

**LIST OF OPEN ELECTIVES  
TO BE OFFERED IN THE ODD SEMESTER (CEG / ACT CAMPUS)**

<b>FACULTY OF CIVIL ENGINEERING</b>								
<b>DEPARTMENT OF CIVIL ENGINEERING</b>								
<b>SL. NO.</b>	<b>COURSE CODE</b>	<b>COURSE TITLE</b>	<b>CATEGORY</b>	<b>CONTACT PERIODS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>B.E. Civil Engineering</b>								
1.	CE7591	Human Values and Professional Ethics for Engineers	OE	3	3	0	0	3
<b>B.E. Geoinformatics</b>								
2.	GI7591	Geo Spatial Mapping	OE	3	3	0	0	3
3.	GI7592	Remote Sensing Concepts	OE	3	3	0	0	3
<b>B. E. Agricultural and Irrigation Engineering</b>								
4.	AI7591	Farm Management	OE	3	3	0	0	3
5.	AI7592	Hydrology	OE	3	3	0	0	3
<b>FACULTY OF ELECTRICAL ENGINEERING</b>								
<b>DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING</b>								
<b>B.E. Electrical and Electronics Engineering</b>								
6.	EE7591	Introduction to Control Systems	OE	3	3	0	0	3
7.	EE7592	Fundamentals of Soft Computing	OE	3	3	0	0	3
<b>FACULTY OF MECHANICAL ENGINEERING</b>								
<b>DEPARTMENT OF MECHANICAL ENGINEERING</b>								
<b>B.E. Mechanical Engineering and B.E. Materials Sciences and Engineering</b>								
8.	ME7591	Computation Mechanics of Fluids	OE	3	3	0	0	3
9.	ME7592	Product Design and Process Development	OE	3	3	0	0	3
<b>DEPARTMENT OF INDUSTRIAL ENGINEERING</b>								
<b>B.E. Industrial Engineering</b>								
10.	IE7591	Introduction to Industrial Engineering	OE	3	3	0	0	3
11.	IE7592	Quantitative Techniques for Decision Making	OE	3	3	0	0	3
<b>DEPARTMENT OF MANUFACTURING ENGINEERING</b>								
<b>B.E. Manufacturing Engineering</b>								
12.	MF7591	Electronics Packaging Technology	OE	3	3	0	0	3
13.	MF7592	Sustainable Development and Manufacturing	OE	3	3	0	0	3
<b>DEPARTMENT OF PRINTING TECHNOLOGY</b>								
<b>B.E. Printing Technology</b>								
14.	PT7591	Digital Photography	OE	3	3	0	0	3
15.	PT7592	Creativity and Innovation	OE	3	3	0	0	3
<b>DEPARTMENT OF MINING ENGINEERING</b>								
<b>B.E. Mining Engineering</b>								
16.	MI7591	Tunnelling Engineering	OE	3	3	0	0	3

FACULTY OF INFORMATION AND COMMUNICATION ENGINEERING								
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING								
SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
<b>B.E. Computer Science and Engineering</b>								
17.	CS7591	Python Programming	OE	3	3	0	0	3
18.	CS7592	Web Design and Management	OE	3	3	0	0	3
<b>DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING</b>								
<b>B.E. Electronics and Communication Engineering</b>								
19.	EC7591	Consumer Electronics	OE	3	3	0	0	3
20.	EC7592	Principles of Modern Communication Systems	OE	3	3	0	0	3
<b>B.E. Biomedical Engineering</b>								
21.	BM7591	Principles of Telemedicine	OE	3	3	0	0	3
22.	BM7592	Electronics in Medicine	OE	3	3	0	0	3
<b>DEPARTMENT OF INFORMATION SCIENCE AND TECHNOLOGY</b>								
<b>B.Tech. Information Technology</b>								
23.	IT7591	Mobile Application Development	OE	3	3	0	0	3
24.	IT7592	Information Technology Essentials	OE	3	3	0	0	3
<b>FACULTY OF TECHNOLOGY</b>								
<b>DEPARTMENT OF LEATHER TECHNOLOGY</b>								
<b>B.Tech. Leather Technology</b>								
25.	LT7591	Leather Manufacture	OE	3	3	0	0	3
26.	LT7592	Skin Protein	OE	3	3	0	0	3
<b>DEPARTMENT OF TEXTILE TECHNOLOGY</b>								
<b>B.Tech. Textile Technology and B.Tech. Apparel Technology</b>								
27.	TT7591	Basics of Textile Technology	OE	3	3	0	0	3
28.	TT7592	Textile Fibres	OE	3	3	0	0	3
<b>DEPARTMENT OF CERAMIC TECHNOLOGY</b>								
<b>B.Tech. Ceramic Technology</b>								
29.	CT7591	Ceramic Materials	OE	3	3	0	0	3
30.	CT7592	Processing of Ceramics	OE	3	3	0	0	3
<b>DEPARTMENT OF BIO TECHNOLOGY</b>								
<b>B.Tech. Pharmaceutical Technology</b>								
31.	PM7591	Human Genetics	OE	3	3	0	0	3
32.	PM7592	Fundamentals of Biochemistry	OE	3	3	0	0	3
<b>B.Tech. Industrial Biotechnology</b>								
33.	IB7591	Introduction to Biotechnology	OE	3	3	0	0	3
34.	IB7592	Introduction of Cancer Biology	OE	3	3	0	0	3
<b>B.Tech. Food Technology</b>								
35.	FT7591	Biomolecules	OE	3	3	0	0	3
36.	FT7592	Food Safety	OE	3	3	0	0	3
<b>DEPARTMENT OF CHEMICAL ENGINEERING</b>								
<b>B.E. Chemical Engineering</b>								
37.	CH7591	Separation Techniques	OE	3	3	0	0	3
38.	CH7592	Industrial Water Technology	OE	3	3	0	0	3

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
<b>DEPARTMENT OF APPLIED SCIENCE AND TECHNOLOGY</b>								
<b>B.Tech. Petroleum Engineering and Technology</b>								
39.	AS7591	Basic Concepts in Petroleum Engineering	OE	3	3	0	0	3
40.	AS7592	Introduction to Industrial Safety Management	OE	3	3	0	0	3
<b>FACULTY OF SCIENCE AND HUMANITIES</b>								
<b>DEPARTMENT OF CHEMISTRY</b>								
B.E./B.Tech./B.Arch. students can take these electives.								
41.	CY7591	Industrial Catalysis	OE	3	3	0	0	3
42.	CY7592	Industrial Chemistry	OE	3	3	0	0	3
<b>DEPARTMENT OF ENGLISH</b>								
43.	HS7591	Basic Language Skills Course	OE	3	3	0	0	3
44.	HS7592	Science Fiction	OE	3	3	0	0	3
<b>DEPARTMENT OF PHYSICS</b>								
45.	PH7591	Electromagnetic Theory	OE	3	3	0	0	3
46.	PH7592	Physics of Semiconductor Devices	OE	3	3	0	0	3

**OBJECTIVES**

- This course gives an opportunity for the students to know the various moral and ethical issues through various prominent theories. It educates the code of ethics as well as the industrial standards and how they can be used for ensuring safety and reducing the risk. The course enunciated the Rights and Responsibilities of individuals. Various other ethical global issues also have been explained along with case studies.

**UNIT I HUMAN VALUES****9**

Introduction to Human Values - Moral and Ethical values - Law and Ethics - Integrity - Work ethics - Civic virtue - Respect for others - Living peacefully - Caring – Sharing - Honesty - Courage - Valuing time - Cooperation - Commitment - Empathy - Sympathy - Self confidence – Character – Behaviour - Spirituality.

**UNIT II ENGINEERING ETHICS****9**

Introduction - Senses of Engineering Ethics - Moral issues - Types of inquiry - Moral dilemma - Moral Autonomy - Kohlberg's theory - Gilligan's theory - Consensus and Controversy - Models of Professional roles - Theories about right action - Self-interest - Customs, Manners and Religion - Uses of Ethical Theories.

**UNIT III ENGINEERING AS SOCIAL EXPERIMENTATION****9**

Engineering as Experimentation - Engineers as responsible Experimenters - Codes of Ethics - A Balanced Outlook on Law – Case studies.

**UNIT IV RESPONSIBILITIES, RIGHTS AND SAFETY****9**

Collegiality and Loyalty – Respect for Authority – Collective Bargaining – Confidentiality – Conflicts of Interest – Occupational Crime – Professional Rights – Employee Rights - Safety and Risk - Assessment of Safety and Risk - Risk Benefit Analysis and Reducing Risk Case studies.

**UNIT V GLOBAL ISSUES****9**

Multinational Corporations – Environmental Ethics – Computer Ethics – Weapons Development – Engineers as Managers – Engineers as Expert Witnesses and Advisors – Moral Leadership – Sample Code of Conduct.

**TOTAL: 45 PERIODS****OUTCOMES:**

- Upon completion of the course, the student should be able to practice ethics in society, discuss the ethical issues related to engineering and realize the responsibilities and rights in the society.

**TEXTBOOK :**

1. Mike W. Martin and Roland Schinzinger, "Ethics in Engineering", Tata McGraw Hill, New Delhi, 2003.

**REFERENCES:**

1. Charles B. Fleddermann, "Engineering Ethics", Pearson Prentice Hall, New Jersey, 2004.
2. Charles E. Harris, Michael S. Pritchard and Michael J. Rabins, "Engineering Ethics – Concepts and Cases", Thompson Wadsworth, A Division of Thomson Learning Inc., United States, 2000

**OBJECTIVES:**

- To introduce concepts of Cartography and GIS
- To expose the process of map making and production
- To introduce GIS data structures, data input and data presentation

**UNIT I ELEMENTS OF CARTOGRAPHY 9**

Definition of Cartography - Maps - functions - uses — Types of Maps – Map Scales and Contents – Map projections – shape, distance, area and direction properties – perspective and mathematical projections – Indian maps and projections – Map co-ordinate systems – UTM and UPS references

**UNIT II MAP DESIGN AND PRODUCTION 9**

Elements of a map - Map Layout principles – Map Design fundamentals – symbols and conventional signs - graded and ungraded symbols - color theory - colours and patterns in symbolization – map lettering - map production – map printing– colours and visualization – map reproduction - Map generalization - geometric transformations – bilinear and affine transformations

**UNIT III FUNDAMENTALS OF GIS 9**

Introduction to GIS - Definitions – History of GIS - Components of a GIS – Hardware, Software, Data, People, Methods – Types of data – Spatial, Attribute data- types of attributes – scales/ levels of measurements - spatial data models – Raster Data Structures – Raster Data Compression - Vector Data Structures - Raster vs Vector Models- TIN and GRID data models.

**UNIT IV DATA INPUT AND TOPOLOGY 9**

Scanner - Raster Data Input – Raster Data File Formats – Georeferencing – Vector Data Input –Digitiser – Datum Projection and reprojection -Coordinate Transformation – Topology - Adjacency, connectivity and containment – Topological Consistency – Non topological file formats - Attribute Data linking – Linking External Databases – GPS Data Integration - Raster to Vector and Vector to Raster Conversion

**UNIT V DATA OUTPUT AND QUALITY 9**

Data quality - Basic aspects - completeness, logical consistency, positional accuracy, temporal accuracy, thematic accuracy and lineage – Metadata – GIS Standards – Interoperability - OGC - Spatial Data Infrastructure - -Data Output - Map Compilation – Chart/Graphs – v

**TOTAL: 45 PERIODS****OUTCOMES:**

At the end of the course, the student shall

- Be familiar with appropriate map projection and co-ordinate system for production of Maps and shall be able to compile and design maps for the required purpose.
- Be familiar with co-ordinate and datum transformations
- Understand the basic concepts and components of GIS, the techniques used for storage of spatial data and data compression
- Understand the concepts of spatial data quality and data standard

**TEXTBOOKS:**

1. Arthur, H. Robinson, Elements of Cartography, Seventh Edition, John Wiley and Sons, 2004.
2. Kang-Tsung Chang, "Introduction to Geographic Information Systems", McGraw Hill Publishing, 2<sup>nd</sup> Edition, 2011.
3. Ian Heywood, Sarah Cornelius, Steve Carver, Srinivasa Raju, "An Introduction to Geographical Information Systems, Pearson Education, 2<sup>nd</sup> Edition, 2007.

**REFERENCES:**

1. John Campbell, "introductory Cartography", Wm.C. Brown Publishers, 3<sup>rd</sup> Edition, 2004
2. C.P. Lo Albert K.W. Yeung, Concepts and Techniques of Geographic Information Systems, Prentice Hall of India Publishers, 2006

**OBJECTIVES:**

- To introduce the concepts of remote sensing processes and its components.
- To expose the various remote sensing platforms and sensors and to introduce the elements of data interpretation

**UNIT I REMOTE SENSING AND ELECTROMAGNETIC SPECTRUM 9**

Definition – components of RS – History of Remote Sensing – Merits and demerits of data collation between conventional and remote sensing methods - Electromagnetic Spectrum – wave theory, particle theory, Stefan – Boltzmann Law and Wien’s Law – visible and non visible spectrum – Radiation sources: active & passive; Radiation Quantities

**UNIT II EMR INTERACTION WITH ATMOSPHERE 9**

Standard atmospheric profile – main atmospheric regions and its characteristics – interaction of radiation with atmosphere - Scattering (Rayleigh, Mie, non-selective scattering) absorption and refraction – Atmospheric effects on visible, infrared, thermal and microwave spectrum – Atmospheric windows.

**UNIT III EMR INTERACTION WITH EARTH 9**

Energy balance equation – Specular and diffuse reflectors – Spectral reflectance & emittance – Spectro radiometer / Spectrophotometer – Spectral Signature concepts – Typical spectral reflectance curves for vegetation, soil and water body – Factors affecting spectral reflectance of vegetation, soil and water body.

**UNIT IV PLATFORMS AND SENSORS 9**

Ground based platforms –Airborne platforms – Space borne platforms – Classification of satellites – Sun synchronous and Geosynchronous satellites – Resolution concepts – Scanners - Along and across track scanners – Orbital and sensor characteristics of different satellites – Airborne and Space borne TIR sensors – Calibration – S/N ratio – Passive/Active microwave sensing – Airborne and satellite borne RADAR –SAR –LIDAR , UAV – High Resolution Sensors

**UNIT V DATA PRODUCTS AND VISUAL INTERPRETATION 9**

Photographic (film and paper) and digital products – quick look products - High Resolution data products data - ordering – interpretation – basic characteristics of image elements – interpretation keys (selective and elimination) – visual interpretation of natural resources.

**TOTAL: 45 PERIODS****OUTCOMES:**

At the end of the course the student will be able to understand

- The characteristics of electromagnetic radiation and its interaction with earth features
- The types and configuration of various satellites and sensors
- The elements of data interpretation

**TEXT BOOKS:**

1. Richards, Remote sensing digital Image Analysis-An Introduction Springer - Verlag 1993.
2. Lillesand, T.M. and Kiefer R.W. Remote Sensing and Image interpretation, John Wiley and Sons, Inc, New York, 2002.

**REFERENCES:**

1. Janza, F.Z., Blue H.M. and Johnson,J.E. Manual of Remote Sensing. Vol.I, American Society of Photogrametry, Virginia, USA, 2002.
2. Verbyla, David, Satellite Remote Sensing of Natural Resources. CRC Press, 1995
3. Paul Curran P.J. Principles of Remote Sensing. Longman, RLBS, 2003.

**OBJECTIVE:**

- To expose the students to the basic concepts and fundamental knowledge in Farm Management
- Farm financial analysis investment and budgeting for farms.

**UNIT I FARM MANAGEMENT****9**

Farm management - need and analysis – scope – Definitions – objectives – Farm management and its relationship with other sciences – Farm management decisions – farm business organizations – factors influencing the size of the farm.

**UNIT II FARM PLANNING AND BUDGETING****9**

Farm planning – necessity – characteristics of good farm plan – limitations of farm planning – farm budgeting – farm enterprise budgeting – partial budgeting – complete budgeting – whole farm planning and budgeting – Farm inventory – methods of valuation.

**UNIT III FARM RECORDS AND ACCOUNTANCY****9**

Benefits of farm records – limitations in the maintenance of farm records – records maintained in a farm – farm accountancy terms and concepts – journals – ledgers – cash book – depreciation – methods of computation - risk and uncertainty - Distinction between risk and uncertainty – sources of risk and uncertainty – production and technical risks – Price or marketing risk – Financial risk – methods of reducing risk - Concept of risk and uncertainty – causes for uncertainty – Managerial decisions to reduce risks in production process.

**UNIT IV MANAGEMENT OF FARM RESOURCES****9**

Management of resources – types of resources- land, labour, capital and measurement of their efficiencies – Mobilization of farm resources- Cost of machinery and maintenance – Break even analysis – Investment analysis – Discounting techniques - land use planning – owning the land – leasing – buying the land – land appraisal – farm layout – farm labour management – classification of farm labour – farm labour efficiency – capital management.

**UNIT V APPLICATION OF TECHNIQUES TO FARM MANAGEMENT****9**

Linear programming – dynamic programming – simulation – farm efficiency measures – physical efficiency measures – financial efficiency measures - Type of farming – Specialization, Diversification, Mixed farming, Dry farming and Ranching – Systems of farming -co-operative farming, Capitalistic farming, collective farming, State farming and Peasant farming.

**TOTAL: 45 PERIODS****TEXT BOOKS:**

1. Johl, S.S., and Kapur, T.R., 'Fundamentals of Farm Business Management', Kalyani publishers, Ludhiana, 2007.
2. Subba Reddy, S., Raghu Ram, P., Neelakanta Sastry T.V and Bhavani Devi I, 'Agricultural Economics', India Book House Ltd., 2006.
3. Devi, I., 'Agricultural Economics' Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi, 2006.

**REFERENCES:**

1. Raju, V.T., "Essentials of Farm Management", Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi, 2002.
2. Subba Reddy, S., and Raghu Ram, P. 'Agricultural Finance and Management', Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi, 2002.
3. Sankhayan, P.L. 'Introduction to Farm Management', Tata McGraw Hill Publishing Co. Ltd., New Delhi, 2001
4. Muniraj, R., "Farm Finance for Development", Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi, 2000.

**AI7592**

**HYDROLOGY**

**L T P C**  
**3 0 0 3**

**OBJECTIVE:**

- To introduce the student to the concept of hydrological aspects of water availability and requirements. At the completion of the course the student should be able to quantify, control and regulate the water resources.

**UNIT I           ATMOSPHERIC WATER SYSTEM**

**9**

Hydrological cycle- Climate – Weather – Layers in atmosphere – Types and forms of precipitation – Hydro meteorological measurements – Cyclones – Winds – Wind – Monsoon – Clouds – Requirements of Precipitation

**UNIT II           HYDROLOGIC PROCESSES**

**10**

Rainfall – Types of Rain gauges – Adequacy of network – Spatial analysis of rainfall data using Thiessen and Isohyetal method – Frequency and Intensity/duration Analysis – Consistency – Missing data – Abstractions – Infiltration – Evaporation – Interception – Process , Estimation and Measurement – Depression and detention storages

**UNIT III          RUNOFF**

**9**

Watershed, catchment and basin – Catchment characteristics – factors affecting runoff - Runoff estimation using empirical – Strange's table and SCS methods – Stage discharge relationships – Flow measurements – Hydrograph – Unit Hydrograph

**UNIT IV          GROUNDWATER AND RAIN WATER HARVESTING**

**9**

Origin – Classification and properties of aquifers – Groundwater potential – Darcy's law - Importance - RWH in rural and urban areas - RWH from building roof and open areas Direct storage sumps - RWH structures.

**UNIT V          FLOODS AND DROUGHTS**

**8**

Natural Disasters – Flood Estimation – Frequency analysis – Flood control – Definitions of droughts – Meteorological, hydrological and agricultural droughts – IMD method –NDVI analysis – Drought Prone Areas Program (DPAP).

**TOTAL: 45 PERIODS**

**TEXT BOOKS:**

1. Subramanya .K. Engineering Hydrology- Tata McGraw Hill, 2013.
2. Jayarami Reddy .P. Hydrology, Tata McGraw Hill, 2008.
3. Raghunath .H.M., Hydrology, Wiley Eastern Ltd., 2004.

**REFERENCES:**

1. David Keith Todd. Groundwater Hydrology, John Wiley & Sons, Inc.2007.
2. Ven Te Chow, Maidment, D.R. and Mays, L.W. Applied Hydrology, McGraw Hill International Book Company, 2010.

**EE7591**

**INTRODUCTION TO CONTROL SYSTEMS**

**L T P C**  
**3 0 0 3**

**AIM**

To learn the concepts of linear Systems theory and its analysis.

**OBJECTIVES**

To impart knowledge on Different system representation, block diagram reduction and Mason's rule.

- Time response analysis of LTI systems and steady state error.
- The open loop and closed loop frequency responses of systems
- Stability concept.
- State variable analysis.



**UNIT I MATHEMATICAL MODELS OF PHYSICAL SYSTEMS 9**

Definition & classification of system – terminology & structure of feedback control theory – Analogous systems - Physical system representation by Differential equations – Block diagram reduction– Signal flow graphs.

**UNIT II TIME RESPONSE ANALYSIS & ROOT LOCUS TECHNIQUE 9**

Standard test signals – Steady state error & error constants – Time Response of I and II order system – Root locus – Rules for sketching root loci.

**UNIT III FREQUENCY RESPONSE ANALYSIS 9**

Correlation between Time & Frequency response – Polar plots – Bode Plots – Determination of Transfer Function from Bode plot.

**UNIT IV STABILITY CONCEPTS & ANALYSIS 9**

Concept of stability – Necessary condition – RH criterion – Relative stability – Nyquist stability criterion – Stability from Bode plot – Relative stability from Nyquist & Bode – Closed loop frequency response.

**UNIT V STATE VARIABLE ANALYSIS 9**

Concept of state – State Variable & State Model – State models for linear & continuous time systems – Solution of state & output equation – controllability & observability.

**TOTAL: 45 PERIODS**

**TEXT BOOKS**

1. Benjamin C. Kuo, Automatic Control Systems, PHI Learning Private Ltd, 2010.
2. J. Nagrath and M. Gopal, Control Systems Engineering, Tata McGraw-Hill Education Private Limited, Reprint, 2010.

**REFERENCES**

1. Richard C. Dorf and Robert H. Bishop, Modern Control Systems, Pearson Education, Third Impression, 2009.
2. Control System Dynamics" by Robert Clark, Cambridge University Press, 1996 USA. ISBN: 0-521-47239-3.
3. John J. D'Azzo, Constantine H. Houpis and Stuart N. Sheldon, Linear Control System Analysis and Design with Matlab, CRC Taylor & Francis, Reprint 2009
4. S. Palani, Control System Engineering, Tata McGraw-Hill Education Private Limited, First Reprint, 2010.
5. Yaduvir Singh and S. Janardhanan, Modern Control, Cengage Learning, First Impression 2010. 6. Katsuhiko Ogata, 'Modern Control Engineering', PHI Learning Private Ltd, 5 th Edition 2011.

**EE7592**

**FUNDAMENTALS OF SOFT COMPUTING**

**L T P C  
3 0 0 3**

**AIM**

To cater the knowledge of Neural Networks, Fuzzy Logic Control, Genetic Algorithm and Evolutionary Programming and their applications for controlling real time systems.

**OBJECTIVES**

- To expose the students to the concepts of feed forward neural networks.
- To provide adequate knowledge about feedback neural networks.
- To teach about the concept of fuzziness involved in various systems.
- To provide adequate knowledge about fuzzy set theory.
- To provide comprehensive knowledge of fuzzy logic control and adaptive fuzzy logic and to design the fuzzy control using genetic algorithm.
- To provide adequate knowledge of application of fuzzy logic control to real time systems.
- To expose the ideas of GA and EP in optimization and control

**UNIT I ARCHITECTURES – ANN 9**  
Introduction – Biological neuron – Artificial neuron – Neuron modeling – Learning rules – Single layer – Multi layer feed forward network – Back propagation – Learning factors.

**UNIT II NEURAL NETWORKS FOR CONTROL 9**  
Feed back networks – Discrete time hop field networks – Transient response of continuous time networks – Applications of artificial neural network - Process identification – Neuro controller for inverted pendulum.

**UNIT III FUZZY SYSTEMS AND FUZZY LOGIC CONTROL 9**  
Classical sets – Fuzzy sets – Fuzzy relations – Fuzzification – Defuzzification – Fuzzy rules - Membership function – Knowledge base – Decision-making logic – Optimisation of membership function using neural networks – Adaptive fuzzy system.

**UNIT IV OPTIMIZATION TECHNIQUES 9**  
Gradient Search – Non-gradient search – Genetic Algorithms: Operators, search algorithm, penalty – Evolutionary Programming: Operators, Search Algorithms – Applications to Electrical problems.

**UNIT V APPLICATION OF FLC 9**  
Fuzzy logic control – Inverted pendulum – Image processing – Home heating system – Blood pressure during anesthesia – Introduction to neuro fuzzy controller.

**TOTAL: 45 PERIODS**

**TEXT BOOKS:**

1. Laurance Fauset, Englewood cliffs, N.J., 'Fundamentals of Neural Networks', Pearson Education, 1992.
2. Timothy J. Ross, 'Fuzzy Logic with Engineering Applications', Tata McGraw Hill, 1997.
3. David Goldberg, "Genetic Algorithms and Machine learning", PHI

**REFERENCES:**

1. Jacek M. Zurada, 'Introduction to Artificial Neural Systems', Jaico Publishing home, 2002.
2. H.J. Zimmermann, 'Fuzzy Set Theory & its Applications', Allied Publication Ltd., 1996.
3. Simon Haykin, 'Neural Networks', Pearson Education, 2003.
4. John Yen & Reza Langari, 'Fuzzy Logic – Intelligence Control & Information', Pearson Education, New Delhi, 2003.
5. Ethem Alpaydin, "Introduction to Machine learning (Adaptive Computation and Machine Learning series)", MIT Press, Second Edition, 2010.
6. Zhang Huaguang and Liu Derong, "Fuzzy Modeling and Fuzzy Control Series: Control Engineering", 2006

**ME7591**

**COMPUTATIONAL MECHANICS OF FLUIDS**

**L T P C**  
**3 0 0 3**

**OBJECTIVES:**

- This course aims to introduce numerical modeling and its role in the field of heat, fluid flow and combustion it will enable the students to understand the various discretisation methods and solving methodologies and to create confidence to solve complex problems in the field of heat transfer and fluid dynamics.
- To develop finite volume discretised forms of the CFD equations.
- To formulate explicit & implicit algorithms for solving the Euler Equations & Navier Stokes Equations.

**PRE-REQUISITE:**

Students should have good exposure to Partial Differential equations. Students must know the basics of Fluid Mechanics and Heat transfer.

**UNIT I GOVERNING DIFFERENTIAL EQUATIONS AND DISCRETISATION 8 TECHNIQUES**

Basics of Heat Transfer, Fluid flow – Mathematical description of fluid flow and heat transfer – Conservation of mass, momentum, energy and chemical species - Classification of partial differential equations – Initial and Boundary Conditions – Discretisation techniques using finite difference methods – Taylor’s Series - Uniform and non-uniform Grids, Numerical Errors, Grid Independence Test.

**UNIT II DIFFUSION PROCESSES: FINITE DIFFERENCE AND FINITE 12 VOLUME METHODS**

Steady one-dimensional diffusion, Two and three dimensional steady state diffusion problems, Discretisation of unsteady diffusion problems – Explicit, Implicit and Crank-Nicholson’s schemes, Stability of schemes.

**UNIT III CONVECTION – DIFFUSION PROCESSES: FINITE VOLUME METHOD 9**

One dimensional convection – diffusion problem, Central difference scheme, upwind scheme – Hybrid and power law discretization techniques.

**UNIT IV FLOW PROCESSES: FINITE VOLUME METHOD 8**

Discretisation of incompressible flow equations – Pressure based algorithms, SIMPLE, SIMPLER & PISO algorithms

**UNIT V TURBULENCE AND ITS MODELLING 8**

Description of turbulent flow, free turbulent flows, flat plate boundary layer and pipe flow. Algebraic Models, One equation model,  $k - \epsilon$  &  $k - \omega$  models Standard and High and Low Reynolds number models.

**TOTAL: 45 PERIODS**

**OUTCOME:**

- On successful completion of this course the student will be able to apply concept of CFD to analyse flow in thermal systems.

**REFERENCES**

1. Muralidhar, K., and Sundararajan, T., “Computational Fluid Flow and Heat Transfer”, Narosa Publishing House, New Delhi, 2003.
2. Muralidhar, K., and Sundararajan, T., “Computational Fluid Flow and Heat Transfer”, Narosa Publishing House, New Delhi, 2003.
3. Subas and V.Patankar “Numerical heat transfer fluid flow”, Hemisphere Publishing Corporation, 1980.
4. Versteeg and Malalasekera, N, “An Introduction to computational Fluid Dynamics The Finite volume Method,” Pearson Education, Ltd., 2007.
5. Taylor, C and Hughes, J.B. “Finite Element Programming of the Navier-Stokes Equation”, Pineridge Press Limited, U.K., 1981.
6. Anderson, D.A., Tannehill, J.I., and Pletcher, R.H., “Computational fluid Mechanics and Heat Transfer” Hemisphere Publishing Corporation, New York, USA, 2012.
7. Fletcher, C.A.J. “Computational Techniques for Fluid Dynamics 1” Fundamental and General Techniques, Springer – Verlag, 1991.
8. Fletcher, C.A.J. “Computational Techniques for fluid Dynamics 2” Specific Techniques for Different Flow Categories, Springer – Verlag, 1988.
9. Bose, T.K., “Numerical Fluid Dynamics” Narosa Publishing House, 1997.

<b>ME7592</b>	<b>PRODUCT DESIGN AND PROCESS DEVELOPMENT</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**OBJECTIVES:**

- To understand the basic concepts of Product Design and Process Development.
- To appreciate the importance and learn various stages of design, creation, selection and development of concepts, managing the processes and prototyping of products.

**UNIT I INTRODUCTION TO PRODUCT DESIGN 9**

Introduction – Characteristics of Product – Challenges in Product Development – Different Development Processes – Generic Product Development Process – Product Development Process Flow – Product Development Organizations – Case Studies.

**UNIT II IDENTIFYING CUSTOMER NEEDS, PRODUCT SPECIFICATIONS 9**

Identification of Customer Needs: Data Collection from customers; interpretation of raw data of customer needs; organization of the needs into a hierarchy; establishment of relative importance of needs; reflecting on the results and the process. Product Specifications: Establishment of Target and Setting - up of Final Specifications – Case Studies.

**UNIT III CONCEPT GENERATION, SELECTION, TESTING 9**

Concept Generation: Five Step process of Concept Generation. Concept Selection: Methodology of concept screening and concepts coring. Concept Testing: Seven Step Activities of concept testing – Case Studies.

**UNIT IV PRODUCT ARCHITECTURE, INDUSTRIAL DESIGN, DESIGN FOR MANUFACTURE 9**

Product Architecture: Implications and Establishing the Architecture – Delayed Differentiation. Industrial Design: Need and Impact–Industrial Design Process. Design for Manufacturing: Five Steps in achieving the Design for Manufacturing – Case Studies.

**UNIT V PROTOTYPING AND PRODUCT DEVELOPMENT ECONOMICS 9**

Prototyping – Principles of Prototyping – Prototyping Technologies – Planning for Prototypes. Elements of Economic Analysis – Four Step activities of economic analysis.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

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

- Launch own ideas and the ideas of others, which would enable them to manage to work with innovation and development in large companies
- Apply new theories on innovation and change, including emerging paradigms such as user- driven innovation, open innovation and market forecasting in practice.

**TEXT BOOK:**

1. Ulrich K.T., Eppinger S. D. and Anita Goyal, "Product Design and Development" McGraw-Hill Education; 5 edition,2015.

**REFERENCES:**

1. Belz A., 36-Hour Course: "Product Development" McGraw-Hill,2010.
2. Rosenthal S., "Effective Product Design and Development", Business One Orwin, Home wood, 1992, ISBN 1-55623-603-4.
3. PughS., "Total Design –Integrated Methods for Successful Product Engineering", Addison
4. Wesley Publishing, 1991, ISBN 0-202-41639-5.

**IE7591**

**INTRODUCTION TO INDUSTRIAL ENGINEERING**

**L T P C**  
**3 0 0 3**

**OBJECTIVE:**

The objective of this course is to provide foundation in Industrial Engineering in order to enable the students to make significant contributions for improvements in diverse organisations.

**UNIT I INTRODUCTION**

**9**

Concepts of Industrial Engineering – History and development of Industrial Engineering – Roles of Industrial Engineer – Applications of Industrial Engineering – Production Management Vs Industrial Engineering – Operations Management – Production System – Input Output Model – Productivity – Factors affecting Productivity – Increasing Productivity of resources – Kinds of Productivity measures.

**UNIT II PLANT LOCATION AND LAYOUT**

**9**

Factors affecting Plant location – Objectives of Plant Layout – Principles of Plant Layout – Types of Plant Layout – Methods of Plant and Facility Layout – Storage Space requirements – Plant Layout procedure – Line Balancing methods.

**UNIT III WORK SYSTEM DESIGN**

**9**

Need – Objectives – Method Study procedure – Principles of Motion Economy – Work Measurement procedures – Work Measurement techniques.

**UNIT IV STATISTICAL QUALITY CONTROL**

**9**

Definition and Concepts – Fundamentals – Control Charts for variables – Control Charts for attributes – Sampling Inspection – Sampling Plans – Sampling Plans.

**UNIT V PRODUCTION PLANNING AND CONTROL**

**9**

Forecasting – Qualitative and Quantitative forecasting techniques – Types of production – Process planning – Economic Batch Quantity – Tool control – Loading – Scheduling and control of production – Dispatching–Progress control.

**TOTAL: 45 PERIODS**

**OUTCOME:**

The students will acquire knowledge on the basics of Industrial Engineering and they will apply these fundamentals knowledge to solve practical problems in different organisations.

**TEXT BOOK:**

1. O.P.Khanna, 2010, Industrial Engineering and Management, Dhanpat Rai Publications.

**REFERENCES:**

1. Ravi Shankar, 2009, Industrial Engineering and Management, Galgotia Publications & Private Limited.
2. Martand Telsang, 2006, Industrial Engineering and Production Management, S. Chand and Company.

**IE7592**

**QUANTITATIVE TECHNIQUES FOR DECISION MAKING**

**L T P C**  
**3 0 0 3**

**OBJECTIVES:**

On successful completion of the course the students should be able:

- To Formulate LP and find optimal solution. Also resolve transportation and assignment problems.
- To find optimal solutions for Net work problems.
- To design inventory system for a production environment.
- To design a queue system and solve practical problems.
- To apply the probability techniques in the decision making.



**UNIT I INTRODUCTION TO ELECTRONICS PACKAGING 9**

History, definition, wafer preparation - crystal growth, crystal trimming and grinding, wafer slicing, edge rounding, lapping, etching, polishing, laser inspection

Printed circuit boards, types- single sided, double sided, multi layer and flexible printed circuit board, design, materials, manufacturing, inspection.

Electronic Packaging - Through hole technology(THT), Surface mount technology(SMT) and Mixed technology

**UNIT II ELECTRONIC COMPONENTS AND PACKAGING 7**

Through hole components – axial, radial, multi leaded, odd form. Surface-mount components-active, passive. Interconnections - chip to lead interconnection, die bonding, wire bonding, TAB, flip chip, chip on board, multi chip module, direct chip array module, leaded, leadless, area array and embedded packaging, package marking and testing. miniaturization and trends.

**UNIT III SURFACE MOUNT TECHNOLOGY PROCESS 12**

SMT equipment and material handling systems, handling of components and assemblies - moisture sensitivity and ESD, safety and precautions needed, IPC and other standards, stencil printing process - solder paste material, storage and handling, stencils and squeegees, process parameters, quality control. Component placement- equipment type, packaging of components for automated assembly, soldering- wave soldering, reflow process, process parameters, profile generation and control, lead free soldering, adhesive, underfill and encapsulation process

**UNIT IV INSPECTION AND TESTING OF POPULATED PCBs 9**

Inspection techniques, equipment and principle - X-ray Radiography, X-ray Laminography, Ultrasonic Imaging, Automated Optical Inspection, Laser Inspection, Infrared Inspection. Testing of PCB assemblies-Manual Testing, Populated Substrate shorts testing, In-Circuit Analysis, In-Circuit Testing, Functional Testing, In-Product Testing.

Defects and Corrective action - stencil printing process, component placement process, reflow soldering process,

**UNIT V REPAIR, REWORK, QUALITY AND RELIABILITY OF ELECTRONICS ASSEMBLIES 8**

Repair tools, methods, rework criteria and process - coating removal, conductor repair, base board repair, Reliability fundamentals, reliability testing, failure analysis, design for manufacturability, assembly, testing, reliability, and environment.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

- Upon completion of this course, the students will have a better understanding of assembly of PCBs and to perform quality inspection and repair & rework on the Printed Circuit Board Assembly.

**TEXT BOOKS:**

1. Prasad R., "Surface Mount Technology – Principles and practice", second Edition, Chapman and Hall, 1997, New York, ISBN 0-41-12921-3.
2. Tummala R.R., "Fundamentals of microsystem packaging", Mc -Graw Hill, 2001, ISBN 00-71-37169-9.

**REFERENCES:**

1. Puligandla Viswanadham and Pratap Singh, "Failure Modes and Mechanisms in Electronic Packages", Chapman and Hall, New York, 1997, N.Y. ISBN 0-412-105591-8.
2. Totta P., Puttlitz K. and Stalter K., "Area Array Interconnection Handbook", Kluwer Academic Publishers, Norwell, MA, USA, 2001. ISBN 0-7923-7919-5.
3. Lee N.C., "Reflow Soldering Process and Trouble Shooting SMT,BGA,CSP and Flip Chip Technologies", 2001, Elsevier Science.
4. Zarrow P. and Kopp D. "Surface Mount Technology Terms and Concepts", 1997, Elsevier Science and Technology,.ISBN 0750698756.

5. Harper C.A., "Electronic Packaging and Interconnection Handbook" Second Edition, McGraw Hill Inc., New York, N.Y., 1997, ISBN 0-07-026694-8.
6. Martin B. and Jawitz W., "Printed Circuit board materials handbook", McGraw-Hill Professional, 1997.

**MF7592                    SUSTAINABLE DEVELOPMENT AND MANUFACTURING**

**L T P C  
3 0 0 3**

**OBJECTIVES:**

To impart knowledge on the principles of balancing social, economic and environmental dimensions for the development and the associated international and national frameworks. To impart knowledge on the creation of manufactured products that use processes that are non-polluting, conserve energy and natural resources, and are economically sound and safe for employees, communities and consumers.

**UNIT I                    SUSTAINABLE DEVELOPMENT AND ENVIRONMENTAL ISSUES                    9**

Sustainable Development - Challenges - Factors - linkages - determinants - Global Environmental Issues - Population, Income, and Urbanization - Health Care - Food, Fisheries and Agriculture - Materials and Energy Flows - Transportation - Precautionary Principle - Forestry - Water Resources - Valuation of Nature's Services - Coping with Global Problems.

**UNIT II                    SUSTAINABLE DEVELOPMENT INDICATORS                    9**

Need for Indicators - Statistical Procedures - Emissions, Diffusion and Impact Model - Aggregating Indicators - Other Weighting Systems - Use of Principal Component Analysis - Three Environmental Quality Indices - Environmental Assessment - Milestones in Environmental Management - Millennium Development Goals - Legislation, International Law and Multilateral Environmental Agreements.

**UNIT III                    SOCIAL DIMENSIONS                    9**

Social Dimensions and Policies - Social Development Indicators - The Economics of Sustainability - Sustainability: Externalities, Valuation and Time Externalities - Natural Resource Accounting - International Cooperation - Organizations Responsible for Sustainable Development - Peoples' Earth Charter - Sustainable Development: Crisis, Conflict and Compromise.

**UNIT IV                    SUSTAINABLE MANUFACTURING                    9**

Value Creation by Sustainable Manufacturing - Global Value Creation - Modelling - Lean Production Systems - Cleaner Production - Manufacturing Processes and Equipment - Process Improvement - Product - Production System - Combinations - Dry and Cryogenic Machining - Remanufacturing, Reuse and Recycling - Product Design for Resource Efficiency and Effectiveness.

**UNIT V                    ENERGY, ENVIRONMENT AND ECONOMICS OF SUSTAINABLE  
MANUFACTURING                    9**

Innovative Energy Conversion - Green Supply Chain and Transportation - Adequate Environments for Entrepreneurial Initiative - Technology and Motivation in the Use of Renewable Energy - Enterprise Innovativeness - Knowledge Sharing - Economics for Sustainable Development.

**TOTAL :45 PERIODS**

**OUTCOME:**

Upon completion of this course, the students will have a better understanding of the concept of sustainable development and be able to create products that use processes that are non - polluting, conserve energy and natural resources, and are economically sound and safe for people.



**TEXT BOOKS:**

1. Peter P. Rogers, Kazi F. Jalal and John A. Boyd, An Introduction to Sustainable Development, Glen Educational Foundation, 2008.
2. Sustainable Manufacturing: Shaping Global Value Creation, edited by Gunther Seliger, Springer Science & Business Media, 2012.

**REFERENCES:**

1. Sayer. J. and Campbell. B., "The Science of Sustainable Development: Local Livelihoods and the Global Environment" (Biological Conservation, Restoration & Sustainability), Cambridge University Press, London, 2003.
2. Kirby. J., O Keefe P. and Timberlake, "Sustainable Development", Earth scan Publication, London, 1993.
3. Jennifer A. Elliott, "An Introduction to Sustainable Development", London: Routledge: Taylor and Francis group, 2001.
4. Low. N. Global Ethics and Environment, London: Routledge, 1999.
5. Douglas Muschett, Principles of Sustainable Development, St.Lucie Press, 1997.
6. J. Paolo Davim, Sustainable Manufacturing, John Wiley & Sons, 2013.
7. Mrityunjay Singh, Tatsuki Ohji, Rajiv Asthana, Green and Sustainable Manufacturing of Advanced Material, Elsevier, 2015.

**PT7591****DIGITAL PHOTOGRAPHY****L T P C  
3 0 0 3****OBJECTIVES**

The students should be made to:

- Understand the principles of digital photography and its applications.
- Learn about Lighting techniques and image editing soft wares
- Gain knowledge on the different techniques and genres of photography

**UNIT I INTRODUCTION****9**

History of Photography, Basics of Digital Photography, Basic art and Visualizations, Types of digital photography, Types of Digital Cameras and accessories, Parts of a Camera, Camera lenses, Exposures - Apertures, shutter speeds and ISO, Applications of digital photography.

**UNIT II LIGHT AND LIGHTING TECHNIQUES****9**

Colour Temperature, Electromagnetic spectrum, Different types of Lights and their applications – Soft light, Hard light, Available Light, Key-Low, High, Side, Fill Light, Kicker, Background light. Three point lighting; Five point lighting, Light Reflectors and Diffusers. Light meters and Light measuring Devices.

**UNIT III PHOTOJOURNALISM****9**

Introduction to photojournalism, Documenting, Presenting news using photographs, Different types of photojournalism, Picture editing for Newspaper and magazines, Role of a photo editor, Telling stories through pictures, Ethics in Photojournalism.

**UNIT IV DIGITAL RETOUCHING AND DIGITAL OUTPUT****9**

Image size and Resolution, Selection of Tools and Techniques for Digital Manipulation, Image compression and file formats. Selective Effects to images and filters, Image Processing software – Adobe Photoshop; Color and Tonal value correction, Ethics in image editing; Evaluating an image and imaging problems.

**UNIT V GENRES OF PHOTOGRAPHY AND PORTFOLIO MAKING****9**

Black and white photography, Wildlife photography, Landscape, Cityscape, Architecture, Advertising, Fashion, Food, Automobile, Sports, Travel, Children, Thematic photography, Portfolio making, Case studies and Photography in online applications.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

Upon completion of the course, the student should be able to:

- Use appropriate techniques for acquiring digital images.
- Edit and Retouch a digital Image.
- Design a portfolio with digital photography.

**TEXT BOOKS:**

1. Scott Kelby, "The Digital Photography Book", 3rd edition, Peachpit Press, 2009
2. Ben long, "Complete Digital Photography", Charles River Media, Third Edition, 2005.

**REFERENCES:**

1. Fil Hunter, Steven Biver, "Paul Fuqua, Light-Science & Magic: An Introduction to Photographic Lighting", Focal Press, 2007
2. Balakrishna Aiyer, "Digital Photojournalism", Authors press, 2005.

**PT7592****CREATIVITY AND INNOVATION****L T P C  
3 0 0 3****OBJECTIVES**

The students should be made to:

- Understand the nuances involved in Creativity & Innovation.
- Get hands on experience in applying creativity in problem solving.

**UNIT I INTRODUCTION****9**

Need for Creative and innovative thinking for quality, components of Creativity, Methodologies and approaches, individual and group creativity, organizational role in creativity, types of innovation, barriers to innovation, innovation process, establishing criterion for assessment of creativity & innovation.

**UNIT II THINKING AND VISUALIZATION****9**

Definitions and theory of functioning of mind heuristics and models: attitudes, Approaches and Actions that support creative thinking - Advanced study of visual elements and principles- line, plane, shape, form, pattern, texture gradation, color psychology & symmetry. Techniques to enhance visualization – provocation, cross fertilize, mastermind, OPV, Brain gym.

**UNIT III CREATIVITY****9**

Methods and tools for Directed Creativity – Basic Principles – Tools that prepare the mind for creative thought – stimulation – Development and Actions: Processes in creativity ICEDIP – Inspiration, Clarification, Distillation, Perspiration, Evaluation and Incubation – Creativity and Motivation.

**UNIT IV CREATIVE PROBLEM SOLVING****9**

Generating and acquiring new ideas, product design, service design – case studies and hands-on exercises, stimulation tools and approaches, six thinking hats, lateral thinking – Individual activity, group activity, Brainstorming, Brain writing.

**UNIT V INNOVATION****9**

Achieving Creativity – Introduction to TRIZ methodology of Inventive Problem Solving - the essential factors – Innovator's solution – creating and sustaining successful growth – Disruptive Innovation models.

**TOTAL: 45 PERIODS****OUTCOME:**

Upon completion of the course, the student should be able to:

- Apply his/her creative and innovative skills in solving complex problems confronting corporate realm.

## TEXT BOOK

1. Floyd Hurr, "Rousing Creativity: Think New Now" ISBN 1560525479, Crisp Publications Inc. 1999

## REFERENCES

1. Geoffrey Petty, "How to be better at Creativity", The Industrial Society, 1999
2. Clayton M. Christensen Michael E. Raynor, "The Innovator's Solution", Harvard Business School Press Boston, USA, 2003
3. Semyon D. Savransky, "Engineering of Creativity – TRIZ", CRC Press New York USA, 2000

MI7591

## TUNNELLING ENGINEERING

L T P C  
3 0 0 3

### OBJECTIVES:

- To introduce the basic concept of tunnelling & ground improvement techniques
- Students will be able to understand the fundamentals design of tunnels
- Students will be able to recognize the different types of tunnelling methods, operations and equipment.

### UNIT I INTRODUCTION

8

Terminology & general aspects, historical developments of tunnelling, classification of tunnelling methods, merits and demerits, conditions favourable for tunnel construction - parameters influencing location, shape and size; surface and subsurface conditions; planning and site investigations like geology, hydrogeology, geological disturbances etc.,

### UNIT II GEOMECHANICS

8

Classification and characterisation of rock mass and soil, in-situ determination of engineering properties of rock mass, geotechnical exploration for soil profile, effect of geological structures on tunnel excavation, stress analysis using numerical methods; instrumentation and measurements in tunnelling.

### UNIT III CONVENTIONAL TUNNELLING METHODS

10

Factors affecting choice of excavation technique; various tunnelling methods - soft ground and hard rock, shallow tunnelling, deep tunnelling; Scaling factor using their properties in tunnel design; Operation cycles in conventional tunnelling; selection of drilling equipment, drilling tools, drillability factors; types of drilling patterns and vertical drilling; selection of blasting techniques - explosives, initiators,; blast design, tunnel blast performance - powder factor, equipment selection for mucking and transportation.

### UNIT IV MODERN TUNNELLING METHODS

10

Tunnelling by roadheaders and impact hammers - cutting principles, method of excavation, selection, limitations and technical problems, tunnel boring machines - boring principles, method of excavation, selection, performance, limitations and technical challenges, scope of application, special methods - New Austrian tunnelling; Immersed tunnelling, micro tunnelling, tunnel jacking, technical considerations and limitations.

### UNIT V SUPPORTS, VENTILATION AND SAFETY

9

Ground squeeze, rock burst, types of supports, design and selection of support - lining, rock bolt, grouting, ground treatment in tunnelling, tunnel ventilation systems during and after completion - methods of ventilation, air conditioning, tunnelling utilities - lighting and drainage of tunnels, risk management of tunnelling; Safety aspects in road, rail tunnels and metro tunnels.

### OUTCOMES

The students will able to design the tunnel for the given geo-technical conditions and choose the type of the equipment and operations.

## REFERENCES

1. Bernhard M. Markus T. Ulrich M., "Handbook Of Tunnel Engineering I & II: Basics And Additional Services For Design And Construction", John Wile Publications, 2014.
2. Brady B H G, Brown E T, "Rock Mechanics: for Underground Mining", Springer's Publishers, 3<sup>rd</sup> Edition, 2004.
3. Champan D, "Introduction to Tunnel Construction", CRC Press, 1<sup>st</sup> Editions, 2010.
4. Kuesel, T. R., King, E. H., Bickel, J. O. , "Tunnel Engineering Handbook", Springer US, 2<sup>nd</sup> edition, 2011.
5. Ramamurthy T N, "Engineering in Rocks for Slopes Foundations and Tunnels", PHI Learning Pvt Ltd, 2<sup>nd</sup> Edition, 2010.
6. Subhash C Saxena, "Tunnel Engineering", Dhanpat Rai & Sons , New Delhi, 1998.
7. Srinivasan R, Bhaskar R C, "Harbour, Dock and Tunnel Engineering", Charotar Publishers, 2003.

**CS7591**

**PYTHON PROGRAMMING**

**L T P C**  
**3 0 0 3**

### OBJECTIVES:

- To introduce Object Oriented Programming using an easy-to-use language.
- To use iterators and generators.
- To test objects and handle changing requirements.
- To be exposed to programming over the web.

### UNIT I INTRODUCTION TO PYTHON

**9**

Function Declaration - Import - Objects - Indenting as Requirement - Exceptions - Unbound Variables - Case Sensitive - Scripts - Native Data Types - Booleans - Numbers - Lists - Tuples - Sets - Dictionaries - Comprehensions - List Comprehensions - Dictionary Comprehensions - Set Comprehensions.

### UNIT II STRINGS

**9**

Strings - Unicode - Formatting - String Methods - Bytes - Encoding - Regular Expressions - Verbose - Case Studies

### UNIT III CLASSES

**9**

Closures - List of Functions - List of Patterns - File of Patterns - Generators - Defining Classes - Instantiating Classes - Instance Variables - Iterators – Itertools - Assert - Generator Expressions

### UNIT IV FILES

**9**

Reading and Writing Text Files - Binary Files - Stream Objects - Standard Input, Output and Error.

### UNIT V XML and SERIALIZATION

**9**

XML - Atom Feed - Parsing HTML - Searching for Nodes - html - Generation - Serializing Objects - Pickle Files - Versions - Debugging - Serializing to JSON

**TOTAL: 45 PERIODS**

### OUTCOMES:

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

- Understand the concepts of object oriented programming.
- Use generators and iterators
- Develop test cases and handle refactoring.
- Use objects to program over the web.

**TEXTBOOKS:**

1. Mark Pilgrim, "Dive into Python 3", Apress, 2009.
2. Allen Downey, Jeffrey Elkner, Chris Meyers, "How to Think Like a Computer Scientist - Learning with Python", Green Tea Press, 2002.

**REFERENCES:**

1. John V. Guttag, "Introduction to Computation and Programming using Python", Prentice Hall of India, 2014.
2. Mark Lutz, "Learning Python: Powerful Object-Oriented Programming", Fifth Edition, O'Reilly, Shroff Publishers and Distributors, 2013.

CS7592

WEB DESIGN AND MANAGEMENT

L T P C  
3 0 0 3**OBJECTIVES:****To understand the issues and process of Web design.**

- To learn the concepts of Web design patterns and page design.
- To understand and learn the scripting languages with design of web Applications.
- To learn the maintenance and evaluation of web design Management.

**UNIT I SITE ORGANIZATION AND NAVIGATION****8**

User centered design – Web medium–Web design process– Basics of web design –Introduction to software used for web design – DOBE IMAGE READY, DREAM WEAVER, FLASH etc – Evaluating process – Site types and architectures – Navigation theory – Basic navigation practices –Search – Sitemaps.

**UNIT II ELEMENTS OF PAGE DESIGN****9**

Browser compatible design issues – Pages and Layout – Templates – Text – Color –Images – Graphics and Multimedia – GUI Widgets and Forms – Web Design patterns – STATIC pages: Slice – URL in ADOBE IMAGEREADY. Creation and Editing of sitemap – layer, tables, frameset, - CSS style – Forms –tools like insert, rollover etc., in DREAMWEAVER

**UNIT III SCRIPTING LANGUAGES AND ANIMATION USING FLASH****10**

Client side scripting: XHTML – DHTML – JavaScript – XML Server side scripting: Perl –PHP – ASP / JSP Designing a Simple web application - Introduction to MACROMEDIA FLASH, importing other file formats to Flash – saving and exporting Flash files, Frame by frame animation – Motion Tweening – Shape Tweening

**UNIT IV PRE-PRODUCTION MANAGEMENT****9**

Principles of Project Management – Web Project Method – Project Road Map – Project Clarification – Solution Definition – Project Specification – Content – Writing and Managing content.

**UNITV PRODUCTION, MAINTENANCE AND EVALUATION****9**

Testing, Launch and Handover – Maintenance – Review and Evaluation – **Case Study:-** Using the skills and concepts learnt with the ADOBE IMAGEREADY, DREAMWEAVER, FLASH, and scripts

**TOTAL: 45 PERIODS****OUTCOMES:****Upon completion of the course, the students will be able to**

- Identify the various issues of web design process and evaluation.
- Determine templates for web pages and layout.

- Develop simple web applications using scripting languages.
- Determine the various issues of web project development.
- Address the core issues of web page maintenance and evaluation.

#### REFERENCES:

1. Thomas A. Powell, "The Complete Reference – Web Design", Tata McGraw Hill, Third Edition, 2003.
2. Ashley Friedlein, "Web Project Management", Morgan Kaufmann Publishers, 2001.
3. H.M.Deitel, P.J.Deitel, A.B.Goldberg, "Internet and World Wide Web– How to Program", Third Edition, Pearson Education 2004.
4. Joel Sklar, "Principles of Web Design", Thomson Learning, 2001.
5. Van Duyn, Landay, and Hong "The Design of Sites: Patterns for creating winning websites", 2<sup>nd</sup> Edition, Prentice Hall, 2006.
6. Lynch, Horton and Rosenfeld, "Web Style Guide: Basic Design Principles for Creating Web Sites", 2<sup>nd</sup> Edition, Yale University Press, 2002.
7. Photoshop 7 Bible Professional Edition, Wiley John & Son INC, New York, Deke McClelland, 2000.
8. Flash Web Design, The Art of Motion Graph, Curtis Hillman, New Riders Publishing, Indianapolis, IN, U.S.A, 2000
9. M.E. Morris, and R.J. Hinrichs, Web Page Design, Prentice Hall, 1996.
10. Mark Von Wodtke, Mind over Media: Creative Thinking Skills for Electronic Media, McGraw-hill, New York, 1993
11. Adobe Flash CS3 professional on demand by Steve Johnson, Andy Anderson, Perspection inc, 2012.
12. Adobe Photoshop CS3 studio techniques, Ben Wilmore, 2012.
13. Adobe Dreamweaver CS6 classroom in a book, Adobe creative team, 2012.

**EC7591**

**CONSUMER ELECTRONICS**

**L T P C**  
**3 0 0 3**

#### **UNIT I CONSUMER ELECTRONICS FUNDAMENTALS**

**9**

History of Electronic Devices- Vacuum Tubes, Transistors, Integrated Circuits- Moore Law, Semiconductor Devices, Diodes, Rectifiers, Transistors, Logic Gates, Combinational Circuits, ADC, DAC and Microprocessors, Microprocessor Vs Microcontrollers, Microcontrollers in consumer electronics, Energy management, Intelligent Building Perspective.

#### **UNIT II ENTERTAINMENT ELECTRONICS**

**9**

Audio systems: Construction and working principle of : Microphone, Loud speaker, AM and FM receiver, stereo, 2.1 home theatre, 5.1 home theatre . Display systems: CRT, LCD, LED and Graphics displays Video Players : DVD and Blue RAY. Recording Systems: Digital Cameras and Camcorders.

#### **UNIT III SMART HOME**

**9**

Technology involved in Smart home, Home Virtual Assistants- Alexa and Google Home. Home Security Systems - Intruder Detection, Automated blinds, Motion Sensors, Thermal Sensors and Image Sensors, PIR, IR and Water Level Sensors.

#### **UNIT IV HOME APPLIANCES**

**9**

Home Enablement Systems: RFID Home, Lighting control, Automatic Cleaning Robots, Washing Machines, Kitchen Electronics- Microwave, Dishwasher, Induction Stoves, Smart Refrigerators, Smart alarms, Smart toilet, Smart floor, Smart locks.

## **UNIT V COMMUNICATION SYSTEMS**

**9**

Cordless Telephones, Fax Machines, PDAs- Tablets, Smart Phones and Smart Watches. Introduction to Smart OS- Android and iOS. Video Conferencing Systems- Web/IP Camera, Video security, Internet Enabled Systems, Wi-Fi, IoT, Li-Fi, GPS and Tracking Systems.

### **TEXT BOOKS:**

1. Thomas L Floyd "Electronic Devices" 10th Edition Pearson Education Asia 2018.
2. Philp Hoff "Consumer Electronics for Engineers" - Cambridge University Press.1998.
3. Jordan Frith, " Smartphones as Locative Media ", Wiley. 2014.
4. Dennis C Brewer, " Home Automation", Que Publishing 2013.
- 5.Thomas M. Coughlin, "Digital Storage in Consumer Electronics", Elsevier and Newness 2012.

**EC7592**

## **PRINCIPLES OF MODERN COMMUNICATION SYSTEM**

**L T P C**  
**3 0 0 3**

### **UNIT I**

**9**

The evolution of electronic communication: From smoke signals to smart phones - History of communications: Theoretical Foundations, Development & Applications - Frequencies for communication - Frequency regulations - Overview of communication transmitter and receiver.

### **UNIT II**

**9**

Mobile Cellular Communications: Evolution to cellular networks – Cellular systems generations and standards: 1G, 2G, 3G, 4G - Cellular network components - Components of a mobile phone - setting up a call process - Making a call process - Receiving a call process - Spectrum allocation: Policies and strategies, Role of TRAI.

### **UNIT III**

**9**

Wireless Communication: Introduction - Bluetooth - Infrared communication - IEEE Wireless LANs (Wi-Fi) - IEEE 802.16 (WiMaX) - Future mobile and wireless networks: Introduction to 5G- device to device communication- IoT.

### **UNIT IV**

**9**

Satellite: History of Satellite communication, Basics of Satellites, Types of Satellites, Capacity Allocation - Launch Vehicles and Orbits: Introduction to launching vehicles, Important Orbits, working of rocket, Three Pioneers of Rocketry - Basics of Global Positioning System (GPS) - Applications of GPS.

### **UNIT V**

**9**

RADAR & NAVIGATION: Introduction, Radar Block diagram and Operation, Radar Frequencies, Applications of Radar. Navigation Systems: Introduction & methods of navigation, Instrument Landing System, Microwave landing system- Modern Navigation systems.

### **REFERENCES:**

1. S.Haykin, —Communication Systems, 4/e, John Wiley 2007
2. B.P.Lathi, —Modern Digital and Analog Communication Systems, 3/e, Oxford University Press,2007
3. Rappaport Theodore S - Wireless Communications: Principles and Practice, 2/E, Pearson Education India, 2010
4. Vijay. K. Garg, —Wireless Communication and Networking, Morgan Kaufmann Publishers, 2007.
5. T.Pratt, C. Bostian and J.Allnutt; —Satellite Communications, John Wiley and Sons, Second Edition., 2003
6. M. I .Skolnik —Introduction to Radar Systems, Tata McGraw Hill 2006.
7. Myron Kyton and W.R.Fried —Avionics Navigation Systems, John Wiley & Sons 1997.

**OBJECTIVES:**

- To have a clear understanding of the concepts of Telemedicine, including basic terminologies, services, impact and challenges of telemedicine.
- To understand the generic architecture of telemedicine systems and Constituents of each sub-system of telemedicine.
- To know the computer and networking technologies for telemedicine.
- To understand health records and data management for health care services.
- To implement and understand clinical cum technical aspects of telemedicine.

**UNIT I INTRODUCTION TO TELEMEDICINE 9**

Definitions of telemedicine – History of telemedicine – Organs and Forms of telemedicine – Evolution and benefits of telemedicine – Impact of telemedicine on healthcare delivery – Issues in telemedicine – Type of digital information (audio, video, still images, text and data)

**UNIT II ARCHITECTURE OF TELEMEDICINE SYSTEMS 9**

Telemedicine as a system – Critical sub-systems of telemedicine – Regulatory sub-systems – Optional sub-system of telemedicine – Telecommunications Approach – Elements of telecommunications systems – PTOS, Wireless System. Modalities of telecommunications systems (e-health) – Wireless Communication and Satellite Communications – VSAT based dedicated videoconferencing system – Mobile applications of telemedicine (m-health).

**UNIT III COMPUTER AND NETWORKING TECHNOLOGIES FOR TELEMEDICINE 9**

Internet based telemedicine practices – WWW approach - Applied web browser for healthcare practice – PC based Audio and Video conferencing – Types of network topologies – LAN, WAN and Body Sensor – Personal Area Network (Adhoc network) – 3 tier architecture model.

**UNIT IV DATA AND INFORMATION STANDARDS IN TELEMEDICINE 9**

Role of standards in Healthcare – Health Level Seven (HL7) – Digital Imaging and Communication in Medicine (DICOM), Logical Observation Identifiers Names and Codes (LOINC), Systematized Nomenclature of Medicine – Clinical Terms (SNOMED) Adoption of Information Systems Standards in Healthcare – Ethical and legal aspects of telemedicine, confidentiality of data, and the law, patient rights and consent-Security /access to medical Records, reimbursements. Values to the Patient, Clinician, and Health Care Organization training, cost, administration, Challenges to Successful Implementation – Healthcare Management Information Systems.

**UNIT V CLINICAL AND TECHNICAL ASPECTS OF TELEMEDICINE 9**

Applications of telemedicine – Perspective of clinicians – Telemedicine and diagnostic imaging (teleradiology) – Telemedicine and monitoring of physiological parameters (telehealth) – Telemedicine and surgery (telesurgery). m-health - Diffusion of IT innovations in Healthcare – Healthcare Status, Delivery Systems & Issues in Developing Countries like India – Future of Healthcare – Challenges and Future Trends including Opportunities for rural and emergency /disaster healthcare projects.

**TOTAL:45 PERIODS****OUTCOMES:**

- Demonstrates understanding of the underlying technology principles of a telemedicine system (TMS).
- Demonstrates awareness of the main approaches to providing remote solutions to deliver patient care.
- Evaluate the process and business considerations when defining and implementing a TMS in the remote.



**TEXT BOOKS:**

1. Olga Ferrer Roca, M.Sosa Iudicissa (editors), "Hand book of Telemedicine", IOS press, 2002.
2. Norris.A.C, "Essentials of Telemedicine and Telecare", John Sons & Ltd, 2002.

**REFERENCES:**

1. Wootton R, Craig J, Patterson V, "Introduction to Telemedicine", Royal Society of Medicine Press Ltd, London, 2<sup>nd</sup> edition, 2006, ISBN 1-85315-425-3.
2. Maheu, M.M.Whitten, P.Allen, "E-Health, Telehealth, and Telemedicine" Jossy-Bass, New York, 2001 ISBN: 0-7879-4420-3.
3. Latifi, R. "Current Principles and Practices of Telemedicine and e-Health" IOHS Press, Washington DC, 2008 ISBN: 978-1-85603-806-09.
4. Bashshur, R.L., Shannon G.W. "History of Telemedicine", New Rochelle NY: Mary Ann Liebert Publishers, 2009 ISBN: 978-1-934854-11-2.

**BM7592****ELECTRONICS IN MEDICINE****L T P C  
3 0 0 3****UNIT I ELECTRONICS IN CARDIOLOGY****9**

Physiology of Heart and its abnormalities, Cardiac Monitoring and Recording Devices- ECG, Pacemaker, Defibrillators, Counter pulsation technique, Intra aortic balloon pumping and prosthetic heart valves and Imaging for cardiovascular system.

**UNIT II ELECTRONICS IN NEUROLOGY****9**

Neurons and its abnormalities, EEG, Evoked response – Auditory and Visual sensory, Polysomnography, nerve stimulator and Imaging for brain disorders.

**UNIT III ELECTRONICS IN NEPHROLOGY****9**

Nephrons and its abnormalities, Principle of Haemodialysis, Membrane, Dialysate, Different types of haemodialysers, Artificial kidney, Lithotripsy.

**UNIT IV ELECTRONICS IN CIRCULATORY SYSTEM****9**

Interrelationships among Pressure, Flow, and Resistance, Blood and blood components, blood cell counters, Methods for blood flow meter, EM and ultrasonic blood flow meters, Blood Pressure, Plethysmography technique, Heart Lung machine, Respiration rate, Respiratory volume measurement, spirometer, Ventilators.

**UNIT V ELECTRONICS IN VISUAL AND AUDITORY SYSTEM****9**

Anatomy of eye and its abnormalities, Laser in ophthalmology, Ear and its abnormalities Types of Deafness, Audiometer, Hearing Aids and cochlear implants.

**TOTAL: 45 PERIODS****REFERENCES:**

1. Guyton, Arthur C & John E. Hall, Text book of Medical Physiology – WB Jaunders company Philadelphia – 11<sup>th</sup> edition 2006.
2. Webster J.G Medical Instrumentation application and design – John Wiley and sons New York 4<sup>th</sup> edition 2010.
3. Khandpur R.S Hand Book of Biomedical Instrumentation – Tata Mc Graw Hill publication , New Delhi 3<sup>rd</sup> edition 2014.
4. Joseph J Carr and John m Brown – Introduction to Biomedical equipment Technology- Pearson Education 4th edition New Delhi 2001.

**OBJECTIVES:**

- To learn the characteristics of mobile applications.
- To learn about the intricacies of UI required by mobile applications.
- To study about the design aspects of mobile application.
- To learn development of mobile applications.

**UNIT I INTRODUCTION****9**

Mobile Applications – Characteristics and Benefits – Frameworks and Tools – Introduction to Java – Classes and Objects – Inheritance – Packages and Interfaces – Strings – I/O – Event handling.

**UNIT II USER INTERFACE****9**

Generic UI Development – Multimodal and Multichannel UI – Designing the right UI– Introduction to XML –XML basics – Attributes – DTD - XML schema – Screen Elements and Layouts.

**UNIT III TOOLS****9**

Google Android Platform – Android Application Architecture – Android Studio – Android Widgets and Menus – Event handling – Packaging and Deployment - Apple iPhone Platform

**UNIT IV APPLICATION DESIGN****9**

Memory Management – Design patterns for limited memory – Work flow for Application Development – Techniques for composing Applications – Intents and Services – Fragments – Graphics – Animation.

**UNIT V APPLICATION DEVELOPMENT****9**

Storing and Retrieving data – Communication via the Web – Notification and Alarms – Telephony – Location based services – Apps with Firebase Real Time Database – Project on respective Discipline.

**TOTAL: 45 PERIODS****OUTCOMES:****On Completion of the course, the students should be able to:**

- To design and implement the user interfaces for mobile applications.
- To design the mobile applications that is aware of the resource constraints of mobile devices.
- To develop advanced mobile applications that accesses the databases and the web.
- To develop useful mobile applications in the current scenario using Google Android Studio.

**TEXT BOOKS:**

1. Jeff Friesen, "Learn Java for Android Development: Java 8 and Android" 5th Edition Paperback – 2014
2. Share Conder, Lauren Darcey, "Android Wireless Application Development" Pearson 3<sup>rd</sup> Edition.

**REFERENCES:**

1. Zigurd Mednieks, Laird Dornin, G, Blake Meike and Masumi Nakamura, —Programming Androidll, O'Reilly, 2011.
2. Professional mobile Application Development paperback,2012 Jeff Mcherter (Author),Scott Gowell (Author), Wiley India Private Limited
3. Reto Meier, Wrox Wiley, —Professional Android 2 Application Developmentll, 2010.
4. Alasdair Allan, —iPhone Programmingll, O'Reilly, 2010.
5. Wei-Meng Lee, —Beginning iPhone SDK Programming with Objective-Cll, Wrox Wiley, 2010.
6. Stefan Poslad, —Ubiquitous Computing: Smart Devices, Environments and interactionsll, Wiley, 2009.
5. Pro iOS Table Views: for iPhone, iPad and iPod Touch Paperback,2012, Tim Duckett, Apress
6. iOS Programming: The Big Nerd Ranch Guide Paperback, 2014, Joe COnway, Aaron Hilegass, Christian Keur.

7. iOS in Practise Paperback, 2012, Bear Cachil.
8. Mobile Authentication: Problems and Solutions (SpringerBriefs in Computer Science) Paperback, 2012, Markus Jakobsson.
9. Android App Development for Young Adults & The Rest of US Paperback, 2015, Paula Beer, Carl Simmons.
10. Oracle Mobile Application Framework Developer Guide: Build Multiplatform Enterprise Mobile Apps Paperback, 2014, Luc Bros.
12. Herbert Schildt, "Java : The Complete Reference", Ninth Edition –The McGraw-Hill, 2014.
13. Heather Williamson, "XML : The Complete Reference", The McGraw-Hill, 2001.

**IT7592**

**INFORMATION TECHNOLOGY ESSENTIALS**

**L T P C  
3 0 0 3**

**OBJECTIVES:**

- To introduce the principles required for building web applications.
- To provide working knowledge of the technologies needed for web application development
- To know about scripting languages.
- To understand principles of database access and storage.
- To understand various applications related to Information Technology.

**UNIT I WEB ESSENTIALS**

**9**

Creating a Website - Working principle of a Website - Browser fundamentals - Authoring tools - Types of servers: Application Server - Web Server - Database Server – HTML basics – HTML tags and their use

**UNIT II SCRIPTING ESSENTIALS**

**9**

Need for Scripting languages - Types of scripting languages - Client side scripting - Server side scripting - PHP - Working principle of PHP - PHP Variables - Constants - Operators – Flow Control and Looping - Arrays - Strings - Functions - File Handling - PHP and HTML - Cookies – Sessions - Authentication – Introduction to JavaScript

**UNIT III DATABASE ESSENTIALS**

**9**

Database management - Database terms - MySQL - commands – Data types – Indexes – Functions – Accessing MySQL using PHP.

**UNIT IV NETWORKING ESSENTIALS**

**9**

Fundamental computer network concepts - Types of computer networks - Network layers - TCP/IP model - Wireless Local Area Network - Ethernet - WiFi - Network Routing - Switching - Network components

**UNIT V APPLICATION ESSENTIALS**

**9**

Creation of simple interactive applications - Simple database applications - Multimedia applications - Design and development of information systems – Personal Information System – Information retrieval system – Social networking applications

**TOTAL: 45 PERIODS**

**OUTCOMES:**

**Student will be able to**

- Design and deploy web-sites
- Design and deploy simple web-applications
- Create simple database applications
- Develop an information system
- Describe the basics of networking

**TEXT BOOKS:**

1. Robin Nixon, "Learning PHP, MySQL, JavaScript, CSS & HTML5" Third Edition, O'REILLY, 2014.
2. James F. Kurose, "Computer Networking: A Top-Down Approach", Sixth Edition, Pearson, 2012.

**REFERENCES:**

1. Gottapu Sasibhushana Rao, "Mobile Cellular Communication", Pearson, 2012.
2. R. Kelly Rainer , Casey G. Cegielski , Brad Prince, Introduction to Information Systems, Fifth Edition, Wiley Publication, 2014.
3. it-ebooks.org

**LT7591****LEATHER MANUFACTURE****L T P C  
3 0 0 3****AIM**

- This course aims at introducing the fundamentals of chemistry and technology of leather manufacture.

**OBJECTIVES**

- Through this course the student gains an appreciation of the underpinning science and technology involved in manufacturing of leathers.

**UNIT I RAW MATERIALS AND PRESERVATION****5**

Origin and characteristics of hides and skins; Categories of livestock; Grading systems; Defects in hides and skins; Various preservation techniques and their principles.

**UNIT II PRETANNING PROCESSES****10**

Principles and objectives of beamhouse processes viz., soaking, liming, reliming, deliming, bating, pickling, depickling and degreasing.

**UNIT III TANNING PROCESSES****10**

Definition and objectives of tanning; Types and basic chemistry of vegetable tannins; Basic chemistry of basic chromium sulfate; Principles involved in vegetable and chrome tanning and their mechanism in brief; Combination tannages.

**UNIT IV POST TANNING PROCESSES****10**

Types of syntans; Basic chemistry of phenolic and acrylic syntans; Types of fatliquors; Basic chemistry of fatliquors; Types of dyes; Basic chemistry of acid, basic, direct and metal complex dyes; Principles and objectives of post tanning processes viz., neutralisation, retanning, dyeing and fatliquoring; Various unit operations involved.

**UNIT V FINISHING TECHNIQUES****10**

Types of binders; Basic chemistry of protein, resin and PU binders; Types of pigments; Basic characteristics of pigments; Basic theory of coating; Principles and objectives of finishing; Classification of finishing; Types of auxiliaries and finishes.

**TOTAL : 45 PERIODS****TEXT BOOKS**

1. Sarkar, K.T., Theory and Practice of Leather Manufacture Ajoy Sorcor, Madras, 1981.
2. Dutta, S.S., Introduction to the Principles of Leather Manufacture, Indian Leather Technologists Association, Calcutta, 1980.
3. Thorstenson, T.C., Practical Leather Technology, Robert E. Krieger Publishing Co., alabar, Florida, 1985.
4. Fred O Flaherty, Roddy, T.W. and Lollar, R.M. 'The Chemistry and Technology of Leather', Vol.I & II, Type of tannages, Rober E. Krieger Publishing Co., New York, 1977.
5. Beinkiewicz, K. 'Physical Chemistry of Leather Making', Robert E. Krieger Publishing Co., Florida, 1983.

## REFERENCE

1. Koteswara Rao, C., and Olivannan, M.S., Lecture Notes on dyeing and finishing of leathers, CLRI, Madras, 1983.

LT7592

SKIN PROTEINS

L T P C  
3 0 0 3

### AIM

- To understand the basic structure and function of skin and its components

### OBJECTIVES

- To study the structural organization and histological characteristics of skin
- To study the structure and properties of various biomolecules present in skin
- To study the basic characteristics of enzymes and proteins involved in the maintenance of skin integrity
- To study the nature, biosynthesis, characteristics, structure and functions of collagen and the role of temperature in the stability of collagen and collagen degradation

### UNIT I            **STRUCTURE, CHARACTERISTICS AND FUNCTIONS OF SKIN**            **6**

Organization of skin components in different animals; Structure and function of epidermis, dermis, cutaneous and subcutaneous tissues; hair; fat tissue; nerve; erectopilli muscle; sweat glands; Histological characteristics of Cow, Ox, Buff, Cow Calf, buff calf, Goat and Sheep; Functions and properties of hides and skins.

### UNIT II            **COMPOSITION OF HIDES AND SKINS**            **8**

Chemical constituents of hides and skins; Fibrous and non-fibrous proteins in skin; Structure and properties of mono, di, iligo and polysaccharides; complex carbohydrates; Structure and properties of Fatty acids, Glycerolipids, phospholipids, sphingolipids, glycolipids, steroids; Structure, function and properties of amino acids

### UNIT III            **STRUCTURE, FUNCTION, THERMAL TRANSITION AND DEGRADATION OF COLLAGEN**            **12**

Structure; function and chemical features of collagen; Types of collagen; Tropocollagen molecules; Sub-units of collagen; Kinetics of fibril formation; precipitated forms of collagen; Electron microscopy of the collagen fibre; Biosynthesis; Denaturation temperature; Mechanism of denaturation process; Thermal shrinkage; Factors influencing melting transition; Degradation of collagen - collagenases; Physico - chemical properties methodology, mechanism of action.

### UNIT IV            **ENZYMES AND PROTEINS IN SKIN**            **13**

General and Physical Chemistry of enzymes & proteins in animal skin; Enzyme classification and their functions; enzyme kinetics; Protein classifications; Reactions of proteins with acids, bases and salts; Protein purification; Structural organization of proteins; Reactive groups; Cross linking.

### UNIT V            **RESOURCES FOR HIDES AND SKINS**            **6**

Trends in meat production and consumption practices; Fallen animal recovery systems; Availability of hides and skins in the global scenario; Types of animal byproducts - from abattoirs, meat processing plants, poultry, fishing and other sources. Present methods of collection, processing and utilization in developing countries vis - a - vis developed countries. Flaying of animals

**TOTAL : 45 PERIODS**



TT7592

**TEXTILE FIBRES**

**L T P C**  
**3 0 0 3**

**OBJECTIVES**

- To enable the students to learn about different types of fibres, their production, physical and chemical characteristics

**UNIT I**

**9**

Classification of fibres; definition of fibres; cotton, jute, flax fibres – cultivation, physical and chemical properties

**UNIT II**

**9**

Protein fibres – wool, silk, production, physical and chemical properties

**UNIT III**

**9**

Synthetic fibres – polyester, nylon, acrylic, polyurethanes, polypropylene, polyethylene – production, physical and chemical properties

**UNIT IV**

**9**

Manmade fibres – Viscose, modified viscose, modal, tencel and other metallic and non metallic fibres – production, physical and chemical properties

**UNIT V**

**9**

Introduction to high performance fibres; Identification of textile fibres; specification of fibres

**TOTAL : 45 PERIODS**

**OUTCOMES:**

On completion of this course, the student would know about

- Different types of textile fibres, their method of production, physical and chemical characters
- Identification of a textile fibres

**TEXT BOOKS**

1. Srinivasa Murthy H. V., "Introduction to Textile Fibres", Textile Association, India, 1987.
2. Morton W. E. and Hearle J. W. S., "Physical Properties of Textile Fibres", The Textile Institute, Washington D.C., 2008, ISBN 978-1-84569-220-95
3. Meredith R. and Hearle J. W. S., "Physical Methods of Investigation of Textiles", Wiley Publication, New York, 1989

CT7591

**CERAMIC MATERIALS**

**L T P C**  
**3 0 0 3**

**AIM**

- The course is aimed to enable the students to have a complete knowledge on the basics of mineralogy, different raw materials, Fibers and Composites used commonly in ceramic industries.

**OBJECTIVES**

On completion of the course the students are expected to

- Have learnt about clay formation, clay minerals and types of clays.
- Have studied the different types of fluxes and their characteristics.
- Have learnt the types of silicate minerals, their properties and uses.
- Have an understanding on other ceramic raw materials, their properties and uses.
- Have studied the structural characteristics and properties of oxide, carbide, nitride, carbon and other ceramic materials used for structural applications.
- Have a knowledge about Ceramic Fibers, processing methods, testing and applications of ceramic matrix composites.

<b>UNIT I</b>	<b>SILICA AND ALUMINO-SILICATES</b>	<b>10</b>
Silica - quartz & quartzite; polymorphic transformation; properties. Clay - kaolinite & Montmorillonite minerals; occurrence; types-ball clay, china clay, fire clay, bentonite clay, brick clay; properties-charged nature, cation exchange capacity, plasticity. Fluxes - composition and properties of feldspar group, nepheline syenite; other fluxes-bone ash, lithium containing minerals.		
<b>UNIT II</b>	<b>OXIDE CERAMICS</b>	<b>7</b>
Occurrence, Properties and applications of alumina, zirconia, magnesia, chrome, titania, thoria, mullite, copper oxide superconductors		
<b>UNIT III</b>	<b>NON-OXIDE CERAMICS</b>	<b>8</b>
Structural characteristics, properties and applications of silicon carbide, boron carbide, tungsten carbide, titanium carbide. Structural characteristics properties and applications of silicon nitride, boron nitride, titanium nitride, aluminum nitride.		
<b>UNIT IV</b>	<b>CERAMIC FIBERS</b>	<b>10</b>
Fibers - definition; manufacturing techniques, properties and applications of Glass fibres, Alumina fibres, mullite fibres, zirconia fibres, boron fibres, carbon fibres and graphite fibres. Whisker - definition; formation mechanisms, SiC and Si <sub>3</sub> N <sub>4</sub> whiskers; properties.		
<b>UNIT V</b>	<b>CERAMIC MATRIX COMPOSITES</b>	<b>10</b>
Properties of CMCs – Interfaces – Bonding, CMCs Processing; Cold Pressing and sintering–Hot Pressing–Reaction Bonding–Infiltration–Directed Oxidation– In situ chemical reaction technique–Sol–gel and Polymer Pyrolysis–Self–propagating high temperature synthesis.		

## REFERENCES

1. Mc Colm, Ceramic Science for Materials Technologists, Blackie & Sons Ltd., Glasgow, 1983.
2. Somiya.S et al (ed), Handbook of Advanced Ceramics, Vol.I, Academic Press, 2003.
3. Brook R.J (ed), Concise Encyclopedia of Advanced Ceramic Materials, Pergamon Press, 1991.
4. Parbin Singh, Engineering and General Geology, S.K.Kataria and Sons, New Delhi, 2001.
5. Worrall W.E, Ceramic Raw Materials, Pergamon Press, NY, 1992.
6. Venkat Reddy D, Engineering Geology, Vikas Publishing House Pvt. Ltd., New Delhi, 2010.
- 7.Narottam P.Bansal and Jacques Lamon, Ceramic Matrix Composites - Materials Modeling and Technology, John Wiley & Sons, Inc., Hoboken, New Jersey, 2015.
8. Krishnan K Chawla, Composite Materials Science and Engineering, 2nd Edition, Springer (India) Pvt. Ltd, 2006.

**CT7592**

**PROCESSING OF CERAMICS**

**L T P C**  
**3 0 0 3**

## AIM

- The course is aimed to enable the students to have a thorough knowledge about the different ceramic fabrication process and the advanced processing techniques in ceramics.

## OBJECTIVES

On completion of the course the students are expected to

- Have a thorough knowledge on the preparation of ceramic powder by mechanical and chemical methods.
- Have studied the types & role of additives in various ceramic forming processes.
- Have a better understanding on the mechanisms of sintering and grain growth during sintering.
- Have learnt the advanced processing and sintering.

## UNIT I POWDER PREPARATION

**9**

Powder preparation by mechanical methods – comminution, mechano-chemical synthesis. Powder synthesis by chemical methods – solid state reaction, liquid solutions, vapour phase reactions.



<b>UNIT II</b>	<b>ADDITIVES</b>	<b>9</b>
Types of additives in ceramic forming – solvents, dispersant, binder, plasticizer, other additives. Effect/role of additive in ceramic forming - density, fluidity, viscosity, deflocculation, pH, zeta potential, plasticity.		
<b>UNIT III</b>	<b>WET FORMING METHODS</b>	<b>9</b>
Casting methods – Plaster mould preparation and slip casting in plaster mould, pressure casting, gel casting, tape casting, electrophoretic deposition. Plastic forming methods - Pug milling, extrusion, co-extrusion, injection molding		
<b>UNIT IV</b>	<b>DRY FORMING METHODS</b>	<b>9</b>
Pressing- Uniaxial pressing – stress distribution on green body – defects and remedies, vibration compaction, isostatic pressing, reactive hot pressing		
<b>UNIT V</b>	<b>SINTERING</b>	<b>9</b>
Definition, types of sintering – solid state sintering, liquid phase sintering; grain growth – different grain growth process and control of grain growth. Advanced sintering – pressure assisted sintering, reaction bonded sintering and microwave sintering.		

#### REFERENCES

1. Alan G.King, Ceramic Technology and Processing, Noyes Publication, USA, 2001.
2. James S. Reed, Principle of Ceramic Processing, John Willey and Sons, NY, 1988.
3. Mohamed N.Rahaman, Ceramic Processing, Taylor & Francis, 2007.
4. David W. Richerson, Modern Ceramic Engineering, 3rd Edn., Taylor & Francis, 2005.
5. Paul De Garmo E, Black J.J and Ronald A.Kohser, Materials and Processes in Manufacturing, 8th Edn, Prentice - Hall India Pvt. Ltd., New Delhi, 1997.
6. Reed J.S, Introduction to the Principles of Ceramic Processing, Willey, New York, 1988.
7. John G.P.Binner (Ed), Advanced Ceramics Processing and Technology, Noyes Publications, New Jersey, 1990.
8. Burtrand Lee and Sridhar Komarnei (Eds.), Chemical Processing of Ceramics, 2nd Edn., Taylor & Francis, 2005.

<b>PM7591</b>	<b>HUMAN GENETICS</b>	<b>L T P C</b>
		<b>3 0 0 3</b>

#### AIM

- To provide knowledge on the basics of genetics.

<b>UNIT I</b>	<b>MENDELIAN GENETICS:</b>	<b>9</b>
History Mendel's Laws of inheritance. Why is knowledge of medical genetics important for everyone. Common Terminology: Alleles, Dominant, recessive, incomplete dominance, co-dominant, autosomes, allosomes, genes, cross, testcross, backcross, expressivity penetrance, mutation.		
<b>UNIT II</b>	<b>AUTOSOMAL INHERITANCE:</b>	<b>9</b>
Pedigree symbols, analysis, interpretation of a pedigree. Autosomal dominant and recessive inheritance, characteristic recurrence risks, Dominant versus Recessive – cautions. Reduced penetrance. Age-dependent penetrance, Pleitropy and heterogeneity, Marfan syndrome, anticipation, consanguinity in Human populations and its consequences. Why you should not marry your close relative?		
<b>UNIT III</b>	<b>SEX-LINKED INHERITANCE:</b>	<b>9</b>
Sex determination in humans, TDF, SRY Sex-linked dominant and recessive inheritance, X-inactivation, Holandric Traits, color blindness, Hemophilia, Lyon's Hypothesis, Barr Bodies Turner syndrome, Klinefelter syndrome, Gynandromorphy, Mosaicism and Transgenders.		

**UNIT IV CLINICAL CYTOGENETICS AND KARYOTYPING: 9**

Karyotype analysis aminocentesis, chorionic villi sampling, preimplantation genetic diagnosis, abnormalities of chromosome structure and number. Chromosome abnormalities and pregnancy loss, abnormalities of chromosome structure and clinical phenotypes, chromosome instability syndromes. Deletions, Inversions and translocation – aberration in chromosomal structure. Maternal age and chromosome abnormalities example, Down syndrome.

**UNIT V ETHICS IN CLINICAL GENETICS: 9**

Population screening for genetic disease, Fetal treatment, Eugenics, bioethics medical genetics and Euthensia. Principles and practice of clinical genetics. Genetic Screening and Gene testing. Ethical Issues and Genetic counseling.

**TEXT BOOKS:**

1. Gardner, E. J.etal., "Principles of Genetics", 8<sup>th</sup> Edition, JohnWiley & Sons, 1991
2. Tamarin, R. H. "Principles of Genetics" 7<sup>th</sup> Edition, Tata McGraw-Hill, 2002.
3. Sambamurthy, A.V.S.S. "Genetics", 2<sup>nd</sup> Edition, Narosa, 2005.

**PM7592**

**FUNDAMENTALS OF BIOCHEMISTRY**

**L T P C  
3 0 0 3**

**AIM**

- To enable students learn the fundamentals of Biochemical Pathways and about biomolecules.

**OBJECTIVES**

- To ensure students have a strong grounding in structures and reactions of biomolecules.
- To introduce them to metabolic pathway of the major biomolecules and relevance to clinical conditions .
- To correlate biochemical processes with biotechnology applications

**UNIT I CONCEPTS IN BIOCHEMISTRY 6**

Basic principles of organic chemistry, types of functional groups, biomolecules, chemical nature, water, pH and biological buffers

**UNIT II INTRODUCTION TO BIOMOLECULES 12**

Carbohydrates (mono, di, oligo & polysaccharides) Proteoglycans, glycosaminoglycans. mutarotation, glycosidic bond, reactions of monosaccharides, reducing sugars

Lipids: fatty acids, glycerol, saponification, iodination, hydrogenation, phospholipids, glycolipids, sphingolipids, cholesterol, steroids, prostaglandins. Lipoproteins LDL, HDL Amino Acids, Peptides, Proteins, measurement, structures, hierarchy of organization primary, secondary, tertiary and quaternary structures.

Nucleic acids: DNA as hereditary material. Watson-Crick structure of DNA, mRNA, tRNA and rRNA.

**UNIT III CONCEPTS OF METABOLISM 8**

Functions of Proteins, Enzymes. Introduction to biocatalysts, metabolic pathways.

**UNIT IV INTERMEDIARY METABOLISM AND REGULATION 12**

Glycolysis, TCA cycle, gluconeogenesis, pentose phosphate shunt, fatty acid synthesis and  $\beta$ -oxidation, urea cycle, interconnection of pathways and metabolic regulation. High energy compounds, Calculation of ATP Oxidative phosphorylation and respiratory chain.

**UNIT V BIOENERGETICS****7**

High energy compounds, electronegative potential of compounds, Oxidative phosphorylation and respiratory chain, ATP cycle, calculation of ATP yield during oxidation of glucose and fatty acids.

**TEXT BOOKS**

1. Lehninger Principles of Biochemistry 6th Edition by David L. Nelson, Michael M. Cox
2. Satyanarayana, U. and U. Chakrapani, "Biochemistry" 3rd Rev. Edition, Books & Allied (P) Ltd., 2006.
3. Rastogi, S.C. "Biochemistry" 2nd Edition, Tata McGraw-Hill, 2003.

**REFERENCES**

1. Berg, Jeremy M. et al. "Biochemistry", 6th Edition, W.H. Freeman & Co., 2006.
2. Voet, D. and Voet, J.G., "Biochemistry", 3rd Edition, John Wiley & Sons Inc., 2004.
3. Murray, R.K., et al "Harper's Illustrated Biochemistry", 27th Edition, McGraw-Hill, 2006.

**IB7591****INTRODUCTION TO BIOTECHNOLOGY****L T P C  
3 0 0 3****Aim**

- To give a preliminary introduction about biotechnology, its principles and prospects for engineers who contemplate on using it for interdisciplinary research and application

**UNIT I INTRODUCTION TO BIOTECHNOLOGY & IT'S SCOPE****9**

Definition of biotechnology, mile stones in biotechnology – Who can be a biotechnologist? Applications of biotechnology in interdisciplinary (Mathematics, Chemistry, Microbiology, Aquaculture etc) and engineering (Fermentation Technology, Electronics, Plastic Technology etc) specialties, Future prospects of biotechnology industries – GM crops, animals, microbes, etc.

**UNIT II PROTEINS AS PRODUCTS****9**

Definition of Proteins: Amino Acids – Structure, Functions and Uses; Structure, Function and Importance of Proteins. Uses of Proteins: Therapeutic proteins e.g. used for treatment of irritable bowel syndrome, Branch Chain Amino Acids; A protein from the industry using microbes: *Corynebacterium* sp. – A case study, recombinant proteins, enzymes: Streptokinase, amylase, lipase etc., Production of recombinant human insulin.

**UNIT III DNA, GENES, GENOMES & RDNA TECHNOLOGY****9**

DNA: Structure – Gene: One gene one Enzyme concept, One Gene many enzyme concept, One gene many polypeptide concept, Genomes, what is genomics? – Transgenic animals and their applications, DNA Vaccines, Edible vaccines, What is recombinant DNA Technology? – A Case study

**UNIT IV MEDICAL BIOTECHNOLOGY****9**

Gene testing – identification of protein and genetic disorders, Gene screening – a tool for phenotypic screening e.g. Cancer identification & Gene therapy e.g. Cystic Fibrosis as a case study, Transgenic Pigs as a artificial organ donors

**UNIT V DNA FINGERPRINTING, FORENSIC SCIENCE & ETHICS IN BIOTECHNOLOGY****9**

Case study – Homicide, Disputed parentage, Immigration issues, Ethics in Biotechnology – GM crops – Ethical issues; Golden Rice – Eradication of Blindness

**REFERENCES:**

1. Modern Biotechnology by Primrose
2. Biotechnology the biological principles by M. D. Trevan, S. Bofley
3. Molecular Cell Biology by Lodish
4. Genes V And VI by Lewin Benjamin

**AIM**

- To provide knowledge on biological aspects of cancer.

**OBJECTIVES**

- To impart basic concepts of cancer biology and various stages in carcinogenesis.
- To gain insight on cancer metastasis and its molecular mechanism.
- To understand cancer prognosis.

**UNIT I CELL STRUCTURE, FUNCTION AND DIVISION 9**

Cell organization, structure of organelles, extra cellular matrix and cell junctions. Cell cycle – mitosis, meiosis, cell cycle regulation and apoptosis.

**UNIT II INTRODUCTION TO CANCER 9**

Definition, causes, cancer types and stages, hallmarks of cancer, modulation of cell cycle in cancer, carcinogenesis – initiation, promotion and progression, diet and cancer.

**UNIT III CANCER PROGRESSION 9**

Benign and malignant tumors, progress towards metastatic cancer, metastatic cascade and tumor cell invasion, angiogenesis.

**UNIT IV CANCER GENES AND SIGNAL TRANSDUCTION 9**

Activation of kinases, oncogenes/proto-oncogenes activity, retrovirus and oncogenes, tumor suppressor genes and growth factors related to transformation.

**UNIT V CANCER DETECTION AND THERAPEUTICS 9**

Detection using biochemical assays, tumor markers, molecular tools for early diagnosis of cancer. Types of therapy – chemotherapy, immunotherapy, radiotherapy and gene therapy.

**TOTAL : 45 PERIODS**

**OUTCOMES**

- To create awareness about basics of cancer.
- To understand the cancer microenvironment and its influence on the human system.
- To have understanding on medical applications for cancer.

**TEXT BOOKS**

1. Lodish, Harvey et al., “Molecular Cell Biology”, 5 th Edition, W.H.Freeman, 2005.
2. Cooper, G.M. and R.E. Hansman “The Cell : A Molecular Approach”, 4 th Edition, ASM Press, 2007.
3. Alberts, Bruce et al., “Molecular Biology of the Cell”, 4 th Edition, Garland Science (Taylors Francis), 2002.
4. Weinberg, R.A. “The Biology of Cancer” Garland Science, 2007.

**REFERENCES**

1. McDonald, F et al., “ Molecular Biology of Cancer” 2nd Edition, Taylor & Francis, 2004.
2. King, Roger J.B. “Cancer Biology” Addison Wesley Longman, 1996.



**AIM:**

- To educate the students on the importance of safe food.

**OBJECTIVES:**

- To expose students to the public concern of foods
- To help understand hazards in food
- To envelop awareness on food-borne illness.
- To understand low diet and good health can be obtained through safe food, supplements functional foods and nutraceuticals.

**UNIT I CONCEPTS OF FOOD SAFETY 9**

Understanding what is safe food. Definition of food safety. Adultration of food, Contamination malnutrition, obesity and metabolic syndrome. Unhygiene preparation filter, coloured foods and cancer, pesticides in food and health issues, Physical hazards, migration, cross-contamination.

**UNIT II HAZARDS DUE TO FOOD PROCESSING 9**

Trans fatty acids and Cardio vascular diseases. Plastics in packaging; presence of vinyl polymer packaged drinking water and hazard thermal decomposition during barbecuing pyrolytic products and cancer- non-nutritive sweeteners of hazards. Preservatives – chemical, sulphites phenolic antioxidants, fat substitutes antibiotics and veterinary drugs.

**UNIT III BIOLOGICAL HAZARDS 9**

Fungal toxins, aflatoxins, allergens, bacterial toxins, botulin, proper handling and storage procedures. Water activity and temperature of storage of meats, dairy and vegetables. Prevention of microbial hazards, sanitation, antimicrobial plastics, Intelligent packing. Prevention of food-borne illnesses. Pathogens in foods, *E.coli*, *Salmonella*, *C.botulinum*, *Campylobacter*. How to reduce food spoilage. Storage of uncooked food.

**UNIT IV HEALTH CLAIMS, LABELLING & SAFE FOOD 9**

Sports nutrition, nutraceuticals, pKV formula foods, health claims, labelling of the label. HACCP, GMP consumer protection, responsibilities of the food service operator. Hygiene procedures. Cost of Illness.

**UNIT V GLOBALIZATION AND FOOD SAFETY 9**

Genetically modified food (GM), Safety and labelling, Food audit, International food Standards ISO 9000, environmental issues in packaging.

**TEXT BOOKS**

1. Fortin, N.D. "Food Regulation: Law, Science, Policy, and Practice". John Wiley, 2009.
2. Lightbourne, Muriel "Food Security, Biological Diversity and Intellectual Property Rights" Ashgate, 2009.
3. Mehta, Rajesh and J. George "Food Safety Regulation Concerns and Trade : The Developing Country Perspective". Macmillan, 2005.

**OBJECTIVES**

The students will be able to

- infer the concepts of separation techniques
- acquire knowledge on separation by membrane and adsorption
- familiarize with ionic separation and other commercial process

**UNIT - I RECENT TRENDS IN SEPARATION TECHNIQUES: 9**

Recent trends in separation techniques based on size, surface properties, ionic properties and other special characteristics of substances. Process concept, theory and equipment used in cross flow filtration, cross flow electro filtration and dual functional filter. Surface based solid – liquid separations involving a second liquid, Sirofloc filter

**UNIT – II ADSORPTION BASED AND OTHER SEPARATION PROCESSES: 9**

Adsorption - Types of adsorption, nature of adsorbents, adsorption equilibria, Adsorption operations - stage wise operations, crystallization, Oil spill Management, Foam separation, Aqueous two phase extraction

**UNIT – III SOLID SEPARATION PROCESS: 9**

Concept of size, Shape, Magnetic separation, Eddy-current separation, Ballistic separation, Color separation, Wet Separation Process, liquid-solid and liquid- liquid separation by hydrocyclones, Surface velocity classifier, Elutriators, Impingement separator, Electrostatic precipitation membrane.

**UNIT – IV MEMBRANE TECHNOLOGY: 9**

Mechanism and equipments employed for micro-filtration, Ultrafiltration, Nanofiltration, Reverse osmosis, Concentration polarization, Operation layout of the modules, Pervaporation and Application of membrane technology in process industries.

**UNIT – V IONIC SEPARATION PROCESSES: 9**

Working principle, controlling factors, equipment employed for electrophoresis, Dielectrophoresis, ion exchange chromatography, electro dialysis and permeation techniques for solids, liquids and gases.

**TOTAL : 45 PERIODS**

**TEXT BOOKS:**

1. King, C.J., "Separation Processes", Tata McGraw–Hill Publishers, New Delhi, 1982.
2. Jimmy L. Humphery and George E. Keller., "Separation Process Technology", McGraw-Hill Publishers, 1997.
3. Seader, J.D. and E.J. Henley, "Separation Process Principles", 2nd Ed., John Wiley, 2006.
4. McCabe, W.L., Smith, J.C., and Harriot, P., "Unit Operations in Chemical Engineering", 7th Edn., McGraw-Hill, 2005.

**REFERENCES:**

1. Ronald.W. Rousseau., "Handbook of Separation Process Technology", Wiley India Pvt Ltd, 2009.
2. Osadar and Varid Nakagawal., "Membrane Science and Technology", Marcel Dekkar , 1992.

**COURSE DESCRIPTION:**

- This course aims on the students to know about technologies used for Produced Water in the Industry sector. The course will cover technologies on membranes, ion exchange, lime softening, demineralization and filtration. The course will cover separation principles on non-conventional design, commissioning of water treatment plants for next generation

**OBJECTIVES:**

- To select the best treatment strategy for treating water based on nature of Pollutant.
- To learn about the water treatment issues based on impurities present in water..
- To teach the students the various aspects of treatment methodologies and pollutant removal through separation processes.

**UNIT I WATER TREATMENT TECHNOLOGIES 6**

Overall introduction about technologies adopted for water treatment – Rapid mixing- Flocculation-sedimentation –filtration- Disinfection- Membrane technology-nanotechnology.

**UNIT II CHEMICAL, BIOLOGICAL AND PHYSIOCHEMICAL TECHNOLOGY 12**

Introduction- aeration-Coagulation- Neutralization-Precipitation- Ion exchange- Advanced oxidation process- Flocculation-adsorption- settling - Bioreactors for treatment- Advanced biological treatments

**UNIT III MEMBRANE AND NANOTREATMENT TECHNOLOGY 9**

Membranes for water treatment - membrane separation process-ultra filtration- nanofiltration-nanomaterials as membrane filtration.

**UNIT IV DESIGN AND CONSTRUCTION 9**

Introduction- Design and construction of wastewater treatment plants on novel technology-nanofiltration and hybrid technologies- sustainable treatment technologies

**UNIT V SELECTION OF WATER TREATMENT TECHNOLOGY 9**

Introduction – Aeration-chemical-Physical-Biological-Membrane- Nano technology-Hybrid technologies- Environmental regulations and compliance- cost and safety based treatment.

**OUTCOMES****At the end of the course, the student should be able to:**

- understand the treatment technologies available for water treatment.
- Knowledge on conventional non-conventional based technologies
- Analyze different treatment types and select based on suitability for commissioning.

**TEXT BOOKS:**

- 1) Parimal Pal , “Industrial Water Treatment Process Technology” Butterworth-Heinemann. 2017.
- 2) Salomone, Roberta, Saija, Giuseppe, “Pathways to Environmental Sustainability- Methodologies and Experiences”, Springer International Publishing, 2014.

**REFERENCES:**

1. Lois Wright Morton, Susan S. Brown, “Pathways for Getting to Better Water Quality: The Citizen Effect,” Springer-Verlag New York,2011.
2. M. H. Unsworth,, D. Fowler, “Deposition of Pollutants on Plants and Soils; Principles and Pathways” Springer Netherland,1988.
3. Brian Alloway, David C. Ayres, “Chemical Principles of Environmental Pollution, Second Edition”, CRC Press, 1997.



**AS7591**                      **BASIC CONCEPTS IN PETROLEUM ENGINEERING**                      **L T P C**  
**3 0 0 3**

**UNIT I              RESERVOIR ENGINEERING                      10**

Origin, migration, accumulation of petroleum, Properties of oil & natural gas, Reservoir deliverability, petrophysical properties of reservoir rocks, reservoir geometry, reservoir drive mechanisms, Reserve estimation

**UNIT II              OIL AND WELL DRILLING TECHNOLOGY                      10**

Well planning, drilling rigs, Rig operating systems, drilling fluids- functions & properties, drill bit types & their applications, drill string, drilling problems- their control & remedies

**UNIT III              PETROLEUM PRODUCTION OPERATIONS                      9**

Petroleum production system, formation damage, well stimulation techniques, artificial lift techniques, Nodal system analysis

**UNIT IV              EOR TECHNIQUES                      9**

Basic principle & mechanism of EOR, Screening of EOR process, recovery efficiency, permeability heterogeneity, EOR methods: chemical flooding, thermal recoveries (steam stimulation, steam flooding, ISC), microbial EOR

**UNIT V              LATEST TRENDS IN PETROLEUM ENGINEERING                      7**

Coal Bed Methane, Shale gas, Oil shale, gas hydrate, heavy oil

**TOTAL: 45 PERIODS**

**REFERENCES**

1. Guo, B, Lyons, W.C. and Ghalambor, A., Petroleum production engineering: a computer assisted approach, Gulf Professional Publishing, Burlington
2. Devereux, S., "Drilling Technology", PennWell Publishing Company, 1999
3. Donaldson, E.C. and G. V. Chilingarian, T. F. Yen, "Enhanced oil Recovery – I & II"
4. Ahmed, T, "Reservoir Engineering Handbook", 3rd Edition, Elsevier, 2006.

**AS7592**                      **INTRODUCTION TO INDUSTRIAL SAFETY MANAGEMENT**                      **L T P C**  
**3 0 0 3**

**UNIT I              NEED FOR SAFETY IN INDUSTRIES AND REGULATION                      10**

Importance & objectives of safety- Safety Programmes – components and realization; evolution of modern safety concept- safety policy – safety organization, Implementation of safety procedures – periodic inspection and replacement; Accidents -identification and prevention; Criteria for setting & layout of plant, Factories Act and Safety Regulations.

**UNIT II              HAZARDS & RISK ANALYSIS                      9**

Fire hazards- Chemical hazards, Toxic hazards, Explosion hazards, Electrical hazards, Mechanical hazards, Radiation hazards, Noise hazards-Over all risk analysis—emergency planning-on site & off site emergency planning, risk management ISO 14000, EMS models case studies. Quantitative risk assessment

**UNIT III              SAFETY AUDIT AND TECHNIQUES                      10**

Objective of safety audit- Hazard identification safety audits, checklist, what if analysis, vulnerability models event tree analysis fault tree analysis, Hazard & Operability (HAZOP) studies- Hazard Analysis (HAZAN)-Fault Tree Analysis, Consequence Analysis, Preliminary Hazard Analysis (PHA), Job Safety Analysis (JSA), safety – survey, inspection, sampling

**UNIT IV SAFETY EDUCATION AND TRAINING 9**

Importance of training-identification of training needs-training methods – programme, seminars, conferences, competitions – method of promoting safe practice - motivation – communication - role of government agencies and private consulting agencies in safety training – creating awareness, awards, celebrations, safety posters, safety displays, safety pledge, safety incentive scheme, safety campaign – Domestic Safety and Training.

**UNIT V HUMAN FACTORS IN PROCESS SAFETY 7**

Man-machine system Concept – Human factors Engineering and its Applications, Human Behaviour – Individual difference –Motivation –Frustration and Conflicts – Attitudes, Ergonomic Principles – ergonomics Application, Impending safety factors, PPE

**TOTAL : 45 PERIODS**

**REFERENCES**

1. Handley, W., "Industrial Safety Hand Book ", 2nd Edn., McGraw-Hill Book Company, 1969.
2. Heinrich, H.W. Dan Peterson, P.E. and Rood, N., " Industrial Accident Prevention", McGraw-Hill Book Co., 1980.
3. Krishnan N.V. "Safety Management in Industry" Jaico Publishing House, Bombay, 1997.
4. John Ridley, "Safety at Work", Butterworth & Co., London, 1983.
5. Blake R.B., "Industrial Safety" Prentice Hall, Inc., New Jersey, 1973.
6. McCornick, E.J., Human Factors in Engineering and Design, Tata McGraw-Hill, 1982.

**CY7592 INDUSTRIAL CHEMISTRY L T P C  
3 0 0 3**

**OBJECTIVES**

- Elaborate study of fuels-introduction – classification, preparation, properties - alternate fuels.
- To get introduced to high polymers such as rubber and plastics and to industrial importance of cementing materials.
- To get introduction on the chemistry of various industrial processes such as sugar and leather processing.

**UNIT I INORGANIC CEMENTING MATERIALS 9**

Introduction - Lime and its manufacture - Gypsum plaster - cement - types of cement, chemical composition-manufacture of Portland cement - chemical composition of Portland cement - setting and hardening of Portland cement. Heat of hydration of cement - special cement - concrete and RCC - decay of concrete-glass and ceramics - Introduction - manufacture of glass - varieties of glasses- plasticity of clay - white wares, glazing- applications - Earthenware's and stoneware's - optical fibers.

**UNIT II FUELS AND COMBUSTION 9**

Introduction - classification of fuels - calorific value - gross calorific value and net calorific value - characteristics of a good fuel. theoretical calculation of calorific value of a fuel - solid fuels – wood-coal - classification of coal by rank - selection of coal - analysis of coal and its significance -types of coking - types of carbonization of coal - role of sulphur in coal - role of ash in coal. Gaseous fuels - producer gas - water gas - natural gas - oil gas - biogas - components - composition-preparation - advantages- disadvantages and applications of coal gas.

**UNIT III RUBBER AND PLASTICS 9**

Introduction to rubber - latex - processing latex - mastication - compounding of rubber - vulcanizations of rubber - engineering polymers thermoforming - degradation stability and environment- synthetic rubbers - preparation and applications of SBR - butyl rubber - nitrile rubber - neoprene and silicone rubber- plastic materials - classification of plastics (or resins) - moulding constituents of a plastic - fabrication techniques used for thermoplastic resin (moulding process)-important thermoplastic resins- natural resins - celluloses - polyethylene – PVC.

**UNIT IV PAINTS, PIGMENTS AND INSULATING MATERIALS 9**

Paints - ingredients and their functions required properties of a paint - paint constituents and their functions - manufacture of paint- types of pigments - characteristics of pigment - oils - uses in paint - emulsion paints - special paints - paint remover. varnishes - lacquers – enamels-electrical insulating materials - dielectric properties - requirements of an electrical insulating material - classification of insulating material - electrical rigid insulations.

**UNIT V SUGAR AND LEATHER CHEMISTRY 9**

Sugar Chemistry - introduction - manufacture of cane sugar - recovery of sugar from molasses - preparation of celotex - manufacture of sucrose from beat root - testing and estimation of sugar-leather chemistry - introduction - manufacture of leather preparation of hides for tanning - vegetable, chrome and oil tanning - byproduct.

**TOTAL: 45 PERIODS****OUTCOMES**

- Will have knowledge about adsorption and oxidation process.
- Will gain idea about various methods available for water treatment.
- Will appreciate the necessity of water and acquire knowledge of preliminary treatment.

**TEXTBOOKS:**

1. K. Bagavathi, "Sundari Applied Chemistry", 1<sup>st</sup> Ed., MJP Publishers, , 2006.
2. Jayashree Ghosh, "Fundamental Concept of Applied Chemistry", S. Chand & Company Ltd., 2006.
3. B.K. Sharma, "Industrial chemistry,Krishna Prakashan Media (p) Ltd"., 2011.

**REFERENCES:**

1. A. Heaton, "An Introduction to Industrial Chemistry. 3<sup>rd</sup> Ed., Chapman and Hall, New York, 1996.
2. H.L. White, "Introduction to Industrial Chemistry", 1<sup>st</sup> Ed., John Wiley, 2015.

**ELECTROMAGNETIC THEORY****PH7591**

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3	0	0	3

**OBJECTIVES:**

- To learn the electromagnetic theory due to the fields produced by stationary and moving charges and propagation of fields

**UNIT I ELECTROSTATICS AND POLARIZATION 9**

Gauss's law – Field due to an infinite, straight, uniformly charged wire – Multipole expansion of a charge distribution -- Field inside a uniformly polarized sphere – Electric field inside a dielectric – Electric displacement and polarizability – Claussius-Mossotti relation – Polarization of polar molecules and Langevin equation and Debye relation – Electrostatic energy.

**UNIT II BOUNDARY VALUE PROBLEMS IN ELECTROSTATICS 9**

Boundary conditions – Potential at a point between the plates of a spherical capacitor – Potential at a point due to uniformly charged disc – Method of image charges – Point charge in the presence of a grounded conducting sphere -- Point charge in the presence of a charged, insulated conducting sphere -- Conducting sphere in a uniform electric field– Laplace equation in rectangular coordinates.

**UNIT III MAGNETOSTATICS 9**

Magnetic scalar and vector potentials – Magnetic dipole in a uniform field – Magnetization current – Magnetic intensity – Magnetic susceptibility and permeability – Hysteresis –Correspondences in electrostatics and magnetostatics.

**UNIT IV FIELD EQUATIONS AND CONSERVATION LAWS 9**  
 Continuity equation – Displacement current – Maxwell’s equations and their physical significance – Poynting theorem – Energy in electromagnetic fields – Electromagnetic potentials – Maxwell’s equations in terms of electromagnetic potentials – Lorentz and Coulomb gauges.

**UNIT V ELECTROMAGNETIC WAVES AND WAVE PROPAGATION 9**  
 Electromagnetic waves in free space – Propagation of electromagnetic waves in isotropic dielectrics and in anisotropic dielectrics – Reflection and refraction of electromagnetic waves: Kinematic and dynamic properties – TM and TE modes – Propagation in rectangular waveguides – Cavity resonator.

**TOTAL : 45 PERIODS**

**OUTCOMES:**

- At the end of the course, the students will able to
- understand the electrostatics and polarization principles,
  - acquire knowledge on boundary value problems, physics of charges and electric fields,
  - get knowledge on magnetostatics, hysteresis and correspondence between electro- and magnetostatics,
  - have the necessary understanding on field equations and conservation laws, and
  - gain knowledge on principles of electromagnetic wave propagation and its applications in waveguides.

**TEXT BOOKS:**

1. Griffiths, D.J. “ Introduction to Electrodynamics”, Pearson, 2014.
2. Jackson, J.D. “Classical Electrodynamics”, John-Wiley, 1999.
3. Sadiku, M.N.O. & Kulkarni, S.V. “Principles of Electromagnetics”, Oxford University Press, 2015.

**REFERENCES**

1. Chow, T.L. “Electromagnetic Theory”, Jones and Bartlett Learning, 2012.
2. Jordan, E.C. & Balmain, K.G. “Electromagnetic Waves and Radiating Systems” PHI, 2015.

<b>PH7592</b>	<b>PHYSICS OF SEMICONDUCTOR DEVICES</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**OBJECTIVES:**

- To learn the physics principles behind the operation of some important semiconductor devices.

**UNIT I PROPERTIES OF SEMICONDUCTORS 9**

Crystal structure - reciprocal lattice - Brillouin zone and rules for band (*k*- space) representation. Dynamics of electrons in periodic potential: Kronig - Penny and nearly free electron models - Real methods for band structure calculations; Bandgaps in semiconductors - Holes and effective mass concept - Properties of conduction and valance bands – semiconductor defects - lattice mismatched structures – strained epitaxy.

**UNIT II ELECTRONIC LEVELS IN SEMICONDUCTORS 9**

Particles in an attractive potential, bound states – Bloch theorem - Fermi distribution and energy - Density of states - Valance and conduction band density of states - intrinsic carrier concentration - intrinsic Fermi level. Extrinsic semiconductors: n and p type doping - Densities of carriers in extrinsic semiconductors and their temperature dependence - extrinsic semiconductor Fermi energy level - Degenerate and non - degenerate semiconductors – Tailoring electronic properties: alloys & quantum wells.

**UNIT III CHARGE TRANSPORT****9**

Scattering Mechanism: electron - electron and electron - phonon scattering. Transport under an electric field – carrier transport by diffusion – charge injection and quasi-Fermi levels – Carrier generation and recombination – current conductivity.

**UNIT IV OPTICAL TRANSPORT****9**

Electron - hole pair generation and recombination: band to band (direct and indirect band gap transitions) and intra band (impurity related) transitions, free - carrier & phonon transitions. Excitons : Origin, electronic levels and properties. Radiative and non-radiative recombination (Shockley - Read - Hall and Auger) processes. Carrier transport - continuity equations. Optical constants: Kramers - Kronig relations.

**UNIT V SEMICONDUCTOR DEVICES****9**

Processing of Semiconductor devices - p-n Semiconductor junctions - Homo and hetero junctions. Semiconductors – MOS capacitor – MOSFET – Zener-Bloch oscillations – Resonant tunnelling - Quantum structures, density of states and excitons, semiconductor photonic structures: 1D, 2D and 3D photonic crystals. Active and passive optoelectronic devices: performance and response enhancement

**TOTAL : 45 PERIODS****OUTCOMES:**

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

- gain knowledge on various crystal structures, energy bands and semiconductor defects,
- acquire knowledge on the basics of electronic energy levels, carrier concentration and tuned electronic properties,
- get knowledge on carrier transport mechanisms,
- have the necessary understanding on the concepts of optical transport mechanisms, and
- have adequate knowledge on different functional semiconductor devices.

**TEXT BOOKS:**

1. Neamen, D. & Biswas, D., "Semiconductor Physics and Devices", McGraw-Hill, 2012.
2. Pierret, R.F., "Semiconductor Device Fundamentals", Pearson, 2006
3. Sze, S.M. & K.K. Ng, "Physics of Semiconductor Devices", Wiley, 2008.

**REFERENCES**

1. Brennan, K.F. "The Physics of Semiconductors", Cambridge University Press, 1999.
2. Umesh K. Misra & Jasprit Singh, "Semiconductor Device Physics & Design", Springer, 2008.