riley.W.F, "*Experimental Stress Analysis"*, McGraw Hill Inc., New York, 1978.
2. Hetyenyi.M, "*Hand Book of Experimental Stress Analysis"*, John Wiley and Sons Inc., New York, 1972.

REFERENCES

1. Srinath.L.S, Raghava.M.R, Lingaiah, Gargesha.K, G.Pant.B and Ramachandra.K, "*Experimental Stress Analysis"*, Tata McGraw Hill, New Delhi, 1984.
2. Pollock.A.A, "*Acoustic Emission in Acoustics and Vibrations Progress'*, ed. by Stephens R.W.B.,Chapman and Hall, 1983.

AS1205 - EXPERIMENTAL STRESS ANALYSIS												
Course Designed by		**Department of Aerospace engineering**										
1	Student Outcome	a	b	c	d	e	f	g	h	i	j	k
		x				x						x
2	Mapping of instructional objectives with student outcome	1-3				1-3						1-3
3	Category	General (G)		Basic Sciences(B)		Engineering Sciences and Technical Arts (E)				Professional Subjects(P)		
		--		--		--				x		
4	Broad Area	Aerodynamics		Propulsion		Aircraft Structures				General		
		--		--		x				--		
5	Approval	23rd meeting of Academic Council, May 2013										

AS1206	**ARTIFICIAL INTELLIGENCE / EXPERT SYSTEMS IN DESIGN AND MANUFACTURING**	**L**	**T**	**P**	**C**
	Total Contact Hours-45	**3**	**0**	**0**	**3**
	Prerequisite				
	Nil				

PURPOSE

To present the basics of Artificial intelligence and different techniques in AI and Expert systems in a structured manner

INSTRUCTIONAL OBJECTIVES

To evolve basic ideas of

1. Artificial Intelligence and expert system matching techniques, memory organization and communication
2. To acquire clear concepts of Fuzzy logic, AI Programming languages and application of Object Oriented Programming
3. Speech recognition for knowledge acquisition for the use of Artificial Intelligence and Expert system in Industrial manufacturing and Design Domain

UNIT I - INTRODUCTION (9 hours)

History, Definition of A.I., Emulation of Human cognitive process. The knowledge search tradeoff, stored knowledge, semantic nets, An abstract view of modeling, Elementary knowledge. Computational Logic, Analysis of compound statements using simple logic connectives, predicate logic, knowledge organization and manipulation, knowledge acquisition.

UNIT II - PROGRAMMING AND LOGICS IN A.I. (9 hours)

LISP and other A.I, programming languages - Introduction to LISP, syntax and Numeric functions, LISP and PROLOG distinction, input, output and local variables, Interaction and recursion, property list and arrays, alternative languages, formalised symbolic logics- properties of WFRS, Non-deductive inference methods in consistencies and uncertainties-Truth maintenance system, default reasoning and the closed world assumption, Model and Temporary logics

UNIT III - FUZZY LOGIC (9 hours)

Introduction to fuzzy logic with examples - Probabilistic reasoning, Bayesian probabilistic inference, Dempstor shafer theory, possible world representations, Ad- Hoc methods. Structure knowledge - Graph, frames and related structures - Object oriented representation- Objects classes, messages and methods, simulation example using OOPS program, OOP languages. Search and control strategies - Concepts, search problems, uniformed or Blined search, searching AND/OR graphs

UNIT IV - KNOWLEDGE ORGANISATION, COMMUNICATION AND EXPERT SYSTEM (9 hours)

Matching Techniques - Need for matching, Matching problem, Partial matching, fuzzy matching, RETE matching algorithm. Knowledge organization - Indexing and Retrieval techniques, Integration of knowledge in memory organization systems, Perception, Communication and Expert System. Overview of linguistics - Basic semantic Analysis and representation structures, natural language generation.

UNIT V - PATTERN RECOGNITION AND LEARNING TECHNIQUES (9 hours)

Pattern recognition system - understanding speech recognition, Image transformation, low level processing, Medium and High level processing, vision system architecture, Rule Based system architecture, knowledge acquisition and validation, Knowledge system Building Tools, Use of Al and Expert Systems in Manufacturing and Design.

TEXT BOOKS

1. Dan W.Pattorson, "*Introduction to Artificial Intelligence and Expert Systems"*, Prentice Hall of India, 2001.
2. Robert J. Schalkoll, "*Artificial Intelligence"* (An Engineering Approach), McGraw Hill International Edition, 1990.

REFERENCES

1. Elaini Rich, "*Artificial Intelligence"*, McGraw Hill Book Company, 1988.
2. Eugene Chirnink and Drew Mc Dermot., "*Introduction to Artificial Intelligence"*, Addison Wosloy Longman Inc., 1998.
3. George F. Lugor, William A. Stubblefield., "*Artificial Intelligence"*, The Benjamin/cummings publishing company Inc, second edition, 1992.

AS1206 - ARITIFICIAL INTELLIGENCE/EXPERT SYSTEMS IN DESIGN AND MANUCACTURING												
Course Designed by		**Department of Aerospace engineering**										
1	Student Outcome	a	b	c	d	e	f	g	h	i	j	k
					x							x
2	Mapping of instructional objectives with student outcome				1-3							1-3
3	Category	General (G)			Basic Sciences(B)		Engineering Sciences and Technical Arts (E)			Professional Subjects(P)		
		--			--		--			x		
4	Broad Area	Aerodynamics			Propulsion		Aircraft Structures			General		
		--			--		--			x		
5	Approval	23rd meeting of Academic Council, May 2013										

	AVIONICS	**L**	**T**	**P**	**C**
AS1207	Total Contact Hours-45	**3**	**0**	**0**	**3**
	Prerequisite				
IC1051	**ELECTRONICS AND INSTRUMENTATION**				
AS1008	**AIRCRAFT SYSTEMS AND INSTRUMENTS**				

PURPOSE

To familiarize the students in the area of avionics and its architecture

INSTRUCTIONAL OBJECTIVES

1.	To know about the microprocessor, digital computers and database
2.	To have a knowledge of avionics system and flight decks

UNIT I - INTRODUCTION TO AVIONICS **(9 hours)**

Need for avionics in civil and military aircraft and space systems - Integrated avionics and weapon systems - Typical avionics subsystems, design, technologies.

UNIT II - PRINCIPLES OF DIGITAL SYSTEMS (9 hours)

Digital computers - Microprocessors - Memories

UNIT III - DIGITAL AVIONICS ARCHITECTURE (9 hours)

Avionics system architecture - Databases - MIL - STD - 1553B - ARINC - 420 - ARINC - 629.

UNIT IV - FLIGHT DECKS AND COCKPITS (9 hours)

Control and display technologies: CRT, LED, LCD, EL and plasma panel - Touch screen - Direct voice input (DVI) - Civil and Military Cockpits: MFDS, HUD, MFK, HOTAS.

UNIT V - INTRODUCTION TO AVIONICS SYSTEMS (9 hours)

Communication systems - Navigation systems - Flight control systems - Radar-Electronic Warfare — Utility systems Reliability and maintainability - Certification.

TEXT BOOKS

1. Middleton.D.H, Ed., "*Avionics systems"*, Longman Scientific and Technical, Longman Group UK Ltd., England, 1989.
2. Spitzer.C.R, "*Digital Avionics systems"*, Prentice-Hall, Englewood Cliffs, N.J., U.S.A., 1987.

REFERENCES

1. Malvino.A.P and Leach.D.P, "*Digital Principles and Application"*, Tata McGraw Hill, 1990.
2. Gaonkar.R.S, "*Microprocessors Architecture - Programming and Applications"*, Wiley and Sons Ltd, New Delhi, 1990.

AS1207 – AVIONICS												
Course Designed by		Department of Aerospace engineering										
1	Student Outcome	a	b	c	d	e	f	g	h	i	j	k
		x				x						
2	Mapping of instructional objectives with student outcome	1-2				1-2						
3	Category	General(G)		Basic Sciences(B)		Engineering Sciences and Technical Arts (E)				Professional Subjects(P)		
		--		--		--				x		
4	Broad Area	Aerodynamics		Propulsion		Aircraft Structures				General		
		--		--		--				x		
5	Approval	23rd meeting of Academic Council, May 2013										

	CREATIVITY INNOVATION AND NEW PRODUCT DEVELOPMENT	L	T	P	C
AS1208	Total Contact Hours-45	3	0	0	3
	Prerequisite				
	Nil				

PURPOSE

The students should develop their leadership qualities and creative thinking capability in product development

INSTRUCTIONAL OBJECTIVES

1.	To improve their creativity and problem solving methods
2.	To improve their knowledge in project selection
3.	To understand the Patent Laws
4.	To know the Quality standards

INTRODUCTION

The process of technological innovation - factors contributing to successful technological innovation - the need for creativity and innovation - creativity and problem solving - brain storming - different techniques.

UNIT I - PROJECT SELECTION (9 hours)

Collection of ideas and purpose of project - Selection criteria.

UNIT II - PROJECT EVALUATION (9 hours)

Screening ideas for new products (evaluation techniques).

UNIT III - NEWP RODUCT DEVELOPMENT (9 hours)

Research and new product development - Patents - Patent search - Patent laws - International code for patents - Intellectual property rights (IPR).

UNIT IV - NEW PRODUCT PLANNING (9 hours)

Design of proto type - testing - quality standards - marketing research - introducing new products.

UNIT V - LABORATORY (9 hours)

Creative design - Model Preparation - Testing - Cost evaluation - Patent application.

TEXT BOOKS

1. Harry Nystrom; *Creativity and innovation*, John Wiley & Sons, 1979.
2. Brain Twiss; *Managing technological innovation*, Pitman Publishing Ltd., 1992.
3. Paul Sloane; The leader's guide to lateral thinking skills kogan page india, 2008.

REFERENCES

1. Harry B, Watton, "*New Product Planning"*, Prentice Hall Inc., 1992.
2. Khandwalla, RN.,- "*Fourth Eye (Excellence through Creativity) - Wheeler Publishing"*,Allahabad, 1992. I.P.R. Bulletins, *TIFAC*, New Delhi, 1997.

AS1208 - CREATIVITY, INNOVATION AND NEW PRODUCT DEVELOPMENT												
Course Designed by		**Department of Aerospace engineering**										
1	Student Outcome	a	b	c	d	e	f	g	h	i	j	k
		x		x		x	x					
2	Mapping of instructional objectives with student outcome	1		2		1	3-4					
3	Category	General (G)		Basic Sciences(B)		Engineering Sciences and Technical Arts (E)			Professional Subjects (P)			
		--		--		--			x			
4	Broad Area	Aerodynamics		Propulsion		Aircraft Structures			General			
		--		--		--			x			
5	Approval	23rd meeting of Academic Council, May 2013										

	COMPOSITE MATERIALS AND STRUCTURES	**L**	**T**	**P**	**C**
AS1209	Total Contact Hours-45	**3**	**0**	**0**	**3**
	Prerequisite				
ME1010	**MECHANICS OF SOLIDS**				
AS1203	**THEORY OF ELASTICITY**				

PURPOSE

This course is designed to provide a broad over view of the analysis of stress and strains in composite materials

INSTRUCTIONAL OBJECTIVES

Upon completion of the course, the student will be able to appreciate

1.	Familiarize on types of composite materials and fabrication process.
2.	Familiarize with the method of analysis of composite materials.
3.	Familiarize with the governing equation of different laminates.
4.	Familarize with sandwich construction and failure models of sandwich panels

UNIT I - STRESS STRAIN RELATION **(9 hours)**

Introduction- Advantages and application of composite materials, reinforcements and matrices – Generalized Hooke's Law – Elastic constants for anisotropic, orthotropic and isotropic materials.

UNIT II - METHODS OF ANALYSIS **(9 hours)**

Micro mechanics – Mechanics of materials approach, elasticity approach to determine material properties – Macro Mechanics – Stress-strain relations with respect to neutral axis, arbitrary axis – Determination of material properties. Experimental characterization of lamina.

UNIT III - LAMINATED PLATES **(9 hours)**

Governing differential equation for a general laminate, angle ply and cross ply laminates. Failure criteria for composites.

UNIT IV - SANDWICH CONSTRUCTIONS **(9 hours)**

Basic design concepts of sandwich construction -Materials used for sandwich construction - Failure modes of sandwich panels.

UNIT V - FABRICATION PROCESS **(9 hours)**

Various Open and closed mould processes. Manufacture of fibers – Types of resins and properties and applications – Netting analysis

TOTAL 45 hours

TEXT BOOKS

1. Calcote.L.R, "*The Analysis of laminated Composite Structures",* Von – Noastrand Reinhold Company, New York 1998.
2. Jones.R.M, "*Mechanics of Composite Materials"*, McGraw-Hill, Kogakusha Ltd., Tokyo, 1985.

REFERENCES

1. Agarwal.B.D, and Broutman.L.J, "*Analysis and Performance of Fibre Composites*", John Wiley and sons. Inc., New York, 1995.
2. Lubin.G, "*Handbook on Advanced Plastics and Fibre Glass*", Von Nostrand Reinhold Co., New York, 1989

AS1209 - COMPOSITE MATERIALS AND STRUCTURES												
Course Designed by		**Department of Aerospace engineering**										
1	Student Outcome	a	b	c	d	e	f	g	h	i	j	k
		x				x						x
2	Mapping of instructional objectives with student outcome	1-4				1-4						1-4
3	Category	General (G)		Basic Sciences(B)		Engineering Sciences and Technical Arts (E)				Professional Subjects(P)		
		--		--		--				x		
4	Broad Area	Aerodynamics		Propulsion		Aircraft Structures				Aircraft Systems		
		--		--		x				--		
5	Approval	23rd meeting of Academic Council, May 2013										

BI1201	MACHINE LEARNING IN BIOINFORMATICS	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite				
	Knowledge of Molecular Biology.				

PURPOSE

To provide knowledge about the development and application of computer methods for management, analysis, interpretation, and prediction, as well as for the design of experiments.

INSTRUCTIONAL OBJECTIVES

1.	To impart knowledge about building good probabilistic models.
2.	To impart knowledge about automate the process of data analysis.

UNIT I - MACHINE LEARNING FOUNDATIONS (9 hours)

Introduction-Bayesian modeling-Cox Jaynes axioms- Bayesian inference and induction- models structures examples.

UNIT II - MACHINE LEARNING ALGORITHMS (9 hours)

Dynamic programming- EM/ GEM algorithms-Markov chain Monte carlo methods-simulated annealing genetic algorithm-Neural networks.

UNIT III - APPLICATIONS (9 hours)

Sequence coding- correlations- Prediction: secondary structure, signal peptides and cleavage sites-applications for DNA & RNA nucleotide sequences-Performance evaluation.

UNIT IV - HIDDEN MARKOV MODELS **(9 hours)**

Introduction- likelihood & Basic algorithms- Learning algorithms- Applications: general aspects, proteins, DNA and RNA.

UNIT V - PROBABILISTIC MODELS **(9 hours)**

Models for phylogeny-substitution probabilities-Data likelihood-optimal trees-modeling for array data.

TEXT BOOKS

1. Søren Brunak, Pierre F Baldi, "*Bioinformatics: The Machine Learning approach*", MIT Press, 2001.
2. Balas Kausik Natarajan, "*Machine Learning: A Theoretical Approach*", Morgan Kaufmann, 1991.

REFERENCES

1. Steffen Schulze-Kremer, "*Molecular Bioinformatics: Algorithms and Applications*", Walter de Gruyter, 1996.
2. Yi-Ping Phoebe. Chen, "*Bioinformatics Technologies*", Springer, 2005.
3. Zheng Rong Yang, "*Machine Learning Approaches to Bioinformatics*" (Science, Engineering, and Biology Informatics), World Scientific Publishing Company; 1 edition 2010.

BI1201 MACHINE LEARNING IN BIOINFORMATICS												
Course Designed by		**Department of Bioinformatics**										
1	Student Outcome	a	b	c	d	e	f	g	h	i	j	k
		x				x						
2	Mapping of instructional objectives with student outcome	1				2						
3	Category	General (G)		Basic Sciences (B)		Engineering Sciences and Technical Arts (E)					Professional Subjects (P)	
		--		--		--					x	
4	Broad Area	Biotechnology		Information Technology		Bioinformation Technology					Allied Bioinformatics	
		--		--		x					--	
5	Approval	23rd meeting of Academic Council, May 2013										

	PRINCIPLES AND APPLICATIONS OF BIOINFORMATICS	L	T	P	C
BI1202	Total Contact Hours - 45	**3**	**0**	**0**	**3**
	Prerequisite				
	Nil				

PURPOSE

To provide knowledge about the principles, concepts and applications of bioinformatics in diverse fields of life science and applied research.

INSTRUCTIONAL OBJECTIVES

1.	To impart knowledge about various principles of bioinformatics.
2.	To impart knowledge about the applications of bioinformatics in diverse fields.

UNIT I - DATABASES (10 hours)

Central Dogma of Molecular Biology; Abbreviations and Structures of bases & amino acids Introduction to bioinformatics, Need for bioinformatics and its databases, Nucleotide databases; Protein databases; Family Databases; Sequence retrieval systems; Genome databases, Metabolic Pathway database; Specialized database; Structural database.

UNIT II - SEQUENCE ANALYSIS (9 hours)

Analysis of protein and nucleic acid sequences, Pair wise Sequence Alignment; Dynamic Programming, Heuristic approach (BLAST & FASTA), Scoring Matrices; Multiple Sequence Alignment; Methods in multiple sequence alignment.

UNIT III - PHYLOGENY& STRUCTURE PREDICTION (10 hours)

Phylogenetic Analysis - Methods of Construction of Phylogenetic trees; Methods for Prediction of Secondary and Tertiary structures of Proteins; Model validation and evaluation; Methods for comparison of 3D structures of proteins.

UNIT IV - GENOME ANALYSIS (8 hours)

Methods in gene prediction – Predictive methods using DNA and protein sequences; Comparative genomics.

UNIT V - APPLICATIONS OF BIOINFORMATICS (8 hours)

Applications of Bioinformatics in biotechnology, proteomics, genomics, medicine and other related fields; Disease genes, Drug Discovery & Drug designing; Computer aided drug design, ADME.

TEXT BOOKS

1. Lesk.A.M, "*Introduction to Bioinformatics*", 1st Edition, Oxford University Press, 2002.
2. Gautham.N, "*Bioinformatics*", Narosa Publishing Company, 2006.
3. Westhead.D.R, Parish.J.H and Twyman.R.M, "*Instant Notes Series – Bioinformatics*" 1st Edition, Viva Books Private Limited, 2003.

REFERENCES

1. Bernhard Haubold and Thomas Wiehe, "*Introduction to Computational Biology – An Evolutionary Approach*" BirkhauserVerlag, 2006.
2. Krane, DE; Raymer, ML, "*Fundamental concepts of Bioinformatics*", Benjamin Cummings, 2003.
3. Baldi.P and Brunak.S, "*Bioinformatics*" Affiliated East-West Press, 2003.
4. David W Mount, "*Bioinformatics – Sequence and Genome Analysis*", Cold Spring Harbor Laboratory Press, 2001.
5. Mannhold.R, Kubinyi.H, Timmerman.H, (Editors) "*Bioinformatics – From Genomes to Drugs – Methods & Principles in medicinal chemistry*" Vol-14, Wiley-VCH, 2002.
6. Gerhardvogel.H, Wolgang.H, "*Drug Discovery& Evaluation. Pharmacological assays*" Springer, 2006.
7. Eric M. Gordon & James F.Kerwin (Editors), "*Combinatorial chemistry & Molecular Diversity in drug discovery*", Wiley, 1998.
8. Stuart M. Brown, *"Essentials of Medical Genomics"*, John Wiley & Sons, 2002.
9. Andreas D. Baxevanis & Francis Ouelette.B.F, "*Bioinformatics: A Practical Guide to the Analysis of Genes and Proteins"*, 2nd Edition" John Wiley & Sons, 2004.

BI1202 PRINCIPLES AND APPLICATIONS OF BIOINFORMATICS												
Course Designed by		**Department of Bioinformatics**										
1	Student Outcome	a	b	c	d	e	f	g	h	i	j	k
		x				x						
2	Mapping of instructional objectives with student outcome	1				2						
3	Category	General(G)		Basic Sciences (B)		Engineering Sciences and Technical Arts(E)		Professional Subjects(P)				
		--		--		--		x				
4	Broad Area	Biotechnology		Information Technology		Bioinformation Technology		Allied Bioinformatics				
		--		--		x		--				
5	Approval	23rd meeting of Academic Council, May 2013										

BI1203	BIOSIMULATIONS USING MATLAB	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite				
	Nil				

PURPOSE

To Build Biological models and perform simulation using MatLab Platform

INSTRUCTIONAL OBJECTIVES

1.	Simulation fundamentals and Principles
2.	MatLab fundamentals for Biosimualtions
3.	Simbiology operations for model building.
4.	Simulation Analysis.
5.	Enhanced simulation using various plugins

UNIT I - INTRODUCTION TO SIMULATION (9 hours)

Ensembles of Simulation: kinetic laws-Biological models-principles of Metabolic simulation.

UNIT II - MATLAB FOR SIMULATION (9 hours)

Matrices-Graphics in Matlab-Graph theory- Ode solvers-Stochastic simulation-Mcode.

UNIT III - SIMBIOLOGY (9 hours)

Model Building-Reaction Settings and parameterization-simulation settings and choice of solvers-plot analysis.

UNIT IV - ADVANCED SIMULATION AND ANALYSIS (9 hours)

Parameter scan: Parameter estimation-Sensitivity analysis-PK/PD Models-Population fit.

UNIT V - EXTENDED APPLICATIONS FOR SIMBIOLOGY (9 hours)

Metabolic pathway analysis: Extended plugin for simulation and analysis. Future applications of simulation and advantages of simulation.

TEXT BOOK

1. Alterovitz.G, Ramoni.M.F, *"Systems Bioinformatics: An Engineering Case-Based Approach"*, Artech House, 2007.

REFERENCES

1. Semmlow, *"Biosignal and Biomedical Image Processing",* Marcel Dekker, Inc., 2004.
2. Hoppensteadt, Peskin, "*Modeling and Simulation in Medicine and Life Sciences*", Springer, 2002.

BI1203 BIOSIMULATIONS USING MATLAB												
Course Designed by		Department of Bioinformatics										
1	Student Outcome	a	b	c	d	e	f	g	h	i	j	k
		x	x	x		x			x	x		x
2	Mapping of instructional objectives with student outcome	1	2	3		3			4	4		5
3	Category	General(G)		Basic Sciences(B)		Engineering Sciences and Technical Arts(E)			Professional Subjects (P)			
		--		--		--			x			
4	Broad Area	Biotechnology		Information Technology		Bioinformation Technology			Allied Bioinformatics			
		--		--		x			--			
5	Approval	23rd meeting of Academic Council, May 2013										

BI1204	DATA MINING IN BIOINFORMATICS	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite				
	Nil				

PURPOSE

Data Mining for Bioinformatics enables students to meet the challenge of mining vast amounts of biomolecular data to discover real knowledge. Covering theory, algorithms, and methodologies, as well as data mining technologies, with emphasis on data-intensive computations used in data mining applied to bioinformatics

INSTRUCTIONAL OBJECTIVES

1.	Integrated database
2.	Strategies in Data mining
3.	Clustering Techniques
4.	Classification techniques
5.	Validation and Benchmarking

UNIT I - BIOINFORMATICS AND DATABASE INTEGRATION (10 hours)

Introduction to Bioinformatics- HGP to functional Genomics a overview-Biological database classification-Knowledge discovery in database- data cleaning-Data integration-Data warehousing.

UNIT II - FEATURE SELECTION & EXTRACTION STRATEGIES IN DATA MINING (9 hours)

Data transformation-feature selection-Feature construction and Extraction-Feature interpretation. Normalization techniques: Data processing-Data analysis-Ontologies in Bioinformatics.

UNIT III - CLUSTERING TECHNIQUES IN BIOINFORMATICS (9 hours)

Clustering techniques: Methods-Application of Distance based methods-Clustering- K-Means-Hierarchical -Fuzzy clustering- Advanced Clustering techniques.

UNIT IV - CLASSIFICATION TECHNIQUES IN BIOINFORMATICS (8 hours)

Parameter scan- Parameter estimation-Sensitivity analysis-PK/PD Models-Population fit.

UNIT V - VALIDATION AND BENCHMARKING (9 hours)

Performance evaluation techniques-Performance measure- Cluster validation techniques-Validity indices.

TEXT BOOK

1. Sumeet Dua, *"Data Mining for Bioinformatics"*, Taylor & Francis Group, 2012.

REFERENCE

1. J.T.L.WangM.J.Zaki, "*Data Mining in Bioinformatics*" Springer, 2005.

BI1204 DATA MINING IN BIOINFORMATICS												
Course Designed by		**Department of Bioinformatics**										
1	Student Outcome	a	b	c	d	e	f	g	h	i	j	k
		x	x	x		x			x			x
2	Mapping of instructional objectives with student outcome	1	2	3		4			5			5
3	Category	General(G)		Basic Sciences (B)		Engineering Sciences and Technical Arts (E)			Professional Subjects (P)			
		--		--		--			--			
4	Broad Area	Biotechnology		Information Technology		Bioinformation Technology			Allied Bioinformatics			
		--		--		x			--			
5	Approval	23rd meeting of Academic Council, May 2013										

	BIOINFORMATICS FOR BIOENGINEERS	L	T	P	C
BI1205	Total Contact Hours - 45	3	0	0	3
	Prerequisite				
	Knowledge of Molecular Biology.				

PURPOSE

Introduce the bioengineers to the various concepts in bioinformatics and its utility in diverse fields of life and applied sciences.

INSTRUCTIONAL OBJECTIVES

1.	To gain knowledge about bioinformatics.
2.	To understand the principles and techniques available in bioinformatics.
3.	To apply the concepts of bioinformatics to explore the hidden information in the sequences.
4.	To understand the various applications of bioinformatics in related fields.

UNIT I - BIOLOGICAL DATABASES (10 hours)

Introduction to bioinformatics, Need for bioinformatics, Introduction to single letter code of amino acids, symbols used in nucleotides, Nucleotide databases, and Protein databases, Family databases; Genome and Metabolic Pathway database; Structure database. Difference between primary, secondary and composite databases.

UNIT II - SEQUENCE ANALYSIS (10 hours)

Analysis of protein and nucleic acid sequences, Local and Global Alignment, Indels, Edit Distance, Hamming Distance, Similarity, Identity and Homology, Dynamic Programming, Blast, Fasta and its types, Scoring Matrices PAM & BLOSUM Matrices; Difference between PAM and Blosum, Multiple sequence alignment – methods in multiple sequence alignment, Sum of pairs, Progressive, Iterative methods.

UNIT III - PHYLOGENY (9 hours)

Evolutionary analysis: distances - clustering methods – rooted and unrooted tree representation – distance based methods, Maximum Parsimony method, Maximum Likelihood method, Bootstrapping strategies. Tools for phylogeny analysis – Phylip, Paup.

UNIT IV - STRUCTURAL BIOINFORMATICS (8 hours)

Levels of Protein structure, Methods for Prediction of Secondary and Tertiary structures of Proteins, Evaluation of the predicted models; Molecular Mechanics force field, Energy Minimization; Methods for comparison of 3D structures of proteins, Tools for secondary and tertiary structure prediction.

UNIT V - DRUG DESIGNING **(8 hours)**

Introduction, Conventional drug design approaches, irrational vs. rational, various steps of drug design process- QSAR, Lipinski rule-pharmacokinetics and dynamics-ADME properties, Examples and uses of computer based drug discovery; pharmacophore and docking- scoring.

TEXT BOOKS

1. David W. Mount, *"Bioinformatics: Sequence and Genome Analysis"* Cold Spring Harbor Laboratory Press, 2001.
2. Andrew R. Leach, "*Molecular Modeling: Principles and Applications*" Prentice Hall, 2001.
3. Baldi.P and Brunak.S, *"Bioinformatics"* Affiliated East-West Press, 2003.

REFERENCES

1. Gautham, *"Bioinformatics"*, Narosa Publishing Company, 2006
2. Lesk.A.M, "*Introduction to Bioinformatics*" 1st Edition, Oxford University Press, 2002.
3. Westhead.D.R, Parish.J.H and Twyman.R.M, "*Instant Notes Series – Bioinformatics*" 1st Edition, Viva Books Private Limited, 2003.
4. Bernhard Haubold and Thomas Wiehe, "*Introduction to Computational Biology – An Evolutionary Approach*" Birkhauser Verlag, 2006.
5. Krane, DE; Raymer, ML, *"Fundamental concepts of Bioinformatics"*, Benjamin Cummings, 2003.
6. Wu-Pong Susanna, Rojanasakul, Youngyut, "*Biopharmaceutical Drug Design and Development, Molecular modeling – Principles and Applications*", Prentice Hall, 2008.
7. Mannhold.R, Kubinyi.H, Timmerman.H, (Editors) *"Bioinformatics – From Genomes to Drugs – Methods & Principles in Medicinal Chemistry"* Vol-14, Wiley-VCH, 2002.

BI1205 BIOINFORMATICS FOR BIOENGINEERS												
Course Designed by		**Department of Bioinformatics**										
1	Student Outcome	a	b	c	d	e	f	g	h	i	j	k
		x		x		x						
2	Mapping of instructional objectives with student outcome	1		3,4		2						
3	Category	General (G)		Basic Sciences (B)			Engineering Sciences and Technical Arts (E)				Professional Subjects (P)	
		--		--			--				x	
4	Broad Area	Biotechnology		Information Technology			Bioinformation Technology				Allied Bioinformatics	
		--		--			x				--	
5	Approval	23rd meeting of Academic Council, May 2013										

BM1201	**INTRODUCTION TO BIOMEDICAL DEVICES**	**L**	**T**	**P**	**C**
	Total contact hours - 45	**3**	**0**	**0**	**3**
	Prerequisite				
	Knowledge of Basic Electronic Devices, Physiological system				

PURPOSE

To gain basic knowledge about various physiological systems and to understand basic principles related to the working of different diagnostic, Therapeutic and imaging biomedical equipments.

INSTRUCTIONAL OBJECTIVES

1.	To gain adequate knowledge of electrical conduction system, nervous system and respiratory system.
2.	To understand the basic principle of different types of electrodes used for bio potential measurement and able to design bio-electrodes.
3.	To understand basic knowledge about the working of bio-potential recorders.
4.	To bring out the importance of imaging techniques used in day today life.
5.	To provide knowledge of medical diagnostic, assistive and therapeutic equipments.

UNIT I - BIOELECTRODES AND BIOCHEMICAL SENSORS (9 hours)

Physiological systems of body, Components of Medical Instrumentation System, Origin of Bio-potential: Action Potential, Nernst Equation, Goldman equation, Propagation of Action Potential, Bio Electrodes: Surface Electrodes, Micro Electrodes, Needle Electrodes, Biochemical Electrodes: pH, pO_2, pCO_2.

UNIT II - CARDIOVASCULAR SYSTEM AND MEASUREMENTS (9 hours)

Electrical conduction system of the heart, Cardiac cycle, Blood pressure measuring techniques, Blood flow measuring techniques, Real time ECG system, TMT machine, Cardiac output Measuring techniques, Characteristics and origin of heart sound, Phonocardiography

UNIT III - NERVOUS SYSTEM AND RESPIRATORY SYSTEM MEASUREMENTS (8 hours)

Physiology of nervous system, EEG wave types, 10-20 lead system, EEG recorder, Electromyography, Mechanism of respiration, Pulmonary Function Measurement, Spirometry, Respiratory Gas Analyzer

UNIT IV - ASSISTING AND THERPEUTIC EQUIPMENTS (10 hours)

Cardiac Pacemakers: internal and external types, Defibrillators, Ventilators and Anesthesia machine, Diathermy, Nerve and muscle stimulators, Heart – Lung machine, Haemo Dializers unit, Audio meters, Patient monitoring system

UNIT V - MEDICAL IMAGING SYSTEM AND BIOTELEMETRY (9 hours)

X-ray machine - Radio graphic and fluoroscopic techniques, Computer tomography, Gamma Camera, SPECT and PET, MRI, Ultrasonography, Endoscopy, Thermography, Biotelemetry systems

TEXT BOOKS

1. Khandpur.R.S, *"Hand-book of Biomedical Instrumentatio",* Tata McGraw Hill, 2nd Edition, 2003.
2. John G. Webster, "Medical *Instrumentation application and design*", John Wiley, 3rd Edition, 1997.
3. Carr, Joseph.J, Brown, John.M, *"Introduction to Biomedical equipment technology",* John Wiley and sons, New York, 4th Edition, 1997.

REFERENCES

1. Geddes.L.A and Baker.L.., "*Principles of Applied Biomedical Instrumentation",* John Wiley, 3rd Edition, 1975, Reprint 1989.
2. Stuart MacKay.R, "*Bio-Medical Telemetry: Sensing and Transmitting Biological Information from Animals and Man",* Wiley-IEEE Press, 2nd Edition, 1968.
3. Leslie Cromwell, Fred J. Weibell, Erich A. Pfeiffer, *"Biomedical Instrumentation and Measurements"*, Prentice Hall India, 2nd Edition, 1997.
4. Rajarao.C and Guha.S.K, *"Principles of Medical Electronics and Bio-medical Instrumentation",* Universities Press (India) Ltd, First Edition, Orient Longman Ltd, 2001.

BM1201 INTRODUCTION TO BIOMEDICAL DEVICES												
Course Designed by		Department of Biomedical Engineering										
1	Student Outcome	a	b	c	d	e	f	g	h	i	j	k
			x									x
2	Mapping of instructional objectives with student outcome		1-3									4,5
3	Category	General(G)		Basic Sciences (B)		Engineering Sciences and Technical Arts (E)				Professional Subjects(P)		
		--		--		--				x		
4	Broad Area	Biomedical Electronics Engg		Basics of Biomedical Engg		Biomedical Instrumentation Engg				Biomedical Imaging Engg		Health Care Engg
		--		--		x				--		--
5	Approval	23rd meeting of Academic Council, May 2013										

	INTRODUCTION TO BIOMECHANICS	L	T	P	C
BM1202	Total contact hours - 45	3	0	0	3
	Prerequisite:				
	Basic knowledge of joint movement of both extremities in human				

PURPOSE

To provide the knowledge of biomechanical concepts and their application to human movement

INSTRUCTIONAL OBJECTIVES

1.	To obtain the knowledge of how the principles of mechanics can be used to analyze human movement.
2.	To study about the bone structure and cartilage
3.	To study and analyze about the structure and functions of skeletal muscle
4.	To study and analyze the mechanics of upper extremity
5.	To study and analyze the mechanics of lower extremity

UNIT I - FUNDAMENTALS OF MECHANICS (9 hours)

Newton"s laws-mechanical behavior of bodies in contact, work, power and energy relationship - Angular kinematics of human movement-measuring angles, angular kinematic relationships –relationships between linear and angular motion - Angular kinetics of human movement-resistance to angular acceleration, angular momentum - Equilibrium and human movement-equilibrium, center of gravity, stability and balance - Kinematic concepts for human motion-forms of motion and joint movement terminology -basic concepts related to kinetics -mechanical loads on the human body .

UNIT II - BONE AND CARTILAGE (9 hours)

Bone structure & composition, blood circulation in bone - mechanical properties of bone, visco-elastic properties of bone, Elasticity and strength of bone - Maxwell & Voight models - visco-elastic properties of articular cartilage - Anisotropy and composite models for bone - Bone growth and development - Bone response to stress – Osteoporosis: Causes, diagnosis, and surgical treatment.

UNIT III - MECHANICS OF SKELETAL MUSCLE (9 hours)

Skeletal muscle: Structure, muscle fibers, types and its architecture, motor units- Sliding element theory- Function – Contraction- Hill"s three element model - Factors affecting muscular force generation - Muscular strength, power and endurance - Muscle injuries .

UNIT IV - MECHANICS OF UPPER EXTREMITY (9 hours)

Shoulder, Elbow, Wrist and Joint of Hand and Spine: Hip, Knee, Knee, and Foot: Structure, movement, and application of loads

UNIT V - MECHANICS OF LOWER EXTREMITY (9 hours)

Hip, Knee, Ankle, and Foot: Structure, movement, and application of loads

TEXT BOOKS

1. Fung.Y.C, "*Biomechanics: Mechanical Properties of Living Tissues*", Springer, 2nd edition, 1993.
2. Susan .J. Hall, "*Basic biomechanics*", Tata Mcgraw Hill, 4th edition, 2004.

REFERENCES

1. Webster.J.G, "*Medical instrumentation –Application & design*", John Wiley and sons Inc. 3rd ed. 2003.
2. Schneck.D.J and Bronzino.J.D, "*Biomechanics- Principles and Applications*", CRC Press, 2nd edition, 2000.
3. Duane Knudson, "*Fundamentals of Biomechanics*", Springer, 2nd edition, 2007

BM1202 INTRODUCTION TO BIOMECHANICS													
Course Designed by		Department of Biomedical Engineering											
1	Student Outcome	a	b	c	d	e	f	g	h	i	j	k	
		x								x		x	
2	Mapping of instructional objectives with student outcome	2								1		3-5	
3	Category	General (G)		Basic Sciences(B)		Engineering Sciences and Technical Arts (E)				Professional Subjects(P)			
		--		--		--				x			
4	Broad Area	Biomedical Electronics Engg		Basics of Biomedical Engg		Biomedical Instrumentation Engg				Biomedical Imaging Engg		Health Care Engg	
		--		--		--				--		x	
5	Approval	23rd meeting of Academic Council, May 2013											

BM1203	FUNDAMENTALS OF BIOSIGNAL PROCESSING	L	T	P	C
	Total contact hours - 45	3	0	0	3
	Prerequisite				
	Basic knowledge in signals and systems				
PURPOSE					
To learn the fundamental concepts of signal processing and to apply common signal processing techniques for various biomedical signals.					

INSTRUCTIONAL OBJECTIVES	
1.	To make them understand the fundamentals of origin of bio-signals
2.	To impart knowledge about normal and abnormal ECG characteristics
3.	To provide an in-depth knowledge about the basic concepts of EEG signal characteristics
4.	To study the characteristics of heart rate variability.
5.	To apply various signal processing techniques in analyzing the various Bio-signal

UNIT I - PHYSIOLOGICAL ORIGIN OF SIGNALS (9 hours)

Bioelectric signals- ECG, EEG, EP, EMG, ENG, ERG, EGG, Mechanical signals-PCG, pressure signal, Bio-acoustic signals-Auscultation, Korotkoff"s sound

UNIT II - NORMAL AND ABNORMAL ECG SIGNAL CHARACTERISTICS (9 hours)

ECG data acquisition, ECG lead system, ECG parameters and their estimation, ECG waveform analysis, Signal averaged ECG, Correlation analysis of ECG signals, Arrhythmia analysis and monitoring

UNIT III - HEART RATE VARIABILITY ANALYSIS (9 hours)

Physiology of Heart rate variability, clinical significance, Influences on HRV, quantifying HRV-time domain methods -frequency domain methods, Non linear HRV, pitfalls in understanding HRV, clinical implications of HRV.

UNIT IV - EEG SIGNAL CHARACTERISTICS (9 hours)

EEG signal and its characteristics, EEG analysis, data acquisition and classification of sleep states, EEG segmentation- periodogram, linear prediction method-Auto-regressive model.

UNIT V - ANALYSIS OF NONSTATIONARY SIGNALS (9 hours)

Analysis of speech signals, EMG analysis, Principle component analysis for random bio signals**,** Analysis of non stationary signals, Comparison of stationary and non stationary signals

TEXT BOOKS

1. Reddy.D.C, "*Biomedical Signal Processing:Priniciples and Techniques",* Tata McGraw-Hill, New Delhi,2nd edition ,2005.
2. Rangaraj.M.Rangayyan, "*Biomedical signal processing",* IEEE press, first edition*, 2002*

REFERENCES

1. Joseph.D.Bronzino, "*Biomedical Engineering Handbook"*, CRC Press, 3rd edition ,2005
2. http://www.biocomtech.com/hrv-science/heart-rate-variability-analysis

BM1203 FUNDAMENTALS OF BIOSIGNAL PROCESSING													
Course Designed by		Department of Biomedical Engineering											
1	Student Outcome	a	b	c	d	e	f	g	h	i	j	k	
		x				x							
2	Mapping of instructional objectives with student outcome	1-2				3-5							
3	Category	General(G)		Basic Sciences(B)		Engineering Sciences and Technical Arts (E)				Professional Subjects(P)			
		--		--		--				x			
4	Broad Area	Biomedical Electronics Engg		Basics of Biomedical Engg		Biomedical Instrumentation Engg				Biomedical Imaging Engg		Health Care Engg	
		--		--		--				x		--	
5	Approval	23rd meeting of Academic Council, May 2013											

BT1201	NEUROBIOLOGY	L	T	P	C
	Total No. of Contact Hours - 45	3	0	0	3
	Prerequisite				
	Nil				

PURPOSE

To provide basic understanding of the nervous system and its effects on physiological functions and behavior.

INSTRUCTIONAL OBJECTIVES

1.	To study the functioning of brain.
2.	Discuss the importance of brain in health and diseases, technology, etc..

UNIT I - INTRODUCTION TO NEUROSCIENCE (8 hours)

Introduction to Nervous system-Neurons and glia-Membrane potential - Action potential -Development of nervous system-Neurogenesis

UNIT II - NEUROCHEMICALS AND SENSORY NERVOUS SYSTEM (8 hours)

Divisions of the nervous system—Central and peripheral nervous systems-Neurotransmitters-Amino acids-Neuropeptides—Sensation and perception-Vision—Hearing and equilibrium--Taste and Smell-Body senses

UNIT III - NEURAL CONTROL OF MOVEMENT, MEMORY, AND LEARNING

(12 hours)

Movement—Anatomy and physiology of the neuromuscular junction—Nervous system control of movement—Basal Ganglia—Cerebellum—Motor neurons—Spinal reflexes-- Learning and Memory—Types of learning—Phases of memory formation—Anatomy and physiology of learning and memory

UNIT IV - NEUROENDOCRINE-IMMUNE NETWORK AND HOMEOSTASIS

(9 hours)

Emotions and reward systems—Neuroanatomy of emotions—Reward mechanisms—Neuroendocrine and Immune network—Hypothalamus and endocrine system—Role of hypothalamus in homeostasis: circadian rhythms, ingestion, temperature control, reproduction, stress response—Bidirectional communication between neuroendocrine system and immune system-its role in health and disease

UNIT V - NEURODEGENERATIVE DISEASES **(8 hours)**

Sleep and wakefulness—Arousal and wakefulness—Types and stages of sleep-sleep and memory—Diseases of injuries of the nervous system—Neuromuscular disorders-Basal ganglia disorders—Spinal cord injury—Traumatic brain injury—Stroke—Dementia

TEXT BOOK

1. Eric R. Kandel, James H. Schwartz, Thomas M. Jessell, "*Principles of Neural Science*," McGraw-Hill, 5th Edition, 2012.

REFERENCE

1. Robert Ader, "*Psychoneuroimmunology*," Academic Press; 4th edition, 2006.

BT1201 NEUROBIOLOGY													
Course Designed by		Department of Biotechnology											
1	Student Outcomes	a	b	c	d	e	f	g	H	i	j	k	
		x		x	x				x	x	x	x	
2	Mapping of instructional objectives with student outcomes	1		1	1,2				1	1,2	1	1,2	
3	Category	General(G)		Basic Sciences (B)		Engg. ci. & Tech. Arts (E)			Professional Subjects (P)				
		--		--		--			x				
4	Broad Area	Biotechnology		Bioprocess Engineering					Chemical Engineering				
		x		--					--				
5	Approval	23rd meeting of Academic Council, May 2013											

BT1202	IMMUNOTECHNOLOGY	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite				
	Nil				

PURPOSE

The course aims at imparting thorough knowledge in various immunologica techniques and immunodiagnostics.

INSTRUCTIONAL OBJECTIVES

1.	To strengthen the knowledge of students about immune system and how they fight against pathogens.
2.	To impart knowledge on the usage of various immunological techniques.

UNIT I - INTRODUCTION TO THE IMMUNE SYSTEM (10 hours)

Introduction to the Immune system – Basic concepts – Various components of the immune system – Innate immune response – Inflammatory response.Cellular and non-cellular components.Adaptive immunity.

UNIT II - IMMUNOLOGICAL TECHNIQUES (9 hours)

Antigen–Antibody reactions–Antibody as a tool-Diagnostic techniques-Immunoprecipitation –Immuno electrophoresis– immunoassays – radio immuno assay (RIA) Immunocytochemical techniques – ELISA- different types-Western Blot-Immunofluorescence –Flowcytometry.

UNIT III - PRODUCTION AND APPLICATION OF ANTIBODIES (9 hours)

Types of antigens their structure, preparation of antigens for raising antibodies, handling of animals, adjuvants and their mode of action. Production of Monoclonal and polyclonal antibodies vaccines-types and applications.

UNIT IV - ASSESSMENT OF CELL MEDIATED IMMUNITY (9 hours)

Identification of lymphocytes and their subsets in blood-T Cell activation parameters, stimulation of cytokines, macrophages activation.and functional studies-Preparation and storage of tissues identification of virus cell types and antigens in tissues, isolation and characterization of cell types from inflammatory sites and infected tissues.

UNIT V - MOLECULAR IMMUNOLOGY (8 hours)

Application of recombinant DNA technology for the production of anti-idiotypic antibodies catalytic antibodies- humanization of antibodies and genetically engineered antibodies-Applications of immunotherapy.

TEXT BOOKS

1. Chakravarty.A.K, "*Immunology and Immunotechnology"* Oxford University Press, 2006.
2. Talwar.G.P and Gupta.S.K, "*A hand book of practical and clinical immunology*" Vol 12 CBS Publication 1992.

REFERENCES

1. Weir.D.M, "*Practical Immunology*"Blackwell Scientific publication Oxford 1990.
2. Austin.J.M and Wood K.J. "*Principles of cellular and molecular immunology*" Oxford University press 1991.
3. Janeway, Travers, Walport, Shlomchik "*Immunobiology"* 7th Edition,, Garland, 2005.
4. Peterwood, "*Understanding Immunology"*, 2nd Edition, Pearson Education Ltd, 2006.

BT1202 IMMUNOTECHNOLOGY												
Course Designed by		Department of Biotechnology										
1	Student Outcome	a	b	c	d	e	f	g	h	i	j	k
		x		x	x				x	x	x	
2	Mapping of instructional objectives with student outcome	1		2	2				1	2	1	
3	Category	General (G)		Basic Sciences(B)		Engineering Sciences and Technical Arts(E)		Professional Subjects(P)				
		--		--		--		x				
4	Broad Area	Biotechnology		Bioprocess Engineering		Chemical Engineering						
		x		--		--		--				
5	Approval	23rd meeting of Academic Council, May 2013										

BT1203	TISSUE ENGINEERING	L	T	P	C
	Total No. of Contact Hours – 45 hrs	3	0	0	3
	Prerequisite				
	Nil				

PURPOSE

To provide the scientific basis for understanding of the interactions of cells with biomaterials employed for the fabrication of implants for tissue engineering.

INSTRUCTIONAL OBJECTIVES

1.	To familiarize the students with the basic concepts and principles of utilization of biomaterials and cells for tissue engineering
2.	To understand the different strategies of preparation of scaffolds and their applications in tissue engineering

UNIT I - CELL AND TISSUE BIOLOGY **(9 hours)**

Cell and tissue definitions, Basic principles, Structure-function relationships, Stem cells, Basic principles, Adult and embryonic stem cells.

UNIT II - BIOMATERIALS **(9 hours)**

Introduction to synthetic polymers, Biodegradable materials vs permanent materials, Natural biopolymers, Metals, Ceramics, Mechanical properties of biomaterials, Surface modification and characterization, Immune response to biomaterials, *In vitro* biocompatibility, *In vitro* protein adsorption.

UNIT III - EXTRACELLULAR MATRIX (ECM) **(9 hours)**

Introduction to Cell Adhesion and Biomaterials, ECM and Functional Integration of Implanted Materials, Basement Membranes and Focal Adhesions, Focal Adhesions as Signaling Complexes.

UNIT IV - SCAFFOLD DESIGN AND FABRICATION **(9 hours)**

Scaffold design and fabrication, Natural and Synthetic Polymers for Scaffold Fabrication, Scaffold Design Properties.Principles of cell migration, 3D organization and angiogenesis. Introduction to Bioreactors in Tissue Engineering.

UNIT V - CLINICAL IMPLEMENTATION **(9 hours)**

Tissue Engineering of Skin, Bone Tissue Engineering, Cartilage Tissue Engineering, Neuronal Tissue Engineering, Cardiovascular Tissue Engineering.

TEXT BOOKS

1. Palsson, Bernhard and Sangeeta.N, "*Tissue Engineering*," Prentice Hall, 2003.
2. Clemens van Blitterswijk, "*Tissue Engineering*," Academic Press, 2008.

BT1203 TISSUE ENGINEERING												
Course Designed by		**Department of Biotechnology**										
1	Student Outcome	a	b	c	d	e	f	g	h	i	j	k
			x		x							
2	Mapping of instructional objectives with student outcome		1-2		1-2							
3	Category	General (G)		Basic Sciences(B)		Engineering Sciences and Technical Arts (E)					Professional Subjects (P)	
		--		--		--					x	
4	Broad Area	Biotechnology		Bioprocess Engineering		Chemical Engineering						
		x		--		--					--	
5	Approval	23rd meeting of Academic Council, May 2013										

BT1204	MARINE-BASED PHARMACEUTICALS	L	T	P	C
	Total No. of Contact Hours – 45	3	0	0	3
	Prerequisite				
	Nil				

PURPOSE

To provide an adequate knowledge of marine, resources, toxins, drugs and the clinical status of marine drugs.

INSTRUCTIONAL OBJECTIVES

1.	To understand the marine natural resources and its potential status.
2.	To gain information about the methods of isolation of bioactive metabolites and their applications.
3.	To know the clinical status of the drugs and their patents.

UNIT I - PROPERTIES OF MARINE ENVIRONMENT (9 hours)

World oceans and seas – physical, chemical and biological properties. **Important marine sources** – fishes, crustaceans and mollusks.

UNIT II - POTENTIAL NATURE OF SOURCES (9 hours)

Potential marine plants and microbes - seaweeds, mangroves, cyanobacteria and actinomycetes.

UNIT III - BIOACTIVE METABOLITES (10 hours)

Neurotoxins, bioactive proteins, glycosaminoglycans, agar-agar, fatty acids and enzymes – sources, effects and applications.

UNIT IV - METHODS OF ELUCIDATION OF MEDICINALLY IMPORTANT COMPOUNDS (9 hours)

Bioactive peptides – Carotenoids - Biochemical assays for identification – Chromatographic based purification – ion exchange, gel filtration – Structure elucidation – MS/MS, NMR. Toxicological measurement of drugs – LD_{50}.

UNIT V - CLINICAL STATUS AND PATENTS OF MARINE DRUGS (8 hours)

Current status of the marine drugs and their clinical phase trials – Current medically important marine drugs and their applications - Patents and recognition for the marine drugs.

TEXT BOOKS

1. Milton Fingerman and Rachakonda Nagabhushanam, "*Recent Advances in Marine Biotechnology (Series) Biomaterials and Bioprocessing"*, Science Publishers, 2009.
2. Proksch and Werner E.G.Muller, "*Frontiers in Marine Biotechnology",* Horizon Bioscience, 2006.
3. Le Gal.Y, Ulber.R, *Marine Biotechnology I: "Advances in Biochemical Engineering/Biotechnology",* (Series editor: T. Scheper), Springer-Verlag Berlin Heidelberg. Vol. 96, 2005.
4. Le Gal.Y, Ulber.R, "*Marine Biotechnology II: Advances in Biochemical Engineering/Biotechnology",* (Series editor: T. Scheper), Springer-Verlag Berlin Heidelberg. Vol. 97, 2005.

REFERENCES

1. Attaway.D.H and Zaborsky.O.R, (eds). "*Marine Biotechnology: Volume I, Pharmaceuticals and Bioactive Natural Products"*, New York: Plenum. 1993.
2. Powers.D.A, "*New frontiers in marine biotechnology: Opportunities for the 21st century." In: Marine Biotechnology in the Asian Pacific Region,* (Eds). Lundin.C.G and Zilinskas.R. A. The World Bank and SIDA. Stockholm. 1995.

BT1204 MARINE-BASED PHARMACEUTICALS												
Course Designed by		**Department of Biotechnology**										
1	Student Outcome	a	b	c	d	e	f	g	h	i	j	k
							x		x		x	
2	Mapping of instructional objectives with student outcome						1		2		3	
3	Category	General(G)		Basic Sciences(B)			Engineering Sciences and Technical Arts (E)				Professional Subjects(P)	
		--		--			--				x	
4	Broad Area	Biotechnology		Bioprocess Engineering			Chemical Engineering					
		x		--			--				--	
5	Approval	23rd meeting of Academic Council, May 2013										

BT1205	**BIOREFINERY**	**L**	**T**	**P**	**C**
	Total No. of Contact Hours - 45	**3**	**0**	**0**	**3**
	Prerequisite				
	Nil				

PURPOSE

The purpose of this course is to provide an understanding of fundamental concepts in understanding biofuel/bioenergy; renewable feedstocks, their production, availability and attributes for biofuel/bioenergy production.

INSTRUCTIONAL OBJECTIVES	
1.	To provide a thorough understanding of various renewable feedstocks of importance their availability and attributes for biofuels production.
2.	To provide a thorough understanding of the broad concept of second and third generation biofuel product ion from biomass and other low-cost agri-residues and biowastes.
3.	To provide students with tools and knowledge necessary for biofuel facility operations.
4.	To teach our students to analyze and design processes for biofuel production.

UNIT I - CHEMISTRY & BIOCHEMISTRY OF BIOMASS (9 hours)

Types of biomass (e.g. wood waste, forestry residues, agricultural residues, perennial annual crops, organic municipal solid waste). Composition of lignocellulose (lignin, hemicellulose, cellulose); energy crops; chemical pretreatment; enzymatic pretreatment; degradation of cellulose; trichoderma cellulases; bacterial cellulases; and comparison with degradation of high starch crops.

UNIT II - BIODIESEL (9 hours)

Sources and processing of biodiesel (fatty acid methyl ester); nature of lipids, especially fatty acids and triglycerides. Sources and characteristics of lipids for use as biodiesel feedstock; and conversion of feedstock into biodisel (transesterification). Use of vegetable oil (SVO) and waste vegetable oil (WVO). Engineering, economics and environmental issues of biodisel; major policies and regulations pertaining to the production, distribution, and use of biodiesel.

UNIT III - BIOMETHANE (9 hours)

Biomethane or biogas; Hydrolysis; anaerobic digestion; methanogenesis (acetoclastic, hydrogenotrophic), rates of methane formation; and one and two stage fermentation.Thermal depolymerization. Use of exhaust gases (e.g. CO_2, H_2S and H_2) from geothermal power plants and industrial operations (e.g. coal and oil refineries) as an energy source (methane and hydrogen). Integration of biomass technologies (generation of methane and hydrogen) with fuel cells.

UNIT IV - GASIFICATION & PYROLYSIS TECHNOLOGIES (9 hours)

Gasification processes and the main types of gasifier designs; production of electricity by combining a gasifier with a gas turbine or fuel cell. Combined-cycle electricity generation with gas and steam turbines, and generation of heat and steam for district heating systems or CHP, including Kalina Cycle. Production of

synthesis gas (i.e. CO, H_2, H_2O, CO_2, tar vapor and ash particles) for subsequent conversion to hydrogen and transport fuels; advanced gas cleaning technologies for biomass. Biological conversion of syngas into liquid biofuels. Fast pyrolysis technology to produce liquid bio-oil or pyrolysis oil (synthetic oil) from biomass, refined to produce a range of fuels, chemicals, and fertilizers; biorefineries, and new uses for glycerine in biorefineries.

UNIT V - POLICIES AND FUTURE R&D OF BIOFUELS & BIOENERGY (9 hours)

Analysis of both current and future EU regulations and directives on biofuels and bioenergy.Tax regulations.Evaluation of different production alternatives to produce bioenergy; competitiveness of bioenergy alternatives in agriculture compared to other energy sources.Evaluation of current and future R&D needs; legal framework to support sustainable development and increased use of biofuels; government policies and programs with regard to biofuels and investment opportunities worldwide.

TEXT BOOKS

1. Robert C. Brown, "*Biorenewable Resources: Engineering*," New Products from Agriculture, Wiley-Blackwell Publishing, 2003
2. Samir K. Khanal, "*Anaerobic Biotechnology for Bioenergy Production: Principles and Applications*," Wiley-Blackwell Publishing 2008

REFERENCE

1. Martin Kaltschmitt; Hermann Hofbauer. "*Biomass Conversion and Biorefinery*," Springer Publishing, 2008.

<table>
<tr><th colspan="14">BT1205 BIOREFINERY</th></tr>
<tr><th colspan="2">Course Designed by</th><th colspan="12">Department of Biotechnology</th></tr>
<tr><td rowspan="2">1</td><td rowspan="2">Student Outcomes</td><td>a</td><td>b</td><td>c</td><td>d</td><td>e</td><td>f</td><td>g</td><td>h</td><td>i</td><td>j</td><td>k</td></tr>
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<tr><td>2</td><td>Mapping of instructional objectives with student outcomes</td><td>1</td><td></td><td>4</td><td></td><td>2</td><td></td><td></td><td></td><td></td><td></td><td>3</td></tr>
<tr><td rowspan="2">3</td><td rowspan="2">Category</td><td colspan="3">General (G)</td><td colspan="2">Basic Sciences (B)</td><td colspan="4">Engg. Sci. & Tech. Arts (E)</td><td colspan="2">Professional Subjects (P)</td></tr>
<tr><td colspan="3">--</td><td colspan="2">--</td><td colspan="4">--</td><td colspan="2">x</td></tr>
<tr><td rowspan="2">4</td><td rowspan="2">Broad Area</td><td colspan="3">Biotechnology</td><td colspan="2">Bioprocess Engineering</td><td colspan="6">Chemical Engineering</td></tr>
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<tr><td>5</td><td>Approval</td><td colspan="12">23rd meeting of Academic Council, May 2013</td></tr>
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BT1206	COMPREHENSIVE BIOPROCESS ENGINEERING	L	T	P	C
	Total No. of Contact Hours - 45	3	0	0	3
	Prerequisite				
	Nil				

PURPOSE

This subject puts emphasis on the basic engineering principles of bioprocess and operation of the bioreactor. It also highlights the application of biotechnological process in industries and waste treatment

INSTRUCTIONAL OBJECTIVES

1.	To familiarize the basic concepts of industrial bioprocess engineering such as upstream process, design and operation of the bioreactor
2.	To reveal the techniques of product recovery and purification for commercialization of the bioproduct, and also to analyze the cost involved in the process
3.	To know the fundamentals of modeling and simulation of bioprocess and also the application of biotechnology in industrial production of bio products

UNIT I - INTRODUCTION TO BIOPROCESS (8 hours)

Classification of fermentation process, generalized flow sheet for industrial fermentation process – Inoculum development, Media design and optimization, Sterilization of media, Basic design and construction of Bioreactor and its ancillaries, Types of fermentor, Market economics related to fermentation process.

UNIT II - SCALE UPAND MONITORING OF FERMENTATION OF PROCESS (9 hours)

Scale up criteria for bioreactors – On line data analysis for measurement of important physio chemical and biochemical parameters, Methods of online and offline biomass estimation, microbial calorimetry, Flow Injection Analysis for measurement of substrate, products and other metabolites.

UNIT III - RECOVERY AND PURIFICATION OF PRODUCTS (9 hours)

Role and importance of bioseparation process, Strategies to recover and purify products, Separation of insoluble products, Cell disruption methods, Separation of soluble products, finishing steps for purification.

UNIT IV - MODELLING AND SIMULATION OF BIOPROCESSES (9 hours)

Study of structured and unstructured models for analysis of various bioprocesses- Monod's model, Leudeking – Piret model, Model simulation using MATLAB – SIMULINK and ISIM software packages.

UNIT V - APPLICATIONS OF FERMENTATION PROCESSES (10 hours)

Biological waste treatment: An example of the industrial utilization of mixed cultures, Biological conversion of wastes to products – Production Single Cell Protein, Anaerobic processes – Industrial production of ethanol, Lactic acid, Acetone – Butanol, Aerobic processes – Industrial production of Citric acid, Baker's yeast, Penicillin, High Fructose Corn Syrup.

TEXT BOOKS

1. Michael L. Shuler and Fikret Kargi, "*Bioprocess Engineering Basic concepts*", Prentice Hall, 1992.
2. Pauline.M.Doran, "*Bioprocess Engineering Principles*", Academic Press, 2003.
3. Scragg, "*Bioreactors in Biotechnology*", Ellis Horwood series, 1991.

REFERENCES

1. Peter F.Stanbury, Allan Whitaker, "*Principles of Fermentation Technology*" Prentice -Hall, 2003.
2. Ghasem D. Najafpour, "*Biochemial Engineering and Biotechnology*" Elsevier, 2011.

BT1206 COMPREHENSIVE BIOPROCESS ENGINEERING												
	Course Designed by	**Department of Biotechnology**										
1	Student Outcomes	a	b	c	d	e	f	g	h	i	j	k
			x	x								x
2	Mapping of instructional objectives with student outcomes		2	1								3
3	Category	General(G)		Basic Sciences(B)			Engg. Sci. & Tech. Arts (E)			Professional Subjects (P)		
		--		--			--			x		
4	Broad Area	Biotechnology		Bioprocess Engineering			Chemical Engineering					
		--		x			--			--		
5	Approval	23rd meeting of Academic Council, May 2013										

BT1207	**ACTIVATED CARBON TECHNOLOGY**	**L**	**T**	**P**	**C**
	Total No. of Contact Hours – 45	**3**	**0**	**0**	**3**
	Prerequisite				
	Nil				

PURPOSE

The purpose of this course is to provide an understanding of fundamental concepts and underlying principles in adsorption. In addition, the course is expected to develop the adsorption technical skill in students, to enable them to interpret the adsorption principles in environmental engineering.

INSTRUCTIONAL OBJECTIVES	
1.	To describe and analyze the adsorption principles.
2.	To understand the kinetics of the adsorption
3.	To carry out the technical evaluation of alternative adsorption processes and present the solution of adsorption problems
4.	To search for, compile and critically analyze the technical informations on adsorption processes and materials used
5.	To provide experience in various industries adopting adsorption process

UNIT I - ADSORBENTS (9 hours)

Adsorbents - Types – materials- Adsorption enthalpy-Characteristics and general requirements. Isotherms - Linear, Freundlich, Langmuir, BET -Silica gel- Zeolites - Activated carbon-Properties-Characterisation.

UNIT II - ADSORPTION PROCESS (9 hours)

Adsorption processes, causes and types of adsorption, influencing factors, adsorption equilibrium and development of adsorption isotherms, activated carbon adsorption kinetics, analysis and design of GAC and PAC contactors.

UNIT III - DESIGN OF ADSORPTION COLUMNS (9 hours)

Adsorption, adsorbents, batch adsorption, design of fixed-bed adsorption columns- kinetic studies - scale-up laboratory adsorption column.

UNIT IV - GAS AND LIQUID PHASE ADSORPTION (9 hours)

Theory and applications of the physical and chemical processes of sorption, and absorption in both gas-phase and liquid-phase environmental engineering systems.

UNIT V - APPLICATION AND CASE STUDIES (9 hours)

Application of activated adsorption technnology- Industrial applications and Case studies.

TEXT BOOKS

1. Douglas M. Ruthven, "*Principles of Adsorption and Adsorption Processes*", Wiley, 1984
2. Jean Rouquerol, Francoise Rouquerol, Kenneth S.W.Sing, "*Adsorption by Powders and Porous Solids: Principles, Methodology and Applications*", Academic Press, 1998

REFERENCES

1. Richard I. Masel, "*Principles of Adsorption and Reaction on Solid Surfaces",* Wiley, 1996
2. Diran Basmadjian, "*The Little Adsorption Book: A Practical Guide for Engineers and Scientists,"* CRC Press, 1996
3. Jacques Fraissard, "*Physical Adsorption: Experiment, Theory, and Applications*", Springer, 1997
4. McCabe.W.L, Smith.J.C and Harriott.P, "*Unit Operations of Chemical Engineering"*, McGraw-Hill, 1993.

BT1207 ACTIVATED CARBON TECHNOLOGY												
Course Designed by		**Department of Biotechnology**										
1	Student Outcomes	a	b	c	d	e	f	g	h	i	j	k
			x		x	x			x			x
2	Mapping of instructional objectives with student outcomes		1		5	2			3			4
3	Category	General(G)			Basic Sciences (B)			Engg. Sci. & Tech. Arts (E)			Professional Subjects (P)	
		--			--			--			x	
4	Broad Area	Biotechnology			Bioprocess Engineering						Chemical Engineering	
		x			--						--	
5	Approval	23rd meeting of Academic Council, May 2013										

CE1202	**DIGITAL IMAGE PROCESSING**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	**3**	**0**	**0**	**3**
	Prerequisite				
	Nil				

PURPOSE

The purpose of this course is to describe about the procedure of digital image data acquisition, processing and analysis

INSTRUCTIONAL OBJECTIVES

1.	To understand the digital image models and digital image data products
2.	To study the fundamentals of Digital image Processing
3.	To study the digital image segmentation and edge detection
4.	To study and understand the image file formats and Image compression
5.	To study and apply the digital image processing for pattern recognition

UNIT I - INTRODUCTION (9 hours)

Digital image representation – image models, image types, image quality – colour models- Image acquisition – image sampling and quantization – pixel relationships – satellite image processing.

UNIT II - BASIC DIGITAL IMAGE PROCESSING (9 hours)

Fundamental steps in Digital Image Processing – grey level transformation – Histogram equalization – multi image operation – spatially dependant Transformation – templates and convolution – Transformation – Image enhancement techniques – image restoration.

UNIT III - SEGMENTATION AND EDGE DETECTION (9 hours)

Introduction - Region operations – Basic Edge Detection – second order Detection – Pyramid Edge Detection – Crack Edge Detection – Edge Following – Thresholding – Morphological operations

UNIT IV - IMAGE COMPRESSION (9 hours)

Introduction – Principle of compression – Types of compression – Runlength Encoding – Huffman Coding – Modified Huffman Coding – Modified READ – LZW – Arithmatic Coding – JPEG – Other State-of-the-Art Image Compression – Image Compression Standard Fie Formats.

UNIT V - PATTERN RECOGNITION (9 hours)

Introduction, System Component, Complexity of Pattern Recognition, Object Representation, Feature Detection, Recognition Strategies – Classification, Matching, Feature Indexing. Verification – Template matching, Morphological Approach, Symbolic, Analogical Methods. Digital Image Processing Software – MATLAB, EASI/PACE, ERDAS Imagine.

TEXT BOOKS

1. Rafael C. Gonzalez, Richard.E, "*Digital Image Processing (3rd Edition")* Woods Prentice Hall, 2007.
2. Anji Reddy.M, Hari Shankar.Y, "*Textbook of Digital Image Processing",* BS Publications, 2006.

REFERENCES

1. Robert Shcowebgerdt , "*Remote sensing models & methods for image processing"*, III edition, 2004.
2. W.G.Rees – "*Physical Principles of Remote Sensing"*, Cambridge University Press, 2nd edition, 2001.

3. John A.Richards, Springer –"*Verlag, Remate Sensing Digital Image Analysis* "1999.
4. John R. Jensen, "*Introductory Digital Image Processing: A Remote Sensing Perspective* ", 2nd Edition, 1995.
5. Thomas M Lillesand and Kiefer.R.W, "*Remote sensing and Image interpretation* "John Wiley & Publications 2000.

CE1202 DIGITAL IMAGE PROCESSING												
Course Designed by		Department of Civil Engineering										
1	Student Outcome	a	b	c	d	e	f	g	h	i	j	k
		x		x		x						
2	Mapping of instructional objectives with student outcome	1-5		1-5		1-5						
3	Category	General(G)		Basic Sciences(B)		Engineering Sciences and Technical Arts (E)				Professional Subjects(P)		
		--		--		--				x		
4	Broad Area	Structural Engineering		Geotechnical Engineering		Water Resources Engineering				Geomatics Engineering		
		--		--		--				x		
5	Approval	23rd meeting of Academic Council, May 2013										

CE1203	SOIL CHEMISTRY AND ITS IMPACT	L	T	P	C
	Total contact hours - 45	3	0	0	3
	Prerequisite				
	NIL				

PURPOSE

To impart a sound knowledge on the principles of chemistry involving the different application oriented topics required for all engineering branches.

INSTRUCTIONAL OBJECTIVES

1.	To identify soil deposits and clay minerals.
2.	To understand interaction between soil and pollutant movement in the ground.
3.	The role of applied soil chemistry the field of engineering

UNIT I - INTRODUCTION TO SOIL, SOIL DEPOSITS AND CLAY MINERALS **(9 hours)**

Introduction - Major mineral groups in earth's crust, sediments and clays – formation of soils – various soil deposits– classification and identification – Anion and Cation exchange capacity of clays – specific surface area – bonding in clays.

UNIT II - SOIL INTERACTION WITH POLLUTANTS (9 hours)

Introduction to Geo environmental engineering – environmental cycle – sources, production and classification of waste – causes of soil pollution – factors governing soil-pollutant interaction – failures of foundations due to pollutants – case studies.

UNIT III - PHYSICAL AND PHYSIO-CHEMICAL BEHAVIOUR OF SOILS (9 hours)

Physical and physio – chemical behaviour of soils –effect of ion concentration, ionic valency, dielectric constant, temperature on double layer – stern layer – attractive and repulsive forces in clays – soil structure – soil water – mechanism of soil – water interactions.

UNIT IV - SOIL STRUCTURE (9 hours)

Water and air in soil , inorganic components of soil, organic matter and major organic compounds in soil - Weathering- physical aspect and chemical weathering (reactions involved in general) - Soil structure in clay - volume change behavior of soils-problems associated-factors influencing volume change.

UNIT V - APPLIED SOIL CHEMISTRY (9 hours)

Soil acidity – saline soil chemistry – application of soil chemistry to chemical transport process – sorption and process – soil microbe – using soil chemistry principle in other fields.

TEXT BOOK

1. Mitchell.J.K," *Fundamentals of Soil Behaviour"*, John Wiley, New York, 1993.

REFERENCES

1. Yong.R.N and Warkentin.B.P, "*Introduction to Soil Behaviour"*, Macmillan, Limited, London, 1979.
2. Grim.R.E, "*Applied Clay Mineralogy"*, McGraw Hill, New York, 1966.
3. Lambe.T.W and Whitman.R.V, "*Soil Mechanics"*, John Wiley and Sons, New York, 1979.
4. Hesse.R.P, "*A textbook of soil chemical Analysis"*, CBS publishers & distribution, shahdara, delhi, 1994.
5. Manahan. S.E, "*Environmental Chemistry*", CRC press. 7th Edition 2000.

CE1203 SOIL CHEMISTRY AND ITS IMPACT												
Course Designed by		Department of Civil Engineering										
1	Student outcome	a	b	c	d	e	f	g	h	i	j	k
		x				x						x
2	Mapping of instructional objectives with student outcome	1,2,3				1,2,3						2,3
3	Category	General (G)			Basic Sciences (B)		Engineering Sciences and Technical Arts (E)				Professional Subjects (P)	
		--			--		--				x	
4	Broad area	Structural Engineering			Geotechnical Engineering		Water Resources Engineering				Geomatics Engineering	
		--			x		--				--	
5	Approval	23rd Meeting of Academic Council, May 2013										

CE1204	WATER POLLUTION AND ITS MANAGEMENT	L	T	P	C
	Total Contact Hours- 45	3	0	0	3
	Prerequisite				
	Nil				

PURPOSE

To learn the fundamental concepts in the field of water pollution and its management

INSTRUCTIONAL OBJECTIVES

1.	To know the basics, importance of Water Pollution
2.	To study the various Effects of Water pollution
3.	To learn the importance of methods of control of Water Pollution
4.	To understand the various Water Pollution control Act

UNIT I - SOURCES & CHARACTERISTICS OF WATER POLLUTION (9 hours)

Water pollution-Sources & types of water pollution –Physical, chemical & biological –Effect of waterpollution.Drinking water quality standards waste Water treatment –Primary, secondary, tertiar-water pollution prevention & control act – 1974.

UNIT II - W ATER QUALITY & STANDARDS (9 hours)

Quality of surface waters, Water quality in flowing waters, Water quality in impoundedwaters, Groundwater quality, Water quality standard Microbiological quality ofdrinking water, and d Chemical quality of drinking water

UNIT III - INDUSTRIAL ACTIVITY & MITIGATION MEASURES (9 hours)

Role of water in different industries-Effluent discharge characteristics-Discharge Standards for Rivers and Streams-Role of stakeholders,Public NGOS,Government

in Protection of Water bodies-Control Measures-Mitigation Measures for Industrial Water Contamination due to industries.

UNIT IV - WATER POLLUTION REGULATIONS (9 hours)

Administrative regulation under recent legislations in water pollution control. Water (Prevention & control of pollution) Act 1974 as amended by Amendment Act 1988. Water (Prevention & control of pollution) Rules 1975 Water (Prevention & control of pollution) Cess Act. 1977 as amended by Amendment Act 1991.

UNIT V - ROLE OF REGULATORY BOARDS (9 hours)

Sustainable Development,Rain Water Harvesting-Methods-Water Pollution-Causes and Effects-Role of Regulatory bodies and Local bodies-CPCB-TWAD Board – CMWSSB etc-Case Studies related to Effective Water Management.

TEXT BOOK

1. Fair.G.M, "*Water and Waste water engineering Vol.I & II"* .John Wiley and sons, Newyork. 2010.

REFERENCES

1. Metcalf & Eddy, "*Wastewater engineering, Treatment and Reuse"*, Tata MacGrawhill publications, 2008.
2. Eckenfelder, W.W., ""*Industrial Water Pollution Control*", McGraw-Hill, 2009.
3. Arceivala.S.J, "*Wastewater Treatment for Pollution Control*", Tata McGraw-Hill, 2008.
4. ***"Aruna Venkat Environmental Law and Policy"*,** PHI learning private limited New Delhi, 2011.
5. Water Management In India,"*Concept Publishing Company"*, New Delhi, 2004.

CE1204 WATER POLLUTION AND ITS MANAGEMENT												
Course Designed by		Department of Civil Engineering										
1	Student outcome	a	b	c	d	e	f	g	h	i	j	k
		x		x		x						
2	Mapping of instructional objectives with student outcome	1-4		1-4		1-4						
3	Category	General (G)		Basic Sciences (B)		Engineering Sciences and Technical Arts (E)				Professional Subjects (P)		
		--		--		--				x		
4	Broad area	Structural Engineering		Geotechnical Engineering		Water Resources Engineering				Geomatics Engineering		
		-		--		x				--		
5	Approval	23rd meeting of Academic Council, May 2013										

CE1205	GLOBAL WARMING AND CLIMATE CHANGE	L	T	P	C
	Total Contact Hours- 45	3	0	0	3
	Prerequisite				
	Nil				

PURPOSE	
To learn about the global warming and climate change.	
INSTRUCTIONAL OBJECTIVES	
1.	To know the basics, importance of global warming
2.	To know the concept of mitigation measures against global warming

UNIT I - EARTH'S CLIMATE SYSTEM (9 hours)

Role of ozone in environment-ozone layer-ozone depleting gases-Green House Effect, Radiative Effects of Greenhouse Gases-The Hydrological Cycle-Green House Gases and Global Warming – Carbon Cycle.

UNIT II - ATMOSPHERE AND ITS COMPONENTS (9 hours)

Importance of Atmosphere-Physical Chemical Charcterestics of Atmosphere-Vertical structure of the atmosphere-Composition of the atmosphere-Atmospheric stability-Temperature profile of the atmosphere-Lapse rates-Temperature inversion-effects of inversion on pollution dispersion.

UNIT III - IMPACTS OF CLIMATE CHANGE (9 hours)

Causes of Clmate change : Change of Temperature in the environmen-Melting of ice Pole-sea level rise-Impacts of Climate Change on various sectors – Agriculture, Forestry and Ecosystem – Water Resources – Human Health – Industry, Settlement and Society – Methods and Scenarios – Projected Impacts for Different Regions– Uncertainties in the Projected Impacts of Climate Change – Risk of Irreversible Changes.

UNIT IV - OBSERVED CHANGES AND ITS CAUSES (9 hours)

Climate change and Carbon credits- CDM- Initiatives in India-Kyoto Protocol-Intergovernmental Panel on Climate change- Climate Sensitivity and Feedbacks – The Montreal Protocol – UNFCCC – IPCC –Evidences of Changes in Climate and Environment – on a Global Scale and in India .

UNIT V - CLIMATE CHANGE AND MITIGATION MEASURES (9 hours)

Clean Development Mechanism –Carbon Trading- examples of future Clean Technology – Biodiesel – Natural Compost – Eco- Friendly Plastic – Alternate Energy – Hydrogen – Bio-fuels – Solar Energy – Wind – Hydroelectric Power – Mitigation Efforts in India and Adaptation funding.Key Mitigation Technologies and

Practices – Energy Supply – Transport – Buildings – Industry – Agriculture – Forestry - Carbon sequestration – Carbon capture and storage (CCS)- Waste (MSW & Bio waste, Biomedical, Industrial waste – International and Regional cooperation.

TEXT BOOK

1. Dash Sushil Kumar, "*Climate Change – An Indian Perspective*", Cambridge University Press India Pvt. Ltd, 2007.

REFERENCES

1. Adaptation and mitigation of climate change-Scientific Technical Analysis. Cambridge University Press, Cambridge, 2006.
2. Atmospheric Science, J.M. Wallace and P.V. Hobbs, Elsevier / Academic Press 2006.
3. Jan C. van Dam, Impacts of "*Climate Change and Climate Variability on Hydrological Regimes*", Cambridge University Press, 2003.

CE1205 GLOBAL WARMING AND CLIMATE CHANGE												
Course Designed by		Department of Civil Engineering										
1	Student outcome	a	b	c	d	e	f	g	h	i	j	k
		x		x		x						
2	Mapping of instructional objectives with student outcome	1,2		1,2		1,2						
3	Category	General (G)		Basic Sciences (B)		Engineering Sciences and Technical Arts (E)				Professional Subjects (P)		
		--		--		--				x		
4	Broad area	Structural Engineering		Geotechnical Engineering		Water Resources Engineering				Geomatics Engineering		
		--		--		x				--		
5	Approval	23rd meeting of Academic Council, May 2013										

CE1206	DISASTER MANAGEMENT AND MITIGATION	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite				
	Nil				

PURPOSE

The purpose of this course is to provide an understanding of basic concepts of various disasters and its management. In addition, the course is expected to develop scientific temperament and mitigation techniques to manage disaster.

INSTRUCTIONAL OBJECTIVES	
1.	To understand basic concepts of disaster and hazards if India.
2.	To study the various natural disasters.
3.	To study the various manmade disasters.
4.	To understand the disaster management principles.
5.	To study the modern techniques used in disaster mitigation and management.

UNIT I - INTRODUCTION TO DISASTER (9 hours)

Meaning, Nature, Importance of Hazard, Risk, Vulnerability and Disaster-Dimensions & Scope of Disaster Management - India's Key Hazards – Vulnerabilities - National disaster management framework - Disaster Management Cycle.

UNIT II - NATURAL DISASTER (9 hours)

Natural Disasters- Meaning and nature of natural disaster; their types and effects. Floods, drought, cyclone, earthquakes, landslides, avalanches, volcanic eruptions, Heat and cold waves, Climatic change: global warming, Sea level rise, ozone depletion.

UNIT III - ANTHROPOGENIC DISASTER (9 hours)

Man Made Disasters- Nuclear disasters, chemical disasters, biological disasters, building fire, coal fire, forest fire, oil fire, air pollution, water pollution, deforestation and industrial waste water pollution.

UNIT IV - APPROACHES IN DISASTER MANAGEMENT (9 hours)

Pre- disaster stage (preparedness) - Preparing hazard zonation maps, Predictability/ forecasting & warning - Preparing disaster preparedness plan - Land use zoning - Preparedness through Information, education. Emergency Stage - Rescue training for search & operation - Immediate relief - Assessment surveys. Post Disaster stage – Rehabilitation - Social Aspect - Economic Aspect and Environmental Aspect.

UNIT V - DISASTER MITIGATION (9 hours)

Meteorological observatory - Seismological observatory - Hydrology Laboratory and Industrial Safety inspectorate. Technology in Disaster Management - Emergency Management Systems (EMS) in the Disaster Management Cycle - Remote Sensing and Geographic Information Systems(GIS) in Disaster Management.

TEXT BOOK

1. Sharma.S.R, *"Disaster management*", A P H Publishers, 2011.

REFERENCES

1. VenuGopalRao.K, *"Geoinformatics for Disaster Management"*, Manglam Publishers and Distributors, 2010.
2. Singh.R.B, "*Natural Hazards and Disaster Management: Vulnerability and Mitigation"*, Rawat Publications, 2006.
3. Gupta.H.K, *"Disaster Management"*, University Press, India, 2003.
4. Gupta.M.C, *"Manuals on Natural Disaster management in India"*, National Centre for Disaster Management,IIPA, New Delhi, 2001.

CE1206 DISASTER MANAGEMENT AND MITIGATION												
Course Designed by		**Department of Civil Engineering**										
1	Student outcome	a	b	c	d	e	f	g	h	i	j	k
		x		x					x			
2	Mapping of instructional objective with student outcome	1-5		1-5					1-5			
3	Category	General(G)		Basic Sciences(B)		Engineering Sciences and Technical Arts (E)			Professional Subjects(P)			
		--		--		--			x			
4	Broad area	Structural Engineering		Geotechnical Engineering		Water Resources Engineering			Geomatics Engineering			
		--		--		--			x			
5	Approval	23rd Meeting of Academic Council, May 2013										

	ENERGY ENGINEERING TECHNOLOGY AND MANAGEMENT	**L**	**T**	**P**	**C**
CH1201	Total Contact Hours - 45	**3**	**0**	**0**	**3**
	Prerequisite				
	Nil				

PURPOSE

This course helps the students to understand the importance, availability, conversion technologies of renewable energy resources and its applications

INSTRUCTIONAL OBJECTIVES

1.	To familiarise the basics of energy concepts, demand and utilisation
2.	To understand the various energy conversion technologies
3.	To familiarise the energy audit principles and concepts
4.	To provide information on various methods of energy management

UNIT I - INTRODUCTION **(9 hours)**

Energy Overview: Basics of energy, Types of energy and its utilization, Energy Characteristics, Energy Chains, Energy Resources, Energy demand –Supply Network, Depletion – Conventional energy sources, Fallouts of energy usage, application of carbon credit, Changing energy consumption trends, Energy Conservation opportunities, New energy technologies

UNIT II - ENERGY CONVERSION TECHNOLOGIES **(9 hours)**

MHD Generators - Basic, Principle, Open Cycle and Closed Cycle MHD Technologies, Materials, Applications, Advantages & Disadvantages. Types of energy conversion plants for various primary energy sources.Power plants with conventional energy sources, nuclear fission reaction power plants, Gas-Turbine power plants, Integrated Coal Gasification combined cycle power plant.

UNIT III - ENERGY STORAGE AND DISTRIBUTION **(9 hours)**

Energy storage systems: Mechanical - Pumped hydroelectric storage, compressed air, energy storage via flywheels, electrical – lead acid battery, Chemical, Electromagnetic energy, Thermal energy- Sensible heat, latent heat, Biological, Distribution of energy

UNIT IV - ENERGY AUDIT **(9 hours)**

Energy Audit: Types and Methodology; Energy Audit Reporting Format; Understanding Energy Costs; Benchmarking and Energy Performance; Matching Energy Usage to Requirement; Maximising System Efficiency; Fuel and Energy Substitution; Energy Audit Instruments; Duties and responsibilities of energy auditors.

UNIT V - ENERGY MANAGEMENT **(9 hours)**

Definition & Objectives of Energy Management; Importance; Indian need of Energy Management; Energy action planning, Energy organisation, energy costing, budgeting, Equipment professionals, staffing, Monitoring and targeting - Data and Information Analysis; Relating Energy Consumption and Production, Design of energy management programs

TEXT BOOKS

1. Rao.S & Dr. Parulakar.B.B, "*Energy Technology"*, Khanna Publishers, New Delhi, 1994
2. David.S, "*Handbook of Industrial energy conservation"*, Van Nostrand, New York, USA, 1997

REFERENCES

1. Altert P.E.Thimann, "*Handbook of Energy Audit"*, The Fairmount Press Inc. Georgia, USA,
2. Murphy.W.R, Mckay.G, "*Energy Management"*, Butterworths.
3. Smith.C.B, "*Energy Management Principles",* Pergamon Press

CH1201 ENERGY ENGINEERING TECHNOLOGY AND MANAGEMENT												
Course Designed by		Department of Chemical Engineering										
1	Student outcome	a	b	c	d	e	f	g	h	i	j	k
				x			x		x			x
2	Mapping of instructional objectives with student outcome			1-4	3-4		1-4		1-4			2-4
3	Category	General (G)		Basic Sciences (B)		Engineering Sciences and Technical Arts (E)				Professional Subjects (P)		
		--		--		--				x		
4	Broad area	Chemical Sciences and Technology		Chemical Principles		Chemical Engineering Applications				Advances in Chemical Engineering		
		--		x		x				--		
5	Approval	23rd meeting of Academic Council, May 2013										

CH1202	RENEWABLE ENERGY TECHNOLOGY	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite				
	Nil				

PURPOSE

This course helps the students to understand the importance, availability, conversion technologies of renewable energy resources and its applications

INSTRUCTIONAL OBJECTIVES

1.	To emphasis the current energy status and role of renewable energy sources.
2.	To familiarize various aspects of Solar energy and utilization
3.	To familiarize various aspects of Wind energy and utilization
4.	To familiarize various aspects of Biomass energy and utilization
5.	To familiarize other renewable energy sources

UNIT I - INTRODUCTION (9 hours)

World energy status, Current energy scenario in India, Environmental aspects of energy utilization, Environment - Economy - Energy and Sustainable Development, Energy planning.Reserves of Energy resources, Renewable energy resources -

potentials -achievements – applications. Technical and social implications, issues in grid integration of power from renewable energy sources.

UNIT II - SOLAR ENERGY (9 hours)

Basic concepts, Solar radiation – Measurement, Solar thermal systems – Flat plate and concentrating collectors, Solar passive space - Solar heating and cooling techniques – Solar desalination – Solar Pond - Solar cooker - Solar dryers-Solar furnaces - Solar pumping, Solar green house- Solar thermal electric power plant – Solar photo voltaic conversion – Solar cells – PV applications, Hybrid systems.

UNIT III - WINDENERGY (9 hours)

Introduction-Availability- Wind power plants , Power from the wind, Wind energy conversion systems, site characteristics, Wind turbines types – Horizontal and vertical axis-design principles of wind turbine – Blade element theory, Magnus effect- Performance. Wind energy Applications – Hybrid systems, Wind energy storage, Safety and environmental aspects.

UNIT IV - BIOMASS ENERGY (9 hours)

Biomass – usable forms- composition- fuel properties – applications, Biomass resources, Biomass conversion technologies - direction combustion - pyrolysis – gasification -anaerobic digestion, Bioethanol and Biodiesel Production - Economics - Recent developments.Energy farming, Biogas technology - Family biogas plants, Community and institutional biogas plants – design consideration – applications.

UNIT V - OTHER RENEWABLE ENERGY SOURCES (9 hours)

Tidal energy – Wave energy – Open and closed OTEC Cycles – Small hydro – Geothermal energy – Social and environmental aspects.Fuel cell technology - types, principle of operation – applications.Hydrogen energy production - Storage – transportation – utilization.

TEXT BOOKS

1. Godfrey Boyle, *"Renewable Energy*", Power for a Sustainable Future, Oxford University Press, U.K, 1996.
2. Twidell.J.W & Weir.A, "*Renewable Energy Sources"*, EFN Spon Ltd., UK, 1986
3. Tiwari.G.N, "*Solar Energy – Fundamentals Design*", Modelling and applications, Narosa PublishingHouse,NewDelhi,2002

REFERENCES

1. Freris.L.L, "*Wind Energy Conversion systems",* Prentice Hall, UK, 1990.
2. Veziroglu.T.N, *"Alternative Energy Sources*", Vol 5 and 6, McGraw-Hill, 1978
3. Johnson Gary.L, *"Wind Energy Systems",* Prentice Hall, New York, 1985.
4. "*Energy planning in Developed countries (U.N.)",* Oxford University Press, 1984.
5. G.D. Rai, *"Non Conventional Energy Sources*", Khanna Publishers, New Delhi, 1999.
6. S.P. Sukhatme, *"Solar Energy*", Tata McGraw Hill Publishing Company Ltd., New Delhi, 1997
7. *"Renewable energy sources of conversion technology:N.K Bansal*", Manfred Kleen Man and Michael Meliss, TMH Publication.
8. Kothari P, K C Singal and Rakesh Ranjan, "*Renewable Energy Sources and Emerging Technologies",* PHI Pvt. Ltd., New Delhi, 2008

CH1202 RENEWABLE ENERGY TECHNOLOGY												
Course Designed by		Department of Chemical Engineering										
1	Student outcome	a	b	c	d	e	f	g	h	i	j	k
			x	x	x		x		x			x
2	Mapping of instructional objectives with student outcome		2-5	2-5	1-5		1		1			2-5
3	Category	General (G)		Basic Sciences (B)		Engineering Sciences and Technical Arts (E)			Professional Subjects (P)			
		x		--		x			x			
4	Broad area	Chemical Sciences and Technology		Chemical Principles		Chemical Engineering Applications			Advances in Chemical Engineering			
		x		x		x			--			
5	Approval	23rd meeting of Academic Council, May 2013										

CH1203	INDUSTRIAL POLLUTION PREVENTION AND CONTROL	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite				
	Nil				

PURPOSE

This course makes the students knowledgeable in various pollution prevention methods and the principles and processes involved in various Industries to control the pollution

INSTRUCTIONAL OBJECTIVES

To familiarize

1. Methods of pollution prevention in industries

2.	Cleaner technologies and sustainability
3.	Principles of various processes involved in the treatment of Air, Water pollution

UNIT I - SUSTAINABILITY (9 hours)

Industrial activity and environment, industrialization and sustainable development-indicators of sustainability-sustainability strategies. Barriers to sustainability, Pollution prevention in achieving sustainability

UNIT II - ENVIRONMENTAL REGULATIONS (9 hours)

Prevention vs control of industrial pollution, Environment policies and Regulations to encourage pollution prevention, Environment friendly chemical processes, Regulations for clean environment and implications for industries

UNIT III - POLLUTION (9 hours)

Definition of pollutant, types of pollution; Air, Water, Land, noise- adverse effects of pollutants eco system and human health - need for effluent treatment and toxicity, control.Water standards for portable, agricultural and left-off streams- air standards for cities, industrial areas, resorts.

UNIT II - AIR POLLUTION CONTROL METHODS (9 hours)

Particulate emission control- gravitational settling chambers- cyclone separators, fabric filters, electrostatic precipitators, wet scrubbers, absorbers. Control of sulphur di oxide, oxides of nitrogen, carbon monoxide and hydrocarbons. Noise pollution measurements and its control.

UNIT IV - PRINCIPLES OF WATER TREATMENT (9 hours)

Primary, secondary and tertiary treatments - advanced waste water treatments; recovery of metals from process effluents

TEXT BOOK

1. Bishop.P, "*Pollution Prevention: Fundamentals and Practice*", McGraw Hill International Edn., McGraw Hill Book Co., Singapore, 2000
2. Freeman.H.M, "*Industrial Pollution Prevention Hand Book*", McGraw Hill, 1995
3. James. G. Mann and Liu.Y.A, "*Industrial Water Reuse and Waste Water Minimization*", McGraw Hill, 1999

REFERENCES

1. Rose.G.R.D, "*Air pollution and Industry"*, Van Nostrand Reinhold Co., New York 1972
2. Pandey.G.N and Carney.G.C, "*Environmental Engineering"*, Tata McGraw Hill, New Delhi,1989
3. Kapoor.B.S, "*Environmental Engineering"*, 3rd Edn., Khanna publishers,1997

CH1203 INDUSTRIAL POLLUTION PREVENTION AND CONTROL												
Course Designed by		Department of Chemical Engineering										
1	Student outcome	a	b	c	d	e	f	g	h	i	j	k
				x			x		x			
2	Mapping of instructional objectives with student outcome			1			2		3			
3	Category	General (G)		Basic Sciences (B)			Engineering Sciences and Technical Arts (E)			Professional Subjects (P)		
		--		--			--			x		
4	Approval	23rd meeting of Academic Council, May 2013										

CH1204	PETROLEUM TECHNOLOGY	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite				
	Nil				

PURPOSE

This course helps detailed knowledge on petroleum refining operations and manufacturing processes

INSTRUCTIONAL OBJECTIVES

1.	To learn petroleum geology, drilling and well engineering, reservoir engineering
2.	Students learn the evaluation of oil stocks, petroleum testing methods fractionation of crude and treatment techniques.
3.	To familiarize the manufacturing methods of important petrochemicals

UNIT I - INTRODUCTION PETROLEUM (9 hours)

Origin and interior of earth; Classification of rocks and properties; plate tectonics and structure; Geological time scales; Origin, migration and accumulation of petroleum; Formation and Evaluation of Crude Oil.

UNIT II - DRILLING AND RESERVOIRS (9 hours)

Types of drilling operation and components; Formation pore pressure and fracture resistance; Casing design; Drill bits; bit operation; Drill string components; Drilling fluids. Classification of reservoirs; Properties of reservoir fluids; Rock properties.

UNIT III - EVALUATION AND TESTING (9 hours)

Overview of Refinery Products, Refinery Configuration and Development. Paraffinic, Mixed and Naphthenic Based Crude Oil, Characterization Factor, Viscosity Index and Correlation Index. Distillation Characteristics, Thermal Properties of Petroleum Fractions and Important Product Properties. Testing of Petroleum Crude, Laboratory Tests- Specific Gravity, Vapour Pressure, Flash and Fire Point, Color, Cloud and Pour Points.

UNIT IV - FRACTIONATION OF PETROLEUM (9 hours)

Dehydration and Desalting of Crudes - Settling and Electric Desalting, Heating of Crude - PipeStill Heaters, Petroleum refining processes, general processing, topping and vacuum distillations. Thermal cracking in vapor, liquid and mixed phase. Overview of Refinery Products.

UNIT V - OLEFIN AND INTERMEDIATES COMPOUNDS (9 hours)

Reforming and cracking: Cracking of Naphtha and Feed stock gas for the production of C_2 and C_3 compounds. Ethylene, Acetylene, Propylene. Production of intermediate chemicals-Acrylonitrile, ethylene oxide, propylene oxide, ethyl chloride, Higher olefins- benzene, toluene, xylene and phenol.

TEXT BOOK

1. Lyons.W.C, Plisga.G.J, "*Standard Handbook of Petroleum and Natural Gas Engineering"*, Elsevier, 2005
2. Mian.M.A, "*Petroleum Engineering Handbook for the Practicing Engineer*", Gulf Professional Publishing, 2005
3. Nelson.W.L, "*Petroleum Refinery Engineering*", McGraw Hill Publishing Company Limited, 1985.

REFERENCES

1. Watkins.R.N, "*Petroleum Refinery Distillations*", 2nd Edition, Gulf Publishing Company,Texas, 1981.
2. Gopala Rao.M and Marshall Sittig, "*Dryden's Outlines of Chemical Technology"*, 3rd Edn.,East-West Press, New Delhi, 1997

CH1204 PETROLEUM TECHNOLOGY												
Course Designed by		Department of Chemical Engineering										
1	Student outcome	a	b	c	d	e	f	g	h	i	j	k
			x	x								
2	Mapping of instructional objectives with student outcome		2	1,3								
3	Category	General (G)		Basic Sciences (B)		Engineering Sciences and Technical Arts (E)			Professional Subjects (P)			
		--		--		--			x			
4	Broad area	Chemical Sciences and Technology		Chemical Principles		Chemical Engineering Applications			Advances in Chemical Engineering			
		--		--		x			--			
5	Approval	23rd meeting of Academic Council, May 2013										

CH1205	INTRODUCTION TO TRANSPORT PROCESSES	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite				
	Nil				

PURPOSE

The objective of this subject is to recognize the fundamental concepts of transport processes and to apply this knowledge to solve the problems in process engineering.

INSTRUCTIONAL OBJECTIVES

1.	To understand the fundamental concepts of heat, mass and momentum operations in process engineering
2.	To understand the interphase transport and transfer coefficients
3.	To understand the rate generation in mass transport

UNIT I - CONCEPTS OF MOMENTUM TRANSPORT (9 hours)

Newton's law of viscosity, viscosity of gases and liquids, shear stress and momentum flux, shell momentum balances in laminar flow.

UNIT II - CONCEPTS OF HEAT TRANSPORT (9 hours)

Conduction; Fourier's law, thermal conductivities of gases, liquids and solids; steady state conduction through planar and cylindrical resistances; resistances in series; conduction with a heat source; shell thermal energy balances.

UNIT III - CONCEPTS OF MASS TRANSPORT (9 hours)

Molecular diffusion, eddy diffusion, bulk flow; definition of concentrations, average velocities and fluxes; Fick's first law; diffusivities of gases and liquids; application to binary mixtures; equimolal counterdiffusion and diffusion through a stationary component; and two-phase mass transfer.

UNIT IV - INTERPHASE TRANSPORT AND TRANSFER COEFFICIENTS (9 hours)

Friction factor, Physical interpretation of Friction factor, Heat transfer coefficient, physical interpretation of heat transfer coefficient, Mass transfer coefficient, physical interpretation of mass transfer coefficient, Dimensional number, Dimensionless numbers and time scales, Transport analogies

UNIT V - RATE OF GENERATION IN MASS TRANSPORT (9 hours)

Stoichiometry of a chemical reaction, the law of combining proportions, rate of reaction, Concept of ideal Continuous Stirred Tank Reactor (CSTR), Plug Flow Reactor (PFR) and Batch reactor.

TEXT BOOK

1. Ismail Tosun, "*Modeling in Transport Phenomena – A Conceptual Approach",* 2nd Edn., Elsevier Publications 2007

REFERENCE

1. Warren L. McCabe, Julian C. Smith and Peter Harriott, "*Unit Operations of Chemical Engineering*", 7th Edn., McGraw Hill International Edition, NewYork 2005.

CH1205 INTRODUCTION TO TRANSPORT PROCESSES												
Course Designed by		Department of Chemical Engineering										
1	Student outcome	a	b	c	d	e	f	g	h	i	j	k
						x						x
2	Mapping of instructional objectives with student outcome					1-3						1-3
3	Category	General (G)		Basic Sciences(B)		Engineering Sciences and Technical Arts (E)				Professional Subjects (P)		
		x		--		x				x		
4	Broad area	Chemical Sciences and Technology		Chemical Principles		Chemical Engineering Applications				Advances in Chemical Engineering		
		--		x		--				--		
5	Approval	23rd meeting of Academic Council, May 2013										

CS1201	DATA STRUCTURES	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite				
	Nil				

PURPOSE

The purpose of this course is to impart knowledge on various data structure concepts to the students.

INSTRUCTIONAL OBJECTIVES

1.	To understand several data structures concepts like stack, queues, linked list, trees and files
2.	To Know the applications of data structures
3.	To get familiarized with solving problems using data structure tools and techniques

UNIT I - INTRODUCTION (9 hours)

Data structure - Definition, Types, Operations - primitive and composite Data Types - Algorithmic notations - Complexity of algorithms - Arrays, Operations on Arrays - Order lists.

UNIT II - STACKS AND QUEUES (9 hours)

STACKS: Array implementation – Operations on stacks - Applications of Stack - Infix to Postfix Conversion, Evaluation of Postfix expression, Recursion.

QUEUES: Array implementation - Operations on Queues -Queue Applications, Circular Queue.

UNIT III - LINKED LISTS (9 hours)

Singly Linked List: Implementation - Operations - Application - Representation of a Polynomial, Polynomial Addition - Doubly Linked List: Implementation – Operations – Circular linked lists.

UNIT IV - TREES AND GRAPHS (9 hours)

TREES: Binary Trees - Conversion of General tree to Binary Tree, Operations - Tree Traversals – **GRAPH:** Definition, Types of Graphs, Hashing Tables and Hashing Functions, Graph Traversal -Depth first traversal, Breadth first traversal

UNIT V - SORTING AND SEARCHING (9 hours)

Sorting concepts - Types - Insertion sort - Selection sort - Bubble sort - Merge sort - Quick sort - Heap sort - Searching concepts - Linear search - Binary search

TEXT BOOK

1. Michael T. Simpson, Kent Backman, James E. Corley, "*Hands-On Ethical Hacking and Network Defense"*, Second Edition, CENGAGE Learning, 2010.

REFERENCES

1. Steven DeFino, Barry Kaufman, Nick Valenteen, *"Official Certified Ethical Hacker Review Guide"*, CENGAGE Learning, 2009-11-01.
2. Patrick Engebretson, "*The Basics of Hacking and Penetration Testing: Ethical Hacking and Penetration Testing Made Easy"*, Syngress Basics Series – Elsevier,August 4, 2011.
8. Whitaker & Newman, "*Penetration Testing and Network Defense"*, Cisco Press, Indianapolis, IN, 2006.

CS1201 DATA STRUCTURES												
Course Designed by		Department of Computer Science and Engineering										
1	Student outcome	a	b	c	d	e	f	g	h	i	j	k
		x	x									x
2	Mapping of instructional objectives with student outcome	1	2									3
3	Category	General(G)		Basic Sciences(B)			Engineering Sciences and Technical Arts (E)					Professional Subjects (P)
		--		--			--					x
4	Broad area	Core Engineering		Computer Hardware Engineering			Software Engineering		Network Engineering			Knowledge Engineering
		x		--			--		--			--
5	Approval	23rd meeting of Academic Council, May 2013										

CS1202	DATABASE CONCEPTS	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite				
	Nil				

PURPOSE

To study the concepts of Relational Database design and query languages

INSTRUCTIONAL OBJECTIVES

1.	To provide a general introduction to relational model
2.	To learn about ER diagrams
3.	To learn about Query processing and Transaction Processing

UNIT I - INTRODUCTION TO DATABASE MANAGEMENT (9 hours)

Introduction to Database Management systems – History - Characteristics – Users- three-level architecture- Entity-- relationship data model.

UNIT II - THE RELATIONAL DATA MODEL AND RELATIONAL ALGEBRA (9 hours)

Data structures – Mapping E-R Model to Relational model – data manipulation – integrity – advantages – rules for fully relational systems – relational algebra – relational algebra queries.

UNIT III - STRUCTURED QUERY LANGUAGE AND NORMALIZATION (9 hours)

SQL – Data definition – manipulation – views SQL in procedural programming – data integrity and constraints – triggers – data control – database security.Normalization – Undesirable properties – single-valued normalization – desirable properties of decompositions – multivalued dependencies

UNIT IV - STORAGE INDEXING AND TRANSACTIONS MANAGEMENT (9 hours)

Different types of memories – secondary storage – buffer management – file structures – heap files – sorted files – index and types – indexed sequential file – B-tree – B+ tree.Transaction management – concepts – examples – schedules – serializability – concurrency control – deadlocks – lock and multiple granularity – nonlocking techniques.

UNIT V - DATABASE BACKUP, RECOVERY AND SECURITY (9 hours)

Database system failure – backup – recovery and concept of log – log-based recovery techniques – types of recovery – log-based immediate update recovery technique. Database Security – violations – identifications and authentication – authorization / access control – security of statistical databases – audit policy – internet applications and encryption.

TEXT BOOK

1. Gupta.G.K, *"Database Management Systems"*, Tata McGraw Hill, 2011.

REFERENCES

1. Silberschatz, Korth.H and Sudarshan.S, *"Database System Concepts"*, 6th Edition, McGraw-HillInternational, 2011.
2. Hector Garcia-Molina, Jeffrey D.Ullman, Jennifer Widom, "*Database System The Complete Book*, 1st Edition, Pearson 2002.
3. Ramez Elmasri and Shamkant B.Navathe, *"Fundamentals of Database Systems"*, Fifth Edition, Pearson, 2008.

CS1202 DATABASE CONCEPTS												
Course Designed by		Department of Computer Science and Engineering										
1	Student outcome	a	b	c	d	e	f	g	h	i	j	k
		x		x								x
2	Mapping of instructional objectives with student outcome	1		2								3
3	Category	General (G)		Basic Sciences (B)		Engineering Sciences and Technical Arts (E)						Professional Subjects (P)
		--		--		--						x
4	Broad area	Core Engineering		Computer Hardware Engineering		Software Engineering			Network Engineering			Knowledge Engineering
		--		--		--			--			x
5	Approval	23rd meeting of Academic Council, May 2013										

CS1203	SOFT COMPUTING	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite				
	Nil				

PURPOSE

This course provides a way to understand the concepts of ANN, Genetic Algorithms and Fuzzy systems and its applications.

INSTRUCTIONAL OBJECTIVES

1.	Basics of ANN and its learning algorithms
2.	Fuzzy principles and relations
3.	Genetic algorithms and its applications
4.	Hybrid systems and usage of MATLAB toolbox

UNIT I - NEURAL NETWORKS (9 hours)

Fundamentals of Neural Networks – History- Architectures- Learning methods- XOR problem-Delta rule- derivation-Backpropagation- applications- parameters in BPN- Associative memory – Hetero associative- BAM- energy function- problems-applications of associative memories- ART1- ART2- applications of adaptive networks

UNIT II - FUZZY LOGIC (9 hours)

Fuzzy set theory – crisp sets – fuzzy sets – crisp relations – Fuzzy relations – Fuzzy systems- Crisp logic – predicate logic – fuzzy logic- fuzzy based systems - Defuzzification methods – applications.

UNIT III - GENETIC ALGORITHMS (9 hours)

Fundamentals of GA – creation of offsprings – encoding – fitness function- reproduction – crossover- insertion& deletion- mutation- bitwise operators – applications.

UNIT IV - HYBRID SYSTEMS (9 hours)

Hybrid systems – Neuro Fuzzy – Neuro Genetic – fuzzy Genetic hybrids- GA based weight determination and applications- fuzzy BPN – simplified fuzzy ARTMAP

UNIT V - PROGRAMMING USING MATLAB (9 hours)

Using Neural Network toolbox – Using Fuzzy Logic toolbox- Using Genetic Algorithm & directed search toolbox.

TEXT BOOK

1. Rajasekaran.S and VijayalakshmiPai.G.A, "*Neural Networks, Fuzzy Logic and Genetic Algorithms"*, PHI, 2011.

REFERENCES

1. Timothy J.Ross, *''Fuzzy Logic with Engineering applications*", John Wiley and Sons, 2010.
2. Jang.J.S.R, Sun.C.T, Mizutani.E, "*Neuro fuzzy and Soft Computing*", PHI Learning Pvt. Ltd., 2012.
3. Davis E.Goldberg, "*Genetic Algorithms: Search, Optimization and Machine Learning*", Addison Wesley, N.Y., 1989.

CS1203 SOFT COMPUTING												
Course Designed by		**Department of Computer Science and Engineering**										
1	Student outcome	a	b	c	d	e	f	g	h	i	j	k
		x		x								x
2	Mapping of instructional objectives with student outcome	1-3		4								4
3	Category	General (G)		Basic Sciences (B)		Engineering Sciences and Technical Arts (E)						Professional Subjects (P)
		--		--		--						x
4	Broad area	Core Engineering		Computer Hardware Engineering		Software Engineering			Network Engineering			Knowledge Engineering
		--		--		--			--			x
5	Approval	23rd meeting of Academic Council, May 2013										

CS1204	WEB DESIGN	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite				
	Computer Networks				

PURPOSE

This course will have full understanding of the basic Web Concepts and Fundamentals of web design for static , Dynamic and active web pages.

INSTRUCTIONAL OBJECTIVES

1.	To study about the Basic web concept and Internet protocols
2.	To learn about the XHTML Forms, Frames and Tables
3.	To learn about CSS.
4.	To Study about the DHTML,CGI, ASP, JSP, Java servlets
5.	To Study about Java applets, Java Beans

UNIT I - INTRODUCTION (9 hours)

HTML and XTML basics- LIST – unordered list – nested and ordered list – Basic HTML Tables – Intermediate HTML table and Formatting – basic HTML Forms and Formatting –More Complex HTML Forms – Frameset Element – Nested Frameset.

Style Sheets and Graphics: Introduction to Style sheets – Formatting Text by Using Style Sheets – Formatting Paragraphs by Using Style Sheets

UNIT II - GRAPHICS IN WEB DESIGN (9 hours)

Graphics: Selecting a Graphics Format – Preparing Graphics for Web Use – Inserting Graphics – Arranging Elements on the Page – Controlling Image Size and Padding –Hyper linking from Graphics – Utilizing Thumbnail Graphics – Including Alternate Text for Graphics.

UNIT III - TABLES&LAYOUTS (9hours)

Navigation: Creating Navigational Aids – Creating Tables

Formatting Tables Layouts:

Creating Division-Based Layouts- Creating User Forms – Using Frames for Layout – Incorporating Audio and Video Dynamic HTML

UNIT IV - DYNAMIC WEB PAGES (10 hours)

Web pages – Tiers – Concept of a Tier – Comparison of Microsoft and Java Technologies – Web Pages – Static Web Pages – Plug-ins – Frames –Forms.

Dynamic Web Pages: Need – Magic of Dynamic Web Pages – Overview of Dynamic Web Page Technologies – Overview of DHTML – Common Gateway

Interface –ASP – ASP Technology – ASP Example – Modern Trends in ASP – Java and JVM – Java Servlets – Java Server Pages.

UNIT V - ACTIVE WEB PAGES **(8 hours)**

Active Web Pages in better solution – Java Applets – Why are Active Web Pages Powerful? – Lifecycle of Java Applets – ActiveX Controls – Java Beans.

TEXT BOOK

1 FaitheWempen*,"Microsoft Step by Step – HTML and XH"*, Prentice Hall of India Private Limited, New Delhi, 2011.

REFERENCES

1. Achyut S Godbole&AtulKahate, "*WEB TECHNOLOGIES TCP/IP to Internet Applications Architectures"*, TMH 2007.
2. Thomas A. Powell, **McGraw**-Hill *"HTML & CSS: The Complete Reference"*, Fifth Edition (Complete Reference Series) Osborne Media; 5 edition, 2010.

CS1204 WEB DESIGN												
Course Designed by		**Department of Computer Science and Engineering**										
1	Student outcome	a	b	c	d	e	f	g	h	i	j	k
		x	x									x
2	Mapping of instructional objectives with student outcome	1,2,4	2,4									3-5
3	Category	General (G)		Basic Sciences (B)		Engineering Sciences and Technical Arts (E)					Professional Subjects (P)	
		--		--		--					x	
4	Broad area	Core Engineering		Computer Hardware Engineering		Software Engineering		Network Engineering			Knowledge Engineering	
		x		--		--		--			--	
5	Approval	23rd meeting of Academic Council, May 2013										

EC1201	**ELECTRONIC CIRCUITS AND SYSTEMS**	**L**	**T**	**P**	**C**
	Total Contact Hours – 45	**3**	**0**	**0**	**3**
	Prerequisite				
	EC1001				

PURPOSE

This course has been designed to help the students to understand how electronic circuits and systems work. This course is essentially practical in its approach, thus encouraging students to assemble and test real circuits at home, or lab. This course also shows how circuit behaviour may be studied with a computer, using circuit simulator.

INSTRUCTIONAL OBJECTIVES	
1.	To provide the students with the basic underpinning knowledge necessary to appreciate the operation of a wide range of electronic circuits and systems.
2.	To learn a great deal from building, testing and modifying simple circuits to more complex circuits.

UNIT I - ANALOG CIRCUITS (7 hours)

Overview on semiconductors, diodes, transistor switches, capacitors, fields and inductors – BJT amplifiers, JFET amplifiers, MOSFET amplifiers.

UNIT II - APPLICATION OF ANALOG CIRCUITS (7 hours)

Operational amplifiers, application of op-amps, active filters, 555 timer and oscillators – power amplifiers – power supplies.

UNIT III - DIGITAL CIRCUITS (7 hours)

Overview on logical circuits, logical operations, combinational and sequential circuits – display devices – converter circuits.

UNIT IV - ELECTRONIC SYSTEMS - I (9 hours)

Audio and video systems – noise – telecommunications – cable transmission, optical transmission – electronic control systems – process control systems.

UNIT V - ELECTRONIC SYSTEMS II (15 hours)

Input and output - microprocessors and programming - sensors and interfacing - The PIC microcontroller - circuit simulation – circuit construction.

TEXT BOOKS

1. Owen Bishop, *"Electronics – Circuits and Systems",* 3rd Edition, Newnes, 2010.
2. Michael Tooley B A, *"Electronic Circuits: Fundamentals and Applications",* 3rd Edition, Newnes, 2006.

REFERENCE

1. John B.Peatman *," Design with PIC Microcontrollers",* Prentice Hall, 1998.

EC1201 ELECTRONIC CIRCUITS AND SYSTEMS												
Course Designed by		Department of Electronics and Communication Engineering										
1	Student outcome	a	b	c	d	e	f	g	h	i	j	k
		x	x	x	x		x		x		x	
2	Mapping of instructional objectives with student outcome	1,2	1,2	2	2		2		1		2	

3	Category	General (G)	Basic Sciences (B)	Engineering Sciences & Technical Arts (E)		Professional Subjects (P)
		--	--	--		x
4	Broad area	Communication	Signal Processing	Electronics	VLSI	Embedded
		--	--	x	--	--
5	Approval	23rd meeting of Academic Council, May 2013				

	TELECOMMUNICATION SYSTEMS	L	T	P	C
EC1202	Total Contact Hours – 45	**3**	**0**	**0**	**3**
	Prerequisite				
	EC1001				

PURPOSE

This course has been designed to cover some of the most important changes that have occurred in the telecommunications industry during the last two or three decades. This course gives an excellent overview of existing technology to allow the readers to better manage voice and data networks.

INSTRUCTIONAL OBJECTIVES

1.	To discuss various analog and digital technologies in voice and data networks.
2.	To understand many telecommunications technologies in the generic sense and their applications and implications.

UNIT I - PSTN TECHNOLOGY (9 hours)

Introduction: History of telecommunications – various networks used to transmit voice, video and data signals – media used to convey telecommunication signals – basics of the three major voice communication technologies – basics of PC-based voice communication systems (CTI) – basics of LAN & WAN – telecommunication standards.

PSTN Technology: Difference between simplex, half-duplex and duplex transmissions – basic understanding of telephone set – history and evolution of Central Exchange Switching – Operator Switch Boards (PBX) – intraoffice and interoffice calls – Extended Area Service (EAS) – circuit switching, packet switching & TDM switching – DTMF signaling – dial register – in-band & out-of-band signaling.

UNIT II - CUSTOMER-PROVIDED EQUIPMENTS (9 hours)

Working of telephone – sidetone – ringers – DTMF dial – feature phone, proprietary telephone, hands-free phone, speaker phones, ISDN telephones – key

systems – CBXs – private-in-line network and a software-defined network – station features – Telecommunication Application Program Interface (TAPI).

UNIT III - ELECTRONICS FOR TELECOMMUNICATIONS (9 hours)

Multiplexing: TDM – FDM – AM technology – WDM & DWDM – PAM & PCM - TDM using PAM & PCM – STDM – various levels of SONET – DS0 & DS1 systems.

Analog & Digital signals: Characteristics of analog and digital signals – conversion of analog voice signal into a digital signal – conversion of PSTN into a digital network – digital data coding techniques – bandwidth vs power loss.

UNIT IV - DATA COMMUNICATIONS & NETWORKING (9 hours)

Data Communications: Various ways to connect DTE & DCE – serial vs parallel transmission – UART, baud rates and MODEM – asynchronous vs synchronous transmission – error detection & error correction techniques – SS7 networks – ISDN – ADSL.

Data Networking: LANs & LAN architectures – OSI model – bridged LAN – LAN medium – NIC – packets, frames – PSN – STDM – PDN – Packet Assembler/Disassembler – switched vitual circuit vs permanent virtual circuit – X.25 packet network – LAPB – frame relay – ATM, Voice-Over ATM.

UNIT V - MOBILES PHONES AND WIRELESS COMMUNICATIONS (9 hours)

Mobile Phones: Evolution of mobile telephone technology – DAMPS vs GSM vs CDMA – PCS Networks.

Wireless Communication: Analog & Digital access – WAP, WLANs, Microwave LANs, radio LANs, infrared LANs, WLL technologies – Satellite communications – satellite earth station – geosynchronous satellite, LEO & MEO satellites – international wireless communication systems.

TEXT BOOKS

1. Marion Cole, *"Introduction to Telecommunications: Voice, Data and Internet",* Pearson Education, 2nd edition, 2008.
2. Anu A. Gokhale, *"Introduction to Telecommunications",* Delmar, 2nd edition, 2005.

REFERENCES

1. Pete Moulton, Jason Moulton, *"The Telecommunication Survival Guide"*, Pearson Education, 2001.
2. Roger L. Freeman, *"Telecommunication System Engineering"*, Wiley-India, 4th edition, 2004.

EC1202 TELECOMMUNICATION SYSTEMS												
Course Designed by		Department of Electronics and Communication Engineering										
1	Student outcome	a	b	c	d	e	f	g	h	i	j	k
		x	x						x		x	
2	Mapping of instructional objectives with student outcome	1,2	1,2						1,2		1,2	
3	Category	General (G)		Basic Sciences (B)		Engineering Sciences & Technical Arts (E)			Professional Subjects (P)			
		--		--		--			x			
4	Broad area	Communication		Signal Processing		Electronics		VLSI	Embedded			
		x		--		--		--	--			
5	Approval	23rd meeting of Academic Council, May 2013										

EC1203	MODERN WIRELESS COMMUNICATION SYSTEMS	L	T	P	C
	Total Contact Hours – 45	3	0	0	3
	Prerequisite				
	EC1001				

PURPOSE

This course is to provide comprehensive background knowledge of wireless and mobile communication for readers. This course is intended for anyone who wants (or needs) to learn about the new wave of wireless networks. It will introduce the readers to all the most important wireless technologies

INSTRUCTIONAL OBJECTIVES

1.	To discuss the fundamentals of cellular mobile wireless networks.
2.	To provide an overview of various approaches to communication networks.
3.	To study the numerous different-generation technologies with their individual pros and cons.
4.	To discuss about the principles of operation of the different access technologies like FDMA, TDMA, SDMA and CDMA and their pros and cons.

UNIT I - TRANSMISSION FUNDAMENTALS (10 hours)

Cellphone Generations: 1G, 2G, 2.5G, 3G & 4G

Transmission Fundamentals: Time domain & Frequency domain concepts, Radio, Analog Vs Digital, channel capacity, transmission media, carrier-based signaling, spread-spectrum signaling.

UNIT II - NETWORK CONCEPTS (12 hours)

Communication Networks: LANs, MANs, WANs, circuit switching, packet switching, ATM

Cellular Networks: Cells, duplexing, multiplexing, voice coding

Multiple Access Techniques: FDMA, TDMA, SDMA, CDMA, spectral efficiency.

UNIT III - PERSONAL COMMUNICATION SERVICES (8 hours)

GSM, HSCSD, GPRS, D-AMPS, CDMA One, CDMA Two, Packet Data Systems.

UNIT IV - 3G & BEYOND (7 hours)

IMT-2000, W-CDMA, CDMA 2000, EDGE, Wi-Fi, WiMAX, OFDM.

UNIT V - MOBILE DATA SERVICES & SHORT-RANGE NETWORKS (8 hours)

Mobile Data Services: Messaging, wireless web, WAP, site design

Short-Range Wireless Networks: Unlicensed spectrum, WLANs, cordless telephony, IrDA, Bluetooth

Smart Phones: Future phones, mobile OSs, smart phone applications.

TEXT BOOKS

1. Andy Dornan, "*The essential guide to wireless communications applications: from cellular systems to Wi-Fi*", 2nd Edition, Prentice Hall, 2002.
2. Misra, "*Wireless Communications and Networks*: 3G & Beyond", Tata McGraw-Hill, 2009.

REFERENCES

1. Theodore S. Rappaport, "*Wireless Communications: Principles and Practice*", 2nd Edition, Pearson Education, 2009.
2. William Stallings, "*Wireless communications and networking*", Prentice Hall, 2002.

EC1203 MODERN WIRELESS COMMUNICATION SYSTEMS												
Course Designed by		**Department of Electronics and Communication Engineering**										
1	Student outcome	a	b	c	d	e	f	g	h	i	j	k
		x	x									
2	Mapping of instructional objectives with student outcome	1-4	3-4									
3	Category	General (G)			Basic Sciences (B)		Engineering Sciences & Technical Arts (E)			Professional Subjects (P)		
		--			--		--			x		
4	Broad area	Communication			Signal Processing		Electronics		VLSI	Embedded		
		x			--		--		--	--		
5	Approval	23rd meeting of Academic Council, May 2013										

EE1201	POWER PLANT INSTRUMENTATION	L	T	P	C
	Total Contact Hours – 45	3	0	0	3
	Prerequisite				
	Nil				

PURPOSE

To enable the student to gain a fair knowledge on various power plants & their related instruments.

INSTRUCTIONAL OBJECTIVES

1.	To get detailed knowledge on thermal power plant.
2.	To learn the measurements of various parameter in power plant and their control.

UNIT I - OVERVIEW OF POWER GENERATION (9 hours)

Brief survey methods of power generation hydro, thermal, nuclear, solar and wind power-Importance of instrumentation in power plants –Layout of Thermal power plant – Complete layout of Boiler and Turbine – Process and instrumentation diagram of thermal power plant – distributed digital control system in power plants.

UNIT II - MEASUREMENTS IN POWER PLANTS (9 hours)

Use of transducers in electrical measurements-current, voltage, power, power factor - function of synchroscope – measurement of non-electrical parameters – flow of feed water, fuel, air and steam - measurement of steam pressure and temperature – Drum level measurement.

UNIT III - ANALYSERS IN POWER PLANTS (9 hours)

Flue gas analysis – oxygen analyzer – CO analyzer – analysis of impurities in feed water and steam – conductivity and dissolved oxygen analyzers – Gas chromatography – PH meter – pollution monitoring instruments , smoke density measurements, dust monitor, radiation detector.

UNIT IV - CONTROL LOOPS IN BOILER (9 hours)

Combustion control – air/fuel ratio control- furnace draft control – drum level control – steam temperature control and attemperation –super heater control - Deaerator control - interlocks in boiler operation.

UNIT V - TURBINE MONITORING AND CONTROL (9 hours)

Speed measurement, vibration and eccentricity measurement, shell temperature monitoring and control – lubricating oil temperature control – cooling system, protection and interlocks in turbines.

TEXT BOOKS

1. Sam G.Dukelow, "*The control of Boilers*", instrument society of America, 1991.
2. Krishnaswamy.K and M.Ponni Bala, "*Power Plant Instrumentation*", Eastern Economy Edition, 2011.

REFERENCES

1. Jain.R.K, "*Mechanical and industrial Measurements*", Khanna Publishers, New Delhi, 1995.
2. Elonka.S.M and Kohan.A.L, "*Standard Boilers Operations*", McGraw Hill, New Delhi, 1994.

EE1201 POWER PLANT INSTRUMENTATION												
Course Designed by		Department of Electrical and Electronics Engineering										
1	Student outcomes	a	b	c	d	e	f	g	h	i	j	k
		x				x			x			
2	Mapping of Instructional objectives with student outcome	1, 2				1,2			1, 2			
3	Category	General (G)		Basic Sciences (B)		Engineering Sciences and Technical Arts(E)			Professional Subjects(P)			
		--		--		--			x			
4	Broad area	Electrical Machines		Circuits & Systems		Electronics			Power Systems		Intelligent Systems	
		x		x		--			x		--	
5	Approval	23rd meeting of Academic Council, May 2013										

EE1202	BIOMEDICAL INSTRUMENTATION	L	T	P	C
	Total Contact Hours – 45	3	0	0	3
	Prerequisite				
	Nil				

PURPOSE

To enable the students to have a fair knowledge about human physiology and bio-medical instruments.

INSTRUCTIONAL OBJECTIVES

1.	To learn the basic human physiology and Transducers.
2.	To understand the applications of measuring, recording and monitoring instruments.
3.	To understand the concepts of various medical instruments and supporting systems.

UNIT I - HUMAN PHYSIOLOGY AND TRANSDUCERS (9 hours)

Introduction, generalized medical instrumentation system, components of instrumentation system, physiological systems of the body, cardiovascular system. Respiratory system, Nervous system, CNS, PNS, generation of bioelectric potentials, Action potential, Resting potential, Neuronal communication.

UNIT II - BIO- POTENTIAL ELECTRODES, TRANSDUCERS & RECORDERS (9 hours)

The electrode – electrolyte interface, Polarization, Ag/Agcl Electrodes, Body surface electrodes, Internal Electrodes. Transducers in general, Pressure Transducers, Temperature transducers, pulse sensors, Basic recording system, Direct Writing recorder, UV recorders, Thermal array recorders, Electrostatic recorder, Instrumentation Tape recorder.

UNIT III - MEDICAL IMAGING SYSTEMS (9 hours)

Information content of an image, Modulation transfer function, Noise – equivalent bandwidth, generation of X-rays, X-ray machine, computed Tomography, Magnetic Resonance Imaging – Principle, Image reconstruction techniques, Basic NMR components, Ultrasonic Imaging systems – Types of ultrasound imaging, Applications of different scan, Bio Telemetry.

UNIT IV - MONITORING SYSTEMS (9 hours)

Electrocardiogram, Effects of artifacts on ECG recordings, ECG recorder Principles, EEG & EMG recorders, ERG, Phonocardiogram, stethoscope, BP measuring Instrument - Sphygmomanometer and cardiac catheterization, ultrasonic blood flow meter, Principle of Photoelectric calorimeter, computerized patient monitoring system. Respiratory rate – Gas volume – Flow rate of Co2, o2 in exhaust air - PH of blood, ESR, GSR measurements – Plethysmography.

UNIT V - SUPPORTING SYSTEMS (9 hours)

Pacemaker systems – Different pacing modes of operation, Transcutaneous Electrical Nerve stimulation (TENS) – Stimulation modes & application techniques, surgical diathermy, Heart lung machine, Hemo Dialysis, Lithotripsy, Laser applications in medicine, and introduction to electrical safety.

TEXT BOOKS

1. Cromwell, "*Bio-Medical Instruments and Measurements",* Prentice Hall of India, 1990.
2. Dr.Arumugam, "*Bio-Medical Instrumentation"*, Anuradha Agencies, 1994.

REFERENCES

1. John. G. Webster, Editor, "*Medical Instrumentation, Application and Design*", John Wiley & Sons.1989.
2. Prof.Venkataram.S.K, "*Bio-Medical Electronics & Instrumentation*", Galgotia Publications, 2000.
3. Khandpur.R.S, "*Hand book of Bio-Medical Instrumentation*", Tata McGraw – Hill, 1987.
4. John. Can. Brown, "*Introduction to Bio Medical Equipment Technology*", Pearson Education of ASIA, 2001.

EE1202 BIOMEDICAL INSTRMENTATION												
Course Designed by		**Department of Electrical and Electronics Engineering**										
1	Student outcomes	a	b	c	d	e	f	g	h	i	j	k
		x				x			x		x	
2	Mapping of Instructional objectives with student outcome	1- 3				2, 3			2, 3		3	

3	Category	General (G)	Basic Sciences (B)	Engineering Sciences and Technical Arts (E)	Professional Subjects(P)
		--	--	--	x

4	Broad area	Electrical Machines	Circuits & Systems	Electronics	Power Systems	Intelligent Systems
		--	x	x	--	--
5	Approval	23rd meeting of Academic Council, May 2013				

EE1203	**RENEWABLE ENERGY RESOURCES**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	**3**	**0**	**0**	**3**
	Prerequisite				
	Nil				

PURPOSE

To import knowledge on different types renewable energy resources.

INSTRUCTIONAL OBJECTIVES

1.	To educate the students scientifically the new developments in renewable energy studies.
2.	To educate scientifically the new developments in non conventional and renewable energy studies.
3.	To emphasize the significance of Green Energy Technologies.

UNIT I - SOLAR ENERGY **(9 hours)**

Solar radiation its measurements and prediction - Solar thermal collectors - Flat plate collectors, Concentrating collectors – Applications - Heating, Cooling,

Desalination, Drying, Cooking, etc - Principle of photovoltaic conversion of solar energy - Types of solar cells and fabrication -Photovoltaic applications - Battery charging, Domestic lighting, Street lighting and water pumping.

UNIT II - WIND ENERGY (9 hours)

Wind energy - Energy chains - Application - Historical background, Merits and limitations - Nature of wind - Planetary and local day / night winds - Wind energy quantum - Power in wind- Turbine efficiency - Torque Thrust calculations - Velocity at different heights - Site selection - Components of Wind Energy Conversion System (WECS).

UNIT III - BIOMASS ENERGY (9 hours)

Energy from Biomass - Biomass as Renewable Energy Source - Types of Bio mass Fuels - Solid, Liquid and Gas - Biomass Conversion Techniques- Wet Process, Dry Process-Photosynthesis - Biogas Generation - Factors affecting Bio-digestion - Classification of bio gas plant - Continuous, Batch and Fixed Dome types - Advantages and Disadvantages.

UNIT IV - TIDAL, OTEC, HYDEL AND GEOTHERMAL ENERGY (9 hours)

Tidal energy: Tide – Spring tide, Neap tide – Tidal range – Tidal Power – Types of tidal power plant – Single and dual basin schemes – Requirements in tidal power plant **-** Ocean Thermal Energy Conversion (OTEC): Principle - Open and closed OTEC Cycles - Hydel Energy: Micro hydro - Geothermal Energy: Geothermal energy sources - Power plant and environmental issues**.**

UNIT V - NEW ENERGY SOURCES (9 hours)

Hydrogen as a renewable energy source - Sources of Hydrogen - Fuel for Vehicles - Hydrogen Production - Direct electrolysis of water, thermal decomposition of water, biological and biochemical methods of hydrogen production - Storage of Hydrogen - Gaseous, Cryogenic and Metal hydride - Fuel Cell – Principle of working, construction and applications.

TEXT BOOKS

1. Rai.G.D, "*Non- conventional resources of energy*", Khanna publishers, Fourth edition, 2010.
2. Khan. B.H, "*Non-Conventional Energy Resources*", The McGraw Hills, Second edition, 2009.

REFERENCES

1. Rao.S & Parulekar, "*Energy Technology*", Khanna publishers, Fourth edition, 2005.
2. Pai.B.R and Ram Prasad.M.S, "*Power Generation through Renewable Sources of Energy*", Tata McGraw Hill, New Delhi, 1991.
3. Bansal.N.K, Kleeman and Meliss, "*Renewable energy sources and conversion Techniques*", Tata McGraw hill, 1990.
4. Godfrey Boyl "*Renewable Energy: Power Sustainable Future*",Oxford University Press, Second edition, 2006.
5. Ryan O'Hayre, Suk-Won Cha and Whitney colella, "*Fuel Cell Fundamentals*", Second edition, 2009.
6. John W Twidell and Anthony D Weir, "*Renewable Energy Resources*", Taylor and Francis, 2006.
7. Freris.L.L, "*Wind Energy Conversion systems*", Prentice Hall, UK, 1990.

EE1203 RENEWABLE ENERGY RESOURCES												
Course Designed by		**Department of Electrical and Electronics Engineering**										
1	Student Outcomes	a	b	c	d	e	f	g	h	i	j	k
		x				x			x		x	
2	Mapping of instructional objectives with student outcome	1				1-3			2		3	
3	Category	General (G)		Basic Sciences (B)		Engineering Sciences and Technical Arts (E)			Professional Subjects (P)			
		--		--		--			x			
4	Broad area	Electrical Machines		Circuits & Systems		Electronics			Power Systems		Intelligent Systems	
		--		--		--			x		--	
5	Approval	23rd meeting of Academic Council, May 2013										

EE1204	SOFT COMPUTING	L	T	P	C
	Total Contact Hours -45	**3**	**0**	**0**	**3**
	Prerequisite				
	Nil				

PURPOSE

To enable the students acquire knowledge on Fuzzy Logic, Artificial Neural Network, Genetic Algorithm and Neuro Fuzzy Controllers

INSTRUCTIONAL OBJECTIVES

1.	To understand the concept of fuzzy logic and controllers
2.	To understand the various architectures of ANN and its learning methods
3.	To learn about basic concepts of genetic algorithm and its operators
4.	To understand the Neuro fuzzy control and its applications

UNIT I - INTRODUCTION TO SOFT COMPUTING (8 hours)

Aims of Soft Computing-Foundations of Fuzzy Sets Theory-Basic Concepts and Properties of Fuzzy Sets- Elements of Fuzzy Mathematics-Fuzzy Relations-Fuzzy Logic

UNIT II - APPLICATION OF FUZZY SETS (9 hours)

Applications of Fuzzy Sets-Fuzzy Modeling – Fuzzy Decision Making-Pattern Analysis and Classification-Fuzzy Control Systems-Fuzzy Information Processing-Fuzzy Robotics.

UNIT III - ARTIFICIAL NEURAL NETWORKS (10 hours)

Artificial Neural Networks-Models of Neuron-Architecture of Feed Forward Neural Networks, Recurrent Neural Networks-Learning methods-supervised and unsupervised learning-Time Delay Neural Networks-Radial Basis Function Neural Networks-Adaptive Resonance Theory (ART) Neural Networks- Associative Neural Memory Models-Application of ANN.

UNIT IV - GENETIC ALGORITHMS (9 hours)

Main Operators- Genetic Algorithm Based Optimization-Principle of Genetic Algorithm- Genetic Algorithm with Directed Mutation-Comparison of Conventional and Genetic Search Algorithms-Issues of GA in practical implementation-Introduction to Particle swarm optimization-PSO operators-GA and PSO in engineering applications.

UNIT V - NEURO-FUZZY TECHNOLOGY (9 hours)

Fuzzy Neural Networks and their learning-Architecture of Neuro- Fuzzy Systems-Generation of Fuzzy Rules and membership functions - Fuzzification and Defuzzyfication in Neuro-Fuzzy Systems- Neuro-Fuzzy Identification - Neuro Fuzzy Control- Combination of Genetic Algorithm with Neural Networks-Combination of Genetic Algorithms and Fuzzy Logic-Neuro-Fuzzy and Genetic Approach in engineering applications.

TEXT BOOKS

1. Sivanandam.S.N, Deepa.S.N, "*Principles of soft computing*",2nd Edition, Wiley India Pvt Limited, 2011.
2. Juh Shing Roger Jang, Cheun Tsai Sun,Eiji Mizutani, *"Neuro fuzzy and soft computing"* ,Prentice Hall, 1997.

REFERENCES

1. Aliev,R.A, Aliev,R.R, "*Soft Computing and its Application*", World Scientific Publishing Co. Pvt. Ltd., 2001.
2. Mehrotra.K, Mohan.C.K, Ranka.S, "*Elements of Artificial Neural Networks*", The MIT Press, 1997.
3. Juh Shing Roger Jang,Cheun Tsai Sun,Eiji Mizutani, "*Neuro fuzzy and soft computing*", Prentice Hall, 1997.
4. Ronald R.Yager, Lofti Zadeh, "*An Introduction to fuzzy logic applications in intelligent Systems*", Kluwer Academic, 1992.
5. Cordón.O, Herrera.F, Hoffman.F, Magdalena.L "*Genetic Fuzzy systems*", World Scientific Publishing Co. Pvt. Ltd., 2001.

EE1204 SOFT COMPUTING												
Course Designed by		**Department of Electrical and Electronics Engineering**										
1	Student Outcome	a	b	c	d	e	f	g	h	i	j	k
		x				x					x	x
2	Mapping of instructional objectives with student outcome	1-4				3,4					1	2,4
3	Category	General (G)	Basic Sciences(B)			Engineering Sciences and Technical Arts (E)				Professional Subjects (P)		
		--	--			--				x		
4	Broad area	Electrical Machines	Circuits & Systems			Electronics				Power Systems	Intelligent Systems	
		--	--			--				x	--	
5	Approval	23rd meeting of Academic Council, May 2013										

EE1205	PRINCIPLES OF CONTROL SYSTEMS	L	T	P	C
	Total Contact Hours-45	3	0	0	3
	Prerequisite				
	Nil				

PURPOSE

To provide an introduction to the analysis of linear control systems. This will permit an engineer to exploit time domain and frequency domain tools.

INSTRUCTIONAL OBJECTIVES

1.	To understand the basic components of control systems.
2.	To gain knowledge in various time domain and frequency domain tools for analysis.
3.	To understand the methods to analyze the stability of systems from transfer function forms.

UNIT I - INTRODUCTION **(9 hours)**

Basic Elements of Control System – Open loop and Closed loop systems – Practical Application of Feedback Control- Differential equation - Transfer function, Modeling of Electrical systems, Translational and rotational mechanical systems - Block diagram reduction Techniques - Signal flow graph

UNIT II - CONTROL SYSTEM COMPONENTS **(9 hours)**

Potentiometer, Synchros, DC & AC Tacho-generator, AC & DC Servo motor, Servomechanism and regulator, actuators. Practical application in industry.

UNIT III - TIME RESPONSE ANALYSIS **(9 hours)**

Time response analysis - First Order Systems - Impulse and Step Response analysis of second order systems - Steady state errors – P, PI, PD and PID Controllers-Simulation of system stability with and without controllers.

UNIT IV - FREQUENCY RESPONSE ANALYSIS **(9 hours)**

Frequency Response - Bode Plot, Polar Plot, Nyquist Plot - Frequency Domain specifications from the plots Constant M and N Circles - Nichol's Chart - Use of Nichol's Chart in Control System

UNIT V - STABILITY ANALYSIS **(9 hours)**

Stability, Routh-Hurwitz Criterion, Root Locus Technique, Construction of Root Locus, Dominant Poles, Application of Root Locus Diagram - Nyquist Stability Criterion - Relative Stability.

TEXT BOKS

1. Ogata. K," *Modern Control Engineering*", Fifth Edition, Prentice Hall, 2008.
2. Nagrath.I.J and Gopal.M, "*Control systems engineering*", 5th edition, New age International (P)Ltd.,Publishers 2008.

REFERENCES

1. Dorf. R and Bishop.R, "*Modern Control Systems*", Twelfth Edition, Prentice Hall, 2011.
2. Nise.N.S, "*Control Systems Engineering*", Sixth Edition, Wiley, 2010.

EE1205 PRINCIPLES OF CONTROL SYSTEMS												
Course Designed by		Department of Electrical and Electronics Engineering										
1	Student outcomes	a	b	c	d	e	f	g	h	i	j	k
		x		x		x			x			
2	Mapping of instructional objectives with student outcome	1-3		2,3		1,3			2,3			
3	Category	General (G)		Basic Sciences (B)		Engineering Sciences and Technical Arts(E)				Professional Subjects(P)		
		--		--		--				x		
4	Broad area	Electrical Machines		Circuits & Systems		Electronics				Power System	Intelligent Systems	
		x		x		--				--	--	
5	Approval	23rd meeting of Academic Council, May 2013										

	MICROCONTROLLER AND THEIR APPLICATIONS	L	T	P	C
EE1206	Total Contact Hours - 45	3	0	0	3
	Prerequisite				
	Nil				

PURPOSE

The purpose of this course is to provide an understanding of Microcontroller instruction set and its interfacing devices. In addition, the course is expected to develop design and analytical skills in students, to enable them logically tackle engineering problems in their chosen area of application.

INSTRUCTIONAL OBJECTIVES

1. To introduce the architecture, programming and interfacing of 8051 Micro controller
2. To introduce microcontroller to different real time applications
3. To introduce ARM 32 bit Microcontrollers

UNIT I - OVERVIEW OF ARCHITECTURE AND MICROCONTROLLER RESOURCES (9 hours)

Architecture of a microcontroller – Microcontroller resources – Resources in advanced and next generation microcontrollers – 8051 microcontroller – Internal and External memories – Counters and Timers – Synchronous serial-cum asynchronous serial communication - Interrupts.

UNIT II - INSTRUCTION SET OF 8051 FAMILY MICROCONTROLLERS (9 hours)

Basic assembly language programming – Data transfer instructions – Data and Bit-manipulation instructions – Arithmetic instructions – Instructions for Logical

operations among the Registers, Internal RAM, and SFRs – Program flow control instructions – Interrupt control flow.

UNIT III - REAL TIME CONTROL (9 hours)

Interrupts: Interrupt handling structure of an MCU – Interrupt Latency and Interrupt deadline – Multiple sources of the interrupts – Non-Maskable interrupt sources – Enabling or disabling of the sources – Polling to determine the interrupt source and assignment of the priorities among them – Interrupt structure in Intel 8051.

Timers: Programmable Timers in the MCUs – Free running counter and real time control – Interrupt interval and density constraints.

UNIT IV - 8051 PROGRAMMING AND APPLICATIONS (9 hours)

Interfacing Serial I/O (8251)- parallel I/O (8255) -Keyboard and Display controller (8279) - ADC/DAC interfacing - Inter Integrated Circuits interfacing (I2C Standard)- LCD-LED and Array of LEDs-Interfacing with the Flash Memory-Prototype MCU based Measuring instruments – Robotics and Embedded control Bus: RS232C-RS485-GPIB8051

UNIT V - REAL TIME OPERATING SYSTEM FOR MICROCONTROLLERS (9 hours)

Real Time operating system – RTOS of Keil (RTX51) – Use of RTOS in Design – Software development tools for Microcontrollers. ARM 32 Bit MCUs: Introduction to 16/32 Bit processors – ARM architecture and organization – ARM / Thumb programming model – ARM / Thumb instruction set – Development tools.

TEXT BOOKS

1. Raj Kamal, "*Microcontrollers Architecture, Programming, Interfacing and System Design"*, Pearson Education, 2005.
2. Mohammed Ali Mazidi and Janice Gillispie Mazidi, "*The 8051 Microcontroller and Embedded Systems",* Pearson Education Asia, New Delhi, 2003.

REFERENCES

1. Deshmuk.A.V, "*Microcontrollers (Theory & Applications)*", TMH, 2005.
2. John B. Peatman, "*Design with PIC Microcontrollers*", Pearson Education, 2005.
3. Kenneth J Ayala, "*The 8051 Microcontroller Architecture Programming and Application*", 2nd Edition, Penram International Publishers (India), New Delhi, 1996.
4. Rafi Quazzaman.M, "*Microprocessors Theory and Applications: Intel and Motorola",* Prentice Hall of India, Pvt. Ltd., New Delhi, 2003.

EE1206 MICROCONTROLLER AND ITS APPLICATIONS												
Course Designed by		Department of Electrical and Electronics Engineering										
1	Student outcomes	a	b	c	d	e	f	g	h	i	j	k
		x		x		x			x		x	x
2	Mapping of IO with students outcome	1-2		1-3		1-3			1-3		1-3	1-3
3	Category	General (G)		Basic Sciences(B)		Engineering Sciences and Technical Arts (E)			Professional Subjects(P)			
		--		--		--			x			
4	Broad area	Electrical Machines		Circuit & Systems		Electronics			Power Systems		Intelligent Systems	
		--		x		x			--		--	
5	Approval	23rd meeting of Academic Council, May 2013										

EE1207	ELECTRICAL MACHINES AND DRIVES	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite				
	Nil				

PURPOSE

This course on Electric machines & Drives aims at introducing control of motor with the help of power electronic converters. Also, To enable the students to get a comprehensive knowledge on various motor & its control.

INSTRUCTIONAL OBJECTIVES

1.	To understand the construction and characteristics of DC motor and its control
2.	To understand the construction and characteristics of single& three phase induction motor.
3.	To understand the stable steady state operation and transient dynamics of motor-load system.
4.	To learn characteristics and control of solid state DC motors drives, induction motor drives

UNIT I - ELECTRO MAGNETIC INDUCTION & BASIC CONCEPTS IN ROTATING MACHINES & DC MOTORS (9 hours)

Introduction to magnetic circuits – Magnetically induced e.m.f and force – AC operation of magnetic circuits – Hysteresis and Eddy current losses. Energy in magnetic systems – Field energy & mechanical force -Constructional features of DC machine – Principle of operation of DC generator – EMF equation

UNIT II - SINGLE PHASE & THREE PHASE INDUCTION MACHINES (9 hours)

Construction and principle of operation of single phase & three phase induction motor - Torque & Power equations – starting and speed control of induction machines - Slip – Torque characteristics.

UNIT III - REVIEW OF ELECTRIC DRIVES (9 hours)

Electric Drives-Advantage of Electric Drives-selection of Motor power rating-Thermal model of motor for heating and cooling - Classes of duty cycle-Determination of motor rating - control of Electric drives- modes of operation - speed control and drive classifications - closed loop control of drives.

UNIT IV - SOLID STATE CONTROL OF DC DRIVES (9 hours)

DC motor and their performance-Braking - Transient analysis – Ward Leonard drives - Transformer and uncontrolled rectifier control - controlled rectifier fed DC drives - Chopper controlled DC drives - Time ratio control and current limit control - Single, two and four quadrant operations - Effect of ripples on the DC motor performance.

UNIT V - SOLID STATE CONTROL OF INDUCTION MOTOR (9 hours)

Induction Motor Drives-Stator control-Stator voltage and frequency control – V/f control – CSI,VSI and cycloconverter fed induction motor drives – slip power recovery schematic control of rotor resistance using DC chopper.

TEXT BOOKS

1. Bose.B.K, "*Power Electronics and Variable frequency drives*", 1st ed, IEEE Press Standard Publications 2002.
2. Kothari.D.P and Nagrath.I.J. "*Electrical Machines"*, Tata McGraw Hill Publishing Co.Ltd, New Delhi, 5th edition 2002.

REFERENCES

1. Dr. Murugesh Kumar K. *DC "Machines & Transformers"*, Vikas Publishing House Pvt. Ltd., 2003.
2. Dubey. G.K, "*Fundamentals of Electrical drives*", Narora publications, 1995
3. Krishnan.R, "*Electric motor drives Modeling, Analysis and Control*", 1st edition, Pearson Publications, 2002.

EE1207-ELECTRICAL MACHINES AND DRIVES												
Course Designed by		Department of Electrical and Electronics Engineering										
1	Student Outcome	a	b	c	d	e	f	g	h	i	j	k
		x		x		x			x		x	
2	Mapping of instructional objectives with student outcome	1-4		1-3		1-3			2-4		3,4	
3	Category	General (G)		Basic Sciences (B)		Engineering Sciences and Technical Arts (E)			Professional Subjects(P)			
		--		--		--			x			
4	Broad Area	Electrical Machines		Circuits & Systems		Electronics			Power Systems		Intelligent Systems	
		x		--		x			--		--	
5	Approval	23rd meeting of Academic Council, May 2013										

	FUNDAMENTALS OF ELECTRIC POWER UTILIZATION	L	T	P	C
EE1208	Total Contact Hours - 45	3	0	0	3
	Prerequisite				
	Nil				

PURPOSE

The purpose of this course is to enable the students to have fair knowledge about electric heating, welding, illumination, traction and their industrial applications.

INSTRUCTIONAL OBJECTIVES

1.	To understand the concept behind illumination and battery maintenance
2.	To select a particular motor for a specific purpose
3.	To have basic knowledge about traction system

UNIT I - ELECTRIC HEATING & WELDING (9 hours)

Advantages of Electric Heating- Modes of heat transfer- Resistance heating – Infra red heating – Arc furnaces- Induction Heating- High frequency eddy current heating- Dielectric heating – Choice of frequency Resistance welding – arc welding- Ultrasonic welding- Preparation of work-Electrodes- Power supply for arc welding- arc welding with D.C and A.C – Circuits used in Resistance welding- Comparison of different types of welding- Simple problems

UNIT II - ILLUMINATION (9 hours)

Production of light – Laws of illumination – lighting calculation – photometers – interior and exterior illumination systems – lighting schemes – factory lighting – flood lighting – electrical lamps – Gaseous discharge lamps – High pressure and low pressure neon sign – high frequency , low pressure discharge tubes.

UNIT III - INDUSTRIAL UTILIZATION **(9 hours)**

Introduction – Selection of Motors- Types of drives- Nature of Load- Running , Starting Characteristics- Speed Control- Types of enclosures- Bearings- Transmission of drive- Choice of drive- Noise- Size and rating- Temperature Rise-time curve- Choice of rating of motors- Insulation Materials- Motors for particular Services

UNIT IV - TRACTION SYSTEMS **(9 hours)**

Different types of traction- Systems of Electric Traction- Track Electrification-comparison between DC and AC systems of Railway electrification

Train movement and Energy Consumption: Typical Speed- Time curves- Factors affecting Schedule Speed- Simplified Speed-time Curve- Mechanics of Train movement- Factors affecting Energy consumption, Specific Energy consumption-Dead weight, accelerating weight and adhesion weight.

UNIT V - BRAKING **(9 hours)**

Advantages and disadvantages of regenerative braking- Calculation of energy returned- Mechanical Regenerative Braking- Mechanical Braking- Mechanical Consideration- Control Equipment- Auxiliary equipment

Power Supply: Current collector-overhead construction for Tramways and Trolley buses and Railways-sag and tension calculation for trolley wire- substations- their location- Feeding and Distributing Systems- Interference in Telecommunication circuits.

TEXT BOOKS

1. Partab.H, "*Art and science of Utilisation of Electrical Energy*", Dhanpat Rai & Sons,1995.
2. Open Shaw Taylor , "*Utilisation of Electrical Energy*", Oriented Longmans Limited.1978

REFERENCES

1. Uppal.S.L, "*Electric Power*", Khanna Publications., 1997.
2. Soni, Gupta &Bhatnagar, "*A Course in Electric Power*" – Dhanpat Rai & Sons, 1999.
3. Gupta.J.B, "*Utilisation of Electric Power & Electric Traction*", S.K.Kataria & sons.1995.

EE1208 FUNDAMENTALS OF ELECTRIC POWER UTILIZATION												
Course Designed by		Department of Electrical and Electronics Engineering										
1	Student Outcome	a	b	c	d	e	f	g	h	i	j	k
		x				x			x			
2	Mapping of instructional objectives with student outcome	1-2				3			3			
3	Category	General(G)		Basic Sciences (B)		Engineering Sciences and Technical Arts (E)			Professional Subjects (P)			
		--		--		--			x			
4	Broad Area	Electrical Machines		Circuit & Systems		Electronics			Power Systems		Intelligent Systems	
		x		x		--			x		--	
5	Approval	23rd meeting of Academic Council, May 2013										

EE1209	INDUSTRIAL ELECTRONICS	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite				
	Nil				

PURPOSE

To enable the students gain a fair knowledge on applications of electronic devices.

INSTRUCTIONAL OBJECTIVES

1.	To understand the operation of basic electronic devices.
2.	To understand the operation of choppers converters and inverters.
3.	To impart knowledge in the control of AC, DC motors.
4.	To know the practical application for power electronics converters in conditioning the power supply.

UNIT I - THYRISTORS AND THEIR APPLICATIONS (9 hours)

Introduction – Applications – Principle of Operating of an SCR – Two-Transistor Analogy of SCR – DIAC – TRIAC – GTO – IGBT – MCT – Basic Triggering circuits for Thyristors –Rectifier Circuits using SCR – Protection of power devices.

UNIT II - INVERTERS, CHOPPERS AND CONVERTERS (9 hours)

Commutation Circuits – Inverters – series and parallel – VSI – Choppers: Step up, Morgan's, Jone's – Single phase and Three phase Converters, Fly-back convertors, Buck-Boost convertors, Dual converters – Introduction to cyclo converters and ac controllers.

UNIT III - SOLID STATE CONTROL OF DC MOTORS (9 hours)

Introduction – Advantage of Electronic Control – D.C. Motor Speed Control – Speed Control of DC Shunt Motors using Thyristor Technology – Overvoltage Protection of DC Motors – Overload Protection of DC Motors – Closed Loop control

UNIT IV - SOLID STATE CONTROL OF AC MOTORS (9 hours)

Introduction – A.C. Motor control – Speed control motors – Speed control A.C. shunt motors using thyristors, Speed – torque characteristic of induction motor – Static stator voltage control – V/f control Static rotor resistance control – Slip power recovery scheme – Self control of synchronous motor

UNIT V - APPLICATIONS (9 hours)

Electronic timers – Digital counters – Voltage regulators – Voltage doubler – Online and offline ups – Switched mode power supply – Principle and application of induction and dielectric heating.

TEXT BOOKS

1. Mohammed H. Rashid, "*Power Electronics: Circuits, Devices and Applications*", Pearson Education India, 2003.
2. Bhattacharya / S Chatterjee.S.K, "*Industrial Electronics and Control*", Tata McGraw-Hill, 1995.

REFERENCES

1. James T. Humphries, Leslie P., "*Industrial Electronics*", Delmar Publications, 1993.
2. Sen.P.C, "*Power Electronics"*, Tata McGraw-Hill, 2008.

EE1209 INDUSTRIAL ELECTRONICS												
	Course Designed by	**Department of Electrical and Electronics Engineering**										
1	Student Outcomes	a	b	c	d	e	f	g	h	i	j	k
		x				x			x		x	
2	Mapping of instructional objectives with student outcome	1				3			1-4		3,4	
3	Category	General (G)		Basic Sciences (B)		Engineering Sciences and Technical Arts (E)			Professional Subjects (P)			
		--		--		--			x			
4	Broad area	Electrical Machines		Circuits & Systems		Electronics			Power Systems		Intelligent Systems	
		x		x		x			--		--	
5	Approval	23rd meeting of Academic Council, May 2013										

EE1210	DSP CONTROL OF ELECTRIC DRIVES	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite				
	Nil				

PURPOSE

This course enables us to understand the concept of digital signal processing and its application of electrical drives

INSTRUCTIONAL OBJECTIVES

1.	To understand the basic concepts of continuous and discrete time signals and systems
2.	To learn the general background in Frequency analysis
3.	To realize the concepts of Discrete Fourier Transform
4.	To emphasize the significance of Wavelet Transform and filtering.
5.	To enrich with the knowledge of Digital signal processing and its applications

UNIT I - INTRODUCTION (9 hours)

Classification of signals, Concept of frequency in Continuous and discrete time signals, A-D and D-A conversion. Discrete time signals and systems: Discrete Time Signals, Discrete Systems, Analysis of discrete time linear time- invariant systems, discrete time systems described by difference equations, Implementation of discrete time systems, Correlation of discrete time signals.

UNIT II - FREQUENCY ANALYSIS OF SIGNALS AND SYSTEM (9 hours)

Frequency analysis of continuous time signals, Frequency analysis of discrete time signal, Fourier transforms. Properties of Fourier transform for discrete time signals, Frequency domain characteristics of LTI systems, LTI systems as frequency selective filters, Inverse system and de-convolution.

UNIT III - DISCRETE FOURIER TRANSFORM (9 hours)

Frequency domain sampling, properties of DFT, linear filtering methods based on DFT, Frequency analysis of signals using DFT.Fast Fourier Transform: Efficient Computation of DFT, FFT algorithms, Direct Computation of DFT, Radix 2 FFT algorithms.

UNIT IV - WAVELET TRANSFORM (9 hours)

Short Time Fourier Transform, Continuous and discrete wavelet transform, Multi resolution analysis, Application of wavelet transform, Cestrum and Homomorphic filtering.

UNIT V - APPLICATIONS OF DSP IN ELECTRIC DRIVES (9 hours)

Advantages of DSP processors in comparison with ordinary processors regarding digital and analog interface, Harmonic analysis using DSP language features, PWM and firing pulse generation, Look up tables and real time computation. DSP applications to Power system: Review of various static and digital relays, Digital signal conditioning and algorithms for digital protection.

TEXT BOOKS

1. Monson.H, Hayes, "*Statistical Digital Signal Processing and Modelling*", John Wiley and Sons Inc., New York, Indian Reprint, 2007.
2. John G.Proakis, Dimitris G. Manolakis, "*Digital Signal Processing*", Pearson, Fourth 2007.

REFERENCES

1. Rafael C. Gonzalez, Richard E. Woods, "*Digital Image Processing*", Pearson, Second Edition, 2004.
2. Sophocles J. Orfanidis*, "Optimum Signal Processing, An Introduction*", McGraw Hill, 1990.

EE1210- DSP CONTROL OF ELECTRIC DRIVES												
Course Designed by		**Department of Electrical and Electronics Engineering**										
1	Student Outcome	a	b	c	d	e	f	g	h	i	j	k
		x		x		x			x			x
2	Mapping of instructional objectives with student outcome	1,2		1-3		2,3			4			4,5
3	Category	General (G)		Basic Sciences (B)		Engineering Sciences and Technical Arts (E)			Professional Subjects (P)			
		--		--		x			x			
4	Broad Area	Electrical Machines		Circuits & Systems		Electronics			Power Systems		Intelligent Systems	
		--		x		x			--		--	
5	Approval	23rd meeting of Academic Council, May 2013										

EI1201	REAL-TIME EMBEDDED SYSTEMS	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite				
	Nil				

PURPOSE

The purpose of this course is to make the students familiarize with real-time and embedded systems.

INSTRUCTIONAL OBJECTIVES	
1.	To understand the basic concepts of real time.
2.	To understand the Real-time programming tools.
3.	To understand basics of real-time OS
4.	To understand the basic concepts of embedded system and interfacing devices.

UNIT I - REAL TIME SYSTEMS (9 hours)

Introduction-Definition & characteristics of real-time systems - Issues in real time computing – Structure and performance measures of a real time system – Classical uniprocessor scheduling algorithms – Uniprocessor scheduling of IRIS tasks – Mode changes – Fault tolerant scheduling.

UNIT II - REAL TIME PROGRAMMING AND RELATION TOOLS (9 hours)

Desired language characteristics –Data typing – Control structures – Facilitating hierarchical decomposition – Package – Run time error handling – over loading and generics – Multi tasking – Low-level programming – Task scheduling – timing specifications – Programming environments – Run time support – Code generation.

UNIT III - REAL TIME OS (9 hours)

The real time kernel-Process scheduling-Round robin- Rate monotonic- Earliest-deadline-Inter task communication and synchronization- Ring Buffer- Mail box implementation- Queues- Semaphore- dead lock- priority inversion– Memory management –process stack management- Comparison and Study of RTOS – VxWorks and μCoS – Introduction to POSIX and OSEK standards

UNIT IV - EMBEDDED SYSTEMS (9 hours)

Introduction to embedded systems – hardware and software components – types- examples- characteristics –system on chip-challenges in embedded computing system design – embedded system design process.

UNIT V - EMBEDDED SYSTEM INTERFACING CONCEPT (9 hours)

Serial and parallel communication devices-wireless devices – timer & counting devices-Watch dog timer – Serial communication using I2C- CAN USB buses – Parallel Communication using ISA- PCI- PCI/X buses-wireless and mobile system protocol.

TEXT BOOKS

1. Krishna.C.M, "*Real Time systems*", 2nd edition, Mc-Graw-Hill Singapore, 1998.
2. Stuart Bennett, "*Real-time Computer Control*",2nd edition, Prentice Hall-London,1998.

REFERENCES

1. Laplante.P.A, "*Real- Time Systems Design and Analysis*", 3rd edition, EEE Press-NewYork, 1992.
2. Rajkamal, "*Embedded system-Architecture- Programming design*", 2nd edition Tata McGraw Hil., 2003.
3. Sriram. V.Iyer & Pankaj Gupta, "*Embedded real time systems Programming*", Tata McGraw Hill., 2007.

EI1201 REAL TIME EMBEDDED SYSTEMS												
Course Designed by		Department of Electronics and Instrumentation Engineering										
1	Student outcome	a	b	c	d	e	f	g	h	i	j	k
		x		x	x			x		x		x
2	Mapping of instructional objectives with student outcome	1,2,4		3,4	1,3,4			1,4		1,3,4		1,3,4
3	Category	General (G)		Basic Sciences (B)			Engineering Sciences and Technical Arts (E)			Professional Subjects (P)		
		--		--			--			x		
4	Broad area	Electronics Engineering		Instrumentation Engineering			Control Engineering			Electrical Engineering		
		x		--			--			--		
5	Approval	23rd meeting of Academic Council, May 2013										

	INSTRUMENTATION IN AEROSPACE AND NAVIGATION	L	T	P	C
EI1202	Total Contact Hours - 45	3	0	0	3
	Prerequisite				
	Nil				

PURPOSE

To expose the students to the field of aerospace engineering and to impart basic knowledge of its navigation instrumentation.

INSTRUCTIONAL OBJECTIVES

1.	To understand the basics of aerospace and navigation
2.	To know the technical aspects of this subject
3.	To get an idea of modern technology
4.	To know about various troubles in aircraft

UNIT I - INTRODUCTION TO AVIATION (9 hours)

History of aviation and space flight–anatomy of airplane and space vehicle with emphasis on control surfaces–airfoil nomenclature–basics of aerodynamics to illustrate lift and drag, types of drag, finite wings, swept wings, flaps– Airplane performance–thrust, power, rate of climb, absolute and service ceiling– range and endurance.

UNIT II - AIR CRAFT INSTRUMENTATION (9 hours)

Basic engine instruments– capacitive fuel content– gauges. Standard atmosphere, altimeters, aneroid – radio altimeters. Aircraft compass– remote indicating magnetic compass– rate of climb indicator–pitot static system– air speed indicator–mach meters– integrated flight instruments– flight testing–recording of flight tests.

UNIT III - RADIO NAVIGATION AIDS (9 hours)

Automatic direction finder – distance measuring equipments–instruments landing system – visual Omni range –radar – optical instruments – engine instruments and control – pressure measurements – thermal meter control –tachometer – accelerometer – smoke and fire detection – propeller controls – twin blade control - cabin pressure and temperature

UNIT IV - SATELLITE AND SPACE VEHICLE INSTRUMENTATIONS (9 hours)

Satellite and space vehicle instrumentation – propulsion controls – sun sensors – horizon sensors – star tracker – stabilization controls.

UNIT V - ELECTRICAL TROUBLES (9 hours)

Hydraulic systems troubles– landing gear troubles– cabin conditioning troubles – indication of unsafe canopy– Boeing condition – Radio troubles – Separate generator –System troubles –Trouble indicator light – Advantages of instrument flight – Black box and its use.

TEXT BOOKS

1. John D Anderson Jr., *"Introduction to Flight"*, McGraw-Hill.
2. Pallett.E.G.H, *"Aircraft Instrumentation and Integrated Systems",* Longman Scientific and Technical, 1992.
3. Nagaraja.N.S, *"Elements of Electronic Navigation",* Tata Mcgraw Hill Publishing Ltd., New Delhi, 1975.

REFERENCES

1. San Darite, "Radio aids to navigation",
2. Douglas M. Considine and Ross.S.D, *"Handbook of Applied Instrumentation"*, McGraw Hill, 1965.
3. John.H. Blakelock, *"Automatic control of aircraft and missiles",* John wiley and sons.inc, 1991.
4. Keyton.M and Walker.R, Fried,*"Avionics navigation systems"*,John Wiley. 1996, 2 Ed.
5. Siouris.G.M, *"Aerospace avionics system",*A modern synthesis, academic press. 1993.
6. Lin.C.F, *"Modern guidance, navigation and control processing",* Prentice hall-1991.

WEB RESOURCE

www.aronautic navigation instruments.com

EI1202 INSTRUMENTATION IN AEROSPACE AND NAVIGATION												
Course Designed by		**Department of Electronics and Instrumentation Engineering**										
1	Student Outcome	a	b	c	d	e	F	g	h	i	J	k
		x	x	x	x	x	x		x	x		x
2	Mapping of instructional objectives with student outcome	1-3	2-4	2-3	1-2	1,2,4	1-2		1,2	1		1-4
3	Category	General (G)		Basic Sciences (B)			Engineering Sciences and Technical Arts (E)				Professional Subjects (P)	
		--		--			--				x	
4	Broad Area	Electronics Engineering		Instrumentation Engineering			Control Engineering				Electrical Engineering	
		--		x			x				--	
5	Approval	23rd meeting of Academic Council, May 2013										

EI1203	**MICRO CONTROLLER BASED SYSTEM DESIGN**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	**3**	**0**	**0**	**3**
	Prerequisite				
	Digital systems, LIC, Microprocessors				

PURPOSE

To enable the students to acquire knowledge about microprocessor-based system design Issues.

INSTRUCTIONAL OBJECTIVES	
1.	Understand about hardware capabilities (e.g. embedded Processor organization; addressing modes; memory hierarchy; parallel and serial bus protocols).
2.	Understand about Hardware/software co-design aspects.
3.	Understand concepts of ARM Processor and programming them.
4.	Understand concepts of PIC controller and programming them.
5.	Understand various interfacing circuits necessary for various applications

UNIT I - EMBEDDED SYSTEMS (9 hours)

Introduction to embedded systems – hardware and software components – types- examples- characteristics –system on chip-challenges in embedded computing system design – embedded system design process.

UNIT II - EMBEDDED SYSTEM INTERFACING CONCEPT (9 hours)

Serial and parallel communication devices-wireless devices – timer & counting devices-Watch dog timer – Serial communication using I2C- CAN USB buses – Parallel Communication using ISA- PCI- PCI/X buses-wireless and mobile system protocol.

UNIT III - ARM PROCESSOR-7 (9 hours)

MSP430 architecture-addressing modes-constant generator and emulsion instructions-instruction set, functions- interrupts low power modes.

UNIT IV - PIC CONTROLLER (9 hours)

PIC microcontrollers: History and features - CCS C Compiler and PIC18F Development System- PIC Architecture & Programming - PIC I/O Port Programming -PIC Programming in C -PIC18 Hardware Connection and ROM loaders- PIC18 Timers Programming -PIC18 Serial Port Programming - Interrupt Programming.

UNIT V - INTERFACING AND APPLICATIONS (9 hours)

Interfacing PIC to LCD, Keyboard, parallel and serial ADC, DAC, Stepper motor interfacing, DC motor interfacing and PWM.

TEXT BOOK

1. Sriram. V.Iyer&Pankaj Gupta, "*Embedded real time systems Programming*", Tata McGraw- Hill, 2007.

REFERENCES

1. Rajkamal, "*Embedded system-Architecture, Programming and Design*", 2nd edition Tata McGraw-Hill, 2003.
2. John H. Davies, "MSP430 Microcontroller Basics", Newnes publishers, First edition, 2008.
3. Rafiquzzaman.M, "*Microcontroller Theory and Applications with the PIC18F"*, Wiley 2011.

EI1203 MICRO CONTROLLER BASED SYSTEM DESIGN												
Course Designed by		**Department of Electronics and Instrumentation Engineering**										
1	Student Outcome	a	b	c	d	e	F	g	h	I	j	k
		x	x	x	x	x					x	x
2	Mapping of instructional objectives with student outcome	1,2,3	3,4	3,4	4,5	3,4,5					3	5
3	Category	General (G)		Basic Sciences (B)			Engineering Sciences and Technical Arts (E)				Professional Subjects (P)	
		--		--			--				x	
4	Broad Area	Electronics Engineering		Instrumentation Engineering			Control Engineering				Electrical Engineering	
		--		--			x				--	
5	Approval	23rd meeting of Academic Council, May 2013										

EI1204	FIBER OPTICS AND LASER INSTRUMENTS	L	T	P	C
	Total Contact Hours - 45	**3**	**0**	**0**	**3**
	Prerequisite				
	Nil				

PURPOSE

To understand and apply optical fiber and laser technology in industrial and medical field.

INSTRUCTIONAL OBJECTIVES

1.	To provide the basic concepts of optical fibers and to provide knowledge about optical sources and optical detectors.
2.	To provide adequate knowledge about industrial applications of optical fibers.
3.	To provide adequate knowledge about Laser fundamentals and to provide adequate knowledge about Industrial application of lasers.
4.	To provide adequate knowledge about holography & Medical applications of Lasers.

UNIT I - OPTICAL FIBERS AND THEIR PROPERTIES (9 hours)

Basic optical laws and definitions– Principles of light propagation through a fiber – Different types of fiber and their properties – Modes of propagation – Attenuation - Signal distortion in optical waveguides – Pulse broadening in graded index waveguides – Absorption losses – Scattering losses – Dispersion – Connectors & Splicers.

UNIT II - OPTICAL SOURCES AND OPTICAL DETECTOR (9 hours)

Optical sources – LED structures – types of LED – planar – dome – surface emitting – Light source materials – Quantum efficiency and LED power – Modulation of an LED.Optical detectors – Principles of photo detection – PIN photodiode – Avalanche photodiode and its characteristics.

UNIT III - INDUSTRIAL APPLICATIONS OF OPTICAL FIBERS (9 hours)

Fiber optic sensors – Fiber optic instrumentation system – Different types of modulators –Interferometric method of measurement of length – Moire fringes – Measurement of pressure –temperature – current – voltage – liquid level and strain.

UNIT IV - LASER FUNDAMENTALS AND ITS APPLICATIONS (9 hours)

Laser rate equation – 3 & 4 level lasers – Properties of laser – Laser modes – Resonator configuration – Q switching – Mode locking – Cavity damping – Types of lasers – gas – solid – liquid and semiconductor lasers – Laser for measurement of length – Atmospheric effects and pollutants – Material processing – Laser heating – Melting – Trimming – Welding – Material removal and vaporization – Calculation of power requirement of laser for material processing

UNIT V - HOLOGRAPHY AND MEDICAL (9 hours)

Holography – Basic principles – Methods of holographic interferometry and applications –Holography for NDT – Medical application of lasers – Laser and tissue interaction – Laser instruments for surgery – Removal of tumors of vocal chords – Brain surgery – Plastic surgery –Gynecology – Oncology.

TEXT BOOKS

1. Senior.J.M, "*Optical Fiber Communication – Principles and Practice"*, Prentice Hall of India, 2nd edition, 2009.
2. Keiser, "*Optical Fiber Communication Systems"*, McGraw Hill Ltd., 2000.

REFERENCES

1. John F. Ready, '*Industrial Applications of Lasers'*, Academic Press, 2004.
2. Khare.R .P,"*Fiber optics and optoelectronics"*, Oxford, 2006.
3. Das.P,"*Lasers and optical engineering"*, Springer international edition, 2009.
4. Ghatak and Thiagarajan .K, "*Introduction to fiber optics"*, Foundation Books, 2000.
5. Sarah.P, '*Lasers and optical fiber communication'*, 2008.
6. Smith.H.M, "*Principles of Holography"*, John Wiley and Sons.

EI1204-FIBER OPTICS AND LASER INSTRUMENTATION												
Course Designed by		**Department of Electronics and Instrumentation Engineering**										
1	Student outcome	a	b	c	d	e	f	g	h	l	j	k
		x	x	x	x	x			x			x
2	Mapping of instructional objectives with student outcome	2-4	1-4	4	3,4	1-4			1-4			3,4
3	Category	General (G)		Basic Sciences (B)			Engineering Sciences and Technical Arts (E)				Professional Subjects (P)	
		--		--			--				x	
4	Broad area	Electronics Engineering		Instrumentation Engineering			Control Engineering				Electrical Engineering	
		--		x			--				--	
5	Approval	23rd meeting of Academic Council, May 2013										

EI1205	**INSTRUMENTATION ENGINEEERING**	**L**	**T**	**P**	**C**
	Total Contact Hours – 45	**3**	**0**	**0**	**3**
	Prerequisite				
	Nil				

PURPOSE

To provide in depth understanding of operation, performance and applications of important measuring Instruments.

INSTRUCTIONAL OBJECTIVES

1.	To make the students familiar with the characteristics of measurement devices
2.	To provide experience on design, testing, and analysis of measurement devices
3.	To have an adequate knowledge in various display and recording devices.
4.	To expose the students to apply the real time experiments.

UNIT I - BASICS OF INSTRUMENTATION (9 hours)

Functional Elements of Instrumentation - Characteristics of Instruments- Static and Dynamic - Errors-Statistical analysis of Errors - Measurement Standards-primary-Secondary-International-working

UNIT II - PRIMARY SENSING ELEMENTS AND TRANSDUCERS (9 hours)

Resistive- Resistance potentiometers - Strain Gauges - Hotwire anemometer-Capacitive- Variable air gap type- Variable area type and Variable permittivity type – Capacitor microphone - Inductive- EI pick up- LVDT and piezoelectric Transducers -Measurement of displacement- velocity and acceleration (Translational and Rotational)

UNIT III - INSTRUMENTS FOR NON ELECTRICAL PARAMETER (9 hours)

Pressure-Bourdon tube - Bellows and Diaphragms- Level Measurement– Float-Displacer type and Bubbler system –Temperature-Thermistors – Resistance-thermometers -Thermocouples and– Flow-Orifice plate -Venturi tube - pH Measurement - Viscosity-Say bolt viscometer and Rotameter type viscometer

UNIT IV - SIGNAL CONDITIONING UNIT (9 hours)

Operational Amplifier-Ideal Operational amplifier –Instrumentation amplifier - Sample and hold circuit-A/D Converter- Successive Approximation-Ramp-Dual-Integration-D/A Converter- Weighted Resistor-R-2R - Filters-Low pass-High Pass-Band Pass- Band Reject

UNIT V - DISPLAY AND RECORDING INSTRUMENTS (9 hours)

Display Devices-Cathode Ray Tube Displays –Seven Segment and dot matrix display –Reading/Recording Devices – X-Y recorders – Magnetic tape recorders – Digital recording and data loggers - Serial and parallel communication devices-RS 232 and RS 485

TEXT BOOKS

1. Liptak.B.G, *"Instrumentation Engineers Handbook (Measurement)"*, CRC Press, 2005
2. Sawhney.A.K, *"A course in Electrical & Electronic Measurement and Instrumentation"*, Dhanpat Rai and Co (P) Ltd., 2004.

REFERENCES

1. Bell.A, "*Electronic Instrumentation and Measurements"*, Prentice Hall of India, New Delhi, 2003.
2. Patranabis, "*Sensors and Transducers"*, 2nd ed., Prentice Hall of India, New Delhi, 2003.

3. Helfrick and Cooper.W.D, "*Modern Electronic Instrumentation and Measurement Techniques"*, Pearson Education, Delhi, 1992.
4. Bentley.J.P, "*Measurement Systems",* Pearson Education, Delhi, 2003.
5. Beckwith.T.G, Marangoni.R.D and Lienhard.J.H, "*Mechanical Measurements"*, 5th edition,Pearson Education, Delhi, 1993.

EI1205- INSTRUMENTATION ENGINEEERING												
Course Designed by		**Department of Electronics and Instrumentation Engineering**										
1	Student outcome	a	b	c	d	E	F	g	h	i	j	k
		x	x	x	x	X	X	x	x	x		
2	Mapping of Instructional objectives with student outcome	1,2	2,4	1,2,4	1,2,3, 4	2	1,2	4	4	2,4		
3	Category	General (G)		Basic Sciences (B)			Engineering Sciences and Technical Arts (E)				Professional Subjects (P)	
		--		--			--				x	
4	Broad area	Electronics Engineering		Instrumentation Engineering			Control Engineering				Electrical Engineering	
		x		x			--				--	
5	Approval	23rd meeting of Academic Council, May 2013										

FP1201	**HUMAN NUTRITION AND HEALTH**	**L**	**T**	**P**	**C**
	Total Contact hours - 45	**3**	**0**	**0**	**3**
	Prerequisite				
	Nil				

PURPOSE

Provides a perspective for understanding about a basis of nutrition and requirement pattern, food for health and disease alleviation.

INSTRUCTIONAL OBJECTIVES

After Successful completion of this course the students will be able to,

1.	Understand about Composition of foods
2.	Know about nutrients metabolites and dietary evaluation.
3.	Calculate energy value of foods

UNIT I - INTRODUCTION TO NUTRITION (9 hours)

Classification of nutrition, RDA for nutrients, Digestion and absorption and metabolism of foods.

UNIT II - MAJOR AND MICRO NUTRIENTS (9 hours)

Carbohydrates ,Proteins, Fat, Vitamins and Minerals- Classification with respect to nutrition aspects, functions and sources.

UNIT III - FOOD AS ENERGY **(9 hours)**

Forms of energy, Energy value of foods, estimation of energy requirement for humans.

UNIT IV - TYPES OF DIET **(9 hours)**

Balanced diet, Modified diet, planning for balanced diet

UNIT V - NUTRITIONAL FOODS **(9 hours)**

Health specific nutrition, nutritive value of fast foods, nutritional evaluation of foods, nutritional labeling

TEXT BOOK

1. Sunetra Roday, "*Food science and Nutrition*". Oxford Publishers 2007.

REFERENCE

1. Norman N. Potter, Joseph H. Hotchkiss. "*Food science*". Springer Publications 1988.

FP1201 HUMAN NUTRITION AND HEALTH												
	Course Designed by	**Department of Food Process Engineering**										
1	Student outcome	a	b	c	d	e	f	g	h	i	j	k
		x										
2	Mapping of instructional objectives with student outcome	1-3										
3	Category	General (G)		Basic Sciences (B)		Engineering Sciences and Technical Arts (E)				Professional Subjects (P)		
		--		--		--				x		
4	Broad area	Basic Bio Sciences		Food Engineering		Product Development				Industrial Application		
		x		--		--				--		
5	Approval	23rd meeting of Academic Council, May 2013										

FP1202	FOOD PRODUCTS DEVELOPMENT	L	T	P	C
	Total Contact hours - 75	0	2	3	3
	Prerequisite				
	Nil				

PURPOSE

To introduce a basic knowledge about the process for developing food products with market perspective

INSTRUCTIONAL OBJECTIVES

1.	To train the students for developing a new product through scientific approach
2.	To make them understand the importance of packaging and nutritional labeling of food products

UNIT I - INTRODUCTION **(6 hours)**

Designing new products- History, current status and future perspective

UNIT II - R & D IN NEW PRODUCT DEVELOPMENT **(6 hours)**

Different phases- screening, Feasibility, Development, Commercialization and maintenance

UNIT III - PRODUCT EXCELLENCE THROUGH EXPERIMENTAL DESIGN **(6 hours)**

Design of experiment- identification of critical factor-optimization

UNIT IV - PACKAGING AND LABELING **(6 hours)**

Role- types of packages and labeling requirements

UNIT V - SHELF LIFE STUDIES **(6 hours)**

Different methods of shelf life study and sensory evaluation techniques.

REFERENCE

1. Ernst Graf and Israel Sam Saguy, "*Food Product development. From concept to Market place*". First edition. CBS publishers and Distributors, New Delhi 1998.

LIST OF EXPERIMENTS **(45 hours)**

1. Experiment on fruit beverage preparation.
2. Experiment on fruit candy preparation.
3. Experiment on fruit preserve preparation.
4. Experiment on milk based beverage preparation.
5. Experiment on osmotic dehydration of fruits and vegetables
6. Experiment on freeze dried products
7. Experiments on spray dried products
8. Experiment on bakery products preparation
9. Experiment on confectionery product preparation
10. Experiment on ready mix preparation
11. Experiment on fermented products preparation

FP1202 FOOD PRODUCTS DEVELOPMENT												
Course Designed by		Department of Food Process Engineering										
1	Student outcome	a	b	c	d	e	f	g	h	i	j	k
		x										
2	Mapping of instructional objectives with student outcome	1-2										
3	Category	General (G)		Basic Sciences (B)		Engineering Sciences and Technical Arts (E)		Professional Subjects (P)				
		--		--		--		x				
4	Broad area	Basic Bio Sciences		Food Engineering		Product Development		Industrial Application				
		--		--		x		--				
5	Approval	23rd meeting of Academic Council, May 2013										

	TECHNOLOGY OF BAKERY AND CONFECTIONERY PRODUCTS	L	T	P	C
FP1203	Total Contact hours - 75	0	2	3	3
	Prerequisite				
	Nil				

PURPOSE

This course covers the fundamentals raw material identification while focusing on the needs of bakery and confectionery industries.

INSTRUCTIONAL OBJECTIVES

By the end of the course students will

1.	Interpret common baking and confectionery terminologies
2.	Exhibit the use of sanitation and safety practices in bakery production
3.	Develop an understanding of process technology for bakery and confectionery products

UNIT I - INTRODUCTION (6 hours)

Status of bakery and confectionery industries in India- Raw materials for bakery and confectionery products- Essential and optional.

UNIT II - BAKERY PRODUCTS TECHNOLOGY (6 hours)

Dough rheology - Bread ,Biscuit, Cookies,Crackers, Cakes, Doughnuts-processing methods.

UNIT III - BAKERY MACHINERY AND EQUIPMENT (6 hours)

Baking equipment – dough mixers, makeup equipments, different oven, slicer.

UNIT IV - CONFECTIONERY PRODUCTS (6 hours)

Chocolate, fondant, caramels, fudge and toffee - processing methods.

UNIT V - SPECIFICATIONS AND SAFETY (6 hours)

PFA Specification of raw materials. FSSA standards for bakery and confectionery industries.

TEXT BOOKS

1. Indian standards Glossary of terms relation to flour milling industry by Indian standard institution, New Delhi
2. S.C. Dubey, Basic Baking, Science and craft
3. The prevention of food adulteration ACT, by Akalank publication, Delhi 1954.

REFERENCES

1. The complete Technology book on bakery products by NIIR Board
2. Chocolate, Cocoa, and confectionery (Science and Technology, 3rd edition by Bernard. W. Minifie., PhD., CBS publishers and Distributors, New Delhi-110002
3. Principles of Bakery and confectionery technology by Yogambal

LIST OF EXPERIMENTS (45 hours)

1. Experiment on determination of quality parameters for raw materials
2. Experiment on preparation of bread
3. Experiment on preparation of cakes
4. Experiment on preparation of Cookies
5. Experiment on preparation of biscuits
6. Experiment on preparation of doughnut
7. Experiment on determination of different stages of sugar cookeries
8. Experiment on preparation of candies
9. Experiment on preparation of chocolate
10. Experiment on preparation of fudge
11. Experiment on preparation of caramel
12. Experiment on preparation of toffee

FP1203 TECHNOLOGY OF BAKERY AND CONFECTIONERY PRODUCTS												
Course Designed by		Department of Food Process Engineering										
1	Student outcome	a	b	c	d	e	f	g	h	i	j	k
		x										
2	Mapping of instructional objectives with student outcome	1-3										
3	Category	General (G)		Basic Sciences (B)		Engineering Sciences and Technical Arts (E)			Professional Subjects (P)			
		--		--		--			x			
4	Broad area	Basic Bio Sciences		Food Engineering		Product Development			Industrial Application			
		--		--		x			--			
5	Approval	23rd meeting of Academic Council, May 2013										

FP1204	TECHNOLOGY OF FERMENTED FOODS	L	T	P	C
	Total Contact hours -75	0	2	3	3
	Prerequisite				
	Nil				

PURPOSE

To impart knowledge and skills related to process technologies and equipment used for the production of various fermented food products

INSTRUCTIONAL OBJECTIVES

Students completing this course should be able

1.	To understand various concepts, principles and procedures involved in the area of fermented food production.
2.	To familiarize with different fermentor types and their design criteria.

UNIT I - FERMENTATION PROCESS (6 hours)

Introduction to fermentation - definition - benefit of fermentation - nutritive value of fermented foods - micro organism -microbial changes in fermented foods

UNIT II - FERMENTATION TYPES (6 hours)

Selection of industrial importance microorganism - production of single cell protein - Medium Composition - Types of fermentation process-Alcoholic and acidic fermentation - Lactic acid fermentation

UNIT III - FERMENTOR (6 hours)

Basic functions of fermentor - Design of fermentor - types of fermentor. Recovery and purifications of food products

UNIT IV - TRADITIONAL FERMENTED PRODUCTS **(6 hours)**

Dosa, Idly, dhokla, Curd, yoghurt, , miso, shrikand, cheese

UNIT V - MODERN FERMENTED PRODUCTS **(6 hours)**

Wine, beer, brandy, vinegar, baker's yeast, sauerkrauts, sausages

TEXT BOOKS

1. Joshi.V.K and Ashok Pandey .Biotechnology: Food Fermentation
2. Pederson.C.S, *"Microbiology of food fermentations"*, AVI Publishing company. Westport, Connecticut 1971.

REFERENCES

1. James M. Jay, Martin.J. Loessner, David. A. Golden, "*Modern Food Microbiology*". Springer Science Media Publisher, New York. USA 2005.
2. Stanbury.P.F, Allan Whitaker and Hall.S.J, "*Principles of Fermentation Technology".* Aditya books private Ltd., New Delhi 1997.

LIST OF EXPERIMENTS **(45 hours)**

1. Experiment on preparation of curd
2. Experiment on preparation of yoghurt
3. Experiment on preparation of cheese
4. Experiment on preparation of shrikhand
5. Experiment on preparation of rabadi
6. Experiment on preparation of Pickles
7. Experiment on preparation of Vinegar
8. Experiment on preparation of wine
9. Experiment on preparation of bread
10. Experiment on preparation of dhokla
11. Experiment on preparation of idly batter
12. Experiment on preparation of Sauerkraut

FP1204 TECHNOLOGY OF FERMENTED FOODS												
Course Designed by		**Department of Food Process Engineering**										
1	Student outcome	a	b	c	d	e	f	g	h	i	j	k
		x										
2	Mapping of instructional objectives with student outcome	1-2										
3	Category	General (G)		Basic Sciences (B)		Engineering Sciences and Technical Arts (E)				Professional Subjects (P)		
		--		--		--				x		
4	Broad area	Basic Bio Sciences		Food Engineering		Product Development				Industrial Application		
		--		--		x				--		
5	Approval	23rd meeting of Academic Council, May 2013+										

	FOOD PROCESSING AND PRESERVATION TECHNOLOGY	L	T	P	C
FP1205	Total Contact hours - 45	**3**	**0**	**0**	**3**
	Prerequisite				
	Nil				

PURPOSE

This course enables the students to know the status of food processing industries and to gain knowledge about different preservation techniques of food.

INSTRUCTIONAL OBJECTIVES

1.	To understand the principles involved in processing and preservation of fruits, vegetables and milk
2.	To know the production technologies of various value added product from food.

UNIT I - INTRODUCTION (9 hours)

Status of food processing sector in India, scope – how to start food processing industries- subsidy/ loan available- Food laws- FSSAI- national and international level.

UNIT II - FRUITS AND VEGETABLES PRESERVATION (6 hours)

Fruits and vegetables processing techniques – drying, canning, freezing, modified atmosphere packaging. Value addition

UNIT III - DAIRY TECHNOLOGY (8 hours)

Milk- composition- quality testing- types of milk- milk flow in industry- pasteurization types- homogenization, standardization. Value added products. CIP.

UNIT IV - CROP PROCESSING (13 hours)

Processing of paddy, wheat, coffee, tea, cocoa, cashew, pepper, cardamom, chilli, turmeric, tapioca, potato

UNIT V - BAKERY AND CONFECTIONERY TECHNOLOGY (9 hours)

Raw materials – essential and optional. Bakery products- bread, biscuit, cookies, cakes. Confectionery products – chocolate, candy, fudge, toffee. Equipments used.

TEXT BOOKS

1. De Sukumar, "*Outlines of Dairy Technology*", Oxford University Press, New Delhi, 1999.

2. Verma.L.R and Joshi.V.K, Post Harvest technology of fruits and vegetables handling, processing, fermentation and waste management. General concepts and principles. Volume 1, Indus Publishing Company, New Delhi 2000.

REFERENCES

1. Verma.L.R and Joshi.V.K, Post Harvest technology of fruits and vegetables handling, processing, fermentation and waste management. General concepts and principles. Volume 2, Indus Publishing Company, New Delhi 2000.
2. Yogambal Ashokkumar, Principles of Bakery and confectionery technology. Published by Asoke K.Ghosh, PHI Learning Private Ltd., New Delhi 2009.

FP1205 FOOD PROCESSING AND PRESERVATION TECHNOLOGY												
Course Designed by		**Department of Food Process Engineering**										
1	Student outcome	a	b	c	d	e	f	g	h	i	j	k
		x										
2	Mapping of instructional objectives with student outcome	1-2										
3	Category	General (G)		Basic Sciences (B)		Engineering Sciences and Technical Arts (E)				Professional Subjects (P)		
		--		--		--				x		
4	Broad area	Basic Bio Sciences		Food Engineering		Product Development				Industrial Application		
		--		x		--				--		
5	Approval	23rd meeting of Academic Council, May 2013										

	DISASTER MANAGEMENT	L	T	P	C
GE1201	Prerequisite	**2**	**0**	**1**	**3**
	Nil				

PURPOSE

This course is being introduced to enable students and citizens to recognize the increasing vulnerability of the planet in general and India in particular to disasters. This, it is expected would create a basis to work towards preparedness and also help us develop a culture of safety and prevention

INSTRUCTIONAL OBJECTIVES

1.	To provide students an exposure to disasters, their significance and types.
2.	To ensure that students begin to understand the relationship between vulnerability,disasters, disaster prevention and risk reduction

3.	To gain a preliminary understanding of approaches of Disaster Risk Reduction (DRR)
4.	To enhance awareness of institutional processes in the country and
5.	To develop rudimentary ability to respond to their surroundings with potential disaster response in areas where they live,with due sensitivity

UNIT I - INTRODUCTION TO DISASTERS (6 hours)

Concepts and definitions of disaster - hazard, vulnerability, resilience, risks, Difference between accidents and disasters

Categories of disasters -Natural disasters – earthquake, cyclone, flood, tsunami, and Man-made disasters – technological, armed conflict and civil strife

UNIT II - DISASTERS: CAUSES, IMPACTS (6 hours)

General causes of natural and man-made disasters Differential impacts- in terms of caste, class, gender, age, location, economical, political, environmental, health, psychosocial, disability. Global trends in disasters - urban disasters, pandemics, complex emergencies, Climate change.

UNIT III - APPROACHES TO DISASTER RISK REDUCTION (6 hours)

Disaster cycle - its analysis, Phases, Culture of safety, prevention, mitigation and preparedness, community based DRR, Structural- nonstructural measures, roles and responsibilities of- community, Panchayati Raj Institutions/Urban Local Bodies (PRIs/ULBs), states, Centre, and other stake-holders.Principles of disaster medical management – Medical triage – pre-hospital medical management of victims. Master planning for the future, capacity building and sustainable management Ethical issues in disaster management – social, religious, caste sensitivities – overriding of ethics under extreme pressure situations.

UNIT IV - INTER-RELATIONSHIP BETWEEN DISASTERS AND DEVELOPMENT (6 hours)

Factors affecting Vulnerabilities, differential impacts, impact of Development projects such as dams, embankments, changes in Land-use, nuclear installations -. Climate Change Adaptation. Relevance of indigenous knowledge, appropriate technology and local resources.

UNIT V - DISASTER RISK MANAGEMENT IN INDIA (6 hours)

Hazard and Vulnerability profile of India

Components of Disaster Relief: Water, Food, Sanitation, Shelter, Health, Waste Management Institutional arrangements (Mitigation, Response and Preparedness, DM Act and Policy, Other related policies, plans, programmes and legislation)

PROJECT WORK: (FIELD WORK, CASE STUDIES) (15 hours)

The project /fieldwork is meant for students to understand vulnerabilities and to work on reducing disaster risks and to build a culture of safety. Projects must be conceived creatively based on the geographic location and hazard profile of the region where the college is located.A few ideas or suggestions are discussed below.

Several governmental initiatives require Urban Local Bodies (ULBs) and Panchayati Raj Institutions (PRIs) to be proactive in preparing DM Plans and community based disaster preparedness plans. Information on these would be available with the district Collector or Municipal Corporations. The scope for students to collaborate on these initiatives is immense. Teachers may explore possibilities.

Teachers could ask students to explore and map Disaster prone areas, vulnerable sites, vulnerability of people (specific groups) and resources. The students along with teachers could work on ways of addressing these vulnerabilities, preparing plans in consultation with local administration or NGOs.

Students could conduct mock drills in schools, colleges or hospitals. They could also work on school safety, safety of college buildings) training in first aid.

Other examples could be- identifying how a large dam, road/ highway or an embankment or the location of an industry affects local environment and resources or how displacement of large sections of people creates severe vulnerabilities may be mapped by student project work.

TEXT BOOKS

1. Alexander David, Introduction in "*Confronting Catastrophe*", Oxford University Press, 2000.
2. Kapur, Anu & others, "*2005: Disasters in India Studies of grim reality*", Rawat Publishers, Jaipur
3. Gupta Anil K, Sreeja S. Nair. 2011 "*Environmental Knowledge for Disaster Risk Management",* NIDM, New Delhi

REFERENCES

1. Andharia J. Vulnerability in Disaster Discourse, JTCDM, Tata Institute of Social Sciences Working Paper no. 8, 2008
2. Blaikie, P, Cannon T, Davis I, Wisner B 1997. At Risk Natural Hazards, Peoples' Vulnerability and Disasters, Routledge.

3. Coppola P Damon, 2007. Introduction to International Disaster Management,
4. Carter, Nick 1991. Disaster Management: A Disaster Manager's Handbook. Asian Development Bank, Manila Philippines.
5. Cuny, F. 1983. Development and Disasters, Oxford University Press.
6. Document on World Summit on Sustainable Development 2002.
7. Govt. of India: Disaster Management Act 2005, Government of India, New Delhi.
8. Government of India, 2009. National Disaster Management Policy,
9. Indian Journal of Social Work 2002. Special Issue on Psychosocial Aspects of Disasters, Volume 63, Issue 2, April.
10. Kapur Anu 2010: Vulnerable India: A Geographical Study of Disasters, IIAS and Sage Publishers, New Delhi.
11. Parasuraman S, Acharya Niru 2000. Analysing forms of vulnerability in a disaster, The Indian Journal of Social Work, vol 61, issue 4, October
12. Pelling Mark, 2003 The Vulnerability of Cities: Natural Disaster and Social Resilience Earthscan publishers, London
13. Reducing risk of disasters in our communities, Disaster theory, Tearfund, 2006.
14. UNISDR, Natural Disasters and Sustainable Development: Understanding the links between Development, Environment and Natural Disasters, Background Paper No. 5. 2002.
15. IFRC, 2005. World Disaster Report: Focus on Information in Disaster, pp.182-225.

Web sites and Web Resources:

16. NIDM Publications at http://nidm.gov.in- Official Website of National Institute of Disaster Management (NIDM), Ministry of Home Affairs, Government of India
17. http://cwc.gov.in , http://ekdrm.net , http://www.emdat.be ,
18. http://www.nws.noaa.gov , http://pubs.usgs.gov , http://nidm.gov.in/
19. http://www.imd.gov.ini

GE1201 DISASTER MANAGEMENT	
Course Designed by	**Faculties of Engineering & Technology, Medicine & Health Sciences and Science & Humanities**
Student outcome	The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental and societal context
Mapping of instructional objectives with student outcome	The stated instructional objectives are directly relevant to the student outcomes
Category	General (G)
Approval	23rd Academic council, May 2013.

GE1202	CYBER SECURITY	L	T	P	C
	Total contact hours - 15	3	0	0	3
	Prerequisite				
	Nil				

PURPOSE

The proliferation of Internet has impacted the lives of people in all professions. Equally, they are also prone to get attacked by hackers and intruders and eventually lose their privacy. Naïve users of Internet, without proper awareness and implications carry out communication in the cyber world. Therefore, it becomes indispensable for every individual to gain knowledge in the fundamentals of cyber security, best practices related to cyber security and legal implications of intruding in the privacy of others. This necessitates the need for this course on Cyber Security.

INSTRUCTIONAL OBJECTIVES

1.	Understand the need for Cyber security and its related threats and attacks
2.	Learn methods to become secure in the cyber world and securely communicate in the cyber world
3.	Become knowledgeable about the best practices related to cyber security, regulations and laws associated with the same.

UNIT I- NEED FOR CYBER SECURITY (9hours)

Introduction to security- CIA triad-Case studies- security attacks-issues related to social networking - Guidelines

UNIT II - METHODS TO SECUREYOURSELF IN THE CYBER WORLD (9 hours)

Why and What of Reversible and Irreversible Cryptographic mechanisms? - Applications of Digital Signature - Good password practices

UNIT III - E-COMMERCE: SECURE TRANSACTIONS (9 hours)

What is E-commerce? – Online banking security- Online shopping fraud- Guidelines and Recommendations

UNIT IV - EVERYDAY SECURITY (9 hours)

Connecting your laptop, mobile devices, PDAs to Internet-Managing your browser-Facebook Security-E-mail security – Safe guarding from Viruses: Antiviruses– Best practices and guidelines

UNIT V - CYBER SECURITY LAWS AND COMPETENT AUTHORITIES (9 hours)

Indian IT Act, 2008 - What is Cyber Forensics? – Functions of cybercrime cell – Responding to a cyber attack

REFERENCES

1. *"Information Security Awareness Handbook*, *ISEA, Department of Electronics* and Information Technology", Government of India, 2010
2. *deity.gov.in/sites/upload_files/dit/.../**itact**2000/it_amendment_**act2008**.pdf*
3. *www.schneier.com/blog/archives/2013/03/**browser**_securit.html*
4. *www.dhses.ny.gov/ocs/awareness-training-events/news/2010-03.cfm*
5. *https://www.watsonhall.com/**e-commerce-security**/*

GE1202 CYBER SECURITY	
Course Designed by	**Department of Information Technology**
Student outcome	The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental and societal context
Mapping of instructional objectives with student outcome	The stated instructional objectives are directly relevant to the student outcomes
Category	General (G)
Approval	23rd Academic council, May 2013.

	PROFESSIONAL ETHICS	L	T	P	C
GE1203	Total Contact Hours - 45	**3**	**0**	**0**	**3**
	Prerequisite				
	Nil				

PURPOSE

To make the students understand ethics in engineering and infuse them with confidence to apply the same in their professional life.

INSTRUCTIONAL OBJECTIVES

1.	To understand the relevance of ethics and morals in engineering
2.	To appreciate the vulnerability to failure of engineering processes
3.	To comprehend the finer aspects of safety and risk with reference to the responsibilities of engineers.
4.	To understand the link between responsibility, rights and accountability
5.	To understand the global impact of engineering profession

UNIT I - MORALS AND ETHICS IN ENGINEERING (9 hours)

Senses of 'Engineering Ethics' – Variety of moral issues – Types of inquiry – Moral dilemmas – Moral Autonomy – Kohlberg's theory – Gilligan's theory –

Indian Theory-Consensus and Controversy – Professions and Professionalism – Professional Ideals and Virtues – Uses of Ethical Theories

UNIT II - ENGINEERING AS SOCIAL EXPERIMENTATION (9hours)

Engineering as Experimentation – Engineers as responsible Experimenters – Research Ethics - Codes of Ethics – Industrial Standards - A Balanced Outlook on Law – The Challenger Case Study – Titanic disaster as Case Study

UNIT III - ENGINEER'S RESPONSIBILITY FOR SAFETY (9 hours)

Safety and Risk – Assessment of Safety and Risk – Risk Benefit Analysis – Reducing Risk – The Government Regulator's Approach to Risk – Disasters at Chernobyl and Bhopal - Case Studies

UNIT IV - RESPONSIBILITIES, RIGHTS AND ACCOUNTABILITY (9 hours)

Collegiality and Loyalty – Respect for Authority – Collective Bargaining – Confidentiality – Conflicts of Interest – Occupational Crime – Professional Rights – Employee Rights – Intellectual Property Rights (IPR) – Discrimination

UNIT V - GLOBAL ISSUES (9 hours)

Multinational Corporations – Business Ethics - Environmental Ethics – Computer Ethics - Role in Technological Development – Weapons Development – Engineers as Managers – Consulting Engineers – Engineers as Expert Witnesses and Advisors – Honesty – Moral Leadership – Sample Code of Conduct

TEXT BOOKS

1. Mike Martin and Roland Schinzinger, *"Ethics in Engineering",* McGraw Hill, New York, 2005.

REFERENCES

1. Charles E Harris, Michael S Pritchard and Michael J Rabins, *"Engineering Ethics oncepts and Cases",* Thompson Learning, 2000.
2. Charles D Fleddermann, *"Engineering Ethics",* Prentice Hall, New Mexico, 1999.
3. John R Boatright, "*Ethics and the Conduct of Business",* Pearson Education, 2003.
4. Edmund G Seebauer and Robert L Barry, *"Fundamentals of Ethics for Scientists and Engineers"*, Oxford University Press, 2001.
5. Prof. (Col) P S Bajaj and Dr. Raj Agrawal, *"Business Ethics – An Indian Perspective",* Biztantra, New Delhi, 2004.

6. David Ermann and Michele S Shauf, *"Computers, Ethics and Society",* Oxford University Press, 2003.
7. Jayashree Suresh, Raghavan, B.S., "*Professional Ethics",* S. Chand & Company Ltd., 2005

GE1203 PROFESSIONAL ETHICS												
Course Designed by		Department of Civil Engineering										
1	Student Outcome	a	b	c	d	e	f	g	h	i	j	k
									x		j	
2	Mapping of instructional objectives with student outcome								1-5		1-5	
3	Category	General(G)										
4	Approval	23rd meeting of Academic Council, May 2013										

	INSTRUMENTS IN BIOENGINEERING RESEARCH	L	T	P	C
GN1202	Total Contact Hours - 45	**3**	**0**	**0**	**3**
	Prerequisite				
	Nil				

PURPOSE

This course helps the engineering students to understand the working principle of the instruments that are used in bioengineering research. This course also provides information on the applications of these instruments in research so that the students with their knowledge and skills in engineering may think of improving the efficiency of the existing instruments or radically designing new equipments.

INSTRUCTIONAL OBJECTIVES

1.	To acquire knowledge about different techniques used in life sciences.
2.	To understand the working principle of various instruments.
3.	To think of improving the existing instruments or designing new equipments.

UNIT I - INSTRUMENTS USED TO VISUALIZE THE MICROORGANISM (10 hours)

Seeing the microscopic organism using Light Microscopy, Fluorescence Microscopy,Confocal Microscopy Looking at sub cellular regions using Electron Microscopy, Types of Electron Microscopy-Transmission Electron Microscopy and Scanning Electron Microscopy

UNIT II - INSTRUMENTS USED TO ANALYZE THE DNA (9 hours)

Visualization of DNA by agarose Gel Electrophoresis and Gel Documentation, Amplification of DNA using Polymerization Chain Reaction (PCR) machine – normal, gradient, and Real time PCR, Reading the DNA using DNA sequencer

UNIT III - INSTRUMENTS USED TO ANALYZE AND PURIFY THE PROTEINS (9 hours)

Visualization of Protein: SDS PAGE and 2D Gel Electrophoresis, Purification of protein: Chromatographic techniques, FPLC and HPLC

UNIT IV - INSTRUMENTS USED TO INVESTIGATE THE CHEMICAL NATURE (9 hours)

Quantification of biological samples: UV visible spectroscopy, Identification of chemical nature of the biological sample: Infra Red spectroscopy and NMR

UNIT V - ADVANCE TECHNIQUES USED IN HEALTH CARE (8 hours)

Biological sensors used in healthcare: Enzyme and Microbial biosensor - Clinical diagnosis by DNA microarray and DNA chip

TEXT BOOKS

1. John G Webster,*Bioinstrumentation,* Wiely, 2003
2. PJan-ChristerJanson, *Protein Purification: Principles, High Resolution Methods, and Applications,* Wiely, 2012

REFERENCES

1. Michelj Dykstra, *Biological Electron Microscopy: Theory, Techniques and Troubleshooting,* Kluwer Academic Publisher, 2003.
2. Marrin C McMaster, HPLC: Practical approach 2nd edition,Wiely-interscience, 2006
3. GreenMR, Sambrook J, *Molecular Cloning:ALaboratary Manual, 4th edition,* CHL Press, 2012

GN1203	DAY-TO-DAY BIOLOGY	L	T	P	C
	Total Contact Hours – 45	3	0	0	3
	Prerequisite				
	Nil				

PURPOSE

The purpose of this study is to know and understand the involvement of biology in day-to-day life. This would give insight into his or her own biological system, the diseases and disorders, antibiotics, and importance of environment in human life. This also provides application of biology in day to day life.

INSTRUCTIONAL OBJECTIVES

1.	The student can understand the biology of human system and health.
2.	This provides student with a scope for selection of healthy food and sustain environment.

UNIT I - BIOLOGY OF HUMAN DISEASES AND DISORDERS (10 hours)

Diabetes mellitus, communicable diseases, genetic disorders, vector borne diseases, antibiotics - mode of action.

UNIT II - BIOLOGY FOR HUMAN (10 hours)

Blood pressure, immune system and immunity, cardiac infarction, in vitro fertilization, cord blood bank, stem cells.

UNIT III - BIOLOGY OF COSMETICS AND DETERGENTS (8 hours)

Biology of complexion and texture, bioactive natural products in industrial use, bio surfactants, antioxidants.

UNIT IV - BIOLOGY AND NUTRITION (9 hours)

Dietary index, carbohydrates, proteins and fats, HDL and LDL, dairy products and application, herbal plants and home remedies.

UNIT V - BIOLOGY AND ENVIRONMENT (8 hours)

Water pollution, air pollution, bioremediation, species biodiversity, global warming and green house effect.

TEXT BOOKS

1. Gareth J. Price, Biology: An Illustrated Guide to Science, Diagram Group, Infobase Publishing, 2006.
2. Pam Dodman, Real-Life Science Biology, Walch Publishing, 2008.

REFERENCES

1. *Biology: The Science of Life,* Stephen Nowicki, http://www.thegreatcourses.com/tgc/courses.
2. Neil Schlager, Science of everyday things: Real-Life Biology**,** Gale Publishing 2002.

GN1204	**GENETICS AND INHERITED DISEASES**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	**3**	**0**	**0**	**3**
	Prerequisite				
	Nil				

PURPOSE

This course is aimed at non- biologists or non- science major who wishes to be exposed to some of the wonders of genetics and wishes to understand causes genetic diseases and ways of managing them.

INSTRUCTIONAL OBJECTIVES

1.	To appreciate and understand the dynamic nature of cell and organisms
2.	To understand the structure and role of biomolecules in the cell.
3.	To apply the knowledge gained on inheritance patterns.
4.	To learn the importance of chromosomal aberrations and its associated disorders.
5.	To gain knowledge on the importance of genetic testing and counseling.

UNIT I - BASICS OF LIFE-CELL (9 hours)

Cell – Cell organelles – Nucleus – Genetic Material - Cytoplasm – Endoplasmic reticulum – Golgi Bodies – Mitochondria - Lysosomes – Unicellular and multicellular organisms

UNIT II - BIOMOLECULES (9 hours)

Biomolecules – Structure and Function of DNA - RNA - Protein.Central Dogma of Life.

UNIT III - INHERITANCE IN HUMANS (9 hours)

DNA – Hereditary factors – Inheritance patterns – Autosomal Dominant & recessive – Sex linked Dominant and Recessive.

UNIT IV - GENETIC DISORDERS (9 hours)

Chromosomal Aberrations - Down syndrome &Klinefelter Syndrome. Gene Mutations -Inborn errors of Metabolism - PKU, Beta – Thalassemia – Muscular Dystrophy.

UNIT V - DIAGNOSIS AND GENETIC COUNSELING (9 hours)

Karyotyping and DNA sequencing, Prenatal diagnosis - Chorionic Villi Sampling & Amniocentesis – Genetic Counseling for prevention of genetic diseases.

TEXT BOOKS

1. Jack J. Pasternak, *"An Introduction to Human Molecular Genetics",* Wiley-Liss, John Wiley & Sons, Inc., Second Edition, 2005.
2. Genes and Diseases, NCBIBookself, **http://www.ncbi.nlm.nih.gov/books/bookres.fcgi/gnd/tocstatic.html.**

REFERENCES

1. Jorde, Carey, Bamshad& White, "*Medical Genetics",* Mosby Elsevier Inc, 4th Edition 2010.
2. Tom Strachan and Andrew P. Read, *"Human Molecular Genetics",*Garland Publishing, Incorporated, 2004.

IC1201	**INTRODUCTION TO AUTOMATION**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	**3**	**0**	**0**	**3**
	Prerequisite				
	Nil				

PURPOSE	
To provide students with fundamentals and some special knowledge in process automation in industries.	
INSTRUCTIONAL OBJECTIVES	
1.	Understand the need for automation in process industries.
2.	Learn about the various technologies used in process automation
3.	Learn programming of PLC.
4.	Understand DCS and communication in DCS.

UNIT I (9 hours)

Programmable Logic Controllers(PLCs): An Overview - Programmable Logic Controllers, Parts of a PLC, Principles of Operation, Modifying the Operation, PLCs versus Computers, PLC Size and Application.

PLC Hardware Components - The I/O Section, Discrete I/O Modules, Analog I/O Modules, Special I/O Modules, I/O Specifications: Typical Discrete I/O Module Specifications,Typical Analog I/O Module Specifications, The Central Processing

Unit (CPU) , Memory Design, Memory Types, Programming Terminal Devices, Recording and Retrieving Data, Human Machine Interfaces (HMIs).

UNIT II **(9 hours)**

Fundamentals of Logic - The Binary Concept,AND, OR, NOT &XOR Function,Boolean algebra,Developing Logic Gate Circuitsfrom Boolean Expressions,Producing the Boolean Equation for a Given Logic Gate Circuit, Hardwired Logic versus ProgrammedLogic, Programming Word Level LogicInstructions.

Basics of PLC Programming - Processor Memory Organization, Program Files, Data Files, Program Scan PLC Programming Languages, Relay-Type Instructions, Instruction Addressing, Branch Instructions, Internal Relay Instructions, Programming Examine If Closed andExamine If Open Instructions, Entering the Ladder Diagram, Modes of Operation.

UNIT III **(9 hours)**

Developing Fundamental PLCWiring Diagrams and LadderLogic Programs - Electromagnetic Control Relays, Contactors, Motor Starters, Manually Operated Switches, Mechanically Operated Switches, Sensors, Output Control Devices, Seal-In Circuits,Latching Relays, Converting Relay Schematics into PLC Ladder Programs, Writing a Ladder Logic ProgramDirectly from a Narrative Description

Programming Timers - Mechanical Timing Relays, Timer Instructions, On-Delay Timer Instruction, Off-Delay Timer Instruction, Retentive Timer, Cascading Timers

Programming Counters - Counter Instructions, Up-Counter, One-Shot Instruction, Down-Counter, Cascading Counters, Incremental Encoder-Counter Applications, Combining Counter and Timer Functions

UNIT IV **(9 hours)**

Program Control Instructions - Master Control Reset Instruction, Jump Instruction, Subroutine Functions, Immediate Input and Immediate Output Instructions, Forcing External I/O Addresses, Safety Circuitry, Selectable Timed Interrupt, Fault Routine, Temporary End Instruction, Suspend Instruction

Data Manipulation Instructions - Data Manipulation, Data Transfer Operations, Data Compare Instructions, Data Manipulation Programs, Numerical Data I/O Interfaces, Closed-Loop Control

UNIT V **(9 hours)**

DISTRIBUTED CONTROL SYSTEMS - Evolution – Different architectures – local control unit – Operator Interface – Displays – Engineering Interface

APPLICATION OF DCS - DCS Applications in power plants, Iron and steel plants, Chemical plants, Cement plants, paper and pulp industries.

TEXT BOOKS

1. Frank D. Petruzella, "*Programmable Logic Controllers"*, Glencoe McGraw Hill Second Edition,
2. Michael Lucas, "*Distributed Control Systems"*, Van Nostrand Reinhold Co.,1986

REFERENCES

1. McMillan.G.K, "*Process/ Industrial instrument and handbook*", McGraw-Hill, New York, 1999
2. Popovic D. and Bhatkar.V.P, "*Distributed Computer Control for industrial automation*", Marcel Dekkar Inc., 1990

IC1201 INTRODUCTION TO AUTOMATION												
Course Designed by		**Department of Instrumentation & Control Engineering**										
1	Student Outcome	a	b	c	d	e	f	g	h	i	j	k
		x		x		x						x
2	Mapping of instructional objectives with student outcome	1		4		2						3
3	Category	General (G)			Basic Sciences (B)		Engineering Sciences and Technical Arts (E)				Professional Subjects (P)	
		--			--		--				x	
4	Broad Area	Instrumentation			Control		Electronics				Electrical	
		--			x		--				--	
5	Approval	23rd meeting of Academic Council, May 2013										

IC1202	**VIRTUAL INSTRUMENTATION**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	**3**	**0**	**0**	**3**
	Prerequisite				
	Nil				

PURPOSE

To enable the students to understand basics, programming techniques, data acquisition and interfacing techniques of virtual instrumentation and to use VI for different applications.

INSTRUCTIONAL OBJECTIVES	
1.	The students will be able to familiarize the basics and need of VI.
2.	The students will be able to learn LabVIEW software basics.
3.	To get better understanding of data acquisition techniques.
4.	The students can have an exposure to different interfacing techniques.
5.	The students can able to design some real time application using LabVIEW software.

VIRTUAL INSTRUMENTATION **(9 hours)**

Historical perspective, Need of VI, Advantages of VI, Define VI, block diagram & architecture of VI, data flow techniques, graphical programming in data flow, comparison with conventional programming.

VI PROGRAMMING TECHNIQUES **(9 hours)**

VIS and sub-VIS, loops & charts, arrays, clusters, graphs, case & sequence structures, formula modes, local and global variable, string & file input.

DATA ACQUISITION BASICS **(9 hours)**

Introduction to data acquisition on PC, Sampling fundamentals, Input/Output techniques and buses.ADC, DAC, DIO, Counters & timers, PC Hardware structure, timing, interrupts, DMA, Software and Hardware Installation, Calibration, Resolution, Data acquisition interface requirements.

VI CHASSIS REQUIREMENTS **(9 hours)**

Current loop, RS 232C/RS 485, GPIB, System basics, interface basics: USB, PCMCIA, VXI, SCXI, PXI etc, networking basics for office & industrial application VISA & IVI.

APPLICATION OF VI **(9 hours)**

Fourier transform, Power spectrum, Correlation methods, windowing & flittering. Application in Process Control projects, Major equipments- Oscilloscope, Digital Multimeter, Pentium Computers, temperature data acquisition system, motion control employing stepper motor.

TEXT BOOKS

1. Sumathi.S & Surekha.P, "*LabVIEW based Advanced Instrumentation*" Springer, 2007.
2. Jovitha Jerome, "*Virtual Instrumentation Using LabVIEW*", PHI Learning Pvt. Ltd, 2010.
3. Herbert. A.J, " *The structure of Technical English"*, Orient Longman 1995

REFERENCES

1. Sanjay Gupta, Joseph John, "*Virtual Instrumentation using LabVIEW"*, 2nd Edition, Tata McGraw Hill Education Private Limited, 2010.
2. Gary W. Johnson, Richard Jennings , "*LabVIEW Graphical Programming*", Fourth Edition, McGraw-Hill publications, 2006
3. Technical Manuals for DAS Modules of Advantech and National Instruments.

IC1202 VIRTUAL INSTRUMENTATION												
Course Designed by		Department of Instrumentation and Control Engineering										
1	Student outcome	a	b	c	d	e	f	g	h	I	j	k
		x	x	x		x						x
2	Mapping of instructional objectives with student outcome	1,3,4,5	2,5	2,5		2,4,5						2,3,4
3	Category	General (G)		Basic Sciences (B)		Engineering Sciences and Technical Arts (E)				Professional Subjects (P)		
		--		--		--				x		
4	Broad area	Instrumentation		Control		Electronics				Electrical		
		x		--		--				--		
5	Approval	23rd meeting of Academic Council, May 2013										

IC1203	FUNDAMENTALS OF MEMS	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite				
	Nil				

PURPOSE

The purpose of this course is to provide an understanding of physical concepts and underlying various engineering and technological applications in microfabrication and MEMS. In addition, the course is expected to develop scientific temperament and analytical skill in students, to enable them logically tackle complex engineering problems in their chosen area of application.

INSTRUCTIONAL OBJECTIVES

1.	To appreciate and understand scientific concepts underlying engineering and technological applications
2.	To understand and apply the Physics behind the micro technology

UNIT I - INTRODUCTION TO MEMS AND MICROFABRICATION (15 hours)

MEMS Roadmap - MEMS markets - MEMS foundries - Benefits of Miniaturization - Benefits of Scaling. Microfabrication: Basic Fabrication Processes – oxidation - film deposition – lithography – etching - ion implantation – diffusion

UNIT II - SURFACE MICROMACHINING AND BULK MICROMACHINING (8 hours)

Surface Micromachining: Basic process flow – release – stiction - material choices - residual stress - Electroplating. Bulk Micromachining: wet etch-based - dissolved wafer process - SOI MEMS – Scream – MEMS – RIE – DRIE

UNIT III - MECHANICS OF MEMS MATERIALS (7 hours)

Stress – strain - material properties - measurement & characterization of mechanical parameters. Microstructural Elements: bending moment and strain - flexural rigidity - residual stress - boundary conditions - spring combinations

UNIT IV - MEMS DEVICES (8 hours)

Pressure sensors- Accelerometers - Gyroscopes- RF MEMS Switch- Temperature sensors - Humidity sensors. Microactuators: Electrostatic – piezoelectric – SMA – Thermoelectric - electromagnetic

UNIT V - FLUID DYNAMICS AND MICROPUMPS (7 hours)

Viscosity – density - surface tension - continuity equation - Newton's second law - Navier-Stokes equation and its interpretation - flow types. Microfluidics: Electrokinetics – electroosmosis – electrophoresis - fabrication methods - Lab on a Chip – micropumps - microvalves.

TEXT BOOKS

1. Tai - Rai Hsu, "*MEMS and Microsystems: Design and Manufacturing*", Tata MC Graw Hill, Edition 2002
2. Stephen D.Senturia, "*Microsystems Design*",Springer,2001

REFERENCES

1. Gregory Kovacs, "*Micro machined Transducers*", Tata Mc Graw Hill,1998
2. Mark Madou, "*Fundamentals of Microfabrication*", CRC Press, 2002

IC1203 FUNDASMENTALS OF MEMS												
Course Designed by		**Department of Instrumentation and Control Engineering.**										
1	Student Outcome	a	b	c	d	e	f	g	h	i	j	k
		x			x	x						x
2	Mapping of instructional objectives with student outcome	2			1	2						2
3	Category	General (G)			Basic Sciences (B)		Engineering Sciences and Technical Arts (E)				Professional Subjects (P)	
		--			--		--				x	
4	Broad Area	Instrumentation			Control		Electronics				Electrical	
		--			x		x				--	
5	Approval	23rd meeting of Academic Council, May 2013										

IC1204	CONTROL THEORY	L	T	P	C
	Total Contact Hours 45	3	0	0	3
	Prerequisite				
	Nil				

PURPOSE

To understand the fundamental need for control system and to understand error analysis

INSTRUCTIONAL OBJECTIVES

1.	Mathematical modeling of systems
2.	Understanding error analysis and types of controllers
3.	Applications of control systems

UNIT I - INTRODUCTION (9 hours)

Control system - objective –Types-Concept of feedback and automatic control-effect of feedback - definition of linear and nonlinear system -Elementary concept of sensitiveness & Steady state error in control system due to step, ramp and parabolic input, concept of error and time constants

UNIT II - MATHEMATICAL MODELING OF DYNAMIC SYSTEM (9 hours)

Electrical analogy of spring-mass-dashpot –Pneumatic and Hydraulic systems-Transfer function concept-pole and zero of transfer function- Block diagram reduction- Signal flow graphs- Mason's gain formula

UNIT III - CONTROLLERS (9 hours)

Need for control-Types-On-Off control-floating control-Single and composite controllers- output of controllers-Derivations

UNIT IV - ERROR ANALYSIS (9 hours)

Steady state error in control system- types of standard signals -step, ramp and parabolic inputs- concept of error and time constants-Numerical Problems in steady state error

UNIT V - APPLICATIONS (9 hours)

Transfer functions of Synchros – AC and DC servomotors – Potentiometers – Encoders- case studies.

TEXT BOOKS

1. Ogata.K, "*Modern Control Engineering*", 4th edition, Pearson Education, New Delhi, 2003 / PHI.

2. Nagrath.I.J & Gopal.M, "*Control Systems Engineering*", New Age International Publishers, 2003.

REFERENCES

1. Gopal. M, "*Control Systems, Principles & Design"*, Tata McGraw Hill, New Delhi, 2002.
2. Bandyopadhyay.M.N, "*Control Engineering Theory and Practice*", PHI, 2003.

IC1204 CONTROL THEORY												
Course Designed by		Department of Instrumentation and Control Engineering										
1	Student outcome	a	b	c	d	e	f	g	h	i	j	k
		x		x	x	x						x
2	Mapping of instructional objectives with student outcome	1		1	2	2						3
3	Category	General (G)		Basic Sciences (B)		Engineering Sciences and Technical Arts (E)				Professional Subjects (P)		
		--		--		--				x		
4	Broad area	Instrumentation		Control		Electronics				Electrical		
		x		x		--				--		
5	Approval	23rd meeting of academic council held on May 2013										

IT1201	INFORMATION SECURITY	L	T	P	C
	Total contact hours - 45	3	0	0	3
	Prerequisite				
	Nil				

PURPOSE

To provide impeccable knowledge on various technical aspects of Information Security & Computer Security principles

INSTRUCTIONAL OBJECTIVES

1.	To provide foundation for understanding the key issues associated with protecting Computer Systems & Information Assets.
2.	To provide competency in designing consistent & reasonable Information security system with appropriate Scanning & Enumeration mechanisms, determining the level of protection and Response to security incidents.

UNIT I - INTRODUCTION TO INFORMATION SECURITY (9 hours)

Introduction to Information Security, Need for Security - Threats to security & Attacks, Computer System Security and Access Controls - System access and data access.

UNIT II - COMMUNICATION SECURITY **(9 hours)**

Introduction to cryptography, cryptosystems, Encryption & Decryption Techniques - classical encryption techniques, communication channel used in cryptographic system, various types of ciphers, Cryptanalysis, Hash function and Data integrity, Security of Hashing function.

UNIT III - NETWORK **(9 hours)**

Introduction to Network Security, Email Security, IP Security, Web Security, Kerberos, X.509 techniques.

UNIT IV - SCANNING & ENUMERATION TECHNOLOGY **(9 hours)**

Malicious softwares, Firewalls, Honey pots, Intrusion Detection system, Intrusion Prevention system

UNIT V - ETHICS IN INFORMATION SECURITY **(9 hours)**

Implementing Information Security, Legal Ethical & Professional issues in Information Security.

TEXT BOOKS

1. Matt Bishop, "*Computer Security: Art and Science",* Addison-Wesley Professional, First Edition, 2003. ISBN: 0201440997.
2. William Stallings, "*Cryptography and Network Security*", Pearson Education, Fourth Edition, 2006. ISBN: 8177587749

REFERENCES

1. Michael E. Whitman, Herbert J. Mattord ,"*Principles of Information Security"* Cengage Learning, Fourth Edition, 2010, ISBN: 1111138214
2. Charlie Kaufman, Radia Perlman, Mike Speciner, "*Network security: private communication in a public world",* Second Edition, ISBN: 0130460192.
3. Dieter Gollmann ,"*Computer Security* ", Third Edition, ISBN: 0470741155.

IT1201 INFORMATION SECURITY															
Course Designed by		**Department of Information Technology**													
1	Student outcome	a	B	c	d	e	f	g	h	i	j	k	l	m	n
											x				
2	Mapping of instructional objectives with student outcome										1-2				

3	Category	General (G)	Basic Sciences(B)	Engineering Sciences and Technical Arts(E)	Professional Subjects (P)		
		--	--	--	x		
4	Broad area	Programming	Networking	Data base	Web System	Human Computer Interaction	Plat form Technologies
		--	x	--	--	--	x
5	Approval	23rd meeting of Academic Council, May 2013					

	INTRODUCTION TO DATABASE MANAGEMENT SYSTEM	L	T	P	C
IT1202	Total contact hours - 45	**3**	**0**	**0**	**3**
	Prerequisite				
	Nil				

PURPOSE

This course provides the students to understand the problems with file processing system and how it can be handled effectively in Database System through various design tools, design techniques and algorithms.

INSTRUCTIONAL OBJECTIVES

1.	To learn the fundamentals of Database management system.
2.	To design of database for any given problem.
3.	To Understand the basics of SQL.
4.	To Provide the proof for good database design.
5.	To Understand the Bio applications of database.

UNIT I - INTRODUCTION **(9 hours)**

Data- Database – DBMS-File Processing System Vs DBMS-Data abstraction-Data Independence-Data Catalog-Three schema Architecture of a database-Functional components of a DBMS.- DBMS Languages-Database users and DBA.

UNIT II - DATABASE DESIGN (9 hours)

ER Model: Objects, Attributes and its Type.Entity set and Relationship set-Design Issuesof ER model-Constraints. Keys-primary key, super key, candidate keys. Introduction to relational model-TabularRepresentation of Various ERSchema. ER Diagram Notations- Goals of ER Diagram- Weak Entity Set- Views.

UNIT III - STRUCTURED QUERY LANGUAGE (9 hours)

SQL: Overview,The Form of Basic SQL Query -UNION, INTERSECT, and EXCEPT– join operations: equi join and non equi join-Nested queries - correlated and uncorrelated- Aggregate Functions-Null values.

UNIT IV - DEPENDENCIES AND NORMAL FORMS (9 hours)

Importance of a good schema design, - Problems encountered with bad schema designs, Motivation for normal forms- functional dependencies, -Armstrong's axioms for FD's- Closure of a set of FD's,- Minimal covers-Definitions of 1NF, 2NF, 3NF and BCNF- Decompositions and desirable properties - Algorithms for 3NF and BCNF normalization.

UNIT V - SEQUENCING DTATABASE (9 hours)

Sequencing Databases-(DNA and proteins Sequencing) – GENOME- GenBank and Swiss Prot- Derived Databases-Pfam, BLOCKS, etc. Structure Databases-Collection- validation of Structure Data- PDB and NDB- Derived Databases, SCOP, PALI, etc

TEXT BOOK

1. Abraham Silberschatz, Henry F. Korth, S. Sudarshan," *Database System Concepts*", McGraw-Hill, 6th Edition , 2010.

REFERENCES

1. Raghu Ramakrishnan, Johannes Gehrke, "*Database Management System*", McGraw Hill., 3rd Edition 2007.
2. Elmasri&Navathe,"*Fundamentals of Database System,"* Addison-Wesley Publishing, 5th Edition, 2008.
3. Date.C.J, "*An Introduction to Database*", Addison-Wesley Pub Co, 8th Edition, 2006.
4. Peter rob, Carlos Coronel, "*Database Systems – Design, Implementation, and Management"*, 9th Edition, Thomson Learning, 2009.

IT1202 INTRODUCTION TO DATABASE MANAGEMENT SYSTEM															
Course Designed by		**Department of Information Technology**													
1	Student outcome	a	b	c	d	e	f	g	h	i	j	k	l	m	n
			x							x		x			
2	Mapping of instructional objectives with student outcome		1-2							5		3-4			

3	Category	General (G)	Basic Sciences(B)	Engineering Sciences and Technical Arts (E)		Professional Subjects (P)	
		--	--	--		x	
4	Broad area	Programming	Networking	Data base	Web System	Human Computer Interaction	Plat form Technologies
		--	--	x	--	--	--
5	Approval	23rd meeting of Academic Council, May 2013					

	WEB DESIGN	L	T	P	C
IT1203	Total contact hours - 45	**3**	**0**	**0**	**3**
	Prerequisite				
	Nil				

PURPOSE

To purpose of the course is to provide the knowledge and skills to build creative, interactive, and well-designed Web sites. To balance the technical skills with artistic skills to create web pages that are conceptually interesting, easily navigable, visually pleasing, and functional with web publishing tools and graphics programs including Dreamweaver, Photoshop and Flash.

INSTRUCTIONAL OBJECTIVES

1.	To understand the principles of creating an effective web page, including an in-depth consideration of information architecture.
2.	To design, create, and maintain of web pages and websites with various multimedia elements.
3.	To develop skills in developing web site with Dreamweaver.
4.	To draw and create symbols in Flash for providing interactivity with the user.
5.	To understand basics of Photoshop and incorporate the artistic skills by applying various brushes and filters

UNIT I - WEB DESIGN INTRODUCTION (9 hours)

Environment and Tools –Web Publishing Fundamentals –Planning a Website

UNIT II - WEB DESIGN – CONCEPTS (9 hours)

Typography and Images –Multimedia Elements –Promoting and maintaining a Website

UNIT III - DREAM WEAVER (9 hours)

Getting Started –Developing a web page –Working with Text and CSS –Adding Images –Working with Links and Navigation –Managing a Web Server and files

UNIT IV - FLASH (9 hours)

Getting Started –Drawing objects –Working with Symbols – Creating Animations

UNIT V - PHOTOSHOP (9 hours)

Photoshop Basics –Working with Layers –Making Selections –Incorporating Color Techniques – Brushes –Filters –Placing Type in an Image

TEXT BOOK

1. Gary B.Shelly, H.Albert Napier, Ollie N. Rivers, "*Web Design: Introductory Concepts and Techniques*", Course Technology, Cengage Learning, Third Edition, 2009.

REFERENCES

1. Sherry Bishop , James E. Shuman , Elizabeth Eisner Reding, "*The Web Collection Revealed Premium Edition: Adobe Dreamweaver CS5, Flash CS5 and Photoshop CS5"*, DELMAR,Cengage Learning, 2010.
2. Tom Negrino, Dori Smith, "*Dreamweaver CS5 for Windows and Macintosh: Visual QuickStart*", Peachpit Press, 2010.
3. Elaine Weinmann, Peter Lourekas, "*Photoshop CS5 for Windows and Macintosh: Visual QuickStart"*, Peachpit Press, 2010.
4. Katherine Ulrich, "*Flash CS5 Professional for Windows and Macintosh: Visual QuickStart",* Peachpit Press, 2011.

IT1203 WEB DESIGN															
Course Designed by		**Department of Information Technology**													
1	Student outcome	a	b	c	d	e	f	g	h	i	j	k	l	m	n
				x						x	x	x			
2	Mapping of instructional objectives with student outcome			1						4-5	2	3			
3	Category	General (G)		Basic Sciences(B)			Engineering Sciences and Technical Arts (E)					Professional Subjects (P)			
		--		--			--					x			

4	Broad area	Programming	Networking	Data base	Web System	Human Computer Interaction	Plat form Technologies
		--	--	--	x	x	--
5	Approval	23rd meeting of Academic Council, May 2013					

	COMMUNICATION SKILLS AND LANGUAGE LABORATORY	L	T	P	C
LE1201	Total Contact Hours - 60	**2**	**0**	**2**	**3**
	Prerequisite				
	Nil				

PURPOSE

The paper enables students to prepare themselves for their professional and interpersonal communication in the globalised context. The course is an integrated theory and lab course to enable students to use 'good' English and to perform well in debates, group discussions, interviews and oral presentations.

INSTRUCTIONAL OBJECTIVES

1.	To improve students' fluency in English, through a well-developed vocabulary and enable them to listen to English by educated English speakers and respond appropriately in different socio-cultural and professional contexts.
2.	To enable students to communicate ideas relevantly and coherently in at placement interviews, group discussions and other recruitment exercises.
3.	To impart skills involved in technical project presentations.

UNIT I - LISTENING COMPREHENSION (12 hours)

PURPOSE: Cultivate effective listening strategies by overcoming barriers

METHOD: Listening and answering questions – Listening to lectures – listening to different accents

PRACTICE: Listening and sequencing of sentences – gap filler exercises - Listening and typing – listen and speak

UNIT II - SPEAKING (12 hours)

PURPOSE: Error free and appropriate use of language in spoken form

METHOD: Sound recognition – Phonetics - Intonation – Ear training - Correct Pronunciation – Common Errors in English

PRACTICE: Conversations - Face to Face Conversation – Telephone conversation – Role play activities (pair & group activities).

UNIT III - WRITING **(12 hours)**

PURPOSE: Enhance accuracy of written communication in academic and professional environ (defining the career objective, projecting one's strengths and skills)

METHOD: Planning structure and presentation - set formats and styles - Vocabulary building through Reading.

PRACTICE: Writing - Resume – summary – letter – reports

UNIT IV - READING **(12 hours)**

PURPOSE: To identify specific components of grammar like tense, verb, sentence structure while reading

METHOD: Loud Reading – pronunciation – spelling – sentence structure – intonation Leisure reading - entertainment Silent Reading – skimming & scanning Skimming: to grasp gist – outline – overview Scanning: information processing – comprehension – critical analysis - vocabulary

PRACTICE: Reading prose – technical & general text – research papers & scientific articles Leisure reading – newspaper – story – poetry

UNIT V - PRESENTATION SKILLS **(12 hours)**

PURPOSE: Effective use of spoken form of language in academic and official environments

METHOD: Power point presentation with visuals - Video samples – Individual presentations

PRACTICE: Types of presentations: narrative, informative, and persuasive Presentation tools – Voice Modulation – Audience analysis - Body language

REFERENCES

1. A Course in English communication by Madhavi Apte, Prentice-Hall of India, 2007.
2. Communication Skills by Leena Sen, Prentice-Hall of India, 2005.
3. Academic Writing- A Practical guide for students by Stephen Bailey, Rontledge Falmer, London& New York, 2004.
4. Technical Report Writing Today by Daniel G. Riordan & Steven E. Pauley, Biztantra Publishers,2005.
5. John Seely, The Oxford Guide to Writing and Speaking, Oxford University Press, New Delhi, 2004.
6. Evans, D, Decisionmaker, Cambridge University Press, 1997.
7. Thorpe, E, and Thorpe, S, Objective English, Pearson Education, Second Edition, New Delhi, 2007.

8. Turton, N.D and Heaton, J.B, Dictionary of Common Errors, Addison Wesley Longman Ltd., Indian reprint 1998.
9. Meyers, Colleen, and Sheryl Holt. (2002). Success with Presentations. Burnsville, MN: Aspen Productions.

LE1201 COMMUNICATION SKILLS AND LANGUAGE LABORATORY												
Course Designed by		Department of English and Foreign Languages										
1	Student outcome	a	b	c	d	e	f	g	h	i	j	k
								x				
2	Mapping of instructional objectives with student outcome							1- 3				
3	Category	General (G)		Basic Sciences (B)		Engineering Sciences and Technical Arts (E)				Professional Subjects (P)		
		x		--		--				--		
4	Approval	23rd meeting of Academic Council, May 2013										

	PROFICIENCY IN ENGLISH AND ACCENT TRAINING	L	T	P	C
LE1202	Total conduct Periods - 60	2	0	2	3
	Prerequisite				
	Nil				

PURPOSE

The course provides English pronunciation without the influence of their mother tongue. The course improves accent so that the students appointed in multinational companies can easily interpret the accent of international clients. In addition, the course enables the students to differentiate the American and British English variations as well.

INSTRUCTIONAL OBJECTIVES

1. Practice English to an impressive and effective level through conversation with a neutralized accent.
2. Learn and practice correct articulation, rhythm and intonation to use correct speech patterns. which can be easily understood both by the native speakers and non native speakers
3. Break down the restrictions and interferences, which our native languages have so strongly built up over the years.

UNIT I - THE PHONETICS OF ENGLISH (12 hours)

- Introduction to phonetics
- The difference between phonetics and phonology
- Phonetic Alphabet (consonants/vowels/diphthongs) and Speech Anatomy
- Allophonic variants of English Phonemes.
- Phonetic transcription

UNIT II - WORD ACCENT (12 hours)

- Syllables in English, syllable typology
- Word stress, primary, secondary, articulatory and acoustic correlates of stress
- How stress affects segmental realization, vowel and consonant reductions
- Accent - Word accentual pattern (I) – Word accentual pattern (II) – The word in connected speech.
- Attending to word-stress while learning new vocabulary - English for specific purposes

UNIT III - SPEECH RHYTHM AND THE ROLE OF INTONATION (12 hours)

- Foreign accent, comprehensibility, and intelligibility in the speech of second language learners. *Language Learning*
- Connected speech, assimilation, strong and weak forms
- clusters and contractions
- dialectal variation
- Sentence stress, narrow and broad focus, stress clash

UNIT IV - A MANAUAL OF AMERICAN AND BRITISH ENGLISH PRONUNCIATION (12 hours)

- Comprehending US/UK accents
- Words in English, said with both a British and American accent.
- Phonetic stress in Indian English vs. American English. British English
- American and British English grammar
- American and British English vocabulary – English for specific purposes

UNIT V - AURAL AND ORAL COMMUNICATION INTEGRATING PRONUNCIATION (12 hours)

- Using student-produced recordings with monolingual groups to provide effective, individualized pronunciation practice.
- Practice technical words to unlearn their usual accent to learn British and American accent
- The effects of nonnative accents on listening comprehension

REFERENCES

1. Avery, Peter and Susan Ehrlich. 2007. "*Teaching American English Pronunciation".*
2. Yavas, Mehmet. 2006. "*Applied English Phonology".*
3. Miller, Sue F. 2006. "*Targeting Pronunciation, 2nd Edition"* (with audio CDs)

4. American Accent Training (American Accent Training) by Ann Cook; Paperback: 210 pages Publisher: Barron's Educational Series
5. English Pronunciation in Use by Mark Hancock; Paperback: 200 pages Publisher: Cambridge University Press
6. Clear Speech Student's book: Pronunciation and Listening Comprehension in American English (Clear Speech) by Judy B. Gilbert; Paperback: 144 pages Publisher: Cambridge University Press
7. Pronunciation Plus Student's book: Practice through Interaction by Martin Hewings, Sharon Goldstein; Paperback: 152 pages, Cambridge University Press
8. Pronunciation Games (Cambridge Copy Collection) by Mark Hancock; Spiral-bound: 112 pages Publisher: Cambridge University Press
9. Ladefoged, Peter (2006) *A Course in Phonetics, Fifth Edition* (Harcourt, Brace, Jovanovich: Fort Worth)

LE1202 PROFICIENCY IN ENGLISH AND ACCENT TRAINING												
Course Designed by		Department of English and Foreign Languages										
1	Student outcome	a	b	c	d	e	f	g	h	i	j	k
								x				
2	Mapping of instructional objectives with student outcome							1- 3				
3	Category	General (G)		Basic Sciences (B)		Engineering Sciences and Technical Arts (E)		Professional Subjects (P)				
		x		--		--		--				
4	Approval	23rd meeting of Academic Council, May 2013										

LE1203	CREATIVE WRITING	L	T	P	C
	Total Contact Hours - 60	2	2	0	3
	Prerequisite				
	Nil				

PURPOSE

This course introduces students to the practice of creative writing in the genres of poetry and fiction. In addition to honing their skills as creative writers, students will develop a critical vocabulary that will aid them in discussing poems and fiction produced by their peers. This course allows for experimentation with writing poetry, short fiction, and creative nonfiction in a writing workshop setting. Far from undertaking the task of making student a professional writer, this class has its goal to familiarize the learner with the dynamics of imaginative literature, the synergy of form and content, and with what makes a particular work effective.

INSTRUCTIONAL OBJECTIVES	
1.	Discuss with some confidence many of the rhetorical devices, from metaphor to enjambment associated with creative writing.
2.	Appreciate the complexity of Poetry, Short Fiction, and Creative Nonfiction.
3.	Understand the importance of Creative Writing as a means of self expression.
4.	Read and discuss with enhanced understanding Poetry, Short Fiction, and Creative Nonfiction
5.	Show improvement in writing and analytical skills.

UNIT I - INTRODUCTION TO LITERARY FORMS (**12 hours)**

Elements of Poetry - Rhythm and Meter
Poetic Forms – Ballad, Lyrics, Elegy, Odes, Haiku, Sonnets
Literary Genres- Short Fiction, Drama, and Non-Fiction

UNIT II - POETRY WRITING (**12 hours)**

Appreciation of the form and content of poem
Techniques - figurative language - (structure - rhythm – imagery – tone – style - point of view, voice - read and discuss numerous poems)
Ballad - **The Ballad of the Landlord by Langston Hughes;**
Lyrics **- Kubla Khan** by **Samuel Taylor Coleridge**
Elegy **- Elegy Written in a Country's Churchyard** by **Thomas Gray**
Odes – **Ode to a Nightingale by John Keats;**
Haik u**- This Other World by Richard Wright**
Sonnet **- On His Blindness by John Milton**
Students Creative Assignment – Students will write three poems.

UNIT III - SHORT FICTION / NOVEL (**12 hours)**

Elements of Fiction - Character – Plot- Setting – Theme - Style; Narrator - Point of view - Tone – Suspension of Disbelief.
Genres - Adventure, Comic, Fantasy, Gothic, Romance, Historical, Horror, Supernatural, Thriller, Science Fiction
Fiction - Gooseberries by Anton Chekhov
Short Story - My Lost Dollar by Stephen Leacock
Students Creative Assignment – Students will write one Short Story

UNIT IV - DRAMA (**12 hours)**

Elements of Drama - Character Plot, Theme, Dialogue, Convention, Genre, Audience, Stagecraft, Design, Conversions

Drama – The King of the Dark Chamber by Rabindranath Tagore
Students Creative Assignment- Students will write a review of the drama read in the class.

UNIT V - NON FICTION (**12 hours)**

Prose, Biography, Memoirs, and Personal Essays
Walden or Life in the Woods by Henry David Thoreau
Students Creative Assignment - Students will write one or two essays

REFERENCES

1. Candace H. Schaefer, Rick Diamond. 1998. The Creative Writing Guide: A Path to Poetry, Nonfiction, and Drama, Longman, New York, USA
2. Shelly Clark and Marjone Saisa, 2009. Road Trip: Conversations with Writers, The Backwaters Press, Nebraska, USA
3. Nikki Moustaki (ed.), 1998. Writing Fiction: The Practical Guide from New York's Acclaimed Creative Writing School, Publisher: Bloomsbury, ISBN: 0156005743.

LE1203 CREATIVE WRITING												
Course Designed by		**Department of English &Foreign Languages**										
1	Student Outcome	a	b	c	d	e	f	g	h	i	j	k
								x				
2	Mapping of instructional objectives with student outcome							1- 5				
3	Category	General (G)		Basic Sciences(B)		Engineering Sciences and Technical Arts (E)					Professional Subjects(P)	
		x		--		--					--	
4	Approval	23rd meeting of Academic Council, May 2013										

LE1204	INDIAN WRITING IN ENGLISH	L	T	P	C
	Prerequisite	**3**	**0**	**0**	**3**
	Total conduct hours - 45				
	Nil				

PURPOSE

The purpose of this course is to provide an understanding of the literary concepts and underlying aesthetics of Indian writing in English.. In addition, the course is expected to offer pleasure as well as develop an artistic temperament and creative writing skills in students, to enable them to discover themselves and tackle complex crises in their workplace and personal lives.

INSTRUCTIONAL OBJECTIVES	
1.	To appreciate and understand literary concepts and the underlying aesthetics of Indian Writing in English
2.	To apply the life skills thus acquired in solving personal and workplace problems.
3.	To appreciate new developments in literature and language.
4.	To emphasize the significance of reading skills and writing skills.
5.	To provide a learning experience that is entertaining and informative.

UNIT I - PROSE (**9 hours)**

Shyness my Shield –M.K.Gandhi
The Imam and the Indian-Amitav Ghosh
The Only Dream worth Having (An Excerpt) End of Imagination) – Arundhathi Roy
(All I can say just a design thing)

UNIT II - POETRY (**9 hours)**

Nissim Ezekiel -The Night of the Scorpion
Kamala Das - An Introduction
Krishnamurti.J. – The Immortal Friend

UNIT III - PLAY (**9 hours)**

Nagamandala- Girish Karnad

UNIT IV - SHORT STORIES (**9 hours)**

The Portrait of a Lady –Kushwant Singh
A Real Durwan -Jhumpa Lahiri

UNIT V - NOVEL (**9 hours)**

Rohinton Mistry - Family Matters
Upamanyu Chatterjee- English August:an Indian Story

REFERENCES

1. Chatterjee,Upamanyu**,** English, August : an Indian story. London: Faber and Faber, 1988
2. Das,Kamala *"Only the Soul Knows how to Sing. Selections from Kamala Das.D.C.Books 1996".*
3. Ezekiel, Nissim. "*The Golden Treasury of Indo-Anglian Poetry"*, Ed. V.K.Gokak, Sahitya Akademi,Delhi, Ajeet Printers,1998

4. Gandhi.M.K ,"Shyness my Shield" "*The Story of My Experiments with Truth"*, **1927**,Navajivan Mudranalaya, Ahmedabad
5. Ghosh, Amitav *"The Imam and the Indian and other Essays, New Delhi, RaviDayal Publishers 2002".*
6. Iyengar, Srinivas.K.R. Indian Writing in English, Sterling 1985
7. Karnad Girish ,"Nagamandala",*Three plays,OUP India,1996*
8. Krishnamurti.J, "The Immortal Friend". *The Golden Treasury of Indo-Anglian Poetry* , Ed. V.K.Gokak, Sahitya Akademi, Delhi, Ajeet Printers,1998
9. Lahiri , Jhumpa "A Real Durwan" *Interpreter of Maladies, Harper Collins,1999*
10. Mistry,Rohinton "Family Matters",McCelland &Stewart 2011
11. Roy,Arundhathi ,"The End of Imagination",Dee Cee Contemporary Series,1998
12. Singh, Kushwant*. The Collected Short Stories of Kushwant Singh.Delhi, Paul Press 1989*

LE1204 INDIAN WRITING IN ENGLISH												
Course Designed by		**Department of English &Foreign Languages**										
1	Student Outcome	a	b	c	d	e	f	g	h	i	j	k
								x				
2	Mapping of instructional objectives with student outcome							1- 5				
3	Category	General (G)		Basic Sciences(B)		Engineering Sciences and Technical Arts (E)					Professional Subjects(P)	
		x		--		--					--	
4	Approval	23rd meeting of Academic Council, May 2013										

LE1205	**SCIENCE FICTION**	**L**	**T**	**P**	**C**
	Prerequisite	**3**	**0**	**0**	**3**
	Total conduct hours- 45				
	Nil				

PURPOSE

To help learners understand the link between Science and Technology and Humanities, especially Fiction form in Literature, with a view to instilling in them a sensitivity to the current issues of the world and probable issues that will crop up in the future world and imbibe in them a fine sensibility to appreciate and handle with balance the borderline problems of interdisciplinary nature with integrity and responsibility.

INSTRUCTIONAL OBJECTIVES	
1.	To enable the learners to appreciate the literary form of Science Fiction
2.	To give them a firsthand linguistic experience of the various types of Science Fiction novels
3.	To equip the learners with the discretion to distinguish between a successful/effective science fiction novel and the one not so
4.	To enhance the learners' communication skills and to develop their potential for creative writing
5.	To spark off the dormant researcher in the learner so that he/she will use it for the betterment of the world

UNIT I - SCIENCE FICTION – AN INTRODUCTION **(9 hours)**

1. What is science fiction? Characteristics.
2. Classification
3. Types
4. A Historical Overview

UNIT II - NOVELS OF OTHER WORLDS **(9 hours)**

1. Utopian Science Fiction Novels Huxley, Aldous. *Island.*1932; Harper Perennial Classics, 2002.
2. Dystopian Science Fiction Novels Huxley, Aldous. *Brave New World.* Chatto and Windus, 1962.

UNIT III - NOVELS OF OTHER BEINGS **(9 hours)**

1. Robots and Science Fiction
   Asimov, Isaac. *I Robot*. Granada, 1950.
2. Aliens and Science Fiction
   Card, Orson Scott. *Ender's Game*. Starscape, 2002.

UNIT IV - NOVELS OF TIME TRAVEL **(9 hours)**

1. Travel into future
   a. H. G. Well's *Time Machine*.
2. Travel into past
   a. Asimov, Isaac and Robert Silverberg. *Child of Time.* Tor, 1993.

UNIT V - NOVELS ON WOMEN'S ISSUES **(9 hours)**

1. Man Controlling Women
   a. Shelley, Mary. *Frankenstein.* 1818; Barnes and Noble, 2009.
2. Varied Identities of Women
   b. RUSS, JOANNA. *THE FEMALE MAN.* BEACON PRESS, 2000.

REFERENCES

1. Seed, David. "*Science Fiction: A Very Short Introduction"*. OUP, 2011.
2. Roberts, Adam. "*Science Fiction".* 2 revised. Routledge, 2005.
3. Moylan, Tom and Raffaella Baccolini. "*Dark Horizons: Science Fiction and the Dystopian Imagination"*. Routledge*,* 2003.
4. Little, Judith.A. "*Feminist philosophy and science fiction: utopias and dystopias",* Prometheus Press, 2007.
5. Atwood, Margaret. "*In Other Worlds".* Anchor, 2012.
6. Reid, Robin.A. "*Women in Science Fiction and Fantasy".* Greenwood Press, 2009.
7. Schneider, Susan. "*Science Fiction and Philosophy: From Time Travel to Superintelligence",* Wiley Blackwell, 2009.
8. Drout, Michael D.C. From "*Here to Infinity: An Exploration of Science Fiction Literature",.* 7 CDs. Published in 2006 by Recorded Books.
9. Melzer, Patricia. "*Alien Constructions: Science Fiction and Feminist Thought",* University of Texas Press, 2006.

LE1205 Science Fiction												
Course Designed by		**Department of English and Foreign Languages**										
1	Student outcome	a	b	c	d	e	f	g	h	i	j	k
								x				
2	Mapping of instructional objectives with student outcome							1- 5				
3	Category	General (G)		Basic Sciences (B)		Engineering Sciences and Technical Arts (E)				Professional Subjects (P)		
		x		--		--				--		
4	Approval	23rd meeting of Academic Council, May 2013										

	INTELLECTUAL PROPERTY RIGHTS , INNOVATION AND TECHNOLOGY	**L**	**T**	**P**	**C**
MB1201	Total contact hours - 45	**3**	**0**	**0**	**3**
	Prerequisites				
	Nil				

PURPOSE

Ideas and innovation have become the most important resource in today's economy. This course uses economic concepts to illustrate the nature of technological innovation and how it transforms competition between firms and generates economic growth.

INSTRUCTIONAL OBJECTIVES	
1.	Understanding major issues in economics of IP rights, technology and innovation
2.	Enhance capability to do economic analysis of IP rights, technology and innovation related policy issues and firms' commercial strategies.

UNIT I - INTRODUCTION (**9 hours)**

Background and Concepts - Brief History of - Institutions - Investing in Knowledge - Market Failures in Knowledge - IP, Public Sponsorship & Prize - IP Law Basics - Means of IP Protection - Patents - Copyrights - Trade Secrets - Others - IP and Antitrust

UNIT II - THE IMPACTS OF IP ON THE PLANT/SEED INDUSTRY (**9 hours)**

The logic of IP - Patenting vs. Company Secrets - Plant Patent Timeline - Empirical Evidence in Plants: A Puzzle - Optimal Design of IP - Scarce Ideas vs. Non-scarce ideas - Policy Levers in IP Design - Breadth - Length - Required - Inventive Steps - Optimal Size of Reward and Structure - Entry Cost Regime - Horizontal Competition Regime - Economic Effects of Exemptions

UNIT III - PROTECTING CUMULATIVE INNOVATIONS (**9 hours)**

Three Types of Cumulativeness - Basic v. Applied Research - Research Tool - Quality Ladders - Policy Levers and Prospecting - Open Source (OS) - Incentive for OS - Licensing, Joint Ventures and Competition Policy - Licensing - Licensing vs. Product Sale - Licensing for Productive Efficiency - New Product Innovation vs. Cost Reduction Innovation - Mergers - Competition Policy in the Innovation Context

UNIT IV - LITIGATION AND ENFORCEMENT (**9 hours)**

Litigation and Enforcement - Remedies for Infringement - How they matter - Enforcement of IP by Technical Means - Limited Sharing of Copyrighted Works - Technology Transfer, Diffusion, and Adoption - Networks and Network Effects - Concepts and Issues - Direct vs. Indirect Network Effects - Physical Networks - Business Strategies - System Competition vs. Standard Competition

UNIT V - INNOVATION TODAY (**9 hours)**

A Private-Public Partnership - University Innovation - Government Grant Process - Mixed Private-Public Incentives - Innovation in the Global Economy - Who Patents and Where - Trade Policy and Treaties - Paris Convention, Berne Convention, TRIPS - PCT and WIPO - National Treatment and Efficient Protection - Harmonization - Externalities and International Cooperation

TEXT BOOKS

1. Christopher May, Susan K. Sell, "*Intellectual Property Rights",* Lynne Rienner Publishers
2. Hideyasu Sasaki, "*Intellectual Property Protection for Multimedia Technology",* Information Science Publishing

REFERENCES

1. Subbaram.N.R. "*Handbook of Indian Patent Law and Practice*", S. Viswanathan Printers and Publishers Pvt. Ltd., 1998.
2. N.S. Gopalakrishnan & T.G. Agitha, "*Principles of Intellectual Property (2009)",* Eastern Book Company, Lucknow

MB1201 INTELLECTUAL PROPERTY RIGHTS , INNOVATION AND TECHNOLOGY												
Course Designed by		School of Management										
1	Student outcome	a	b	c	d	e	f	g	h	i	j	k
							x		x	x	x	
2	Mapping of instructional objectives with student outcome						1-2		1-2	1-2	1-2	
3	Category	General (G)		Basic Sciences (B)		Engineering Sciences and Technical Arts (E)					Professional Subjects (P)	
		x		--		--					--	
4	Approval	23rd meeting of academic council, May, 2013										

MB1202	TOTAL ENGINEERING QUALITY MANAGEMENT	L	T	P	C
	Total contact hours – 45	3	0	0	3
	Prerequisites				
	Nil				

PURPOSE

To understand the Engineering and Management aspects of Planning, Designing, Controlling and Improving Quality in Manufactured products.

INSTRUCTIONAL OBJECTIVES

1.	To understand the fundamentals of quality
2.	To understand the role of TQM tools and techniques in elimination of wastages and reduction of defects
3.	To develop quality as a passion and habit

UNIT I - QUALITY GURUS AND TQM KITEMARKS (9 hours)

Evolution of TQM – Quality Guru's – Edward Deming – Joseph Juran – Philip Crosby – Genichi Taguchi – Walter Shewart – Criteria for Deming's Prize

UNIT II - PRODUCT DESIGN AND ANALYSIS (9 hours)

Basic Design Concepts and TQM – Design Assurance – Design Validation – Failure Mode Effect Analysis – Fault Tree Analysis – Design for Robustness – Value Analysis

UNIT-III - PROCESS IMPROVEMENT AND MODERN PRODUCTION MANAGEMENT TOOLS (9 hours)

Six Sigma Approach – Total Productive Maintenance – Just-In-Time – Lean Manufacturing Paradigms

UNIT IV - QUALITY IMPROVEMENT TOOLS AND CONTINUOUS IMPROVEMENT (9 hours)

Q-7 Tools – New Q-7 Tools – Quality Function Deployment – Kaizen – 5S – Poka-Yoke

UNIT V - QUALITY MANAGEMENT SYSTEMS (9 hours)

Quality Management Systems – Introduction to ISO9000 – TS16949:2002 and EMS14001 certifications.

TEXT BOOKS

1. Total Engineering Quality Management, Sunil Sharma, 1st Edition, MacMillan India Limited.
2. Total Quality Management, Poornima M. Charantimath, 2nd Edition, Pearson Education.

REFERENCES

1. *"Quality and Performance Excellence"*, James R Evans, Edition, 7th Edition, Cengage Learning.
2. "*Quality Management*", Howard S Gitlow, Alan J Oppenheim, Rosa Oppenheim, David M Levine,3rd Edition , Tata McGraw Hill Limited.
3. "*Fundamentals of Quality Control & Improvement*", Amitava Mitra, 3rd Edition, Wiley Publications, 2012.

<table>
<tr><th colspan="13">MB1202TOTAL ENGINEERING QUALITY MANAGEMENT</th></tr>
<tr><th colspan="2">Course Designed by</th><th colspan="11">School of Management</th></tr>
<tr><td rowspan="2">1</td><td rowspan="2">Student outcome</td><td>a</td><td>b</td><td>c</td><td>d</td><td>e</td><td>f</td><td>g</td><td>h</td><td>i</td><td>j</td><td>k</td></tr>
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<tr><td>2</td><td>Mapping of instructional objectives with student outcome</td><td></td><td></td><td></td><td></td><td></td><td>1-3</td><td></td><td>1-3</td><td>1-3</td><td>1-3</td><td></td></tr>
<tr><td rowspan="2">3</td><td rowspan="2">Category</td><td colspan="3">General (G)</td><td colspan="3">Basic Sciences (B)</td><td colspan="4">Engineering Sciences and Technical Arts (E)</td><td colspan="2">Professional Subjects (P)</td></tr>
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<tr><td>4</td><td>Approval</td><td colspan="11">23rd meeting of academic council, May, 2013</td></tr>
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	PRINCIPLES OF TECHNOLOGY AND INNOVATION MANAGEMENT	L	T	P	C
MB1203	Total contact hours - 45	**3**	**0**	**0**	**3**
	Prerequisites				
	Nil				

PURPOSE

To understand the nature, significance, dimensions requirements, concepts, issues, themes, policies and structure of the management of technology and technovation.

INSTRUCTIONAL OBJECTIVES

1.	To understand the importance of technology and innovation management
2.	To understand the technology absorption, incremental innovation, research and development, technovation and technology fusion that dominate the contemporary world industry.

UNIT I - INTRODUCTION (9 hours)

Technology as a driving force – Axes and Atlas of Technology – Strategic Management of Technology

UNIT II - TECHNOLOGICAL ABSORPTION AND INVESTMENTS (9 hours)

Productivity and Incremental Innovation – Technology Absorption – Structure of World Class Manufacturing – Evaluation of Technological Investments

UNIT III - PRODUCT DEVELOPMENT AND MANAGING INNOVATION (9 hours)

Product Development Cycle – Management of Technological Innovation – Technology Fusion and the new R&D – Core Competencies in Technology

UNIT IV - BUILDING AN INNOVATIVE ORGANIZATION (9 hours)

Structural Imperatives of Technology Management – Building Organizational Culture – Organization as a laboratory for Learning

UNIT V - CHANGE MANAGEMENT AND TECHNOVATION (9 hours)

Requisites of National Technology Policy – Coping with Continuous Change – Spectrum of Technological Excellence – Methods of Coping with Uncertainty in Technovation

TEXT BOOKS

1. *"Management of Technology and Innovation"*, P.N.Rastogi, 2nd Edition, SAGE Publications Limited.
2. *"Management of technology and Innovation"*, White & Bruton, 2nd Edition, Cengage Learning.

REFERENCES

1. *"Managing technological innovation"*, Frederick Betz, Edition, 3rd Edition, Wiley Publications
2. "*Encyclopedia of technology and innovation management",* V.K. Narayanan, 1st Edition, Wiley Publications.
3. "*Managing Technology and Innovation*", Robert & Roland, 1st Edition, Routledge.

MB1203 PRINCIPLES OF TECHNOLOGY AND INNOVATION MANAGEMENT												
Course Designed by		**School of Management**										
1	Student outcome	a	b	c	d	e	f	g	h	i	j	k
							x		x	x	x	
2	Mapping of instructional objectives with student outcome						1-2		1-2	1-2	1-2	
3	Category	General (G)		Basic Sciences (B)			Engineering Sciences and Technical Arts (E)				Professional Subjects (P)	
		x		--			--				--	
4	Approval	23rd meeting of academic council, May, 2013										

MB1204	MARKETING MANAGEMENT	L	T	P	C
	Total contact hours - 45	3	0	0	3
	Prerequisites				
	Nil				

PURPOSE

Marketing is the process for creating, communicating, delivering and exchanging offerings that have value for customers, clients, partners and society at large. This course is designed to develop vision on Marketing concepts and their applications.

INSTRUCTIONAL OBJECTIVES

1.	Understanding Marketing Concepts
2.	Evaluate the social, legal, political and ethical concerns in marketing
3.	Describe various marketing mix tools: product, pricing, promotion, and distribution.
4.	Use examples from current events and real-world marketing situations to apply, illustrate, and discuss different marketing strategies.

UNIT I - INTRODUCTION TO MARKETING (9 hours)

Approaches to Marketing –Core concepts of marketing - Marketing Process – Functions of Marketing Environment– The changing marketing environment – Analyzing needs and trends in Macro Environment and Micro Environment.

UNIT II - MARKET SEGMENTATION AND TARGETING (9 hours)

Bases for market segmentation of consumer goods – Market Targeting and positioning strategies –Marketing Information Systems – Marketing Mix – Four P's – Its significance in the Competitive environment.

UNIT III - SHAPING THE MARKET OFFERINGS (9 hours)

Product and Product Line – Product Mix – Product Life Cycle – Managing the product in Product Life Cycle – New Product Decision Process – Types of new products – Test Marketing of a new product – Branding – Packaging – Purpose, Types and New Trends in packaging.

UNIT IV - PRICING AND DISTRIBUTION (9 hours)

Pricing Decisions - Price Determinants - Pricing Policies – Setting the Price – Pricing Methods – Marketing channels – Role – Channel participants – Channel Decisions – Channel Management Channel effectiveness – Channel conflict – Managing conflict.

UNIT V - MARKETING COMMUNICATIONS (9 hours)

Deciding Marketing communications – Promotion – Promotion mix – Advertising – Sales Promotions – Media Decisions – Public Relations- Managing Personal communications – Direct Marketing –Interactive Marketing – Personal Selling – Managing the Sales Force – Interactive Marketing – Internet Marketing – Global Marketing

TEXT BOOKS

1. Philip Kotler, Kevin Lane Keller, "*A framework for marketing management",* 4th edition, Pearson, 2012.
2. Philip Kotler, Kevin Lane Keller, Abraham Koshy, and Mitheleswar Jha, *"Marketing Management",* 13th Edition, Pearson Publications Limited. 2012.

REFERENCES

1. Charles W.Lamb,Joseph F.hair,Sharma,McDaniel, 'MKTG South Asian Perspective, Cengage Learning 2012.
2. Ramaswamy, Namakumari "*Marketing Managemen"*- Global Perspective, Indian Context,4th Edition, MacMillan Publishers India Ltd. (2009), 4th Edition
3. Arun Kumar & Meenakshi, "*Marketing Managemen"*, Vikas Publishing House, 2011

MB1204 MARKETING MANAGEMENT												
Course Designed by		School of Management										
1	Student outcome	a	b	c	d	e	f	g	h	i	j	k
							x		x	x	x	
2	Mapping of instructional objectives with student outcome						1-4		1-4	1-4	1-4	
3	Category	General (G)		Basic Sciences (B)		Engineering Sciences and Technical Arts (E)				Professional Subjects (P)		
		x		--		--				--		
4	Approval	23rd meeting of academic council, May, 2013										

MB1205	INDUSTRIAL MARKETING	L	T	P	C
	Total contact hours - 45	3	0	0	3
	Prerequisites				
	Nil				

PURPOSE

This course on Industrial Marketing examines concepts, principles, and theories that describe and explain the nature of Industrial Markets. Achieving this objective requires the study of the characteristics of business markets, its determinants and its implications for marketing management.

INSTRUCTIONAL OBJECTIVES

1.	Understand the nature and role of business markets
2.	Examine characteristics of business markets and buying situations
3.	Analyze the trends in Industrial Marketing, and apply them to the marketing of an actual product or service
4.	Implement relevant industrial strategies

UNIT I - INTRODUCTION TO INDUSTRIAL MARKETING (9 hours)

The nature of Industrial marketing - Industrial marketing vs. consumer marketing – The Industrial marketing Environment- Understanding Industrial Markets: Demand Issues – Industrial Marketing Environment.

UNIT II - INDUSTRIAL BUYING (9 hours)

Nature of Industrial Buying – Buy Grid Model – Buying behavior - Marketing intelligence - Marketing Research Process – Industrial Market Segmentation – Target Marketing - Positioning.

UNIT III - PRODUCT PLANNING AND PRICING (9 hours)

Product Strategy – New Products and Established product strategies - Industrial Services - Industrial Pricing: Price Determinants - Pricing Policies - Pricing Decisions.

UNIT IV - INDUSTRIAL MARKETING CHANNELS (9 hours)

Channel participants – Channel effectiveness – Marketing logistics - Physical Distribution and Marketing Strategy – Customer Service.

UNIT V - MARKETING COMMUNICATION AND PLANNING (9 hours)

Industrial Marketing Communication - Advertising - Sales promotion – Publicity – Media Plan – Integrated Promotion Plan- Industrial Sales force Management.

TEXT BOOKS

1. Robert R Reeder, Edward G Brierty, Betty H Reeder *"Industrial Marketing Analysis, Planning and control"*, Prentice Hall India, 1991.
2. Havalder, Krishna K, *"Industrial Marketing"* - Tata McGraw Hill, New Delhi.

REFERENCES

1. P.K.Ghosh, *"Industrial Marketing"* Oxford University Press, New Delhi.
2. Vitale, *"Business to Business Marketing"* - Thomson Learning, Mumbai.

MB1205 INDUSTRIAL MARKETING													
Course Designed by		School of Management											
1	Student outcome	a	b	c	d	e	f	g	h	i	j	k	
							x		x	x	x		
2	Mapping of instructional objectives with student outcome						1-4		1-4	1-4	1-4		
3	Category	General (G)		Basic Sciences (B)		Engineering Sciences and Technical Arts (E)				Professional Subjects (P)			
		x		--		--				--			
4	Approval	23rd meeting of academic council, May, 2013											

MB1206	STRESS MANAGEMENT	L	T	P	C
	Total contact hours - 45	3	0	0	3
	Prerequisites				
	Nil				

PURPOSE

This course examines different sources from where individuals experience a stress response. Through diligent individual and group study, students will be able to learn to apply stress management principles in order to achieve high levels of performance and understand the role of relationships to the management of stress and health.

INSTRUCTIONAL OBJECTIVES

1.	Understand the physiological systems that are affected by stressors and the long-term effects and illnesses that can result from stressors.

2.	Understand the specific applications of stress as it relates to the workplace and different target groups.
3.	Create effective stress management plans for individual clients and for workplace environments. Enhancing significance of training and development, performance evaluation

UNIT I - UNDERSTANDING STRESS (9 hours)

Meaning – Symptoms – Work Related Stress – Individual Stress – Reducing Stress -sources of stress –consequence of stress-burnout-symptoms of Burnout-stress verses Burnout-model of stress-strategies for coping stress (individual and organizational strategies) –case study

UNIT II - TIME MANAGEMENT (9 hours)

Techniques – Importance of Planning the day –developing concentration – Prioritizing Beginning at the start – Techniques for conquering procrastination – Sensible delegation – Taking the right breaks – Learning to say "No"

UNIT III - CAREER PLATEAU (9 hours)

Career plateau – Identifying Career plateaus – Structural and Content - Plateauing – Making a fresh start – Importance of Sabbaticals – Counseling out – Executive leasing – Sustaining a marketable Career.

UNIT IV - CRISIS MANAGEMENT (9 hours)

Implications – People issues – Structure issues – Environmental issues – Learning to keep calm - Preventing interruptions – Controlling crisis – Pushing new ideas – Empowerment – Work place Humour, Developing a sense of Humour – Learning to laugh – role of group cohesion and team spirit.

UNIT V - SELF DEVELOPMENT (9 hours)

Improving personality – Leading with Integrity – Enhancing Creativity – Effective decision making – Sensible Communication – The Listening Game – Managing Self – Mediation for peace – Yoga for Life

TEXT BOOKS

1. Bhatia R.L., The Executive Track: An Action Plan for Self Development Wheeler Publishing, New Delhi
2. Charavathy.S.K, *"Human Values for Manager",* McGraw Hill/Henely Management Series

REFERENCES

1. Jeffr Davison, Managing Stress, Prentice Hall of India, New Delhi
2. Jerrold S Greenberg, Comprehensive Stress Management, Jain Books, 2009

MB1206 STRESS MANAGEMENT												
Course Designed by		School of Management										
1	Student outcome	a	b	c	d	e	f	g	h	i	j	k
							x		x	x	x	
2	Mapping of instructional objectives with student outcome						1-3		1-3	1-3	1-3	
3	Category	General (G)		Basic Sciences (B)		Engineering Sciences and Technical Arts (E)					Professional Subjects (P)	
		x		--		--					--	
4	Approval	23rd meeting of academic council, May, 2013										

MB1207	BASICS OF BANKING AND CAPITAL MARKETS	L	T	P	C
	Total contact hours - 45	3	0	0	3
	Prerequisites				
	Nil				

PURPOSE

The course is designed to equip the students with a basic understanding of banking systems in the country. It also presents an overview of the capital markets, in order to help the students acquaint themselves with the fundamentals of valuing investment options.

INSTRUCTIONAL OBJECTIVES

1.	Develop an understanding of the financial and banking systems of the country
2.	Value various investment options and take effective decisions
3.	Apply the learning to practical situations

UNIT I - INDIAN BANKING SYSTEM (9 hours)

Modern Day Banking in India-Reforms in Banking System-Autonomy for Commercial Banks- Best practiced code-Corporate governance in Banks.

UNIT II - VALUATION OF SECURITIES (9 hours)

Valuation of Securities –Bonds-Debentures and Equity Shares.

UNIT II - LEGAL ASPECTS OF BANKING (9 hours)

RBI Act 1934- RBI Functions-Banking Regulation Act 1949-Negotiable Instrument Act- Important Sections of NI Act- Meaning of Cheque, Draft-Dishonour of Cheques-Remittance- Demand Draft.

UNIT IV - PRINCIPLES OF LENDING (9 hours)

Banker Customer Relationship- Bankers Obligations-Right of Appropriation-

Different types of customers-Indian Committee-Chore Committee-Credit Risk Management- Corporate Debt Restructuring-Book principles of Lending.

UNITV - TYPES OF BANKING (9 hours)

Universal Banking- Narrow Banking-Private sector Bank Vs Public Sector Bank Guidelines-Know your customer- Anti money Laundering-Role of Banks-Internet Banking-Mobile Banking-Core Banking Solutions.

TEXT BOOKS

1. Dhanesh Kumar Khatri - Investment Management & Security Analysis – Macmillan – 2nd edition – 2011Hand Book of Banking Information, By N.S.Toor.
2. Shekhar.K.C & Lakshmi Shekhar-Banking Theory and Practice –Vikas Publishing House Pvt. Ltd, 2010

REFERENCES

1. Clifford Gomez - Banking and Finance – Theory, Law & Practice –PHI Learning Pvt. Ltd, 2012
2. Muraleedharan.D - Banking Theory and Practice –PHI Learning Pvt. Ltd, 2011
3. Jyotsna Sethi & Nishwan Batia - Elements of Banking and Insurance –, PHI Learning Pvt. Ltd, 2011

MB1207 BASICS OF BANKING AND CAPITAL MARKETS												
Course Designed by		School of Management										
1	Student outcome	a	b	c	d	e	f	g	h	i	j	k
							x		x	x	x	
2	Mapping of instructional objectives with student outcome						1-3		1-3	1-3	1-3	
3	Category	General (G)		Basic Sciences (B)			Engineering Sciences and Technical Arts (E)				Professional Subjects (P)	
		x		--			--				--	
4	Approval	23rd meeting of academic council, May, 2013										

MB 1208	FINANCE FOR NON FINANCE EXECUTIVES	L	T	P	C
	Total contact hours - 45	3	0	0	3
	Prerequisites				
	Nil				

PURPOSE

The purpose of this course is to acquaint the non finance students with the various concepts, techniques, methods, processes of accounting data, analysis, interpretation, decision making in Finance.

INSTRUCTIONAL OBJECTIVES

1.	Apply the fundamental techniques of financial management in planning his personal finance
2.	Compare the investment options available
3.	Take effective financial decisions in an organization

UNIT I - BASICS OF INDIAN FINANCIAL SYSTEM (9 hours)

Indian Financial System-Functions of Financial Systems-Concepts in Finance-The fundamental Principle of Finance

UNIT II - INVESTMENT ANALYSIS (9 hours)

Capital Budgeting Process-Keys steps in project appraisal-Goals and Benefits-Investment Criteria-Analysis of Risk-Cost of Capital

UNIT III - FINANCING STRATEGY (9 hours)

Financing Strategy –Capital Structure-Financial Instruments-Methods for raising finance.

UNIT IV - SOURCES OF FINANCE (9 hours)

Sources of Finance-Equity capital-Preference Capital-Term Loans-Debentures-Working Capital Advances

UNIT V - BUDGETORY CONTROL (9 hours)

Budget and Budgetary control – Zero Based Budgeting – Performance budgeting.

TEXT BOOKS

1. S.N Maheshwari, Maheshwari.S.K, *"Financial Accounting",* Vikas Publication, 4th edition – 2011.
2. Khan & Jain: *"Financial Management*", Mc GrawHill – 6th edition - 2011

REFERENCES

1. S.K. Bhattacharyya John Dearden *"Accounting for Management Text and Cases",* Vikas publication – Reprint 2011
2. Rajiv Srivastava, Anil Misra "*Financial Management"*, Oxford University Press – 2nd ed. 2011.
3. Maheshwari.S.K, Sharad K Maheshwari, *"Accounting for Management",* Vikas publication – 2011.

MB1208 FINANCE FOR NON FINANCE EXECUTIVES												
Course Designed by		School of Management										
1	Student outcome	a	b	c	d	e	f	g	h	i	j	k
							x		x	x	x	
2	Mapping of instructional objectives with student outcome						1-3		1-3	1-3	1-3	
3	Category	General (G)		Basic Sciences (B)			Engineering Sciences and Technical Arts (E)				Professional Subjects (P)	
		x		--			--				--	
4	Approval	23rd meeting of academic council, May, 2013										

MB1209	FUNDAMENTALS OF ENTREPRENEURSHIP	L	T	P	C
	Total contact hours - 45	3	0	0	3
	Prerequisites				
	Nil				

PURPOSE

To create awareness on entrepreneurship among engineering students and stimulating self motivation to start up enterprise

INSTRUCTIONAL OBJECTIVES

1.	To provide awareness about entrepreneurship
2.	To develop idea generation, creative and innovative skills
3.	To self motivate the students by making aware of different opportunities and successful growth stories
4.	To learn how to start an enterprise and design business plans those are suitable for funding by considering all dimensions of business.
5.	To understand entrepreneurial process by way of studying different case studies and find exceptions to the process model of entrepreneurship.
6.	To run a small enterprise with small capital for a short period and experience the science and art of doing business.

UNIT I - INTRODUCTION TO ENTREPRENEURSHIP (9 hours)

Understanding the Meaning of Entrepreneur; Characteristics and Qualities of an Entrepreneur; Entrepreneurs Vs Intrapreneurs and Managers; Classification of Entrepreneurs; Factors Influencing Entrepreneurship; Entrepreneurial Environment; Entrepreneurial Growth; Problems and Challenges of Entrepreneurs; Entrepreneurial Scenario in India.

UNIT II - MICRO, SMALL AND MEDIUM ENTERPRISES (MSMES) (9 hours)

MSMEs – Definition and Significance in Indian Economy; MSME Schemes, Challenges and Difficulties in availing MSME Schemes, Forms of Business; Women Entrepreneurship; Rural Entrepreneurship; Family Business and First Generation Entrepreneurs.

UNIT III - IDEA GENERATION AND FEASIBILITY ANALYSIS (9 hours)

Idea Generation; Creativity and Innovation; Identification of Business Opportunities; Market Entry Strategies; Marketing Feasibility; Financial Feasibilities; Political Feasibilities; Economic Feasibility; Social and Legal Feasibilities; Technical Feasibilities; Managerial Feasibility, Location and Other Utilities Feasibilities.

UNIT IV - BUSINESS MODEL AND PLAN IN RESPECTIVE INDUSTRY (9 hours)

Business model – Meaning, designing, analyzing and improvising; Business Plan – Meaning, Scope and Need; Financial, Marketing, Human Resource and Production/Service Plan; Business plan Formats; Project report preparation and presentation; Why some Business Plan fails?

UNIT V - FINANCING AND HOW TO START UP BUSINESS? (9 hours)

Financial opportunity identification; Banking sources; Non banking Institutions and Agencies; Venture Capital – Meaning and Role in Entrepreneurship; Government Schemes for funding business; Pre launch, Launch and Post launch requirements; Procedure for getting License and Registration; Challenges and Difficulties in Starting an Enterprise.

TEXT BOOKS

1. Jayshree Suresh, "*Entrepreneurial Development*", Margham Publishers, Chennai , 2011.
2. Poornima M Charantimath, *"Entrepreneurship development small business enterprises"*, Pearson, 2013.

REFERENCES

1. Raj Shankar, "*Entrepreneurship: Theory And Practice",* Vijay Nicole imprints ltd in collaboration with Tata Mc-graw Hill Publishing Co.ltd.-new Delhi, 2012
2. Robert D. Hisrich, Mathew J. Manimala, Michael P Peters and Dean A. Shepherd, "*Entrepreneurship"*, 8th Edition, Tata Mc-graw Hill Publishing Co.ltd.-new Delhi, 2012
3. Martin Roger, "*The Design of Business*", Harvard Business Publishing, 2009
4. Roy Rajiv, *"Entrepreneurship*", Oxford University Press, 2011
5. Drucker.F, Peter, *"Innovation and Entrepreneurship"*, Harper business, 2006.

MB1209 FUNDAMENTALS OF ENTREPRENEURSHIP												
Course Designed by		**School of Management**										
1	Student outcome	a	b	c	d	e	f	g	h	i	j	k
							x		x	x	x	
2	Mapping of instructional objectives with student outcome						1-6		1-6	1-6	1-6	
3	Category	General (G)		Basic Sciences (B)			Engineering Sciences and Technical Arts (E)				Professional Subjects (P)	
		x		--			--				--	
4	Approval	23rd meeting of academic council, May, 2013										

MB1210	OPERATIONS RESEARCH	L	T	P	C
	Total contact hours – 45	3	0	0	3
	Prerequisites				
	Nil				

PURPOSE

To understand the systematic approach to allocate scarce resources and optimizing people, materials and money and to take managerial decisions.

INSTRUCTIONAL OBJECTIVES

1.	To understand the different types of decision making environment and the appropriate decision making approaches and tools to be used
2.	To develop critical thinking and objective analysis of decision problems.

UNIT I - INTRODUCTION (9 hours)

Introduction – Concept of a Model – Steps of Modelling – Scope of Operations Research.

UNIT II - LINEAR PROGRAMMING (9 hours)

Linear Programming – Introduction – Mathematical Formulation – Graphical Solution – General Linear Programming problem.

UNIT III - TRANSPORTATION PROBLEM (9 hours)

Transportation Model – Introduction – Initial Basic Feasible Solution – North West Corner Method – Least Cost Method – Vogels Approximation Method.

UNIT IV - ASSIGNMENT PROBLEM (9 hours)

Assignment Algorithm – Methods and Problems

UNIT V - PROJECT MANAGEMENT: PERT AND CPM (9 hours)

Network Models – Network Models for Project Analysis – CPM – Network Construction – Time Analysis – Cost-Time Trade off – PERT.

TEXT BOOKS

1. *"Operations Research"*, J.K. Sharma, 5th Edition, MacMillan India limited.
2. *"Operations Research",* R.Pannerselvam, 2nd Edition, Prentice Hall India private limited.

REFERENCES

1. *"Operations Research"*, Jay E. Aronson & Stanley Zionts, 3rd Edition, Quorum Books.
2. *"Operations Research Methodologies"*, A. Ravi Ravindran, 2nd Edition, CRC Press.
3. "*Operations Research",* Hamdy A. Taha, 9th Edition, Pearson Education.

MB1210 OPERATIONS RESEARCH												
Course Designed by		**School of Management**										
1	Student outcome	a	b	c	d	e	f	g	h	i	j	k
							x		x	x	x	
2	Mapping of instructional objectives with student outcome						1-2		1-2	1-2	1-2	
3	Category	General (G)		Basic Sciences (B)		Engineering Sciences and Technical Arts (E)					Professional Subjects (P)	
		x		--		--					--	
4	Approval	23rd meeting of academic council, May, 2013										

MB1211	ETHICAL VALUES FOR BUSINESS	L	T	P	C
	Total contact hours - 45	3	0	0	3
	Prerequisites				
	Nil				

PURPOSE

To sensitize the students with the need for ethical values in professional and business aspects of life.

INSTRUCTIONAL OBJECTIVES	
1.	To learn and apply ethical values in Business and to understand the various ethical values in relevance to business.

UNIT I - INTRODUCTION TO ETHICS AND VALUES IN BUSINESS (9 hours)

Business ethical values, meaning, scope and importance – Ethical values, positive, normative and negative values – Moral, Moral standard and judgements. Unethical practices in business – financial cheatings in corporate sectors, land grabbing for business sectors, eviction of permanent citizens and deforestations.

UNIT II - THEORIES AND APPROACHES (9 hours)

Theories and models – Theory of utilitarianism – E.Kant's theory - J.Kohlberg's conditionality theory. Mahatma Gandhi's ethics. Model of compensation for victims – social cost and benefit analysis. Economic profit verses commercial profit.

UNIT III - ETHICAL ISSUES IN BUSINESS (9 hours)

Business ethical values in Market - adulteration, exploitation of consumers, creation of artificial demand, black market, grey market. Production – waste, accidents and safety, Human resource – gender and racial discriminations, child labour, nepotism, power abuse and sexual harassment and labour exploitation. Information technology – cyber crimes, intellectual property rights, copy rights and patent rights securities.

UNIT IV - ENVIRONMENTAL CONCERNS (9 hours)

Unethical practices – Externalities- positive and negative externalities. Market failure and its impacts on ecology and environment. Green house gas emissions Pollutions – air, water, soil. Impacts – depletion of ozone layer, global warming effects, Bio diversity failures –Human health deteriorations.

UNIT V - MEASURES BOTH PREVENTIVE AND REMEDIAL (9 hours)

Corrective measures - Legal penalties – punishments. Waste management – End of – pipe control – 3R Methods – Whistle blowing – Standard settings –Corporate governance – Corporate social responsibility. Government regulations, taxes. Government incentives of grants and subsidies for ethical based business. Business conservative policies versus value based business.

TEXT BOOKS

1. Ghosh.B.N, *"Business Ethics and Corporate Governance"*, Mcgraw Hill Publications , 2012

2. John R. Boatright, and Bibhu Prasan Patra *"Ethics and the Conduct of Business",* Pearson Publications, New Delhi, 2011

REFERENCES

1. Sanjay Mohapatra and Sreejesh.S, *"Case studies in Business ethics and Corporate governance",* Pearson,2013.
2. Mruthynajaya, *"Business ethics and value systems",* PHI learning P Ltd.2013.

MB1211 ETHICAL VALUES FOR BUSINESS												
Course Designed by		School of Management										
1	Student outcome	a	b	c	d	e	f	g	h	I	j	k
							x		x	x	x	
2	Mapping of instructional objectives with student outcome						1		1	1	1	
3	Category	General (G)		Basic Sciences (B)			Engineering Sciences and Technical Arts (E)				Professional Subjects (P)	
		x		--			--				--	
4	Approval	23rd meeting of academic council, May, 2013										

MB1212	INFORMATION SYSTEMS FOR ENGINEERS	L	T	P	C
	Total contact hours - 45	3	0	0	3
	Prerequisites				
	Nil				

PURPOSE

This course is intended to give a basic idea about Information Systems and the need to study the same from the engineering perspective. The different units are intended to expose the students to the various aspects like the transformation of today's businesses with the advent and use of Information Systems, need for security of Information Systems, and the ethical and social issues involved in the use of Information Systems.

INSTRUCTIONAL OBJECTIVES

1.	To understand the basic concepts of Information Systems applicable to Engineers
2.	To study the design, development and security of Information Systems
3.	To learn about the various modules in ethical and social issues in using Information Systems

UNIT I - INTRODUCTION **(9 hours)**

Introduction to Information Technology - Need for information technology; information technology firms - what they are and how they do things; Opportunities in the IT industries

UNIT II - SYSTEMS DESIGN **(10 hours)**

Information Systems: Concepts and overview of information systems; A systematic framework for information systems; Components of information systems; information systems design, analysis and management, types of Information Systems

UNIT III - DATABASE MANAGEMENT SYSTEMS **(8 hours)**

Database Management Systems for information Systems: Data resources, structure and functional aspects: graphic database, data storage and hypermedia; Data design issues and output designs.

UNIT IV - DATA SECURITY **(8 hours)**

Information Systems Security –System Vulnerability and abuse – improve Business value of security & control using various technologies – framework for security and control –recent technologies and tools for protecting information resources

UNIT V - ETHICS IN INFORMATION SYSTEMS **(10 hours)**

Ethical and Social Issues in Information Systems – ethics in an information society – moral dimensions of Information Systems – role of Government in information technology

TEXT BOOKS

1. Kenneth C. Laudon & Jane P.Laudon, *"Management Information* Systems"Managing the Digital Firm-Twelfth Edition, Pearson
2. Gerald V.Post David L. Anderson, *"Management Information System-Solving Business Problems with Information Technology"* Tata McGraw Hill Publishing Co. ltd, New Delhi

REFERENCES

1. Alexis Leon, *"Enterprise Resource Planning"* Tata McGraw Hill Publishing Co. Ltd., New Delhi – 2005
2. Raymond Meleod, JR *"Information Systems"* Mac Millan Publishing Co. ltd – 4th Edition.

3. Gordan B.Davis Margrette H.Olsan, "*Management Information System",* Conceptual Foundations, Structure & Development – Second Edition – Tata McGraw Hill Co. Ltd, New Delhi

MB1212 INFORMATION SYSTEMS FOR ENGINEERS												
Course Designed by		**School of Management**										
1	Student outcome	a	b	c	d	e	f	g	h	i	j	k
							x		x	x	x	
2	Mapping of instructional objectives with student outcome						1-3		1-3	1-3	1-3	
3	Category	General (G)		Basic Sciences (B)		Engineering Sciences and Technical Arts (E)					Professional Subjects (P)	
		x		--		--					--	
4	Approval	23rd meeting of academic council, May, 2013										

MB1213	DATA WAREHOUSING AND DATA MINING	L	T	P	C
	Total contact hours - 45	3	0	0	3
	Prerequisites				
	Nil				

PURPOSE

The subject on "Data warehousing & Data Mining" is to provide an introduction to the field of Data Analysis, which has been defined as the extensive use of data, quantitative analysis, exploratory and predictive models, and fact-based management to drive decisions and actions. The development and use of data warehouses and data marts to support data analytics is discussed. The use of key performance indicators, dashboards and scorecards for performance management and opportunity assessment are addressed

INSTRUCTIONAL OBJECTIVES

1.	Become familiar with the processes needed to develop, report, and analyze business data.
2.	To learn how to use and apply selected analytics software

UNIT I - INTRODUCTION (10 hours)

Introduction: The Evolution Of Data Warehousing (The Historical Context), The Data Warehouse - A Brief History, Characteristics, Operational Database Systems and Data Warehouse (OLTP & OLAP),Today's Development Environment, Data Marts, Metadata.

UNIT II - DATA PROCESSING (10 hours)

Multidimensional Data Models: Types of Data and Their Uses, from Tables and Spreadsheets to Data Cubes, Identifying Facts and Dimensions, Designing Fact Tables, Designing Dimension Table, Data Warehouse Schemas, OLAP Operations.

UNIT III - DATAWAREHOUSE (8 hours)

Principles of Data Warehousing(Architecture and Design Techniques):System Processes, Data Warehousing Components, Architecture for a warehouse, Three-tier Data Warehouse Architecture, Steps for the design and construction of Data Warehouses, Conceptual Data Architecture, Logical Architectures, Design Techniques.

UNIT IV - DATA MINING (8 hours)

Data Mining: Introduction: Motivation, Importance, Knowledge Discovery Process, KDD and Data Mining, Data Mining vs. Query Tools, Kind of Data mining, kind of data, Functionalities, interesting patterns, Classification of data mining systems, Major issues, from Data warehousing to data Mining.

UNIT V - DATA INTEGRATION (9 hours)

Data Integration and Transformation, Data Reduction, Data Warehouse and OLAP Technology for Data Mining: data warehouse, operational database systems and data warehouses, Architecture, Implementation, development of data cube technology, data warehousing to data mining, Data warehouse usage.

TEXT BOOKS

1. Krzysztof J. Cios, Witold Pedrycz, Roman W. Swiniarski, *"Data mining: a knowledge discovery approach"*, Springer, 2007
2. Berson, "*Data Warehousing, Data Mining, & Olap",* Tata McGraw-Hill Education, 2004

REFERENCES

1. D. J. Hand, Heikki Mannila, Padhraic Smyth, "*Principles of data mining*" MIT Press, 2001
2. Soumen Chakrabarti, Earl Cox, Ian H. Witten, Morgan Kaufmann, *"Data mining: know it all"*, 2008

MB1213 DATA WAREHOUSING AND DATA MINING												
Course Designed by		School of Management										
1	Student outcome	a	b	c	d	e	f	g	h	i	j	k
							x		x	x	x	
2	Mapping of instructional objectives with student outcome						1-2		1-2	1-2	1-2	
3	Category	General (G)		Basic Sciences (B)		Engineering Sciences and Technical Arts (E)					Professional Subjects (P)	
		x		--		--					--	
4	Approval	23rd meeting of academic council, May, 2013										

MB1214	COMPUTER NETWORKS AND SECURITIES	L	T	P	C
	Total contact hours - 45	3	0	0	3
	Prerequisites				
	Nil				

PURPOSE

The purpose of learning this course is to provide an introduction to the concepts, terminologies and technologies used in modern day's data communication, computer networking and security issues.

INSTRUCTIONAL OBJECTIVES

1.	To understand the concepts of data communications.
2.	To study the functions of different layers.
3.	To introduce ISO / OSI standards employed in computer networking.

UNIT I - INTRODUCTION (8 hours)

Components – Direction of Data flow – networks – Components and Categories – types of Connections – Topologies –Protocols and Standards – ISO / OSI model – Transmission Media – Coaxial Cable – Fiber Optics – Line Coding – Modems – RS232 Interfacing sequences.

UNIT II - NETWORKS BASICS (7 hours)

Error – detection and correction – Parity – LRC – CRC – Network Layer - Internetworks – Packet Switching and Datagram approach – IP addressing methods – Sub-netting – Routing – Distance Vector Routing – Link State Routing – Routers.

UNIT III - NETWORKING PROTOCOLS **(10 hours)**

Duties of transport layer – Multiplexing – De-multiplexing – Sockets – User Datagram Protocol (UDP) – Transmission Control Protocol (TCP) – Congestion Control – Quality of services (QOS) – Integrated Services - Domain Name Space (DNS) – SMTP – FTP – HTTP - WWW – Security – Cryptography.

UNIT IV - SECURITY SYSTEMS **(10 hours)**

Attacks, Services and Mechanisms, Security Attacks, Security Services, Integrity check, digital Signature, authentication, has algorithms – Ethics in IT

UNIT V - TRENDS IN SECURITY **(10 hours)**

Password Based, Address Based, Cryptographic Authentication. Passwords in distributed systems, on-line vs offline guessing, storing. Cryptographic Authentication: passwords as keys, protocols, KDC's Certification Revocation, Inter-domain, groups, delegation. Authentication of People: Verification techniques, passwords, length of passwords, password distribution, smart cards, biometrics.

TEXT BOOKS

1. Behrouz A. Forouzan, *"Data communication and Networking"*, Tata McGraw-Hill, 2004.
2. Dr. Micheal E.Whitman, Herbert J. Mattord, "*Principles and Practices of Information Security*" Cengage Learning Fourth Indian Reprint, 2010

REFERENCES

1. Charles P, Pfleeger, Shari Lawrence Pfleeger, "*Security in computing",* Pearson, Fifth Impression, 2011

MB1214 COMPUTER NETWORKS AND SECURITIES													
Course Designed by		**School of Management**											
1	Student outcome	a	b	c	d	e	f	g	h	i	j	k	
							x		x	x	x		
2	Mapping of instructional objectives with student outcome						1-3		1-3	1-3	1-3		
3	Category	General (G)		Basic Sciences (B)			Engineering Sciences and Technical Arts (E)				Professional Subjects (P)		
		x		--			--				--		
4	Approval	23rd meeting of academic council, May, 2013											

MBA1215	LEGAL ASPECTS OF BUSINESS	L	T	P	C
	Total contact hours - 45	3	0	0	3
	Prerequisites				
	Nil				

PURPOSE

To familiarize the participants with a working knowledge of Indian laws which are absolutely essential for future managers in their day to day working.

INSTRUCTIONAL OBJECTIVES

1. On completion of this course the participants expected to describe the salient provisions relating to Indian contract act, Sale of Goods Act, F actories Act, Companies Act, and other acts relating to public interest. Become familiar with the precaution to be taken by them as managers when they enter into business relationships with their suppliers, customers or other third parties.

UNIT I - GENERAL PRINCIPLES OF LAW OF CONTRACT (9 hours)

What is a contract and what are the legal implications of a contract? Indian Contract Act – 1872.

UNIT II - SPECIAL CONTRACTS- (9 hours)

Who are the different parties in a special contract and what are their legal rights and duties? Bailment & Pledge, Indemnity and Guarantee-Contract of Agency - Sale of Goods Act.

UNIT III - INDUSTRIAL LAW (9 hours)

Factories Act
Indian Trade Union Act

UNIT IV - COMPANY LAW (9 hours)

Meaning - Definition - Formation of Company - Rights, Duties and Liabilities of Directors - Winding up of Company.

UNIT V - LAW RELATED TO GENERAL PUBLIC (9 hours)

The Consumer Protection Act 1986
The Information Technology Act 2000
The Right to Information Act
SEBI Act 1992

TEXT BOOKS

1. V.Balachandran and S Thothadri, "*Legal Aspects of Business*", Tata Mcgraw Hill publications, 2012
2. Peddina Mohana Rao, *"Business Law",* PHI learning P Ltd, 2013.

REFERENCES

1. Ravindra Kumar, "*Legal Aspects of Business",* Cengage-2011
2. Kapoor.N.D, "*Mercantile Law*", Sultan & Sons
3. Vakul Sharma, "*Cyber Law*" Mac Milan
4. Akhileshwar Pathak, "*Legal aspects of business*" Tata McGraw-Hill
5. Tejpal Sheth, "*Legal Aspects of Business*", Pearson -2012.
6. Chandra Bose, "*Business Law*"PHI-2010

MBA1215 LEGAL ASPECTS OF BUSINESS												
Course Designed by		School of Management										
1	Student outcome	a	b	c	d	e	f	g	h	i	j	k
							x		x	x	x	
2	Mapping of instructional objectives with student outcome						1		1	1	1	
3	Category	General (G)		Basic Sciences (B)		Engineering Sciences and Technical Arts (E)				Professional Subjects (P)		
		x		--		--				--		
4	Approval	23rd meeting of academic council, May, 2013										

MB1216	INDUSTRIAL ENGINEERING AND MANAGEMENT	L	T	P	C
	Total contact hours – 45	3	0	0	3
	Prerequisites				
	Nil				

PURPOSE

To have a systematic understanding of design, improvement and installation of integrated systems of people, materials, money, equipment and energy.

INSTRUCTIONAL OBJECTIVES

1.	To understand the principles and methods of engineering analysis and design to specify predict and evaluate the results obtained from the integrated systems of people, materials, money, equipment and energy.

UNIT I - INTRODUCTION (9 hours)

Concept of Industrial Engineering – Role of Industrial Engineer – Applications of Industrial Engineering – Productivity

UNIT II - FACILITY LOCATION, PLANT LAYOUT AND MATERIALS HANDLING (9 hours)

Plant Location – Factors Influencing Plant Location – Plant Layout – Types of Layout – Material Handling - Principles and Equipments.

UNIT III - WORK STUDY **(9 hours)**

Work Study – Steps in Work Study – Method Study – Steps in Method Study – Charts and Diagrams – Time Study – Steps in Time Study – Problems – Allowances and Ratings.

UNIT IV - PLANT MAINTENANCE **(9 hours)**

Plant Maintenance – Objectives – Organization of Maintenance Department – Types of Maintenance – Plant Maintenance Schedule – Recent Developments in Plant Maintenance.

UNIT V - INSPECTION AND STATISTICAL PROCESS CONTROL **(9 hours)**

Inspection – Purpose – Concepts – Kinds of Inspection – Statistical Quality Control – Control Charts for Mean and Range; Number of defects (C-Chart) and Number of defectives (P-Chart).

TEXT BOOKS

1. *"Industrial Engineering and Management",* Khanna.O.P, 2nd Edition, Dhanpat Rai Publications.
2. *"Industrial Engineering Management",* Verma.A.P, 2nd Edition, S.K.Kataria & Sons.

REFERENCES

1. *"Industrial Engineering and Management",* Dr. Ravi Shankar, 1st Edition, Galgotia Publications.
2. *"Industrial Engineering and Management",* Patil.S.B, 1st Edition, Technical Publications.
3. *"Industrial Engineering and Management*", Nadha Muni Reddy, 1st Edition, New Age International Publications.

<table>
<tr><th colspan="13">MB1216 INDUSTRIAL ENGINEERING AND MANAGEMENT</th></tr>
<tr><td colspan="2">Course Designed by</td><td colspan="11">School of Management</td></tr>
<tr><td rowspan="2">1</td><td rowspan="2">Student outcome</td><td>a</td><td>b</td><td>c</td><td>d</td><td>e</td><td>f</td><td>g</td><td>h</td><td>i</td><td>j</td><td>k</td></tr>
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<tr><td>2</td><td>Mapping of instructional objectives with student outcome</td><td></td><td></td><td></td><td></td><td></td><td>1</td><td></td><td>1</td><td>1</td><td>1</td><td></td></tr>
<tr><td rowspan="2">3</td><td rowspan="2">Category</td><td colspan="2">General (G)</td><td colspan="3">Basic Sciences (B)</td><td colspan="3">Engineering Sciences and Technical Arts (E)</td><td colspan="3">Professional Subjects (P)</td></tr>
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<tr><td>4</td><td>Approval</td><td colspan="11">23rd meeting of academic council, May, 2013</td></tr>
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MB1217	BUSINESS ENVIRONMENT	L	T	P	C
	Total contact hours - 45	3	0	0	3
	Prerequisites				
	Nil				

PURPOSE

To prepare the engineering students for a successful carrier by understanding the socio-politico economic environment in all its complexity.

INSTRUCTIONAL OBJECTIVES

1.	The objective of the course is to enable the students to understand how the economic, political, legal, social, cultural, technological and international environment govern and condition business in a country. It also aims to emphasize the challenges brought forth by various constituents of environment on business and to guide how business should design its policies in such multi-environmental scenario.

UNIT I - INTRODUCTION TO BUSINESS ENVIRONMENT (9 hours)

Introduction, definition, components and overview of Business Environment. Complexity and Diversity of Business Environment in the 21st century. Concept of Business Cycle, Need to scan the business environment and techniques of scanning the business environment. Political Environment: Three political institutions: Legislature, Executive and Judiciary. Brief note on Fundamental rights and Directive Principles of state policy. Rationale and extent of state intervention.

UNIT II - ECONOMIC AND LEGAL ENVIRONMENT (9 hours)

Economic Environment: Concept of Economic systems, objectives, strategies and evaluation of current five year plan. New Industrial policy and industrial licensing. New economic policies, Emerging Economies. Effect of recession on Business and remedies for that.

Legal Environment: Company regulatory legislations in India, FEMA, Latest EXIM policy. Competition Law.

UNIT III - SOCIAL ENVIRONMENT (9 hours)

Public Sector in India: Concepts, philosophy and objectives, performance, problems and constraints. Divestment and Privatisation. Joint sector and cooperative sector in India.Social Environment: Social responsibility of business, consumer movement & Consumer Protection Act 1986, Business Ethics, Cross-Cultural Business Environment, The Environment Protection Act 1986.

UNIT IV - TECHNOLOGICAL ENVIRONMENT (9 hours)

Impact of technology on business. Technological policy, import of technology, appropriate technology, problems in technology transfer.

UNIT V - INTERNATIONAL ENVIRONMENT (9 hours)

Emergence of globalization. Control of foreign direct investment, benefits and problems from MNCs. WTO, its role and functions, implications for India. Trading Blocks.

TEXT BOOKS

1. Gupta.C.B, *"Business Environment"*, Sultan Chand & Sons, 2011.
2. Sheikh and Saleem, *"Business Environment*", Pearson. 2011.

REFERENCES

1. Aswathappa**,** *"Essentials of Business Environment",* Himalaya, 2009.
2. Francis Cherunilam, "*Business Environment: Text & cases*", Himalaya.2010.

MB1217 BUSINESS ENVIRONMENT												
Course Designed by		School of Management										
1	Student outcome	a	b	c	d	e	f	g	h	I	j	k
							x		x	x	x	
2	Mapping of instructional objectives with student outcome						1		1	1	1	
3	Category	General (G)		Basic Sciences (B)			Engineering Sciences and Technical Arts (E)				Professional Subjects (P)	
		x		--			--				--	
4	Approval	23rd meeting of academic council, May, 2013										

	PRODUCT DESIGN, MANAGEMENT TECHNIQUES AND ENTREPRENEURSHIP	L	T	P	C
MB1218	Total contact hours – 45	**3**	**0**	**0**	**3**
	Prerequisites				
	Nil				

PURPOSE

To understand the principles of product design, basic management techniques and entrepreneurial skills.

INSTRUCTIONAL OBJECTIVES

1.	To understand the fundamentals of product design, practical management concepts like leadership and motivation.
2.	To induce entrepreneurial intent as well as understand the practical issues faced by entrepreneurs.

UNIT I - INTRODUCTION TO PRODUCT DESIGN (9 hours)

Product Design – Importance – Objectives – Factors influencing product design – Characteristics of a good product design.

UNIT II - PRODUCT DESIGN AND DEVELOPMENT PROCESS (9 hours)

Product Development Process – Sources of Ideas for designing new products – Stages in Product Design – Effect of Products Design on Product Cost.

UNIT III - MANAGERIAL SKILLS AND MANAGEMENT GURUS (9 hours)

Characteristics of Management – Managerial Skills – Contribution of F.W.Taylor and Henry Fayol – Industrial Ownership.

UNIT IV - LEADERSHIP AND MOTIVATION (9 hours)

Leadership Styles – Qualities of Leadership – Morale – Motivation Theories (Maslow, Herzberg and ERG theory).

UNIT V - ENTREPRENEURSHIP (9 hours)

Entrepreneurship – Functions – Types – Expectations – Sources of finance – Concept of small scale and ancillary units – Sickness and Remedies in SMEs.

TEXT BOOKS

1. "*Text book of production management",* Shridhara Bhat.K, 1st Edition, Himalaya Publishing House.
2. *"Industrial Engineering and Management",* Khanna.O.P, 2nd Edition, Dhanpat Rai Publications.

REFERENCES

1. "*Entrepreneurial Development",* Jayshree Suresh, 5th Edition, Margham Publications.
2. *"Entrepreneurship",* Robert D. Hisrich, 6th Edition, Tata McGraw Hill Publications.
3. *"Entrepreneurship: Theory",* Process and Practice, Donald F. Kuratko, 9th Edition, Cengage Learning.

MB1218 PRODUCT DESIGN, MANAGEMENT TECHNIQUES AND ENTREPRENEURSHIP												
Course Designed by		School of Management										
1	Student outcome	a	b	c	d	e	f	g	h	i	j	k
							x		x	x	x	
2	Mapping of instructional objectives with student outcome						1-2		1-2	1-2	1-2	
3	Category	General (G)		Basic Sciences (B)		Engineering Sciences and Technical Arts (E)				Professional Subjects (P)		
		x		--		--				--		
4	Approval	23rd meeting of academic council, May, 2013										

ME1202	PRODUCT DESIGN AND DEVELOPMENT	L	T	P	C
	Prerequisite	3	0	0	3
	Nil				

PURPOSE

The focus of Product Design and Development is integration of the marketing, design, and manufacturing functions of the firm in creating a new product.

INSTRUCTIONAL OBJECTIVES

1.	Various aspects of product design and development
2.	Concept generation and selection
3.	Intellectual property

UNIT I - INTRODUCTION AND PRODUCT PLANNING AND PROJECT SELECTION (9 hours)

Significance of product design, product design and development process, sequential engineering design method, the challenges of product development, Identifying opportunities evaluate and prioritize projects, allocation of resources

UNIT II - IDENTIFYING CUSTOMER NEEDS AND PRODUCT SPECIFICATIONS (9 hours)

Interpret raw data in terms of customers need, organize needs in hierarchy and establish the relative importance of needs.,
Establish target specifications, setting final specifications

UNIT III - CONCEPT GENERATION AND INDUSTRIAL DESIGN (9 hours)

Activities of concept generation, clarifying problem, search both internally and externally, explore the output,
Assessing need for industrial design, industrial design process, management, assessing quality of industrial design,

UNIT IV - CONCEPT SELECTION **(9 hours)**

Overview, concept screening and concept scoring, methods of selection.

UNIT V - INTELLECTUAL PROPERTY **(9 hours)**

Elements and outline, patenting procedures, claim procedure, Design for Environment: Impact, regulations from government, ISO system and IPR.

TEXT BOOKS

1. Ulrich K. T, Eppinger S.D and Anita Goyal , "*Product Design and Development"*, Tata McGraw Hill, 2009.
2. Otto K, and Wood K, "*Product Design"*, Pearson Education, 2001.

ME1202 – PRODUCT DESIGN AND DEVELOPMENT												
Course Designed by		**Department of Mechanical Engineering**										
1	Student outcomes	a	b	c	d	e	f	g	h	i	j	k
		x		x		x						
2	Mapping of instructional objectives with student outcome	1-3		1-3		1-3						
3	Category	General(G)		Basic Sciences (B)		Engineering Sciences and Technical Arts(E)				Professional Subjects(P)		
		--		--		--				x		
4	Approval	23rd meeting of Academic Council, May 2013										

ME1203	**CONCURRENT ENGINEERING**	**L**	**T**	**P**	**C**
	Prerequisite	**3**	**0**	**0**	**3**
	Nil				

PURPOSE

To study the principles of concurrent engineering and how it can be applied.

INSTRUCTIONAL OBJECTIVES

1.	Basics of concurrent engineering (CE).
2.	Tools and methodologies available in CE.
3.	Various approaches to CE.
4.	Other related aspects of CE.

UNIT I - INTRODUCTION **(5 hours)**

Extensive definition of CE - CE design methodologies - Organizing for CE - CE tool box collaborative product development

UNIT II - USE OF INFORMATION TECHNOLOGY (10 hours)

IT support - Solid modeling - Product data management - Collaborative product commerce - Artificial Intelligence - Expert systems - Software hardware co-design.

UNIT III - DESIGN STAGE (10 hours)

Life-cycle design of products - opportunity for manufacturing enterprises - modality of Concurrent Engineering Design - Automated analysis idealization control - Concurrent engineering in optimal structural design - Real time constraints.

UNIT IV - MANUFACTURING CONCEPTS AND ANALYSIS (10 hours)

Manufacturing competitiveness - Checking the design process - conceptual design mechanism – Qualitative physical approach - An intelligent design for manufacturing system - JIT system - low inventory - modular - Modeling and reasoning for computer based assembly planning - Design of Automated manufacturing.

UNIT V - PROJECT MANAGEMENT (10 hours)

Life Cycle semi realization - design for economics - evaluation of design for manufacturing cost – concurrent mechanical design - decomposition in concurrent design - negotiation in concurrent engineering design studies - product realization taxonomy - plan for Project Management on new product development – bottleneck technology development.

REFERENCES

1. Anderson MM and Hein, L. Berlin, *"Integrated Product Development",* Springer Verlog, 1987.
2. Cleetus.J, "*Design for Concurrent Engineering*", Concurrent Engg. Research Centre, Morgantown, WV, 1992.
3. Andrew Kusaik, "*Concurrent Engineering: Automation Tools and Technology"*, Wiley, John and Sons Inc., 1992.
4. Prasad, "*Concurrent Engineering Fundamentals: Integrated Product Development*", Prentice Hall, 1996.
5. Sammy G Sinha, "*Successful Implementation of Concurrent Product and Process*", Wiley, John and Sons Inc., 1998.

ME1202 – PRODUCT DESIGN AND DEVELOPMENT												
Course Designed by		Department of Mechanical Engineering										
1	Student outcomes	a	b	c	d	e	f	g	h	i	j	k
		x		x	x	x						
2	Mapping of instructional objectives with student outcome	1-4		1-4	1-4	1-4						
3	Category	General(G)		Basic Sciences(B)			Engineering Sciences and Technical Arts(E)			Professional Subjects(P)		
		--		--			--			x		
4	Approval	23rd meeting of Academic Council, May 2013										

ME1205	MEMS AND NANO MANUFACTURING	L	T	P	C
	Prerequisite	3	0	0	3
	Nil				

PURPOSE

To impart knowledge about basics of MEMS and nano manufacturing.

INSTRUCTIONAL OBJECTIVES

1.	Basics of MEMS and Micro systems.
2.	MEMS materials and fabrication processes.
3.	Nanomanufacturing processes
4.	Nanomeasuring devices.
5.	NEMS and Nano systems.

UNIT I - INTRODUCTION TO MEMS AND MICRO SYSTEMS (9 hours)

Definition –fundamentals - development- examples of MEMS. Micro fluidics, micro electronics, micro systems- design and fabrication, working principles and applications. Integrated circuit processes, potential of MEMS in industry, Micro sensors - Thermal sensors, Electrical sensors, Mechanical sensors, Chemical and Biosensors. Microactuators- Electromagnetic and thermal microactuation, Mechanical design of micro actuators, Micro actuator examples, micro valves, micro pumps, micro motors.

UNIT II - MATERIALS AND FABRICATION PROCESSES OF MEMS (9 hours)

MATERIALS: Substrates and wafers, silicon substrate, properties of silicon, silicon compounds, silicon piezo resistors, Galium arsenide, quartz, polymer for MEMS, conductive polymer. Shape memory alloys

FABRICATION PROCESSES: Photolithography, photo resist applications, light sources, X-ray lithography, Electron beam lithography,ion implantation, thin film deposition, diffusion process, bulk and surface machining, LIGA process. Microsteriolithography (MSL) for 3D fabrication, Nano lithography.

UNIT III - NANOMANUFACTURING TECHNIQUES (9 hours)

Chemical vapor deposition-Physical vapor deposition-Electro plating-Etching, types-High energy ball milling-Sol gel process-Inert gas condensation process-Sputtering process-Arc discharge method.

UNIT IV - NANO MEASURING TECHNIQUES (9 hours)

Scanning Electron Microscope (SEM), Transmission Electron Microscope(TEM), STEM, Atomic Force Microscope(AFM)-Types and applications-X ray Diffraction Technique (XRD)-application, Energy dispersive X-ray spectroscopy(EDX), X-Ray spectrometry, Auger Spectroscopy, Differential thermal analysis, Differential scanning calorimetric, Thermo gravimetric analysis, Optical tweezers.

UNIT V - NEMS AND NANOSYSTEMS (9 hours)

Introduction, components, products of Nano systems-Nanoactuators-Bio sensors, Molecular motors, Nanomanipulation- Nano assembly, self assembly- Nano imprint fabrication-Nano thermal sensors, Actuation using piezo electric and shape memory alloys-Electrostatic and CNT actuators. Applications of Nanofluid in Nanomachining.

TOTAL 45 hours

TEXT BOOKS

1. Tai-Ran Hsu, "*MEMS and Microsystems Design and Manufacture"*, Tata McGraw Hill, New Delhi, 2002.
2. Nitaigour Premchand Mahalik, "*MEMS"*, Tata McGraw Hill, New Delhi, 2007.
3. Stephen A. Campbell., "*The Science and Engineering of Microelectronic Fabrication"*, Oxford University Press, 2001.
4. Bharat Bhushan, "*Springer Handbook of Nanotechnology"*, Springer, 2004.
5. Sami Franssila., "*Introduction to Micro fabrication"*, John Wiley & Sons Ltd, 2004.

REFERENCES

1. Mark J. Jackson., "*Micro fabrication and Nanofabrication"*, CRC Taylor & Fancis, 2006.
2. Sergey Edward Lyshevski., "*Nano and Micro electromechanical Systems: Fundamentals of Nano and Micro engineering"*, CRC Press, 2001.
3. Philips V.A., "*Modern Metallographic Techniques and their Applications"*, Wiley Interscience, 1971.
4. Cullity B.D., "*Elements of X- ray Diffraction"*, 4th Edition, Addison Wiley, 1978.
5. Cao.G, "*Nanostructures and Nanomaterials: Synthesis, Properties and Applications"*, Imperial College Press, 2004.

6. Drexler.K.E , "*Nanosystems: Molecular Machinery, Manufacturing, and Computation"*, John Wiley & Sons, 1992.
7. Julian W. Gardner., "*Micro sensor MEMS and Smart Devices"*, John Wiley & Sons, 2001.
8. Mohamed Gad-El-Hak, "*The MEMS Handbook"*, CRC Press, New York,2002.
9. Rai Choudhury, "*MEMS and MOEMS Technology and Applications"*, PHI Learning , 2009.

ME1205 –MEMS AND NANO MANUFACTURING												
Course Designed by		Department of Mechanical Engineering										
1	Student outcomes	a	b	c	d	e	f	g	h	i	j	k
		x				x						
2	Mapping of instructional objectives with student outcome	1-5				1-5						
3	Category	General (G)		Basic Sciences(B)		Engineering Sciences and Technical Arts(E)				Professional Subjects(P)		
		--		--		--				x		
4	Approval	23rd meeting of Academic Council, May 2013										

ME1208	NON DESTRUCTIVE TESTING	L	T	P	C
	Prerequisite	3	0	0	3
	Nil				

PURPOSE

To impart knowledge in various methods of Non Destructive Testing.

INSTRUCTIONAL OBJECTIVES

1.	Principles of various NDT techniques.
2.	The equipment required for the NDT.
3.	The procedure followed in NDT techniques.
4.	Applications of NDT and recent trends in NDT.

UNIT I - VISUAL INSPECTION AND EDDY CURRENT TESTING (9 hours)

Scope and advantages of NDT, Comparison of NDT with DT, classifications of NDT Visual InspectionEquipment used for visual inspection -Magnifying Glass Magnifying Mirror, Microscope Borescope , endoscopes or endoprobes Flexible Fiber Optic Borescope , Video Imagescope .Eddy Current Testing- Principle, Advantages, Disadvantages Factors Affecting Eddy Current Response-Material Conductivity Permeability - Frequency- Geometry-Proximity (Lift off)-Typical Applications, limitations ,Types of Probes.

UNIT II - LIQUID PENETRANT TESTING (**9 hours)**

Liquid penetration testing- Introduction, Principle, Equipment, Procedures, Characteristics of penetrants- developers – Evaluation - hazards Precautions,advantages, limitations and applications.

UNIT III - MAGNETIC PARTICLE TESTING **(9 hours)**

Principle of Magnetic Particle Testing-different methods to generate magnetic fields -Magnetic Particle Testing Equipment- Magnetic Particle Testing Procedures Method of De-Magnetization- Magnetic Particle Medium-Evaluation of Indications and Acceptance Standards- magnetic particle test- applications, advantages and limitations.

UNIT IV - RADIOGRAPHIC TESTING **(9 hours)**

X-ray radiography principle, equipment & methodology - Type of Industrial Radiation sources and Application-Radiographic exposure Factors and Technique-GAMA Ray and X-Ray Equipment- Radiographic Procedure - Radiograph Interpretation, Radiography Image Quality Indicators-Radiographic Techniques-Film Processing-Methods of Viewing Radiographs-Radiographic Testing Procedures for welds. Precautions against radiation hazards.

UNIT V - ULTRASONIC TESTING **(9 hours)**

Introduction, Principle of operation Type of Ultrasonic Propagation- Ultrasonic probes. Types of Transducers -Ultrasonic Testing Techniques. Method for Evaluating Discontinuities-Ultrasonic Testing Procedures for different component –applications, advantages and limitations, Documentation, . Applications in inspection of castings, forgings, Extruded steel parts, bars, pipes, rails and dimensions measurements.

TOTAL 45 hours

TEXT BOOKS

1. American Metals Society, *"Non-Destructive Examination and Quality Control", Metals Hand Book,* Vol.17, 9th Ed, Metals Park, OH, 1989.
2. Bray, Don.E and Stanley, Roderic.K, "*Nondestructive Evaluation: A Tool in Design, Manufacturing, and Service. Revised"*, CRC Press New York, Edition 1997.

REFERENCES

1. www.ndt-ed.org
2. www.krautkramer.com.au

ME1208 – NON DESTRUCTIVE TESTING												
Course Designed by		Department of Mechanical Engineering										
1	Student outcomes	a	b	c	d	e	f	g	h	i	j	k
		x	x			x						x
2	Mapping of instructional objectives with student outcome	1	2,3			3						4
3	Category	General (G)		Basic Sciences (B)		Engineering Sciences and Technical Arts(E)				Professional Subjects(P)		
		--		--		--				x		
4	Approval	23rd meeting of Academic Council, May 2013										

ME1209	NANO PROCESSING	L	T	P	C
	Prerequisite	3	0	0	3
	Nil				

PURPOSE

To impart knowledge about basics of nano machining and different nano measuring devices.

INSTRUCTIONAL OBJECTIVES

1.	The basics of nanomachining
2.	Nanofabrication techniques
3.	Nanomeasuring devices
4.	Nanomaterial application in nanomanufacturing
5.	NEMS and Nano systems

UNIT I - INTRODUCTION (9 hours)

nanomanufacturing – Introduction - Bottom up approach, Mechanical micro machining-Precision micro and nanogrinding-ELID grinding, Principles, methods and applications, Mirror grinding-Laser based micro and nano fabrication-Ultrasonic machining, Micro lathe, Micro-ECM, Micro-EDM and Micro CMM.

UNIT II - NANOFABRICATION TECHNIQUES (9 hours)

Chemical vapor deposition-Physical vapor deposition-Electro plating-Etching, types-High energy ball milling-Sol gel process-Inert gas condensation process-Sputtering process-Arc discharge method.

UNIT III - NANO MEASURING DEVICES (9 hours)

Scanning Electron Microscope, Transmission Electron Microscope, STEM, Atomic Force Microscope-Types and applications-X ray Diffraction Technique-application, Energy dispersive X-ray spectroscope, X-Ray spectrometry, Auger

Spectroscopy, Differential thermal analysis, Differential scanning calorimetric, Thermo gravimetric analysis, Optical tweezers.

UNIT IV - NANOMATERIAL (9 hours)

Carbon nanotubes -Mechanical, Electrical and optical properties-Nano fluids-Preparation methods, properties and applications-Nanocoating, Diamond like coatings-CNT Based nanocomposites-Metal based nanocomposites-CNT based solar and fuel cells-Nano steel-Nano copper-Nano Aluminum.

UNIT V - NEMS AND NANOSYSTEMS (9 hours)

Introduction, components, products of Nano systems-Nanoactuators-Bio sensors, Molecular motors, Nanomanipulation- Nano assembly, self assembly- Nano imprint fabrication-Nano thermal sensors, nanoscale sensors-Actuation using piezo electric and shape memory alloys-Electrostatic CNT actuators.

TOTAL 45 hours

TEXT BOOKS

1. Bharat Bhushan., "*Springer Handbook of Nanotechnology"*, Springer, 2004.
2. Sami Franssila., "*Introduction to Micro fabrication"*, John Wiley & Sons Ltd, 2004.
3. Stephen A. Campbell., "*The Science and Engineering of Microelectronic Fabrication"*, Oxford University Press, 2001.

REFERENCES

1. Mark J. Jackson, "*Micro fabrication and Nanofabrication"*, CRC Taylor & Fancis, 2006.
2. Sergey Edward Lyshevski., "*Nano and Micro electromechanical Systems: Fundamentals of Nano and Micro engineering"*, CRC Press, 2001.
3. Philips.V.A, "*Modern Metallographic Techniques and their Applications"*, Wiley Interscience, 1971.
4. Cullity.B.D, "*Elements of X- ray Diffraction"*, 4th Edition, Addison Wiley, 1978.
5. Cao.G, "*Nanostructures and Nanomaterials: Synthesis, Properties and Applications"*, Imperial College Press, 2004.
6. Drexler.K.E, "*Nanosystems: Molecular Machinery, Manufacturing, and Computation"*, John Wiley & Sons, 1992.
7. Julian W. Gardner, "*Micro sensor MEMS and Smart Devices"*, John Wiley & Sons, 2001

ME1209 – NANO PROCESSING												
Course Designed by		Department of Mechanical Engineering										
1	Student outcomes	a	b	c	d	e	f	g	h	i	j	k
				x	x	x						
2	Mapping of instructional objectives with student outcome			1-5	2-5	1-5						
3	Category	General(G)		Basic Sciences (B)		Engineering Sciences and Technical Arts(E)				Professional Subjects(P)		
		--		--		--				x		
4	Approval	23rd meeting of Academic Council, May 2013										

ME1211	LOW COST AUTOMATION	L	T	P	C
	Prerequisite	3	0	0	3
	Nil				

PURPOSE

To familiarize the students with the basics low cost automation.

INSTRUCTIONAL OBJECTIVES

1. Basic to implement low cost automation systems.
2. Low cost automation using pneumatics and hydraulic devices.
3. Automation in assembly lines.

UNIT I - INTRODUCTION TO AUTOMATION (5 hours)

Automated manufacturing systems, fixed /programmable /flexible automation, Need of automation, Basic elements of automated systems- power, program and control. Levels of automation; control systems: Continuous and discrete control; Low cost automation, Economic and social aspects of automation.

UNIT II - BASICS OF PNEUMATICS AND CIRCUIT DESIGN (12 hours)

Operational principles and application, air compressors, Pneumatic cylinders and air motors, Pneumatic valves, Design of pneumatic circuits: speed control, reciprocating, synchronization and sequencing circuits. Hydro-pneumatic, Electro pneumatic Control in pneumatic systems.

UNIT III - BASICS OFHYDRAULICS AND CIRCUIT DESIGN (12 hours)

Principles of hydraulics, Hydraulic fluids, Filtration technology, Hydraulic- pumps, valves, and actuators. Standards in circuit diagram representation, Power pack design layout, Basic hydraulic circuits.

UNIT IV - ASSEMBLY AUTOMATION (8 hours)

Types and configurations, Parts delivery at workstations-Various vibratory and non-vibratory devices for feeding, hopper feeders, rotary disc feeder, centrifugal and orientation, Product design for automated assembly.

UNIT V - APPLICATIONS AND CASE STUDIES (8 hours)

Material handling- sorting- door opening- labeling Alignment method examples-Direction change-Automatic Screw Fastening- locking and clamping devices.

TOTAL 45 hours

TEXT BOOKS

1. Anthony Esposito, "*Fluid Power with applications"*, Prentice Hall international, 2009.
2. Mikell P Groover, "*Automation, Production System and Computer Integrated Manufacturing*", Prentice Hall Publications, 2007.

REFERENCES

1. Kuo .B.C, "*Automatic control systems*", Prentice Hall India, New Delhi, 2007.
2. Peter Rohner, "*Industrial hydraulic control*", Wiley Edition, 1995.
3. Mujumdar.S.R, "*Pneumatic System*", Tata McGraw Hill 2006.
4. HMT "*Mechatronics"*, HMT, 2008.
5. http://www.misumi-techcentral.com/tt/en/lca/

ME1211 – LOW COST AUTOMATION												
Course Designed by		**Department of Mechanical Engineering**										
1	Student outcomes	a	b	c	d	e	f	g	h	i	j	k
				x		x					x	x
2	Mapping of instructional objectives with student outcome			1-3		1-3					1-3	3
3	Category	General (G)		Basic Sciences (B)		Engineering Sciences and Technical Arts(E)					Professional Subjects(P)	
		--		--		--					x	
4	Approval	23rd meeting of Academic Council, May 2013										

ME1213	MANUFACTURING COST ESTIMATION	L	T	P	C
	Prerequisite	3	0	0	3
	Nil				

PURPOSE

To impart clear knowledge about process planning, costing and estimation of machining time.

INSTRUCTIONAL OBJECTIVES

1.	Cost Estimation and different expenses in industry.
2.	Cost Economics.
3.	Cost estimation in different shops.
4.	Machining time calculation for different process.

UNIT I - COST ESTIMATION (9 hours)

Objective of cost estimation- costing – cost accounting- classification of cost- Elements ofcost. Types of estimates – methods of estimates – data requirements and sources- collectionof cost- allowances in estimation.

UNIT II - COSTS AND EXPENSES (9 hours)

Aims of costing and estimation - Functions and procedure - Introduction to costs, Computing material cost, Direct labor cost, Analysis of overhead costs - Factory expenses, Administrative expenses, Selling and distributing expenses - Cost ladder - Cost of product.

UNIT III - COST ECONOMICS (9 hours)

Budget – need – Types. Budgetary control – Objectives, Benefits. Measures of cost economics – Make or buy decision and Analysis. Depreciation – Causes of depreciation – methods of Depreciation. Allocation of overheads.

UNIT IV - ESTIMATION OF COSTS IN DIFFERENT SHOPS (9 hours)

Estimation in Forging shop - Losses in forging - Forging cost. Estimation in welding shop - Gas cutting - Electric welding. Estimation in foundry shop - Pattern cost - Casting cost - Illustrative examples.

UNIT V - ESTIMATION OF MACHINING TIMES AND COSTS (9 hours)

Estimation of machining time for lathe operations, drilling, boring, shaping, planning, milling and grinding operations - Illustrative examples.

TOTAL 45 hours

TEXT BOOKS

1. Adithan.M.S and Pabla, "*Estimating and Costing"*, Konark Publishers Pvt., Ltd, 1989.
2. Chitale.A.K and Gupta.R.C, "*Product Design and manufacturing"*, Prentice Hall of India, New Delhi, 2007.

REFERENCES

1. Banga.T.R and Sharma.S.C, "*Estimating and Costing"*, Khanna publishers, New Delhi, 1986.
2. Joseph G. Monks, "*Operations Management, Theory and Problems"*, McGraw Hill Book Company, New Delhi, 1982.
3. Narang.G.B.S and Kumar.V, "*Production and Plannin"*, Khanna Publishers, New Delhi, 1995.

ME1213 – MANUFACTURING COST ESTIMATION													
Course Designed by		Department of Mechanical Engineering											
1	Student outcomes	a	b	c	d	e	f	g	h	i	j	k	
		x				x					x	x	
2	Mapping of instructional objectives with student outcome	2-4				3,4					1-3	1-3	
3	Category	General (G)		Basic Sciences (B)		Engineering Sciences and Technical Arts(E)				Professional Subjects(P)			
		--		--		--				x			
4	Approval	23rd meeting of Academic Council, May 2013											

ME1214	MICRO ELECTRO MECHANICAL SYSTEMS	L	T	P	C
	Prerequisite	3	0	0	3
	Nil				

PURPOSE

To provide fundamental knowledge of Micro electro mechanical systems and various fabrication techniques.

INSTRUCTIONAL OBJECTIVES

1.	The fundamentals of MEMS and Microsystems.
2.	Materials and Fabrication process involved in MEMS.
3.	Types of Microsensors and Microactuators and their applications.

UNIT I - INTRODUCTION TO MEMS AND MICRO SYSTEMS (8 hours)

Definition – development- fundamentals of MEMS. Micro fluidics, micro electronics, micro systems- design and fabrication, working principles and applications. Integrated circuit processes, potential of MEMS in industry.

UNIT II - MATERIALS (9 hours)

Substrates and wafers, silicon substrate- properties of silicon, silicon compounds, silicon piezo resistors. Galium arsenide, quartz, polymer for MEMS, conductive polymer. Shape memory alloys

UNIT III - FABRICATION PROCESSES (10 hours)

Photolithography, photo resist applications, light sources, X-ray lithography, Electron beam lithography,ion implantation, thin film deposition, diffusion process, Chemical and physical vapour deposition, bulk and surface machining, LIGA, laser ablation process. Microsteriolithography for 3D fabrication, Nanolithography.

UNIT IV - MICROSENSORS (9 hours)

Classification of physical sensors, Integrated, Intelligent or smart sensors, sensors principle and examples: Thermal sensors, Electrical sensors, Mechanical sensors, Chemical and Biosensors.

UNIT V - MICROACTUATORS (9 hours)

Electromagnetic and thermal microactuation, Mechanical design of micro actuators, Micro actuator examples, micro valves, micro pumps, micro motors. Microactuator systems: ink jet printers, Micro-mirror TV projectors. Micro-opto-electromechanical systems; fundamental principles of MOEMS and MOSFET, Multi disciplinary applications.

TOTAL 45 hours

TEXT BOOKS

1. Tai-Ran Hsu, "*MEMS and Microsystems Design and Manufacture"*, Tata McGraw Hill, New Delhi, 2002.
2. Nitaigour Premchand Mahalik, "*MEMS"*, Tata McGraw Hill, New Delhi, 2007.
3. Mohamed Gad-El-Hak, "*The MEMS Handbook"*, CRC Press, New York, 2002.

REFERENCES

1. Kalpakjian, "*Manufacturing Engineering and Technology"*, 4th edition, Addison Wesley Congmen Pvt. Ltd., Singapore, 2009.
2. Mark Madou, "*Fundamentald of Microfabrication"*, CRC Press, New York, 1997.
3. Maluf.N, "*An introduction to Microelectromechanical sytems engineering"*, Artech House, Boston, 2000.
4. Rai Choudhury,"*MEMS and MOEMS Technology and Applications"*, PHI Learning, 2009.

ME1214 – MICRO ELECTRO MECHANICAL SYSTEMS													
Course Designed by		Department of Mechanical Engineering											
1	Student outcomes	a	b	c	d	e	f	g	h	i	j	k	
		x			x	x							
2	Mapping of instructional objectives with student outcome	1-3			1-3	1-3							
3	Category	General (G)		Basic Sciences (B)			Engineering Sciences and Technical Arts(E)				Professional Subjects(P)		
		--		--			--				x		
4	Approval	23rd meeting of Academic Council, May 2013											

ME1215	INTRODUCTION TO HYDRAULICS AND PNEUMATICS	L	T	P	C
	Prerequisite	3	0	0	3
	Nil				

PURPOSE

To expose the learner to the fundamentals of hydraulic and pneumatic systems.

INSTRUCTIONAL OBJECTIVES

1.	The basics of fluid power systems.
2.	Principles and characteristics of hydraulic and pneumatic components.
3.	Circuit design
4.	Maintenance and troubleshooting.

UNIT I - BASICS OF FLUID POWER SYSTEMS (9 hours)

Fluid power- Introduction – types, Advantages , Applications. Properties of hydraulic fluids – General types of fluids – Fluid power symbols. Basics of Hydraulics- Sources of Hydraulic Power: Pumping theory – Pump classification – Gear pump, Vane Pump, piston pump, construction and working of pumps – pump performance – Variable displacement pumps. seals and fittings.

UNIT II - HYDRAULIC VALVES AND ACTUATORS (9 hours)

Construction of Control Components : Directional control valve- pressure control valve- electrical control solenoid valves, Relays. Fluid Power Actuators: Linear actuators- single, double, tandem and telescopic cylinders – Rotary actuators.

UNIT III - PNEUMATIC SYSTEMS AND COMPONENTS (9 hours)

Pneumatic Components: Properties of air – Compressors – Filter, Regulator, Lubricator Unit– Air control valves, Quick exhaust valves, pneumatic actuators. Fluidics –Introduction to fluidic devices, simple circuits.

UNIT IV - DESIGN OF HYDRAULIC AND PNEUMATIC CIRCUITS (9 hours)

Fluid Power Circuit Design- Speed control, synchronizing, Sequential circuit design for simple applications using cascade method. Electro Hydraulic Pneumatic logic circuits, ladder diagrams, PLC applications in fluid power control. Accumulators: Types, application circuits, sizing of accumulators, Intensifier circuit.

UNIT V- APPLICATION, MAINTENANCE AND TROUBLE SHOOTING (8 hours)

Hydraulic / pneumatic circuits: applied to machine tools, presses, material handling systems, automotive systems, packaging industries, manufacturing automation. Maintenance in fluid power systems – preventive and breakdown. Maintenance procedures. Trouble shooting of fluid power systems – fault finding process, equipments / tools used, causes and remedies. Safety aspects involved.

TOTAL 45 hours

TEXT BOOKS

1. Anthony Esposito, "*Fluid Power with applications"*, Prentice Hall International, 2009.
2. Majumdar.S.R, "*Oil Hydraulic Systems: Principles and Maintenance"*, Tata McGRaw Hill, 2006.
3. Majumdar.S.R, "*Pneumatic systems – principles and maintenance"*, Tata McGraw-Hill, New Delhi, 2006.

REFERENCES

1. Werner Deppert / Kurt Stoll, "*Pneumatic Application:Mechanization and Automation by Pneumatic Control"*, Vogel verlag, 1986.
2. John Pippenger, Tyler Hicks, "*Industrial Hydraulics"*, McGraw Hill International Edition, 1980.
3. Andrew Parr, "*Hydraulics and Pneumatics: A technician's and engineer's guide"*, Elsevier Ltd, 2011.
4. FESTO, "*Fundamentals of Pneumatics"*, Vol I, II and III.
5. Hehn Anton, H., "*Fluid Power Trouble Shooting",* Marcel Dekker Inc., NewYork, 1995.
6. Thomson, "*Introduction to Fluid power",* Prentcie Hall, 2004.

ME1215 – INTRODUCTION TO HYDRAULICS AND PNEUMATICS												
Course Designed by		**Department of Mechanical Engineering**										
1	Student outcomes	a	b	c	d	e	f	g	h	i	j	k
		x			x	x						
2	Mapping of instructional objectives with student outcome	1-4			1-4	1-4						

3	Category	General (G)	Basic Sciences (B)	Engineering Sciences and Technical Arts(E)	Professional Subjects(P)
		--	--	--	x
4	Approval	23rd meeting of Academic Council, May 2013			

ME1216	**PLASTIC ENGINEERING**	**L**	**T**	**P**	**C**
	Prerequisite	**3**	**0**	**0**	**3**
	Nil				

PURPOSE

On completion of the course the student will have knowledge about different Plastics and their applications.

INSTRUCTIONAL OBJECTIVES

1.	Polymerization with their properties.
2.	Various Structure of plastics.
3.	Raw Materials behavior.
4.	Extrusion and Rotational molding process.
5.	Fibre Reinforced Plastics.

UNIT I - INTRODUCTION TO POLYMER (9 hours)

Sources of raw materials –Monomers –Polymers – Polymerization - Types of Polymerization – Classification. Definition and Classification of Plastics – General properties – Historical development of plastic industry-future trends, Thermoplastics, Thermosetting, Engineering & High performance plastics.

UNIT II - STRUCTURE OF PLASTICS (9 hours)

Molecules –Crystallinity – Effect of Crystallinity on properties – crosslinked plastics – Determination of Molecular weight – Effect of Molecular weight on processing and properties – Molecular weight distribution. Linear, branched and cross linked structures in polymers. Flexibility and movement of macromolecules.Glass transition temperature.

UNIT III - RAW MATERIALS (9 hours)

Introduction – Sources and manufacture of raw materials – basic chemistry – Methods of manufacture – Flow behavior – General properties and applications of Styrene and Styrene co-polymers PMMA. Cellulose polymers

UNIT IV - EXTRUSION AND ROTATIONAL MOULDING (9 hours)

Rotational and blow molding Processes – Definition – features of rotational molding –types – Extrusion Process - type of extruders, screw and their output in

terms of drag, leakage and pressure flow, influence of screw dimensions and output, die and screw characteristics. Design of barrel and screw for commodity, heat sensitive and engineering polymers. Barrier Screws.

UNIT V - PRODUCTION OF FRP **(9 hours)**

FRP Process – Introduction - Definition, Principle of Working - types – CFRP and GFRP – Hand lay, Spray, Autoclave, Filament winding, Pultrusion - Defects and remedies.

TOTAL 45 hours

TEXT BOOKS

1. Schwartz & Good man "*Plastics materials and processing"*third edition A.B. Strong, Pearson Educational 2006
2. Biriey &scott "*Plastics materials (properties and application)*", First edition, Standard Publishers Distributors New Delhi, 1998.
3. Billmeyer, FW, *"Text book of polymer science"* second edition 2004.

REFERENCES

1. Berins "*Plastics engineering industry hand book*" fourth edition Kluwer Academic publisher 2002.
2. Harper, "*Modern of Plastics hand book*", McGraw Hill Professional, 2000.
3. Teng.J.G, Chen.J.F, Smith.S.T, Lam.L, "*FRP Strengthened RC structure*", Edition and published Wiley, 2001.

ME1216 – PLASTIC ENGINEERING												
Course Designed by		Department of Mechanical Engineering										
1	Student outcomes	a	b	c	d	e	f	g	h	i	j	k
		x				x						
2	Mapping of instructional objectives with student outcome	1-3				4,5						
3	Category	General (G)		Basic Sciences (B)		Engineering Sciences and Technical Arts(E)					Professional Subjects(P)	
		--		--		--					x	
4	Approval	23rd meeting of Academic Council, May 2013										

ME1217	INTRODUCTION TO ROBOTICS	L	T	P	C
	Prerequisite	3	0	0	3
	Nil				

PURPOSE

To impart knowledge about the basics of robot components and applications.

INSTRUCTIONAL OBJECTIVES	
1.	Basics of Robot anatomy
2.	Working of end effectors and drive systems
3.	Kinematics and transformation analysis of robot
4.	Various types of robot sensors
5.	Robot cell design and applications of robot

UNIT I - ROBOT BASICS (9 hours)

Robot-Basic concepts, Need, Law, History, Anatomy, specification. Robot configurations-cartesian, cylinder, polar and articulate. Robot wrist mechanism, Precision and accuracy of robot-simple problems.

UNIT II - ROBOT ELEMENTS (9 hours)

End effectors-Classification, Types of Mechanical actuation, Gripper force analysis, Gripper design, Robot drive system-Types, Position and velocity feed back devices-Robot joints and links-Types, Motion interpolation.

UNIT III - ROBOT KINEMATICS (9 hours)

Robot kinematics – Direct and inverse kinematics – 2 and 3 DOF of kinematics analysis-Robot trajectories – Control of robot manipulators – Point to point, Contouring motion- 2D and 3D Transformation-Scaling, Rotation, Translation-Homogeneous coordinates, multiple transformation-Simple problems.

UNIT IV - ROBOT SENSORS (8 hours)

Sensors in robot – Touch sensors-Tactile sensor – Proximity and range sensors – Robotic vision sensor-Force sensor-Light sensors, Pressure sensors

UNIT V - ROBOT CELL DESIGN AND APPLICATIONS (10 hours)

Robot work cell design and control – Safety measures in Robot – Robot cell layouts – Multiple robots and machine interference – Robot cycle time analysis – Industrial applications of robots, Nanorobots, Robot programming-Basic program.

TOTAL 45 hours

TEXT BOOKS

1. Deb.S.R, "*Robotics Technology and Flexible Automation*", Tata McGraw - Hill Publishing Company Limited, 2010.
2. Mikell. P. Groover, '*Industrial Robotics Technology*', Programming and Applications, McGraw Hill Co, 2008.

REFERENCES

1. Klafter.R.D, Chmielewski.T.A, and Noggin's., "*Robot Engineering : An Integrated Approac'"*, Prentice Hall of India Pvt. Ltd.,1994.
2. Fu.K.S, Gonzalez.R.C & Lee.C.S.G, "*Robotics control, sensing, vision and intelligence"*, McGraw Hill Book co, 1987
3. Craig.J.J, *"Introduction to Robotics mechanics and control"*, Addison-Wesley, 1999.
4. Ray Asfahl.C, "*Robots and Manufacturing Automation"*, John Wiley & Sons Inc., 1985.
5. Kozyrey, Yu. "*Industrial Robotics*", MIR Publishers Moscow, 1985.

ME1216 – PLASTIC ENGINEERING												
Course Designed by		**Department of Mechanical Engineering**										
1	Student outcomes	a	b	c	d	e	f	g	h	i	j	k
				x	x	x					x	
2	Mapping of instructional objectives with student outcome			1-5	1-5	1-5					1-5	
3	Category	General(G)		Basic Science(B)		Engineering Sciences and Technical Arts(E)				Professional Subjects(P)		
		--		--		--				x		
4	Approval	23rd meeting of Academic Council, May 2013										

ME1220	**BASIC THERMODYNAMICS AND HEAT TRANSFER**	**L**	**T**	**P**	**C**
	Prerequisite	**2**	**2**	**0**	**3**
	Nil				

PURPOSE

This course provides the basic knowledge about thermodynamics, gas power cycles, refrigeration & air conditioning systems and heat transfer.

INSTRUCTIONAL OBJECTIVES

1.	Basic concepts and first law of thermodynamics
2.	Second law of thermodynamics
3.	Gas power cycles
4.	Refrigeration and Air conditioning systems.
5.	Different modes of Heat Transfer

UNIT I - BASIC CONCEPTS OF THERMODYNAMICS (12 hours)

System - Ideal gas laws - Perfect gas, thermodynamic equilibrium, property, state, process, path and cycle, zeroth law of thermodynamics - Point and path functions - Quasi static process, reversible and irreversible processes. First law of thermodynamics, energy, work, heat, PMM1, applications of First law to closed and open systems. Pressure - Volume diagrams, steady flow process, application of steady flow energy equation.

UNIT II - SECOND LAW OF THERMODYNAMICS (12 hours)

Limitations of first law, statements of second law of Thermodynamics, PMM II, Clausius inequality, heat engine, heat pump, refrigerator, Carnot cycle, Carnot theorem, entropy, temperature - Entropy diagram, entropy changes for a closed system. Third law of thermodynamics.

UNIT III - GAS POWER CYCLES (12 hours)

Otto, Diesel, dual cycles: Efficiency, mean effective pressure, comparison. Introduction to Brayton cycle - Reheat and regeneration.

UNIT IV - REFRIGERATION AND AIR-CONDITIONING (12 hours)

Vapour compression refrigeration: Working principle, simple problems in vapour compression refrigeration cycle with sub-cooling and superheating. Introduction to vapour absorption system. Air-conditioning - Factors affecting air-conditioning, types of air-conditioning - Summer, winter, window and central air-conditioning.

UNIT V - HEAT TRANSFER (12 hours)

Modes of heat transfer, steady state heat conduction - Plane wall, composite wall, hollow and composite cylinders. Overall heat transfer coefficient. Convection, empirical relations. Laws of radiations - Concept of block body - Radiant heat transfer between two surfaces.

TOTAL 60 hours

TEXT BOOKS

1. Rajput.R.K, "*Thermal Engineering"*, Lakshmi Publications, 2010.
2. Yunus A.Cengel, "*Introduction to Thermodynamics & Heat Transfer"*, McGraw Hill Higher- Education, 2009.

REFERENCES

1. Kothandaraman.C.P, Domkundwar.S, Anand Domkundwar*, "A Course in Thermal Engineering"*, Dhanpat Rai & Co. (P) Ltd., 2010.
2. Nag.P.K, "*Engineering Thermodynamics"*, Tata McGraw Hill, New Delhi, 2008.
3. Sarkar.B.K, "*Thermal Engineering"*, 3rd Edition, Tata McGraw Hill, New Delhi, 2009

ME1220 – BASIC THERMODYNAMICS AND HEAT TRANSFER												
Course Designed by		Department of Mechanical Engineering										
1	Student outcomes	a	b	c	d	e	f	g	h	i	j	k
		x				x						
2	Mapping of instructional objectives with student outcome	1-5				1-5						
3	Category	General (G)		Basic Sciences (B)		Engineering Sciences and Technical Arts(E)				Professional Subjects(P)		
		--		--		--				x		
4	Approval	23rd meeting of Academic Council, May 2013										

ME1225	RENEWABLE AND SUSTAINABLE ENERGY	L	T	P	C
	Prerequisite	3	0	0	3
	Nil				

PURPOSE

To enable the students to understand the various renewable energy sources and sustainability.

INSTRUCTIONAL OBJECTIVES

1.	Understand the solar and wind energy sources
2.	Gain knowledge on biomass energy
3.	Gain knowledge on wave and ocean energy
4.	Gain knowledge of renewable energy policy
5.	Gain knowledge of sustainable energy

UNIT I - SOLAR AND WIND ENERGY (9 hours)

Solar radiation, types of solar thermal collectors – flat and concentrating collectors, solar thermal applications - water heaters, dryers, stills, refrigeration, air-conditioning, solar pond, central receiver power generation. Basic principle of wind energy conversion system, wind data and energy estimation, site selection, components of wind energy conversion systems, design consideration of horizontal axis wind mill.

UNIT II - BIOMASS ENERGY (9 hours)

Biomass, sources of biomass, thermo-chemical and bio-chemical conversion of biomass - pyrolysis, gasification, combustion and fermentation. Gasifiers – up draft, downdraft and fluidized bed gasifiers. Digesters-fixed and floating digester biogas plants, economics of biomass power generation.

UNIT III - OCEAN, HYDRO AND GEOTHREMAL ENERGY (9 hours)

Wave and tidal energy, ocean thermal energy conversion - principle, types, power plants- small, mini and micro hydro power plants. Exploration of geothermal energy, geothermal power plants. Introduction to direct energy conversion systems – fuel cells and magneto hydrodynamic power generations.

UNIT IV - RENEWABLE ENERGY POLICY (9 hours)

Renewable energy policies, including feed-in tariffs, portfolio standards, policy targets, tax incentives, and biofuels mandates. International policies for climate change and energy security. Economic analysis and comparisons, Life cycle analysis, financial analysis, cost of conserved energy, and externalities. Cost assessment of supply technologies versus energy-efficiency.

UNIT V - SUSTAINABLE ENERGY (9 hours)

Sustainable energy futures, global scenarios, promising technologies, development pathways, clean coal and carbon technologies, electric vehicles, energy fluctuation and energy storage, distributed generation and smart grids.

TOTAL 45 hours

TEXT BOOKS

1. Rai.G.D, "*Non-Conventional Energy Sources"*, Khanna Publishers, 4th edition, New Delhi, 2009.
2. Roland Wengenmayr, Thomas Buhrke*," Renewable energy: Sustainable energy concepts for the future"*, Wiley-VCH, 1st edition, 2008.

REFERENCES

1. Godfrey Boyle, "*Renewable energy"*, Oxford University Press, 2nd edition, 2010
2. Hans-Josef Fell, "*Global cooling strategies for climate protection"*, CRC Press, 2012.
3. Ottmar Edenhofen, "*Renewable energy sources and climate change mitigation"*, Cambridge University Press, 2011.
4. B.K. Hodge, "*Alternative energy systems and applications"*, John Wiley & Sons, 2009.
5. Mark Diesendrof, "*Greenhouse solutions with sustainable energy"*, University of New South Wales Press, 2007.

ME1225 – RENEWABLE AND SUSTAINABLE ENERGY												
Course Designed by		**Department of Mechanical Engineering**										
1	Student outcomes	a	b	c	d	e	f	g	h	i	j	k
		x				x						
2	Mapping of instructional objectives with student outcome	1-5				1-5						
3	Category	General (G)		Basic Sciences (B)		Engineering Sciences and Technical Arts(E)				Professional Subjects(P)		
		--		--		--				x		
4	Approval	23rd meeting of Academic Council, May 2013										

	ENERGY AUDITING	L	T	P	C
ME1226	Prerequisite	**3**	**0**	**0**	**3**
	Nil				

PURPOSE

To familiarize the students about energy management and energy audit.

INSTRUCTIONAL OBJECTIVES

1.	To familiarize about forms of energy
2.	To understand energy management concepts
3.	To learn the methods of energy audit and usage of instruments
4.	To analyse and report the outcome of energy audit

UNIT I - FUNDAMENTALS OF ENERGY (9 hours)

Basics of energy and its various forms: Conventional and non -conventional sources. Different fuels and its energy contents. Renewable energy - solar energy, wind energy, bio energy, hydro energy, geothermal energy, wave energy, tidal energy and OTEC.

UNIT II - ENERGY MANAGEMENT (9 hours)

Energy management- various approaches, cost effectiveness, bench marking, optimization of energy requirement and maximization of system efficiencies. Fuels and energy substitution.

UNIT III - ENERGY AUDIT (9 hours)

Energy audit – need, preliminary audit, detailed audit, methodology and approach. Instruments for audit, monitoring energy and energy savings.

UNIT IV - ASSESSMENT AND REPORTING (9 hours)

Evaluation of saving opportunities – determining the savings in INR, non-economic factors, conservation opportunities, estimating cost of implementation. Energy audit reporting - the plant energy study report, importance, effective organization, report writing and presentation.

UNIT V - ENERGY SAVINGS CASE STUDY (9 hours)

Case study- simple calculations of energy savings and conservation in process equipments like boilers, heat exchangers only.

TOTAL 45 hours

TEXT BOOKS

1. Paul. O. Callaghan., "*Energy Management"*, McGraw-Hill Professional Publishing, 2003.
2. Albert Thumann, "*Handbook of energy audits"*, 6th edition, The Fairmount Press, 2003.

REFERENCES

1. Murphy.W.R and McKay.G, "*Energy Management"*, Butterworths, London, 2007.
2. Steve Doty, Wayne C.Turner, "*Energy Management Handbook"*, Fairmont Press, 7th edition, 2009.
3. Barney L. Capehart, Wayne C.Turner, William J.Kennedy, "*A Guide to Energy Management"*, The Fairmont Press, 6th edition, 2008

ME1226 – ENERGY AUDITING												
	Course Designed by	**Department of Mechanical Engineering**										
1	Student outcomes	a	b	c	d	e	f	g	h	i	j	k
		x				x						
2	Mapping of instructional objectives with student outcome	1-4				1-4						
3	Category	General (G)		Basic Sciences (B)		Engineering Sciences and Technical Arts(E)				Professional Subjects(P)		
		--		--		--				x		
4	Approval	23rd meeting of Academic Council, May 2013										

ME1227	ENERGY CONSERVATION	L	T	P	C
	Prerequisite	3	0	0	3
	Nil				

PURPOSE

To enable the students to acquire the knowledge of energy conservation measures in thermal and electrical energy systems.

INSTRUCTIONAL OBJECTIVES	
1.	Energy conservation principles.
2.	Energy conservation in steam systems.
3.	Energy conservation in fluid flow machinery.
4.	Electrical energy conservation measures.
5.	Energy management concepts.

UNIT I - ENERGY CONSERVATION PRINCIPLES (9 hours)

Energy scenario, principles of energy conservation, resource availability, energy savings, current energy consumption in India, roles and responsibilities of energy managers in industries.

UNIT II - ENERGY CONSERVATION IN STEAM SYSTEMS (9 hours)

Power plant components, conservation measures in steam systems, losses in boiler, methodology of upgrading boiler performance - blow down control, excess air control, pressure reducing stations, condensate recovery , condensate pumping , thermo compressors, recovery of flash steam, air removal and venting, steam traps, cooling towers.

UNIT III - ENERGY CONSERVATION IN FLUID MACHINERY (9 hours)

Centrifugal pumps, energy consumption and energy saving potentials, design consideration, minimizing over design. Fans and blowers - specification, safety margin, choice of fans, controls and design considerations. Air compressor and compressed air systems, selection of compressed air layout, energy conservation aspects to be considered at design stage.

UNIT IV - ELECTRICAL ENERGY CONSERVATION (9 hours)

Potential areas for electrical energy conservation in various industries, conservation methods, energy management opportunities in electrical heating, lighting system, cable selection, energy efficient motors, factors involved in determination of motor efficiency, adjustable AC drives, variable speed drives, energy efficiency in electrical system.

UNIT V - ENERGY MANAGEMENT (9 hours)

Organizational background desired for energy management persuasion, motivation, publicity role, tariff analysis, industrial energy management systems, energy monitoring, auditing and targeting, economics of various energy conservation schemes – energy policy and energy labeling.

TOTAL 45 hours

TEXT BOOKS

1. Reay.D.A, "*Industrial energy conservation"*, Pergamon Press, 1st edition, 2003.
2. White.L.C, "*Industrial Energy Management and Utilization"*, Hemisphere Publishers, 2002.

REFERENCES

1. Smith.C.B, "*Enegy Management Principles*", Pergamon Press, 2006.
2. Hamies, "*Energy Auditing and Conservation; Methods, Measurements, Management and Case study*", Hemisphere, 2003.
3. Trivedi.P.R and Jolka.K.R, "*Energy Management*", Common Wealth Publication, 2002.

ME1227 – ENERGY CONSERVATION												
Course Designed by		**Department of Mechanical Engineering**										
1	Student outcomes	a	b	c	d	e	f	g	h	i	j	k
		x		x							x	
2	Mapping of instructional objectives with student outcome	1-5		1-3							4,5	
3	Category	General (G)		Basic Sciences (B)		Engineering Sciences and Technical Arts(E)					Professional Subjects(P)	
		--		--		--					x	
4	Approval	23rd meeting of Academic Council, May 2013										

ME1228	**SOLAR ENERGY UTILIZATION**	**L**	**T**	**P**	**C**
	Prerequisite	**3**	**0**	**0**	**3**
	Nil				

PURPOSE

To enable the students to acquire knowledge of solar energy fundamentals and various applications.

INSTRUCTIONAL OBJECTIVES

1.	Solar radiation data and its measurement
2.	Operation of solar thermal energy systems
3.	Solar thermal power plants
4.	Solar photovoltaic power plants
5.	Solar energy in buildings

UNIT I - SOLAR RADIATION **(9 hours)**

Sun and earth geometry, solar radiation-beam and diffuse radiations, measurement of solar radiation – pyranometer, pyrheliometer, sunshine recorder. Solar collectors and applications.

UNIT II - SOLAR THERMAL SYSTEMS **(9 hours)**

Flat plate and evacuated tube collectors, domestic hot water and process heat systems, solar cooker, solar dryer, solar desalination and solar pond.

UNIT III - SOLAR POWER PLANT **(9 hours)**

Principles of solar parabolic concentrators-trough and dish types, compound parabolic concentrators, fresnel lens collectors, central receiver plant, direct steam generation systems, solar furnaces.

UNIT IV - SOLAR PHOTOVOLTAICS **(9 hours)**

Solar photovoltaic theory, mono and polycrystalline silicon technologies, PV modules and integrated systems, implementation and maintenance.

UNIT V - SOLAR-CONSCIOUS BUILDINGS **(9 hours)**

Orientation and design of buildings, passive solar heat- thermal capacity, insulation, solar cooling-refrigeration and air-conditioning, space heating, sensible and latent heat energy storages in buildings.

TOTAL 45 hours

TEXT BOOKS

1. Sukhatme.K, Suhas P. Sukhatme, "*Solar energy: Principles of thermal collection and storage"*, Tata McGraw Hill publishing Co. Ltd, 8th edition, 2008.
2. Soteris A. Kalogiru, "*Solar Energy Engineering: Processes and systems"*, 1st edition, Academic press, 2009.

REFERENCES

1. Duffie.J.A, & Beckman.W.A, "*Solar Engineering of Thermal Processes"*, 3rd edition, John Wiley & Sons, Inc., 2006.
2. Martin A. Green, "*Third generation Photovoltaics: Advanced energy conversion"*, 1st edition, 2005.
3. Garg.H.P, Prakash.J, "*Solar energy fundamentals and applications"*, Tata McGraw Hill publishing Co. Ltd, 2006.
4. Yogi Goswami.D, Frank Kreith, Jan F.Kreider, "*Principle of solar engineering"*, 2nd edition, Taylor and Francis, 2nd edition, 2000.
5. Tiwari.G.N, "*Solar energy: Fundamentals, Design, Modeling and Applications"*, CRC Press Inc., 2002.

ME1228 – SOLAR ENERGY UTILIZATION												
Course Designed by		Department of Mechanical Engineering										
1	Student outcomes	a	b	c	d	e	f	g	h	i	j	k
		x				x						
2	Mapping of instructional objectives with student outcome	1-5				1-5						
3	Category	General (G)		Basic Sciences (B)		Engineering Sciences and Technical Arts(E)				Professional Subjects(P)		
		--		--		--				x		
4	Approval	23rd meeting of Academic Council, May 2013										

MH1201	HUMAN COMPUTER INTERFACE	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite				
	Nil				

PURPOSE

To present the concept of Human-computer interaction (HCI) which is an interdisciplinary field that integrates theories and methodologies from computer science, cognitive psychology, design, and many other areas.

INSTRUCTIONAL OBJECTIVES

1.	Design, implement and evaluate effective and usable graphical computer interfaces.
2.	Describe and apply core methodologies from the field of HCI.
3.	Implement simple graphical user interfaces using the Java Swing toolkit.

UNIT I - INTRODUCTION (9 hours)

Introduction : Importance of user Interface – definition, importance of good design. Benefits of good design. A brief history of Screen design.

UNIT II - GUI (9 hours)

The graphical user interface – popularity of graphics, the concept of direct manipulation, graphical system, Characteristics, Web user – Interface popularity, characteristics- Principles of user interface.

UNIT III - HCI DESIGN (9 hours)

Design process – Human interaction with computers, importance of human characteristics human consideration, Human interaction speeds, understanding business junctions.

UNIT IV - CORE METHOLOGIES OF HCI (9 hours)

Screen Designing : Design goals – Screen planning and purpose, organizing screen elements, ordering of screen data and content – screen navigation and flow – Visually pleasing composition – amount of information – focus and emphasis – presentation information simply and meaningfully – information retrieval on web – statistical graphics – Technological consideration in interface design.

UNIT V - SOFTWARE TOOLS AND OTHER DEVICES (9 hours)

Windows – New and Navigation schemes selection of window, selection of devices based and screen based controls. Components – text and messages, Icons and increases – Multimedia, colors, uses problems, choosing colors. Software tools – Specification methods, interface – Building Tools. Interaction Devices – Keyboard and function keys – pointing devices – speech recognition digitization and generation – image and video displays – drivers.

TEXT BOOKS

1. The essential guide to user *"Interface design*", Wilbert O Galitz, Wiley DreamaTech.
2. *"Designing the user interface"*, 3rd Edition Ben Shneidermann, Pearson Education Asia.
3. *"Human – Computer Interaction*", ALAN DIX, JANET FINCAY, GRE GORYD, ABOWD, RUSSELL BEALG, PEARSON, Prentice Hall (2004).

REFERENCES

1. *"Interaction Design PRECE*", ROGERS, SHARPS. Wiley Dreamtech.
2. *"User Interface Design"*, Soren Lauesen, Pearson Education.

<table>
<tr><th colspan="13">MH1201 HUMAN-COMPUTER INTERFACE</th></tr>
<tr><th colspan="2">Course Designed by</th><th colspan="11">Department of Mechatronics</th></tr>
<tr><td rowspan="2">1</td><td rowspan="2">Student Outcome</td><td>a</td><td>b</td><td>c</td><td>d</td><td>e</td><td>f</td><td>g</td><td>h</td><td>i</td><td>j</td><td>k</td></tr>
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<tr><td>2</td><td>Mapping of instructional objectives with student outcome</td><td>1</td><td>2</td><td></td><td>3</td><td>2</td><td></td><td></td><td></td><td></td><td></td><td>3</td></tr>
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<tr><td rowspan="2">4</td><td rowspan="2">Broad Area</td><td colspan="3">Electrical Engineering</td><td colspan="3">Electronics Engineering</td><td colspan="4">Mechanical Engineering</td><td>Computing sciences</td></tr>
<tr><td colspan="3">--</td><td colspan="3">--</td><td colspan="4">--</td><td>x</td></tr>
<tr><td>5</td><td>Approval</td><td colspan="11">23rd meeting of Academic Council, May 2013</td></tr>
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	ARTIFICIAL INTELLIGENCE AND NEURAL NETWORKS	L	T	P	C
MH1202	Total Contact Hours - 45	3	0	0	3
	Prerequisite				
	Nil				

PURPOSE

To study the basic concepts of artificial intelligence and neural networks techniques.

INSTRUCTIONAL OBJECTIVES

1.	Understand the Basic concepts of artificial intelligence
2.	Analyze the Various steps involved in artificial intelligence
3.	Understand the Basic concepts of expert systems
4.	Analyze the Techniques involved in neural networks

UNIT I - INTRODUCTION TO ARTIFICIAL INTELLIGENCE AND KNOWLEDGE REPRESEN TATION (9 hours)

Overview of AI-general concepts – problem spaces and search – search techniques –BFS, DFS –Heuristic search techniques. Knowledge – general concepts – predicate logic – representing simple fact – instance and ISA relationships – resolution – natural deduction.

UNIT II - KNOWLEDGE ORGANISATION AND MANIPULATION (9 hours)

Procedural Vs declaration knowledge – forward Vs backward reasoning – matching techniques – control knowledge / strategies – symbol reasoning under uncertainty – introduction to non – monotonic reasoning – logic for monotonic reasoning.

UNIT III - PERCEPTRON – COMMUNICATION AND EXPERT SYSTEMS (9 hours)

Natural language processing – pattern recognition – visual image understanding – expert system architecture. Knowledge acquisition – general concepts.

UNIT IV - INTRODUCTION TO NEURAL NETWORKS (9 hours)

Biological foundations, ANN models, Types of activation function, Introduction to Network Architectures: Multi Layer Feed Forward Network (MLFFN), Radial Basis Function Network (RBFN), Recurring Neural Network (RNN).

UNIT V - LEARNING ALGORITHMS (9 hours)

Learning process – Supervised and unsupervised learning – Error – Correction learning, Hebbian learning, Boltzmen learning, Single layer and multiplayer

percepturs, Least mean square algorithm, Back propagation algorithm. Application in forecasting and pattern recognition and other engineering problems.

TEXT BOOKS

1. Elaine Rich and Kelvin Knight, "*Artificial Intelligence"*, Tata McGraw Hill, New Delhi, 1991.
2. Stuart Russell and Peter Norvig, "*Artificial Intelligence*": A Modern Approach", Prentice Hall, 1995.
3. Zurada.J.M, "*Introduction to Artificial Neural Systems"*, Jaico Publishers 1992.
4. Simon Haykins, "*Neural Networks – A Comprehensive Foundation"*, Mac Millan College, Proc Con Inc New York, 1994.

REFERENCES

1. Nilson.N.J, "*Principles of Artificial Intelligence, Springer* Verlag, Berlin, 1980.
2. Patterson, "*Introduction to Artificial Intelligence and Expert Systems*", Prentice Hall of India, New Delhi, 1990.

MH1202 ARTIFICIAL INTELLIGENCE AND NEURAL NETWORKS												
Course Designed by		Department of Mechatronics										
1	Student Outcome	a	b	c	d	e	f	g	h	i	j	k
		x										x
2	Mapping of instructional objectives with student outcome	1,3										2,4
3	Category	General(G)		Basic Sciences (B)		Engineering Sciences and Technical Arts (E)				Professional Subjects (P)		
		--		--		--				x		
4	Broad Area	Electrical Engineering		Electronics Engineering		Mechanical Engineering				Computing sciences		
		--		--		--				x		
5	Approval	23rd meeting of Academic Council, May 2013										

MH1203	BIOMEDICAL INSTRUMENTATION	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite				
	Nil				

PURPOSE

To enable the students to develop knowledge of how instruments work in the various department and laboratories of a hospital and thereby recognize their limitations.

INSTRUCTIONAL OBJECTIVES	
1.	Interpret technical aspects of medicine
2.	Solve Engineering Problems related to medical field
3.	Understand medical diagnosis and therapy.

UNIT I - BASIC PHYSIOLOGY (9 hours)

Cell and their structures, neuron-axon- synapse- action and resting potential-electro physiology of cardio pulmonary system- respiration and blood circulation-central nervous system and peripheral nervous system- electrode theory- bipolar and unipolar electrodes- surface electrodes.

UNIT II - ELECTRO PHYSIOLOGICAL MEASUREMENT (9 hours)

ECG, phonocardiography- vector cardiographs- EEG-EMG- ERG – lead system and recording methods- typical waveforms- computer diagnosis.

UNIT III - NON- ELECTRICAL PARAMETER MEASUREMENTS (9 hours)

Measurement of blood pressure- blood flow- cardiac output- plethysmography-cardiac rate- heart sound-measurement of gas volume- flow rate of Co2 and O2 in exhaust air- pH of blood.

UNIT IV - MEDICAL IMAGING AND TELEMETRY (9 hours)

X-ray machine- echocardiography- computer tomography- MRI/NMR-ultrasonography, endoscopy- different types of telemetry system- laser in bio medicine.

UNIT V - ASSISTING AND THERAPEUTIC DEVICES (9 hours)

Cardiac pacemakers- defibrillators- ventilators- muscle stimulator- diathermy-introduction to artificial kidney-artificial heart- lung machine- limb prosthetics-onthotics- elements of audio and visual aids.

TEXT BOOKS

1. Leslie Cromwell, Fred J. Weibell and Erich A. Pleiffer, "*Biomedical Instrumentation andMeasurement"s*, Prentice Hall of India, 1980.
2. Geddes.L.A and Baker.L.E, Principles of Applied "*Biomedical Instrumentation*", John Wiley & Sons,Inc, 1989.
3. Kandpur.R.S, Hand book of "*Biomedical Instrumenation"*, Tata Mc Graw Hill, 1987.
4. Richard Aston, Principles of "*Biomedical Instrumentation and Measurement*", Merrill Publishing Company, 1990.

REFERENCES

1. Jacobson.B and Webster.J.G, "*Medical Clinical Engineers*", Prentice Hall, 1979.
2. John .G Webster, Editor, "*Medical Instrumentation, Application and Design"*, John Wiley and Sons Inc1998.

MH 1203 BIOMEDICAL INSTRUMENTATION												
Course Designed by		**Department of Mechatronics**										
1	Student Outcome	a	b	c	d	e	f	g	h	i	j	k
		x				x				x		
2	Mapping of instructional objectives with student outcome	1				2				3		
3	Category	General (G)		Basic Sciences(B)		Engineering Sciences and Technical Arts (E)				Professional Subjects (P)		
		--		--		--				x		
4	Broad Area	Electrical Engineering		Electronics Engineering		Mechanical Engineering				Computing sciences		
		--		x		--				--		
5	Approval	23rd meeting of Academic Council, May 2013										

MH1204	**SOFTWARE ENGINEERING**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	**3**	**0**	**0**	**3**
	Prerequisite				
	Nil				

PURPOSE

This course in Software Engineering provides an in-depth understanding of the Software Engineering principles and methodologies

INSTRUCTIONAL OBJECTIVES

1.	Planning and Estimation of Software projects
2.	Software Requirements Specification, Software Design Concepts
3.	Implementation issues ,Validation and Verification Procedures
4.	Maintenance of Software and methodologies

UNIT I - PLANNING AND COST ESTIMATION **(9 hours)**

Software project planning: Importance of software – Introduction – Defining the problem – Developing a solution strategy – Planning and development process – Other planning activities. Software cost estimation: Introduction – Software cost factors – Software cost estimation techniques – Staffing level estimation – Estimating software maintenance costs.

UNIT II - SOFTWARE REQUIREMENTS SPECIFICATION (9 hours)

Introduction – The software requirement specifications – Formal specification techniques – Languages and processors for requirements specification: SDAT, SSA, GIST, PSL/PSA, REL/REVS

UNIT III - SOFTWARE DESIGN CONCEPTS (9 hours)

Abstraction – Modularity – Software architecture – Cohesion, coupling – Various design concepts and notations – Real time and distributed system – Design – Documentation – Data flow oriented design – Jackson system development – Design for reuse – Programming standards.

UNIT IV - IMPLEMENTATION ISSUES AND MODERN LANGUAGE FEATURES (9 hours)

Implementation Issues: Introduction – Structured coding techniques – Coding style – Standards and guidelines – Documentation guidelines. Modern Programming Languages Features: The translation process – PL characteristics – PL fundamentals: Type checking – Separate compilation – User defined data types – Data abstraction – Scoping rules – Exception handling – Concurrency mechanisms.

UNIT V - VERIFICATION, VALIDATION AND MAINTENANCE (9 hours)

Introduction – Quality assurance – Walk through and inspections – Static analysis – Symbolic execution – Unit testing and debugging – System testing – Formal verification. Software Maintenance: Introduction – Enhancing maintainability during development – Managerial aspects of software maintenance – Configuration management – Source code metrics – Other maintenance tools and techniques.

TEXT BOOKS

1. Richard Fairley, "*Software Engineering Concepts"*, McGraw Hill, 1985.
2. Roger S. Pressman, "*Software Engineering"* A Practitioner Approach 5th edition , McGraw Hill, 1999
3. Sommerville I, "*Software Engineering"*, 5th edition, Addison Wesley, 1996.

REFERENCES

1. Shooman, "*Software Engineering"*, McGraw Hill, 1983.
2. David Gustafson, "*Software Engineering*", Schaum's outlines, Tata McGraw-Hill, 2003.

MH1204 SOFTWARE ENGINEERING												
Course Designed by		Department of Mechatronics										
1	Student Outcome	a	b	c	d	e	f	g	h	i	j	k
		x								x		x
2	Mapping of instructional objectives with student outcome	1								1,3		2,4
3	Category	General (G)		Basic Sciences (B)		Engineering Sciences and Technical Arts (E)				Professional Subjects (P)		
		--		--		--				x		
4	Broad Area	Electrical Engineering		Electronics Engineering		Mechanical Engineering				Computing sciences		
		--		--		--				x		
5	Approval	23rd meeting of Academic Council, May 2013										

	PRODUCTION AND OPERATIONS MANAGEMENT	L	T	P	C
MH1205	Total Contact Hours - 45	3	0	0	3
	Prerequisite				
	Nil				

PURPOSE

To familiarize and knowledge on production and operations management principles in manufacturing.

INSTRUCTIONAL OBJECTIVES

1.	Apply problem-solving and critical-thinking skills as required in materials and operations management.
2.	Demonstrate the ability to communicate effectively.
3.	Recognize and apply basic appropriate analytical techniques related to decision making in supply chains, inventory theory, and inventory control systems.

UNIT I - INTRODUCTION (9 hours)

Production Systems – Nature, Importance and organizational function. Characteristics of Modern Production and Operations function. Organization of Production function. Recent Trends in Production and Operations Management. Role of Operations in Strategic Management. Production and Operations strategy – Elements and Competitive Priorities. Nature of International Operations Management.

UNIT II - PROJECT AND FACILITY PLANNING (9 hours)

Project Management – Scheduling Techniques, PERT, CPM, Crashing CPM networks – Simple Problems. Facility Location – Theories, Steps in Selection, Location Models – Simple Problems. Facility Layout – Principles, Types, Planning tools and techniques.

UNIT III - MATERIALS MANAGEMENT (9 hours)

Materials Management – Objectives, Planning, Budgeting and Control. Overview of Materials Management Information Systems (MMIS). Purchasing – Objectives, Functions, Policies, Vendor rating and Value Analysis. Stores Management – Nature, Layout, Classification and Coding. Inventory – Objectives, Costs and control techniques. Overview of JIT.

UNIT IV - QUALITY CONTROL (9 hours)

Statistical Quality Control – Control Charts – Mean, Range, Number of Defectives, Number of Defects Charts, OC Curves, Acceptance Sampling-Work Study – Method Study – Symbols, Charts, Diagrams. Time Study

UNIT V - SUPPLY CHAIN MANAGEMENT (9 hours)

Supply Chain- Decision Phases, Process View- Supplier- Manufacturer-Customer chain- Supply chain drivers and modeling systems- strategic sourcing- In-sourcing and Out-sourcing- supply chain network design- Sourcing and Inventory Management.

TEXT BOOKS

1. Richard Francis, L. Leon McGinnis, F. Jr., John White, A., *"Facility Layout and Location - an Analytical Approach"*, 2nd Ed, Phi Learning Publisher, 2006
2. Ebert J Ronald, Adams E Everett, "*Production And Operations Management"*, 5th edition , Phi Learning Publisher, 2009
3. Norman Gaither and Gregory Frazier, "*Operations Management"*, South Western Cengage Learning, 2002.
4. Elwood S. Buffa, Rakesh K. Sarin, **"***Modern Production/Operations Management",* 8th Ed., Wiley Publisher, 2007.

REFERENCES

1. Donald J. Bowersox, David J. Closs and M. Bixby Cooper, "*Supply Chain Logistics Management"*, Tata McGraw Hill, 2008
2. Joseph Monks, "*Operations Management",* 2nd Ed., Tata McGraw-Hill Education.
3. Mahadevan.B, "*Operations Management Theory and practice"*, Pearson Education, 2007.

MH1205 PRODUCTION AND OPERATIONS MANAGEMENT												
Course Designed by		Department of Mechatronics										
1	Student Outcome	a	b	c	d	e	f	g	h	i	j	k
				x				x				x
2	Mapping of instructional objectives with student outcome			3				2				1

3	Category	General (G)	Basic Sciences(B)	Engineering Sciences and Technical Arts (E)	Professional Subjects (P)
		-	-	-	x
4	Broad Area	Electrical Engineering	Electronics Engineering	Mechanical Engineering	Computing sciences
		--	--	x	--
5	Approval	23rd meeting of Academic Council, May 2013			

MH1207	MATERIAL HANDLING SYSTEMS	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite				
	Nil				

PURPOSE

To develop in the engineering student to understand the material handling systems in detail

INSTRUCTIONAL OBJECTIVES

1.	The principles involved in selecting material handling systems
2.	To design a hoisting system for specific application
3.	To select necessary drives with torque rating and efficiency
4.	The types and applications of conveyers and AGV

UNIT I - IINTRODUCTION TO MATERIAL HANDLING SYSTEMS (7 hours)

Overview of Material Handling – Scope and Importance – Types of Material Handling Systems –Factors influencing material handling – Methods of Material handling.

UNIT II - HOISTING MACHINES (10 hours)

Classification construction and applications – Designing of Hoisting Machines in a Crane – Selection of Drives - Motor Rating - Torque and Efficiency Calculation – Hoisting Appliances Belts Ropes Pulleys - Fastening of belt Ropes And Pulleys - Control Of Hoisting Equipments - -Safety Devices in Cranes.

UNIT III - LOAD HANDING ATTACHEMENTS (10 hours)

Load handling attachments - standard forged hook - hook weights - hook bearings - cross piece and casing of hook - crane grab for unit and piece loads - carrier beams and clamps load platforms and side dump buckets - electric lifting magnets - grabbing attachments for loose materials - crane attachments for handling liquid materials.

UNIT IV - SURFACE AND OVERHEAD EQUIPMENTS (10 hours)

Conveyers – Classification Construction and Application – Designing of Simple Belt Conveyer – Chain Conveyer – Drives , Motor Rating, Torque and Efficiency Calculations, Safety Devices in Conveyers.

UNIT V - ASSEMBLY DRAWING OF MACHINE ELEMENTS (8 hours)

Introduction to AGV – Classification construction and applications – Design of Simple Integrated System for Material Handling – Robots in Material Handling.

TEXT BOOKS

1. Heragu.S, PWS Publishing, "*Facilities Design"* Boston, 1997.
2. Approach, 2nd ed., Francis, "*Facility Layout and Location: An Analytical"* McGinnis, and White, Prentice Hall, Englewood Cliffs, New Jersey, 1992.

REFERENCE

1. *"Manufacturing Facilities: Location, Planning, and Design"*, 2nd ed., D.R. Sule, PWS, Boston, 1994.

MH1207 MATERIAL HANDLING SYSTEMS												
Course Designed by		**Department of Mechatronics**										
1	Student outcome	a	b	c	d	e	f	g	h	i	j	k
		x		x							x	x
2	Mapping of instructional objectives with student outcome	1		2							4	3
3	Category	General (G)		Basic Sciences(B)		Engineering Sciences and Technical Arts (E)					Professional Subjects (P)	
		--		--		--					x	
4	Broad area	Electrical Engineering		Electronics Engineering		Mechanical Engineering					Computing sciences	
		--		--		x					--	
5	Approval	23rd meeting of Academic Council, May 2013										

NT1201	APPLICATIONS OF NANOTECHNOLOGY	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite				
	Nil				

PURPOSE

The purpose of this course is to introduce the students to the concept of nanotechnology and also provide an overview about the wide applications of nanotechnology in various technological fields

INSTRUCTIONAL OBJECTIVES

1.	To understand the importance of nanotechnology
2.	To apply the nanotechnology in the field of energy systems
3.	To emphasize the importance of nanotechnology in health care
4.	To appreciate the role of nanotechnology in electronics

UNIT I - INTRODUCTION TO NANOTECHNOLOGY (9 hours)

Nano revolution – Nanomaterials – Classification – Properties at nanoscale: optical, electronic and magnetic – Merits of Nanotechnology and risk factors.

UNIT II - NANOTECHNOLOGY BASED ENERGY SYSTEMS (9 hours)

Nanotechnology for sustainable energy – materials for light emitting diodes – batteries – fuel cells – Renewable energy technology – Energy transport, conversion and storage – Nano, micro and mesoscale phenomena and devices – Micro fuel cell technology - thin film and microfabrication methods – Micro-fuel cell power sources

UNIT III - NANOTECHNOLOGY IN TEXTILES (9 hours)

Nano fibre production - Electrospinning of nano fibers – producing nanofiber structures for tissue engineering – carbon nanotubes and nano composites - multifunctional polymer nanocomposites for industrial applications – nano-filled polypropylene fibers - Improving polymer functionality - Nanostructuring polymers with cyclodextrins, polyolefin/clay nanocomposites

UNIT IV - NANOTECHNOLOGY IN HEALTH CARE (9 hours)

Nanotechnology for pharmaceutical applications – protein and peptide based compounds for cancer, diabetes, infectious diseases and organ transplant – Immunoassay techniques – methods for diagnosis – DNA profiling – cantilever sensors – electrochemical impedance spectroscopy (EIS)

UNIT V - NANOELECTRONICS **(9 hours)**

Memory Devices and Sensors – Electrochemical cells – Electronic noses – Electrochemical cells – Semiconductor sensor array – Nanotube based sensor.

TEXT BOOKS

1. Fahrner.W.R, "*Nanotechnology and Nanoelectronics: Materials, Devices, Measurement Techniques"*, Springer, 2010.
2. Brian R.Eggins, "*Chemical Sensors and Biosensors*", John Wiley & Sons, 2002.

REFERENCES

1. Ed. D. Barcelo," *Comprehensive Analytical Chemistry*", Wilson & Wilson's, 2005
2. P. J. Brown and K, Stevens, "*Nanofibers and Nanotechnology in Textiles*", CRC Press, 2007.
3. Ed. L Gorton "*Biosensors and Modern Biospecific Analytical Techniques*", Elsevier, 2005

NT1201- APPLICATIONS OF NANOTECHNOLOGY												
Course Designed by		**Department of Physics and Nanotechnology**										
1	Student Outcome	a	b	c	d	e	f	g	h	i	j	k
		x			x	x			x			
2	Mapping of instructional objectives with student outcome	1			3	4			2			
3	Category	General(G)		Basic Sciences(B)		Engineering Sciences and Technical Arts (E)			Professional Subjects (P)			
		--		--		--			x			
4	Broad Area	Nanoscience		Nano bio technology		Nanofabrication			Nanoelectronics			
		x		x		x			x			
5	Approval	23rd meeting of Academic Council, May2013										

NT1202	**INTRODUCTION TO NANOELECTRONICS**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	**3**	**0**	**0**	**3**
	Prerequisite				
	Nil				
PURPOSE					
Nanoelectronics are emerging technologies with wide range of inter disciplinary					

applications. The major goals and objectives are to provide the fundamental principles of nanoelectronics and the utilization of nanostructures as nanoelectronic devices.	
INSTRUCTIONAL OBJECTIVES	
1.	To understand the physics of nanoelectronics.
2.	To give deep insight to fabrication and characterization techniques for nanostructures.
3.	To make the learner familiarize with concepts of electron transport in nanostructures.
4.	To further understand the working of various nanoelectronic devices

UNIT I - PHYSICS OF NANOELECTRONICS (9 hours)

Toward the nanoscale - Classical particles - Classical waves - Wave–particle duality - The Schr¨odinger wave equation - Wave mechanics of particles - Atoms and atomic orbitals

UNIT II - MATERIALS FOR NANOELECTRONICS (9 hours)

Semiconductors - Crystal lattices: bonding in crystals - Electron energy bands - Semiconductor heterostructures - Lattice-matched and pseudomorphic heterostructures - Organic semiconductors - Carbon nanomaterials: nanotubes and fullerenes

UNIT III - FABRICATION AND MEASUREMENT TECHNIQUES FOR NANOSTRUCTURES (9 hours)

Bulk crystal and heterostructure growth - Nanolithography, etching, and other means for fabrication of nanostructures and nanodevices - Techniques for characterization of nanostructures - Spontaneous formation and ordering of nanostructures - Clusters and nanocrystals - Methods of nanotube growth- Chemical and biological methods for nanoscale fabrication - Fabrication of nanoelectromechanical systems

UNIT IV - SEMICONDUCTING NANO STRUCTURES (9 hours)

Time and length scales of the electrons in solids - Statistics of the electrons in solids and nanostructures - The density of states of electrons in nanostructures - Electron transport in nanostructures – Electrons in Quantum well, Quantum wire and Quantum dots.

UNIT V - NANOELECTRONIC DEVICES (9 hours)

Resonant tunneling diodes – Field effect transistors – Single electron transfer devices – Potential effect transistors - Light emitting diodes and lasers - Nanoelectromechanical system devices - Quantum dot cellular automata

TEXT BOOKS

1. George W. Hanson, *"Fundamentals of Nanoelectronics"*, Prentice Hall, 2007
2. Vladimir V. Mitin et.al, *"Introduction to Nanoelectronics: Science, Nanotechnology, Engineering, and Applications"* Cambridge University Press, 2012

REFERENCES

1. Mitin.V, Kochelap.V and Stroscio.M, "*Introduction to Nanoelectronics*", Cambridge University Press, 2008
2. Karl Goser et.al, "*Nanoelectronics and Nanosystems: From Transistors to Molecular and Quantum devices*", Springer, 2005.

NT1202 – INTRODUCTION TO NANOELECTRONICS												
Course Designed by		Department of Physics and Nanotechnology										
1	Student outcome	a	b	c	d	e	f	g	h	i	j	k
		x				x						x
2	Mapping of instructional objectives with student outcome	1,4				3						2
3	Category	General (G)		Basic Sciences (B)		Engineering Sciences & Technical Arts (E)				Professional Subjects (P)		
		--		--		--				x		
4	Broad area	Nano science		Nano bio technology		Nano electronics				Nano fabrication		
		--		--		x				--		
5	Approval	23rd meeting of academic council, May 2013										

NT1203	ENVIRONMENTAL NANOTECHNOLOGY	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite				
	Nil				

PURPOSE

The purpose of this course is to provide an understanding of the impact of nanotechnology on the surrounding environment. In addition, the course is expected to instill the student with a research bent of mind to reduce the toxic effects of nanomaterials

INSTRUCTIONAL OBJECTIVES	
1.	To assess health effects due to nanoparticle exposure
2.	To manage the risks caused by nanoparticles in the environment
3.	To educate scientifically the need of sustainable nanotechnology
4.	To emphasize the significance of risk assessment for environmental safety

UNIT I - ASSESSING NANOTECHNOLOGY HEALTH (9 hours)

Nanomaterials: The Current State of Nanotechnology Application - Nanotechnology Risks - Risk Analysis - Hazard Identification - Exposure Assessment for Nanomaterials - Risk Characterization - Risk Management - Best Practices for Nanomaterials in the Workplace - Safety Research - Needs for Engineered Nanoscale Materials

UNIT II - RISK ASSESSMENT AND ENVIRONMENTAL PROTECTION (9 hours)

Context for Technological Risk - Need for Risk Assessment for Nanotechnology - Adaptive Risk Assessment for Nanomaterials - Origins and Development of Risk Assessment - Risk Assessment Used in Environmental Decision Making - Issues in Applying the Four Steps of Risk Assessment to Nanotechnology - Hazard Assessment- Exposure Assessment - Dose-Response Evaluation

UNIT III - SUSTAINABLE NANOTECHNOLOGY DEVELOPMENT (9 hours)

Necessity of Risk Assessment in Nanotechnology - The Pace of Nanotechnology Development and the Paucity of Information - Potential for Wide Dispersion in the Environment Amid Uncertainty - Few Standards or Guidelines - Environmental Risk Issues - Carbon Nanotubes -Defining the Toxic Dose - Environmentally Friendly Nanotechnology - Life Cycle Analysis for Sustainable Nanotechnology

UNIT IV - HUMAN HEALTH, TOXICOLOGY, AND NANOTECHNOLOGICAL RISK (9 hours

Mechanisms of Toxicity - Types of Toxicological Studies - Pulmonary Toxicity Studies - Gastro intestinal Toxicity - *In Vitro* Studies – Dermal - *In Vitro* Toxicity Studies

UNIT V - ENVIRONMENTAL RISKS (9 hours)

Antimicrobial Properties of Nanoscale Silver – Buckyballs, Titanium Dioxide (TiO2) - Short-Term Toxicity Tests - Daphnia LC50 Assays - Studies of Nanomaterial Toxicity to Fish - Buckyballs and Bass-TiO2 in Arsenic - Field Studies - Environmental Exposures - Nanoscale Zerovalent Iron

TEXT BOOKS

1. Jo Ann Shatkin *"Nanotechnology- Health and Environmental risks"*. CRC Press. Taylor and Francis Group 2008
2. David A. Wright , Pamela Welbourn "*Environmental Toxicology"* Cambridge University Press, 2002

REFERENCES

1. Whitacre David.M, "*Reviews of Environmental Contamination and Toxicology"*. Volume 223 , Springer, 2013
2. Lorris G. Cockerham, Barbara S. Shane *"Basic Environmental Toxicology*" CRC Press 1994

NT1203 -ENVIRONMENTAL NANOTECHNOLOGY												
Course Designed by		**Department of Physics and Nanotechnology**										
1	Student Outcome	a	b	c	d	e	f	g	h	i	j	k
							x	x	x		x	
2	Mapping of instructional objectives with student outcome						1	2	3		4	
3	Category	General(G)		Basic Sciences(B)		Engineering Sciences and Technical Arts(E)				Professional Subjects(P)		
		--		--		--				x		
4	Broad Area	Nanoscience		Nano bio technology		Nanofabrication				Nano electronics		
		x		x		x				--		
5	Approval	23rd meeting of Academic Council held on May2013										

NT1204	**MEDICAL NANOTECHNOLOGY**	**L**	**T**	**P**	**C**
	Total Contact Hours – 45	**3**	**0**	**0**	**3**
	Prerequisite				
	Nil				

PURPOSE

The goal of this course is to provide an insight into the fundamentals of nanotechnology in medical research. It will also guide the students to understand how nanoparticles & Nanomaterials can be used for medicinal rationales.

INSTRUCTIONAL OBJECTIVES

1.	To understand the essential features of Nanomedicine
2.	To study the medical based nanotools
3.	To get familiarize with various Nanomaterials based analysis, sensing, imaging & diagnostics techniques in medical nanotechnology

UNIT I - THE PROSPECT OF NANOMEDICINE (9 hours)

Current Medical Practice, The Evolution of Scientific Medicine- Volitional Normative Model of Disease- Treatment Methodology- Evolution of Bedside Practice- The Nanomedical Perspective, Nanomedicine and Molecular Nanotechnology- Pathways to Molecular Manufacturing- Molecular Transport and Sortation

UNIT II - NANOSENSORS & NANOSCALE SCANNING (9 hours)

Nanosensor Technology- Chemical and Molecular Nanosensor- Displacement and Motion Sensors- Force Nanosensor- Thermal Nanosensor- Electric and Magnetic Sensing- Cellular Bio scanning- Macrosensing-intergated nanosensor technologies, genomics &proteomics –real-time & in vivo medical monitoring

UNIT III - NANOPARTICLES FOR IMAGING & DRUG DELIVERY (9 hours)

Nanoparticles for medical imaging, enhancement for X-ray, MRI, IR, Visible & UV imaging- Nanoparticles for targeted imaging & delivery of energy- Nanoparticles for delivery of drugs, materials & fabrication for drug delivery- Nanocapsulation for drug delivery – theranostics.

UNIT IV - NANOMOLECULAR DIAGNOSTICS (9 hours)

Nanodiagnostics- Nanoarrays for Molecular Diagnostics- Nanoparticles for Molecular Diagnostics ,Gold & Magnetic Nanoparticles ,Quantum Dots for Molecular Diagnostics Nanoparticles , Nanocrystal- DNA Nanomachines for Molecular Diagnostics- Nanobarcodes Technology- Cantilevers as Biosensors for Molecular Diagnostics- Nanodiagnostics for the Battle Field -Nanodiagnostics for Integrating Diagnostics with Therapeutics

UNIT V - NANODEVICES FOR MEDICINE & SURGERY (9 hours)

Nanodevices for Clinical Nanodiagnostics, Nanoendoscopy, Nanobiotechnology and Drug Delivery Devices- Tools for Nanosurgery, Nanoscale Laser Surgery,Nanorobotics for Surgery- Nanotechnology for Detection of Cancer, QDs, Dendrimers for Sensing Cancer Cell Apoptosis ,Gold Nanoparticles for Cancer Diagnosis ,Nanotubes for Detection of Cancer Proteins ,Nanoparticles for the Optical Imaging of Tumours- Nanolaser Spectroscopy for Detection of Cancer in Single Cells- Nanoparticles-MRI for Tracking Dendritic Cells in Cancer Therapy

TEXT BOOKS

1. Robert .A. Freital.Jr, *" Nanomedicine "* Landes Bioscience Press 2010
2. Harry F.Tibbals, *" Medical nanotechnology & Nanomedicine ",* CRC press,2011

REFERENCES

1. Robert A. Freitas, "*Nanomedicine, Volume IIA:Biocompatibility*",Landes Bioscience, 2011.
2. Jain.K.K, "*Handbook of Nanomedicine*" Springer, 2012.
3. Mansoor M. Amiji "*Nanotechnology for cancer therapy*", CRC Press, 2006.

NT1204- MEDICAL NANOTECHNOLOGY												
Course Designed by		Department of Physics and Nanotechnology										
1	Student Outcome	a	b	c	d	e	f	g	h	i	j	k
		x			x	x						x
2	Mapping of instructional objectives with student outcome	1			2	2						3
3	Category	General(G)		Basic Sciences(B)		Engineering Sciences and Technical Arts(E)				Professional Subjects(P)		
		--		--		--				x		
4	Broad Area	Nanoscience		Nanobio technolgy		Nano electronics				Nano fabrication		
		x		x		--				--		
5	Approval	23rd meeting of Academic Council, May 2013										

NT1205	NANO SCALE SURFACE ENGINEERING	L	T	P	C
	Total Contact Hours – 45	**3**	**0**	**0**	**3**
	Prerequisite				
	Nil				

PURPOSE

The purpose of this course is to provide a basic understanding on surface science of Nanomaterials related with their properties

INSTRUCTIONAL OBJECTIVES

1.	To acquire the basic knowledge on Surfaces science of nanomaterials
2.	To understand the various mechanisms involved in bonding of molecules at surfaces
3.	To enhance the knowledge on analysis and problem solving methods using various analytical techniques

UNIT I - NANOTECHNOLOGY-AN INTRODUCTION (9 hours)

Introduction to Nanotechnology – A brief history of nanotechnology – size of the atoms – molecules and surfaces - properties at nano scale – applications of nanotechnology.

UNIT II - SURAFACE CRYSTALLOGRAPHY (9 hours)

Introduction to surfaces and interfaces - Surface energy - Some basic concepts of bulk crystallography - Surface Energy - Surface crystallography – Notation for Surface structures - Surface states and electronic structure.

UNIT III - MECHANICS OF SURFACE BONDS (9 hours)

Adsorption and Desorption – Adsorption Kinetics – Coverage dependence – Temperature dependence – Angular and Kinetic energy dependence – Thermal deposition – Desorption Kinetics – Thermal desorption spectroscopy – Adsorption Isotherms – Non-Thermal desorption.

UNIT IV - SURFACE ANALYSIS I (9 hours)

Surface specificity – Spectrum of secondary electrons – Electron energy analyzers – Auger Electron spectroscopy – Electron Energy Loss Spectroscopy – Photoelectron Spectroscopy.

UNIT V - SURFACE ANALYSIS II (9 hours)

Field Emission Microscopy - Field Ion Microscopy - Transmission Electron Microscopy - Reflection Electron Microscopy - Low-Energy Electron Microscopy - Scanning Electron Microscopy - Scanning Tunneling Microscopy - Atomic Force Microscopy .

TEXT BOOKS

1. Hari Singh Nalwa, "*Nanostructured Materials and Nanotechnology*", Academic Press, 2002.
2. K. Oura, V. G. Lifshits, A. A. Saranin, A. V. Zotov and M. Katayama, "*Surface Science – An Introduction*" Springer, 2009.

REFERENCES

1. Unertl.W.N, *"Physical structure"* Elsevier Science B. V, 2006.
2. Riviere.J.C and Myhra.S, "*Handbook of Surface and Interface analysis"*, CRC Press, 2009.
3. Nabok.A, "*Organic and Inorganic Nanostructures*", Artech House, 2005.
4. Dupas.C, Houdy.P, M.Lahmani, "*Nanoscience: Nanotechnologies and Nanophysics*", Springer, 2007.

NT1205 NANO SCALE SURFACE ENGINEERING												
Course Designed by		Department of Physics and Nanotechnology										
1	Student outcome	a	b	c	d	e	f	g	h	i	j	k
		x				x						x
2	Mapping of instructional objectives with student outcome	1				2						3

3	Category	General (G)	Basic Sciences (B)	Engineering Sciences and Technical Arts (E)	Professional Subjects (P)
		--	--	--	x
4	Broad area	Nanoscience	Nano biotechnology	Nano electronics	Nano fabrication
		x	--	--	--
5	Approval	23rd meeting of academic council, May 2013			

	NANOTECHNOLOGY FOR ADVANCED COMPUTING	L	T	P	C
NT1206	Total Contact Hours - 45	**3**	**0**	**0**	**3**
	Prerequisite				
	Nil				

PURPOSE

Nanotechnology is a new and promising technology with the potential of exponentially powerful computation. Understanding basic concepts of nanocomputing is very essential.

INSTRUCTIONAL OBJECTIVES

1.	To understand the physics of nanocomputing.
2.	To make the learner familiarize with designing of information processing machines.
3.	To give the deep insight in to concepts of parallel processing nanosystems.
4.	To provide adequate knowledge in soft computing techniques.

UNIT I - PHYSICS OF NANOCOMPUTING (9 hours)

The development of Microelectronics – The region of Nanoelectronics - The Complexity Problem – The challenge initiated by Nanoelectronics - Basics of Nanoelectronics: Electromagnetic Fields and Photons – Quantization of Action, Charge, and Flux – Electrons behaving as waves – Electrons in potential wells – Diffusion Process.

UNIT II - NANOSYSTEMS AS INFORMATION PROCESSING MACHINES (9 hours)

Nanosystems as Functional Machines – Information Processing as Information Modification – System Design and its interfaces – Requirements of Nanosystems. Uncertainties: Removal of Uncertainties by Nanomachines – Uncertainties in Nanosystems – Uncertainties in the Development of Nanoelectronics.

UNIT III - NANOCOMPUTING WITH IMPERFECTIONS (9 hours)

Introduction – Nanocomputing in the presence of Defects and faults – Triple and N- Modular Redundancy – NAND Multiplexing – Defect Tolerance - Molecular Circuits – Reconfigurable –Hardware – Quadrillion Transistor Logic Systems.

UNIT IV - PARALLEL ARCHITECTURES FOR NANOSYSTEMS (9 hours)

Mono and Multiprocessor Systems – Some considerations to Parallel Processing – Influence of Delay Time – Power Dissipation - Architecture for Processing in Nanosystems: Classic Systolic Arrays – Processor with large memory – Processor array with SIMD and PIP Architectures – Reconfigurable Computers – The Teramac - Concept as a Prototype.

UNIT V - SOFT COMPUTATION (9 hours)

Methods of Soft Computing – Fuzzy Systems – Evolutionary Algorithms – Connectionistic Systems – Computationally Intelligent Systems – Characteristics of Neural Networks in Nanoelectronics -Local Processing – Distributed and Fault-tolerant Storage – Self-organization.

TEXT BOOKS

1. Karl Goser et.al, "*Nanoelectronics and Nanosystems: From Transistors to Molecular and Quantum devices*", Springer, 2005.
2. Mark A Ratner and Daniel Ratner, "*Nanotechnology: A Gentle Introduction to the Next Big Idea*", Prentice Hall, 2002.

REFERENCES

1. Eric Drexler, "*Nanosystems: Molecular Machinery, Manufacturing, and Computation*", Wiley, 1992.
2. Vishal Sahni et.al, "*Nanocomputing: The Future of Computing*", Tata McGraw-Hill Education, 2008.

NT1206 – NANOTECHNOLOGY FOR ADVANCED COMPUTING												
Course Designed by		**Department of Physics and Nanotechnology**										
1	Student outcome	a	b	c	d	e	f	g	h	i	j	k
		x			x	x						x
2	Mapping of instructional objectives with student outcome	1			2	4						3
3	Category	General (G)		Basic Sciences (B)		Engineering Sciences and Technical Arts (E)				Professional Subjects (P)		
		--		--		--				x		
4	Broad area	Nano science		Nanobio technology		Nano electronics				Nano fabrication		
		--		--		x				--		
5	Approval	23rd meeting of academic council, May 2013										

SE1201	SOFTWARE TESTING AND REUSE	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite				
	Nil				

PURPOSE

The purpose of this course is to provide an understanding of concepts and techniques for testing software and assuring its quality.

INSTRUCTIONAL OBJECTIVES

1.	A solid background knowledge of the state of the art in software testing
2.	A keen awareness of the open problems in software testing and maintenance
3.	Testing Object Oriented software

UNIT I - INTRODUCTION (9 hours)

Testing as an Engineering Activity – Role of Process in Software Quality – Testing as a Process – Basic Definitions – Software Testing Principles – The Tester's Role in a Software Development Organization – Origins of Defects – Defect Classes – The Defect Repository and Test Design – Defect Examples – Developer/Tester Support for Developing a Defect Repository. People and organizational issues in testing – organization structures for testing teams – testing services - Test Planning – Test Plan Components – Test Plan Attachments – Locating Test Items – test management – test process - Reporting Test Results.

UNIT II - TEST CASE DESIGN (9 hours)

Introduction to Testing Design Strategies – The Smarter Tester – Test Case Design Strategies – Using Black Box Approach to Test Case Design Random Testing – Requirements based testing – positive and negative testing -–– Boundary Value Analysis – decision tables - Equivalence Class Partitioning state-based testing– cause effect graphing – error guessing - compatibility testing – user documentation testing – domain testing 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.

UNIT III - LEVELS OF TESTING (9 hours)

The Need for Levels of Testing – Unit Test – 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 – types of system

testing - Acceptance testing – performance tests - Regression Testing – internationalization testing – ad-hoc testing - Alpha – Beta Tests – testing OO systems –usability and accessibility testing. Software test automation – skills needed for automation – scope of automation – design and architecture for automation – requirements for a test tool – challenges in automation - Test metrics and measurements

UNIT IV - INTRODUCTION & DOMAIN ENGINEERING (9 hours)

Software reuse and software engineering –state the art and the practice - Aspects of software reuse- Software reuse Organizations – Support services – Institutionalizing reuse. Building Reusable assets – Domain Analysis: Basic concepts – domain scoping – Domain vs application requirements – Domain analysis methods – Domain analysis Tools.

UNIT V - MANAGERIAL ASPECTS OF SOFTWARE REUSE (9 hours)

Software Reuse metrics – Software reuse cost estimation – software reuse return on Investment – Component based software engineering – product-line Engineering – COTS based development.

EXERCISE

Using QTP Tool, following experiments shall be carried out:

1. Write a test case for a Login module.
2. Record and Replay.
3. Parameterization.
4. Synchronization.
5. Text Checkpoints.
6. Database Checkpoints.
7. Image and bitmap Checkpoints.
8. Call to new and existing action.
9. Recovery Scenario Manager.
10. Testing web application

TEXT BOOKS

1. Paul Ammann, Jeff Offutt, "*Introduction to Software Testing*", Cambridge University Press, 2008.
2. Aditya P. Mathur, "*Foundations of Software Testing*", Pearson, 2008

REFERENCES

1. SrinivasanDesikan, Gopalaswamy Ramesh, "*Software Testing: Principles and Practices*", Pearson 2012
2. Hongji Yang (De Montfort University, UK) and Xiaodong Liu (Edinburgh Napier University, UK), *"Software Reuse in the Emerging Cloud Computing"* Era, 2012.
3. Hafedh Milihttp://www.amazon.com/dp/0471398195/ref=rdr_ext_tmb - #, Ali Mili, Sherif Yacoub , Edward Addy, *"Reuse-Based Software Engineering: Techniques, Organizations, and Control",* John Wiley &Sons, 2002.
4. Ivar Jacobson, Martin Gres, Patrick Johnson, *"Software Reuse",* Pearson Education, 2004.
5. Carma McClure, *"Software Reuse: A Standards-Based Guide"*, IEEE, 2001.

SE1201 - SOFTWARE TESTING AND REUSE												
Course Designed by		**Department of Software Engineering**										
1	Student outcome	a	b	c	d	e	f	g	h	i	j	k
		x	x		x	x		x				x
2	Mapping of instructional objectives with student outcome	1,2	2		2	3		1				2
3	Category	General (G)		Basic Sciences (B)		Engineering Sciences and Technical Arts (E)				Professional Subjects (P)		
		--		--		--				x		
4	Broad area	Software Engineering		Computer Science Engineering		Knowledge Engineering						
		x		--		--						
5	Approval	23rd meeting of Academic Council, May 2013										

SE1202	SOFTWARE DEVELOPMENT AND MANAGEMENT	L	T	P	C
	Total Contact Hours - 45	**3**	**0**	**0**	**3**
	Prerequisite				
	Nil				

PURPOSE

This course aims at the role of software developers in getting exposure on plan ning and controlling aspect of software development

INSTRUCTIONAL OBJECTIVES

1.	To learn the process life cycle models
2.	To learn the basic concepts of requirements, design, code construction and debugging
3.	To understand the different reviews, walkthroughs and code inspections

4.	To understand the techniques available with which a project's ai ms and objectives, timetable, activities, resources and risks can be kept under control
5.	To Appreciate of other management issues like team structure, group dynamics and understand communication

UNIT I - INTRODUCTION TO SOFTWARE DEVELOPMENT (9 hours)

Process Life Cycle Model – Waterfall Model – Incremental Model – Agile Methodology – eXtreme Programming (XP) – Requirements – Functional Specification - Types of Requirements – User Requirements – Domain Requirements – Non-Functional Requirements – Analyzing the requirements

UNIT II - DESIGN & CODE CONSTRUCTION (9 hours)

Design process – Desirable design characteristics – Design heuristic – Code construction – Method and Function size – Formatting Layout and style – General Layout, Issues and Techniques - Declaration and Commenting Style Guidelines – Identifier Naming Conventions – Defensive Programming

UNIT III - DEBUGGING & REVIEWS (9 hours)

An approach to debugging – source code control – Unit Testing – Code coverage – Data Coverage – Characteristics of Tests – JUnit: A Testing Framework – Walkthroughs – Code Reviews – Code Inspection – Inspection Roles – Inspection Phases and Procedures – Summary of Review Methodologies

UNIT IV - PROJECT MANAGEMENT & EVALUATION (9 hours)

Project Definition – Contract Management – Activities Covered by Software Project Management – Overview Of Project Planning – Stepwise Project Planning Strategic Assessment – Technical Assessment – Cost Benefit Analysis- Cash Flow Forecasting – Cost Benefit Evaluation Techniques – Risk Evaluation. – Software effort estimation

UNIT V - MANAGING PEOPLE AND ORGANIZING TEAMS (9 hours)

Introduction – Understanding behavior – organizational behavior – selecting the right person for the job – instruction in the best methods – motivation – the Oldman – Hackman Job Characteristics Model – working in groups – becoming a team – decision making – leadership – organizational structures – stress – health and safety – Case studies

TOTAL 45 hours

TEXT BOOKS

1. John Duley, *"Software Development and Professional Practice",* Apress, 1st edition, 2011.
2. Bob Hughes and Mike Cotterell, *"Software Project Management"*, 5TH edition, Tata McGraw Hill, 2009.

REFERENCES

1. Dan Pilone and Russ Miles, *"Head First Software Development",* 2008.
2. Ramesh Gopalaswamy, *"Managing Global Projects",* Tata McGraw Hill, 2011.
3. Singh.S.N and Gupta.S.C, *"Software Project Management",* Global Publications Pvt Ltd, 2009.

SE1202 – SOFTWARE DEVELOPMENT AND MANAGEMENT												
Course Designed by		Department of Software Engineering										
1	Student outcome	a	b	c	d	e	f	g	h	i	j	k
			x	x				x				x
2	Mapping of instructional objectives with student outcome		1,2,	3				5				4
3	Category	General (G)			Basic Sciences (B)		Engineering Sciences and Technical Arts (E)				Professional Subjects (P)	
		--			--		--				x	
4	Broad area	Hardware Computer Science Engineering			Software Engineering		Basic Engineering				Knowledge Engineering	
		--			x		--				--	
5	Approval	23rd meeting of Academic Council, May 2013										

SE1203	OBJECT ORIENTED PROGRAMMING	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite				
	Nil				

PURPOSE

To provide a comprehensive introduction to Object Oriented Programming (OOP) uses c++, Java and c# programming language. This course aims to teach OOP concepts, such as classes, interfaces, inheritance, and polymorphism.

INSTRUCTIONAL OBJECTIVES

1.	The Student will able to understand the Basics object-oriented programming concepts

2.	The Student will able to understand and apply the object oriented concept like Classes and Objects, encapsulation, Inheritance, Polymorphisms in c++
3.	The Student will able to understand java environment and its features
4.	The Student will able to understand and apply the object oriented concept like Classes and Objects, encapsulation, Inheritance, Interface, Polymorphisms in java
5.	The Student will able to understand c# environment and the differences with c++ and java

UNIT I - INTRODUCTION TO OBJECT ORIENTED PROGRAMMING WITH C++ (9 hours)

Introduction to C++ - Object-Oriented Programming Concepts - Review of constructs of C used in C++: Basic Language Elements, control structures, input and output statement, structure, unions, functions, pointers and arrays, preprocessor directives - Classes and Objects : Object Scope, Data Abstraction, Enforcing Data Encapsulation, 'this' Pointer, Dynamic creation of objects - Constructors and Destructors : The Default Constructor, The Destructor, Parameterized Constructors, Copy constructor.

UNIT II - EXTENDING CLASSES AND INHERITANCE IN C++ (9 hours)

Defining member functions, Methods and access modifiers, Accessing class data and methods, Friend class and friendly functions, Returning objects, Arrays of Objects - Function and Operator Overloading : Function Overloading, Operator overloading - using friend function, Dealing with strings using operators, Converting data types, Inheritance, Virtual functions and Polymorphism, Templates, Exception Handling

UNIT III - INTRODUCTION TO JAVA (9 hours)

Java Fundamentals - The Java Environment, Java's Key Features, Java virtual machine, Basic Language Elements - The First Application - The 'Classpath' in Java, Java Archives - Java Classes : Classes & Packages, The 'import' Statement, The Importance of Encapsulation, Java Constructors, Access Modifiers (private, default and public), Method Overloading

UNIT IV - EXTENDING JAVA CLASSES (9 hours)

Polymorphism and Inheritance, the 'Protected' Modifier, Using 'this' and 'super', The 'final' keyword, Static Members & Methods - Interfaces & Abstract Classes,

The Complete Construction Process, The Class 'Object', Nested Classes, Enums in Java - Exception handling

UNIT V - INTRODUCTION TO C# (9 hours)

Introduction to C # : Evaluation of C#, characteristics of C#, application of C#, difference between C++, Java and C# - Introduction to C# environment - Overview of C#: Programming structure of C#, Basic Language Elements, The First Application - Classes: Classes as Structured Data, Methods - Constructors and Initialization - Methods: Method Overloading - Inheritance - Virtual Methods and Polymorphism - Exceptions – Interfaces.

EXERCISE PROGRAMS

1. Design C++ classes with static members, methods with default arguments, friend functions and Function Overloading in c++
2. Operator Overloading with and without friend function : +, -, ++, --, >>, << in c++
3. Develop a template of linked-list class and its methods in c++
4. Define stack and queue class with necessary exception handling in c++
5. Simple java program for method overloading, exception handling and Access Specifiers
6. Inheritance and Interface in Java
7. Constructor and Constructor overloading in java
8. Overriding in java
9. Simple program in c# with constructor, method, exception
10. polymorphism and interface in c#

TEXT BOOKS

1. Ira Pohl, "*Object-Oriented Programming Using C++*", 2/e, Pearson Education, 2006.
2. Thomas Wu, "*An Introduction to Object-Oriented Programming with Java*", 5th Edition, McGraw-Hill Education, 2009.

REFERENCES

1. Herbert Schildt, "*C# 3.0: A Beginner's Guide*", McGraw-Hill Education, 2009.
2. Ramesh Vasappanavara et al, *"Object-oriented Programming Using C++ and Java",* First Impression, Pearson, 2011.
3. Dan Clark, "*Beginning C# Object-Oriented Programming*", Apress, 2011.
4. E Balagurusamy, "*Object Oriented Programming Using C++ and JAVA*", McGraw-Hill Education, 2012.

SE1203 - Object Oriented Programming												
Course Designed by		Department of Software Engineering										
1	Student outcome	a	b	c	d	e	f	g	h	i	j	k
		x	x									x
2	Mapping of instructional objectives with student outcome	2,4	1,3									5
3	Category	General (G)		Basic Sciences(B)		Engineering Sciences and Technical Arts (E)			Professional Subjects (P)			
									x			
4	Broad area	Software Engineering		Computer Engineering		Knowledge Engineering						
		x										
5	Approval	23rd meeting of Academic Council, May 2013										

SE1204	SOFTWARE ENGINEERING PRACTICES	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite				
	Nil				

PURPOSE

The main purpose of this course is to impart knowledge on the basic principles of software development life cycle.

INSTRUCTIONAL OBJECTIVES

1.	Understand the software life cycle models.
2.	Understand the importance of the software development process
3.	Understand the importance of modeling and modeling languages
4.	Design and develop correct and robust software products

UNIT I - INTRODUCTION **(9 hours)**

Software Engineering-Software Process- Generic process model-Prescriptive process model-specialized, unified process-Agile development-Agile Process-Extreme Programming- Other agile Process models-Software engineering Knowledge-core Principles-Principles that guide each framework Activity.

UNIT II - REQUIREMENTS **(9 hours)**

Requirements Engineering-Establishing the Groundwork-Eliciting Requirements-Developing use cases-Building the requirements model-Negotiating, validating Requirements-Requirements Analysis-Requirements Modeling Strategies.

UNIT III - DESIGN **(9 hours)**

Design Process- Design concepts: Abstraction, Architecture, patterns, Separation of Concerns, Modularity, Information Hiding, Functional Independence, Refinement, Aspects, Refactoring, Object Oriented Design Concepts, Design Classes- Design Model: Data, Architectural, Interface, Component, Deployment Level Design Elements .

UNIT IV - QUALITY AND TESTING **(9 hours)**

Software Quality- Software Quality Dilemma- Achieving Software Quality- Testing: Strategic Approach to software Testing- Strategic Issues- Testing: Strategies for Conventional Software, Object oriented software, Web Apps-Validating Testing- System Testing- Art of Debugging.

UNIT V - MAINTENANCE AND REENGINEERING **(9 hours)**

Software Maintenance-Software Supportability- Reengineering- Business Process Reengineering- Software Reengineering- Reverse Engineering- Restructuring- Forward Engineering- Economics of Reengineering

TEXT BOOKS

1. Roger S. Pressman, *"Software Engineering – A Practitioner's Approach",* seventh edition, 2010.
2. Ian sommerville, *"Software Engineering"* Pearson Edu, 9th edition, 2010.

REFERENCES

1. Hans Van Vliet *"Software Engineering: Principles and Practices",* 2008.

SE1204 – SOFTWARE ENGINEERING PRACTICES													
Course Designed by		**Department of Software Engineering**											
1	Student outcome	a	b	c	d	e	f	g	h	i	j	k	
		x	x			x							
2	Mapping of instructional objectives with student outcome	1	2,3			4							
3	Category	General (G)		Basic Sciences (B)		Engineering Sciences and Technical Arts (E)					Professional Subjects (P)		
		--		--		--					x		
4	Broad area	Software Engineering		Computer Engineering		Knowledge Engineering							
		x		--		--							
5	Approval	23rd meeting of Academic Council, May 2013											

TE1201	WIRELESS COMMUNICATION NETWORKS	L	T	P	C
	Total contact hours-45	3	0	0	3
	Prerequisite				
	Nil				

PURPOSE

This course discusses the principles that underline the analysis and design of Wireless communication Networks.

INSTRUCTIONAL OBJECTIVES

1. To understands the functions and operational principles of the various components of wireless networks, and how the connections are setup and maintained.
2. To realize the complicated nature of wireless propagation and to apply simple models to calculate link budget,
3. To become familiar with the existing and emerging wireless communication technologies.

UNIT I - WIRELESS MEDIUM (9 hours)

Air Interface Design – Radio propagation mechanism – Pathloss modeling and Signal Coverage– Effect of Multipath and Doppler – Channel Measurement and Modelling – Simulation of RadioChannel.

UNIT II - WIRELESS MEDIUM ACCESS (9 hours)

Fixed Assignment Access for Voice Networks – Random Access for Data Networks -Integrationof Voice and Data Traffic.

UNIT III - WIRELESS NETWORK OPERATION (9 hours)

Wireless Network Topologies – Cellular Topology – Cell fundamentals – Signal to InterferenceRatio – Capacity Expansion – Mobility Management – Resources and Power Management –Security in Wireless Networks.

UNIT IV - WIRELESS WAN (9 hours)

GSM and TDMA Technology – Mobile Environment – Communication in the Infrastructure –CDMA Technology – IS95 – IMT2000 – Mobile Data Networks – CDPD Networks – GPRS –Mobile Application Protocol.

UNIT V - WIRELESS LANS AND HIPERLANS (9 hours)

Introduction to wireless LANs – IEEE 802.11 – WPAN IEEE 802.15 –Mobile AdhocNetworks(MANET)- Principle and operation - Wireless Home Networking – Concepts ofBluetooth Technology – Wireless Geolocation.

TEXT BOOKS

1. William Stallings, *"Wireless Communications and Networks"*, Second Edition Prentice Hall,India 2007.
2. Kaveth Pahlavan, K.Prasanth Krishnamurthy, *"Principles of Wireless Networks"*, Pearson Education Asia, 2002.

REFERENCES

1. Leon Garcia, Widjaja, *"Communication Networks"*, Tata McGraw Hill, New Delhi, 2000.
2. Jon W Mark, Weihua Zhuang,"*Wireless communication and Networking"*, Prentice HallIndia, 2003.

TE1201 WIRELESS COMMUNICATION NETWORKS												
Course Designed by		Department of Telecommunication Engineering										
1	Student outcome	a	b	c	d	e	f	g	h	i	j	k
		x	x	x								
2	Mapping of instructional objectives with student outcome	1	2	3								
3	Category	General (G)			Basic Sciences (B)		Engineering Sciences and Technical Arts (E)				Professional Subjects (P)	
		--			--		--				x	
4	Broad area	Circuit Analysis and Programming			System Design		Communication Engineering				Networking	
		x			x		--				--	
5	Approval	23rd meeting of Academic Council, May 2013										

TE1202	DIGITAL LOGIC CIRCUITS	L	T	P	C
	Total contact hours-45	3	0	0	3
	Prerequisite				
	Nil				

PURPOSE

To understand the fundamentals of Combinational circuits and sequential circuits and to address a wide variety of memory devices and PLD's.

INSTRUCTIONAL OBJECTIVES

1.	To study various number systems and to simplify the mathematical expressions using Boolean functions.
2.	To study the implementation of combinational circuits
3.	To study the design of various synchronous and asynchronous circuits.
4.	To study various memory devices and PLD's.

UNIT I - BOOLEAN ALGEBRA AND LOGIC GATES (12 hours)

Review of number systems and their conversion,Boolean algebra, De-Morgan's theorem, switching functions and simplification using Algebric, K-map & Quine McCluskey method, Canonical and standard forms, SOP's and POS form, Minterm and Maxterm,Binary codes,Logic gates.

UNIT II - COMBINATIONAL LOGIC CIRCUIT (8 hours)

Adders, Subtractors, Magnitude Comparators, Code converters, Encoders, Decoders, Multiplexers and De-multiplexers, Design of combinational circuits

UNIT III - SYNCHRONOUS SEQUENTIAL LOGIC CIRCUIT (9 hours)

Flip flops – SR, D, JK and T. Analysis of synchronous sequential circuits, Design of synchronous sequential circuits – Counters, state diagram, state reduction, state assignment.

UNIT IV - ASYNCHRONOUS SEQUENTIAL LOGIC CIRCUIT (9 hours)

Design of Asynchronous sequential circuits, Analysis of Asynchronous sequential machines, transition table, Flow table, state assignment, Reduction of state and flow tables, Hazards.

UNIT V - MEMORY AND PLDS (7 hours)

Memories: Memory types and terminology –ROM architecture –ROM types– ROM applications-RAM architecture – Static RAM – Dynamic RAM.

PLD's: Fundamentals of PLD – SPLDs – PAL – GAL – PLA-CPLD.

TEXT BOOKS

1. Morris Mano.M, "*Digital Design",* Pearson Education, 2006.
2. Floyd and Jain, "*Digital Fundamentals"*, 8th edition, Pearson Education, 2007.
3. Raj Kamal, "*Digital systems-Principles and Design"*, Pearson education 2nd edition, 2007.

REFERENCES

1. John M.Yarbrough, "*Digital Logic, Application & Design"*, Thomson, 2002.
2. Charles H.Roth, "*Fundamentals Logic Design"*, Jaico Publishing, IV edition, 2002.
3. John F.Wakerly, "*Digital Design Principles and Practice"*, 3rd edition, Pearson Education, 2002.

TE1202 - DIGITAL LOGIC CIRCUITS												
Course Designed by		**Department of Telecommunication Engineering**										
1	Student outcome	a	b	c	d	e	f	g	h	i	j	k
		x	x	x								
2	Mapping of instructional objectives with student outcome	1,4	2	3								
3	Category	General (G)			Basic Sciences (B)		Engineering Sciences and Technical Arts (E)				Professional Subjects (P)	
		--			--		--				x	
4	Broad area	Circuit Analysis and Programming			System Design		Communication Engineering				Networking	
		x			x		--				--	
5	Approval	23rd meeting of Academic Council, May 2013										

TE1203	TELECOM BILLING	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite				
	Nil				

PURPOSE

To provide better understanding of Telecom Billing architecture, Billing Process and Payment Procedures.

COURSE OBJECTIVES

1.	To Understand the Telecom Billing Architecture
2.	To know about various Tariff and Bill structure
3.	Understand the concepts involved in Billing Process
4.	To Gain knowledge on Payment Procedures

UNIT I - BILLING INTRODUCTION (9 hours)

Indian Telecom Service Providers, TRAI, Telecom Billing Instruction, Billing System, Telecom Billing System Architecture, Billing System Requirement, Telecom Billing Products and Services, Tariff Planning & Classification, Portable & Non Portable charges, Refundable & Non Refundable Charges, Charge Overriding.

UNIT II - CUSTOMER DETAILS AND CDR (9 hours)

Telecom Billing Customer Acquisition, Customer Acquisition Process, Customer Life Cycle, Customer Types, Telecom Billing Usage Capturing, CDR, CDR Attributes & Processing, Telecom Billing Rating Process, Duplicate and Rejected Event, Rerating and Partial Event, analysis of Real Time Bill Formats

UNIT III - BILLING PROCESS AND DISCOUNTS (9 hours)

Telecom Billing Process, Bill Cycle and Types, Billing Mode and Bill Suppression, Exceptional Bills, Bill Itemization and Formatting. Telecom Billing Discount Application, Discount Steps & Thresholds, Discount Types, Discount Period & Proration, Bonus Schemes, Telecom Billing Invoice Generation.

UNIT IV - PAYMENT PROCEDURES (9 hours)

Telecom Billing Collection Process, Collection Action Schedule , Soft Collection Actions, Hard Collection Actions, Telecom Billing Payment Processing, Payment Methods, Automatic Payments, Manual Payment, Payment Interfaces, Telecom Billing Disputes & Adjustment, Processing of Disputes, Review of Indian Service Provider Tariffs.

UNIT V - REPORT GENERATION AND INTERFACE MODULES (9 hours)

Telecom Billing Report Generation, Postpaid & Prepaid Scenario, Retail Vs Wholesale Billing, Telecom Roaming Billing, Telecom Billing Support & Maintenance, Support and Service Level Agreement, CRM/OMOF System, Provisioning and Network Inventory System, Network Switches, Mediation and Data Warehouse System, Enterprise Resource Planning, Payment Gateway, Telecom Billing Major System.

TEXT BOOKS

1. Bell.A.T, *"Telecommunication Billing"*, Published by Virtualbookworm.com, July 2005.
2. Nolan Vincent Jones *"Telecommunications Management"*,. Published by Virtualbookworm.com, August 2004.

REFERENCES

1. "*Introduction to Telecom Billing, Usage Events, Call Detail Records, and Billing Cycles*", Avi Ofrane, Lawrence Harte, January 2004.
2. Jane M Hunter, Maud Thiebaud, "*Telecommunications Billing Systems*", McGraw-Hill.
3. Lillian Goleniewski,"*Telecommunications Essentials, The Complete Global Source, 2/E*", September 2007.

TE1203 - TELECOM BILLING												
Course Designed by		**Department of Telecommunication Engineering**										
1	Student outcome	a	b	c	d	e	f	g	h	i	j	k
						x			x			x
2	Mapping of instructional objectives with student outcome					1			2-4			4
3	Category	General (G)			Basic Sciences (B)		Engineering Sciences and Technical Arts (E)				Professional Subjects (P)	
		--			--		--				x	
4	Broad area	Circuit Analysis and Programming			System Design		Communication Engineering				Networking	
		--			--		--				x	
5	Approval	23rd meeting of Academic Council, May 2013										