OPEN ELECTIVES FOR THE YEAR 2017 - 18

14MA8X01	Graph Theory (Except CS & IS)
14MA8X02	Linear Algebra (for all)
14HU8X03	Intellectual Property Rights (for all)
14PH8X04	Advanced Materials Technology (for CV& ME)
14BT8X05	Nano Technology (for all)
14BT8X06	Instrumental methods of Analysis (for CV & ME)
14CV8X07	Environmental Impact Assessment (for all)
14ME8X08	Industrial Pollution Control (for all)
14EE8X10	Non-Conventional Energy Systems (for all)
14EE8X11	Linear Systems Theory (for ME & EC)
14EC8X12	Information and Electronic Communication Technology (for all)
14EC8X13	Robotics (for all)
14CS8X14	Programming with C++ (for all)
14CS8X15	Essentials of Information Technology (for all)
14EC8X18	Consumer Electronics (for all)
14PH8X19	Opto Electronic Devices (for EC, EE, CSE & ISE)
14CH8X21	Chemistry of Natural Products (for Bio-Tech)
14CS8X22	Essentials of IT Service Industry (for all)
14HU8X24	Professional & Cognitive Communique (for all)
14IS8X27	Fundamental of Operating Systems (for all)
14ME8X28	Operations Management and Entrepreneurship (for all)
14PH8X29	Physics of Semiconductor Devices (for EE, EC, CSE & ISE)
14CV8X30	Introduction to Geoinformatics (for all)
14CH8X31	Corrosion Science (for CIV, Mech. & Bio Tech)
14EC8X32	Application of Signal Processing (for all)
14ME8X33	Human Resource Management (for all)

GRAPH THEORY

Sub Code : 14MA8X01 **Credits : 03**
Hrs/Week : 3+0+0+0 **Total Hours : 39**

Course Learning Objectives:

This Course will enable students to

1. Explain subgraphs, bipartite graphs, isomorphic graphs etc..
2. Apply the concept of trees and its properties.
3. Distinguish between planar and nonplanar graphs and apply their properties to solve problems.
4. Represent a graph in terms of adjacency matrix, incidence matrix etc. and vice-versa.
5. Find the shortest path between two vertices in a graph.

UNIT – I

Introduction to graphs: Graphs, digraphs, paths, cycles, complete graph, bipartite graph, connectivity, cut points, bridges, blocks, sub graphs-spanning and induced. **8 Hours**

UNIT – II

Eulerian &Hamiltonian graphs: Trees, Eulerian graphs, characterizations, Hamiltonian graphs. **7 Hours**

UNIT – III

Planar graphs &Coloring: Planar graphs, outer planar graphs, Euler's polyhedron formula, colorability : chromatic number, five color theorem, four color conjecture, chromatic polynomial. **8 Hours**

UNIT – IV

Representations of graphs: adjacency matrix, incidence matrix,circuit matrix,cutset matrix. Shortest paths in weighted graphs, Dijkstra's algorithm to find shortest paths. **8 Hours**

UNIT – V

Spanning trees: Algorithms to find a spanning tree, minimal spanning tree-Kruskal's & Prims algorithm.

8 Hours

Course Outcomes:

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

1. Distinguish between bipartite and complete bipartite graphs, identify whether two graphs are isomorphic, find subgraphs of a graph etc.
2. Distinguish between Eulerian and Hamiltonian graphs.
3. Identify whether a graph is planar and to find the chromatic polynomial of a graph.
4. Apply algorithmic methods to find the shortest path between two given vertices.
5. Use a suitable algorithm to find a minimal spanning tree.

Mapping of POs & COs:

POs / COs	a	b	c	d	e	f	g	h	i	j	k	l
1	H	H										
2	M	L										
3					M							
4					H						M	
5					H						M	

L : Low M: Medium H : High

TEXT BOOKS:

1. Graph Theory: F.Harary, Narosa Publishing House,1988.
2. Graph Theory with applications to Engineering and computer science: Narsingh Deo, Prentice Hall of India, New Delhi, 2001.

REFERENCE BOOKS:

1. Introduction to Graph Theory: D.B.West, Prentice Hall of India, New Delhi.
2. Applications of Graph Theory: Vinod Chandra, Prabhakar Gore, James Moore, North Holland,1979.

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LINEAR ALGEBRA

Sub Code : 14MA8X02 **Credits : 03**
Hrs/Week : 3+0+0+0 **Total Hours : 39**

Course Learning Objectives:

This Course will enable students to

1. Develop a thorough knowledge about the system of linear equations and obtaining their solutions
2. **Interpret vectors in two and three-dimensional spaces both algebraically and geometrically.**
3. **Determine the kernel, range, rank, and nullity of a linear transformation and apply them suitably in their field of study**
4. **Evaluate the eigenvalues and their corresponding eigenspaces and appraise its importance in various fields.**
5. **Make use of Gram-Schmidt process to produce an orthonormal** basis.

UNIT – I

Linear equations: System of linear equations and its solution sets; elementary row operations and echelon forms; matrix operations; invertible matrices, LU-factorization**.**

7 Hours

UNIT – II

Vector spaces: Vector spaces; subspaces; bases and dimension; coordinates; summary of row-equivalence; computations concerning subspaces. **7 Hours**

UNIT – III

Linear Transformations: Linear transformations; algebra of linear transformations; isomorphism; representation of transformations by matrices; linear functions; transpose of a linear transformation. Determinants and elementary properties. **9 Hours**

UNIT – IV

Canonical Forms: Characteristic values; similarity of matrices, Cayley Hamilton theorem, annihilating polynomials; invariant subspaces; diagonalization of symmetric matrices, iterative estimates of characteristic values. **8 Hours**

UNIT – V

Inner Product Spaces: Inner products; inner product spaces; orthogonal sets and projections; Gram-Schmidt process; QR-factorization; least-squares problems; symmetric and unitary operators. **8 Hours**

Course Outcomes:

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

1. Test for consistency of system of linear equations and compute the solution by different methods.
2. Interpret vectors in two and three-dimensional spaces both algebraically and geometrically.
3. Analyze the concept of a linear transformation as a mapping from one vector space to another and be able to calculate its matrix representation with respect to standard and nonstandard bases.
4. Evaluate the eigenvalues and their corresponding eigenspaces and explain its importance in various fields.
5. Make use of Gram-Schmidt process to produce an orthonormal basis and also able to use least square approximation method to obtain the solution of ill conditioned system.

Mapping of POs & COs:

POs / COs	a	b	c	d	e	f	g	h	i	j	k	l
1	H	H										
2	M	L										
3					M							
4					H						M	
5					H						M	

L : Low M: Medium H : High

TEXT BOOKS:

1. M. Artin , Algebra Prentice Hall of India.2004.
2. David C.Lay, "Linear Algebra and its Applications",3rd edition, Pearson Education (Asia) Pte. Ltd, 2005.
3. Gilbert Strang, "Linear Algebra and its Applications", 4th edition, Thomson Learning Asia, 2003.
4. Bernard Kolman and David R. Hill, "Introductory Linear Algebra with Applications", Pearson Education (Asia) Pte.Ltd 7th edition ,2003.

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INTELLECTUAL PROPERTY RIGHT

Sub Code : 14HU8X03 **Credits : 03**
Hrs/Week : 3+0+0+0 **Total Hours : 39**

Course Learning Objectives:

Students should be able to:

1. Understand creativity component in intellectual property, different types of legal protection of intellectual properties and other basic concepts of Intellectual property.
2. Analyze different types of protection for inventions, different types of agreement and treaties for Intellectual properties.
3. Examine patent types, specifications and patent search and database for 'prior art'.
4. Understand the basic procedure of drafting claims and applying for patents and other legal forms of intellectual property rights.
5. Examine the protocol involved in protection of inventions like patents.

UNIT – I

Introduction to Intellectual Property

Invention and Creativity - Intellectual Property (IP) – Importance, Jurisprudential definition and concept of property, rights, duties and their correlation; History and evaluation of IPR – like Patents, Trademarks, Copyright & Related Rights, Industrial Design, Traditional Knowledge, Geographical Indications. **8 Hours**

UNIT – II

Agreements and Treaties

History - General Agreement on Trade and Tariff (GATT). Indian Position vis-a-vis WTO and Strategies; TRIPS Agreement; Madrid Agreement; Hague Agreement; WIPO Treaties; International convention relating to Intellectual Property - Establishment of WIPO - Mission and Activities – Budapest Treaty; PCT; Indian Patent Act 1970 & recent amendments

8 Hours

UNIT – III

Basics of Patents and Concept of Prior Art

Introduction to Patents; Types of patent applications: Ordinary, PCT, Conventional, Divisional and Patent of Addition; Specifications: Provisional and complete; Forms and fees Invention in the context of "prior art"; Patent databases; Searching International Databases; Country-wise patent searches (USPTO, EPO, WIPO, IPO, etc.) **8 Hours**

UNIT – IV

Patent filing procedures

National & PCT filing procedure; Time frame and cost; Status of the patent applications filed; Structure of Patent document, Precautions while patenting – disclosure/non-disclosure; Financial assistance for patenting - introduction to existing schemes; Patent licensing and agreement; Patent infringement- meaning, scope, litigation, case studies **8 Hours**

UNIT – V

Case Studies:

Patents (Basmati rice, Turmeric, Neem, etc.) non-biological cases may be included– Copyright and related rights – Trade Marks – Trade secrets - Industrial design and Integrated circuits – Geographic indications – Protection against unfair competition; Technology transfer and license agreements **7 Hours**

Course Outcomes:

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

1. General understanding of the intellectual property rights and Awareness about different forms of intellectual property rights
2. Awareness about national aand international intellectual property right related legislations
3. Knowledge of National and International Trade Agreements and Agencies functioning in relation to intellectual property rights
4. General understanding of patenting procedures and licensing and ability to evaluate different forms of intellectual property rights
5. General understanding about the provisions, privileges and limitations of intellectual property right holders with an understanding of the legal aspects (civil or criminal) of the use of intellectual property rights.

REFERENCE BOOKS:

1. BAREACT, Indian Patent Act 1970 Acts & Rules, Universal Law Publishing Co. Pvt. Ltd., 2007
2. Kankanala C., Genetic Patent Law & Strategy, 1st Edition, Manupatra Information Solution Pvt. Ltd., 2007
3. Subbaram N.R. " Handbook of Indian Patent Law and Practice ", S. Viswanathan (Printers and Publishers) Pvt. Ltd., 1998.
4. Eli Whitney, United States Patent Number : 72X, Cotton Gin, March 14, 1794.
5. Intellectual Property Today : Volume 8, No. 5, May 2001,
6. WTO and International Trade by M B Rao. Vikas Publishing House Pvt. Ltd.
7. Correa, Carlos M. Intellectual property rights, the WTO and developing countries : the TRIPS agreement and policy options, Zed Books, New York 2000
8. Wadehra, B.L.Law relating to patents, trade marks, copyright designs & geographical indications 2 ed. Universal Law Publishing 2000
9. Sinha, Prabhas Chandra Encyclopaedia of Intellectual Property Rights, 3 Vols. Eastern book corporation, 2006.
10. "Practical Approach to Intellectual Property Rights"; Rachna Singh Puri and Arvind Vishwanathan
11. I.K. International Publishing House Pvt. Ltd.,

Important Links:

http://www.w3.org/IPR/
http://www.wipo.int/portal/index.html.en
http://www.ipr.co.uk/IP_conventions/patent_cooperation_treaty.html
www.patentoffice.nic.in
www.iprlawindia.org/

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ADVANCED MATERIALS TECHNOLOGY

Sub Code : 14PH8X04	**Credits : 03**
Hrs/Week : 3+0+0+0	**Total Hours : 39**

Course Learning Objectives:

1. Provide adequate knowledge in materials technology to understand the current and future scientific and technological developments
2. Equip with background regarding the material properties to assist in the design of new materials with attractive properties.
3. Selection of right materials for specific applications to achieve better performance.
4. Help select ideal materials to reduce the cost of production.

UNIT – I

Structures and Properties of Ceramics- Introduction, Ceramic structures: Crystal structures, Silicate Ceramics, Imperfection in ceramics and diffusionin ionic materials, ceramic phase diagrams, Mechanical properties: Brittle Fracture of Ceramics, Stress- Strain Behavior. Fabrication and processing of glasses and applications. Fabrication and processing of Clay Product--Powder Pressing, Tape casting. **8 Hours**

UNIT – II

Structure and Properties of Polymer - Introduction, Hydrocarbon Molecules, Polymer Molecules, The chemistry of Polymer Molecules, Molecular Weight, Molecular Structure, Molecular Configurations.Types of polymers-Thermoplastic and Thermosetting Polymers, Copolymers, Polymer Crystallinity, Polymer Crystals. Polymer types - Plastics, Elastomers, Fibers, Polymer additives. Mechanical Behavior of Polymers: Stress- Strain Behavior, Mechanism of Deformation and Strengthening of Polymers, Deformation of semi crystalline Polymers, Deformation of Elastomers, Advanced Polymeric Materials. **8 hours**

UNIT – III

Structure and Properties of Composites: Introduction Particle- Reinforced Composites - Large- Particle composites, Dispersion- Strengthened Composites, Fiber- Reinforced Composites- Influence of Fiber Length, Influence of Fiber Orientation and Concentration, The Fiber Phase, The matrix Phase, Polymer- Matrix Composites, Metal- Matrix Composites, Ceramic- Matrix Composites, Hybrid Composites, StructuralComposites. **8 Hours**

UNIT – IV

Shape memory alloys and Metallic glasses: Introduction to shape memory alloys, Fundamental characteristics, shape memory effect (psuedoelasticity), Advantages and disadvantages of SMA, Methods of processing, Commercial shape memory alloys and applications. Introduction to metallic glasses, principle, properties, processing, applications - bulk metallic glass in nanotechnology, metallic glasses for air craft structure. **7 Hours**

UNIT - V

Introduction to Nano materials: Properties of individual nanoparticles, **Semiconducting nanoparticles:** optical properties, photofragmentation, coulombic explosion, **Carbon clusters**: small carbon clusters, C_{60} crystals, alkali doped $C_{60,}$ Super conductivity in C_{60}, **nanostructured crystals**: natural nanocrystals, photonic crystals, **nanostructured ferromagnetism:** Dynamics of nanomagnets, nanopore containment of magnetic particles, ferrofluids. **8 Hours**

Course Outcomes:

1. A solid foundation in the Physics and Chemistry of materials.
2. Fundamental and practical understanding of materials synthesis, processing, and characterization methods.

3. Understanding of inter-relationships between materials composition, processing, and properties, and their application to materials selection.
4. Create ability to apply knowledge from Physics or Engineering technology to solve problems in materials science, both independently and collaboratively.
5. Contribute new directions for designing and utilizing new materials.

REFERENCE BOOKS:

1. Van Vlack L.H. "Elements of Material Science" Addison-Wesley Publishers
2. Narang B.S, "Material Science & Processes" CBS Publishers.
3. Bandyopadhyay A.K. "Nano Materials" New Age International Publishers
4. Dieter G.E, "Mechanical Metallurgy" Revised edition, Tata Mc.Graw-Hill Publishing Co.Ltd.

TEXT BOOKS :

1. William D Callister, "Material Science &Engineering- an introduction'', 6th Edition, Wiley Publishers.
2. Charles P. Poole Jr, "Introduction to Nano technology" Wiley Interscience.
3. V.Rajendran, "Engineering Physics" Tata Mc.Graw-Hill Publishing Co.Ltd.

1) SEE to be conducted out of 100 marks and will be reduced to 50marks
2) Two Questions are to be set from each unit, carrying 20 marks each.
3) Students have to answer any one full question from each Unit.

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NANOTECHNOLOGY

Sub Code	**: 14BT8X05**	**Credits**	**: 03**
Hrs/Week	**: 3+0+0+0**	**Total Hours**	**: 39**

***Prerequisites*:** Chemistry, Physics
***Corequisites*:** Nil

Course Learning Objectives:

The objective of this course is

1. To learn fundamental concepts of nanoscience and nanotechnology
2. To appreciate the application of nanoscience to various fields of engineering.

UNIT - I

INTRODUCTION

Introduction to nanoscience, A Brief History of the Super Small, Definition of nanotechnology, Bottom-Up versus Top-Down; Discussions on nanofabrication, Nanolithography(Dip pen, photo, X-ray, Electron beam, nanosphere lithography), Structure-property relationships in materials, Fabrication of Hard Materials. **6 Hours**

UNIT – II

NANOMATERIAL AND NANO TOOLS

Zero dimensional : Nano particle, 1-D: Nano wires, nano rods, 2-D: Thin films, Special nanomaterials: Buckyballs (Fullerenes), Nanotubes, nanowire, Dendrimers, Nanoshells, magnetic nanoparticle, Quantum Dot (Nanocrystals), self assembled monolayers, Scanning probe microscopy (Scanning tunneling microscopy, Atomic force microscopy). Characterization of nanomaterials: Physical, chemical and structural. Applications of nanomaterial. **8 Hours**

UNIT - III

MICROFLUIDICS

Microflows (Laminar flow), Hagen-Pouiselle equation, micromixing, microvalves & micropumps, Need for the microfluidics, Fabrication of Soft Materials, application of microfluidics. Microfluidics and their applications to lab on chip. **8 Hours**

UNIT - IV

MEMS

Introduction and Overview, Design of MEMS, Sensors, Material aspect of MEMS, Electromagnetic Transducers, Mechanical Transducers, Chemical Transducers, Optical Transducers – Applications of optical and chemical transducers. Recent Developments in MEMS and Nanochips. application of MEMS. **8 Hours**

UNIT – V

APPLICATIONS

Sporting goods equipment, Apparel industry, Cosmetics, Appliances, Automobile/vehicle industry, Paint and Other water resistance coatings, Removing windshield fog, Medical bandages, Organic light-emitting displays, Medical applications, Food and Agriculture. Nanotechnology for data storage. Risk assessment, management, ethical aspects.

9 Hours

TEXT BOOKS:

1. Lindsay, S.M. *Introduction to Nanoscience*, Oxford University Press, 2009.
2. Robert Kelsall and Hamley, I. (Ed.). *Nanoscale Science and Technology*, Wiley, 2005.
3. Bharat Bhushan (Ed.), *Springer Handbook of Nanotechnology*, 3rd Ed., Springer, 2010.

REFERENCE BOOKS:

1. Booker, R. and Earl Boysen (Eds), *Nanotechnology*, Wiley Dreamtech, 2005.
2. Murthy, D.V.S. *Transducers and instrumentation*, Prentice Hall of India, 2010.
3. Schmidt, G. *Nanotechnology Assessment and perspectives*, Springer, 2006.
4. Ratner M. and Ratner, D. *Nanotechnology – A gentle Introduction to the Next Big Idea*, Pearson Education, 2005.
5. Silberzan, J.B.P. *Microfluidics for Biotechnology*, ARTECH house, 2010.
6. Cao, G. *Nanostructure and nanomaterial*, World scientific, 2011.

Course Outcomes:

At the end of this course, the student will be able to

1. Choose the terminologies of nanotechnology and structure-property relationship of materials.
2. Outline the synthesis of nanomaterials, structure and their methods of characterization.
3. Apply nanotechnology concepts in the field of microfluidics.
4. Summarize the applications of MEMS in Engineering field.
5. Utilize nanotechnology for various engineering disciplines.

CO-PO Mapping

	PO											
CO	1	2	3	4	5	6	7	8	9	10	11	12
CO1	M					L						
CO2	M					L			M			
CO3	M		M			M			H			
CO4	M		L			L			M			
CO5	L		M			M			H			

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INSTRUMENTAL METHODS OF ANALYSIS

Sub Code : 14BT8X06 **Credits : 03**

Hrs/Week : 3+0+0+0 **Total Hours : 39**

***Prerequisites*:** Chemistry, Physics

***Corequisites*:** Nil

Course Learning Objectives:

The objective of this course is

1. To use of electronic modules set up as chemical instruments to extract information from chemical process.
2. To learn description of instruments that analyse chemical species base on absorption or emission of electromagnetic radiation.
3. To understand principles and operating conditions various instrumentation system for general engineering applications.

UNIT – I

INTRODUCTION

Types of analytical instrumental methods and their selection, role of computers in analytical methods, performance requirements of analytical instruments, and instrument calibration techniques. Principle of microscopy, light field microscopy, scanning electron microscopy, tunneling electron microscopy and applications **7 Hours**

UNIT – II

SPECTROSCOPIC TECHNIQUES

Basic principles and applications of UV-Visible spectrometry, infrared spectrometry, nuclear magnetic resonance spectrometry, molecular mass spectrometry. Surface spectroscopic techniques: electron spectroscopy and ion spectroscopy; atomic absorption spectroscopy.

9 Hours

UNIT – III

CHROMATOGRAPHIC TECHNIQUES

Introduction to chromatographic separations. Basic principles and theory. Gas chromatography and HPLC: principle, instrumentation, column, detector, mobile phase, sample preparation. Application of chromatographic techniques. **9 Hours**

UNIT – IV

THERMAL AND ELECTROCHEMICAL TECHNIQUES

Principles and applications of thermo-gravimetric analysis (TGA), differential thermal analysis (DTA), differential scanning calorimetry (DSC). Electrochemical methods for analysis, electrochemical cells, types of electrodes, electrode potentials. **8 Hours**

UNIT – V

ENVIRONMENTAL APPLICATIONS

Chemistry, structure, mechanism of action, structure activity relationship and therapeutic applications of the following: Types and concentration of various gas pollutants, instrumental techniques and measurement range for carbon dioxide, sulfur dioxide, nitrogen oxides, hydrocarbons and ozone. Types of water pollutants and detection techniques. **6 Hours**

TEXT BOOK:

1. Willard and Merit, *Instrumental Methods of Analysis*, CSS Publishers, 1986.

REFERENCE BOOKS:

1. Khandpur, R. S. *Handbook of analytical instruments*, TMH., 1996.
2. Skoog, D.A., Holler F.J. and Nieman, T.A. *Principles of Instrumental analysis*, 5th Ed., Harcourt Brace College Publishers, 1998.
3. Chatwal, A. *Instrumental Methods of Chemical Analysis*, Himalaya Publishing House, 2014.
4. Basset, J.G. et al, *Vogel's Text Book of Quantitative Inorganic analysis*, 5th Ed., ELBS, 1998.

Course Outcomes:

At the end of this course, the student will be able to

1. Contrast between classical and instrumental methods of Chemical analysis.
2. Develop sufficient knowledge about the major instrumental methods of chemical analysis so that they can determine what technique should be used to solve a particular problem.
3. Explain concepts and instrumentation of spectrometric measurements.
4. Decide chromatographic techniques for sample analysis.
5. Appraise thermal and electrochemical methods of analysis.

CO-PO Mapping

	PO											
CO	1	2	3	4	5	6	7	8	9	10	11	12
CO1	L					L						
CO2	H		L			L						
CO3	L		L			L			H			
CO4	M		L			L			M			
CO5	L		L			L			H			

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ENVIRONMENTAL IMPACT ASSESSMENT

Sub Code : 14CV8X07 **Credits : 03**
Hrs/Week : 3+0+0+0 **Total Hours : 39**

Course Learning Objectives:

This Course will enable students to

1. At the end of the course the students will be able to:
2. Learn the importance of conducting EIA studies
3. Understand the key elements of EIA
4. Discuss the environmental acts and legislations
5. Discuss case studies on EIA for various projects

UNIT – I

INTRODUCTION

Development activities and ecological factors; EIA, EIS, FONSI. Need for EIA studies, Baseline information, Procedure for conducting EIA, Limitation of EIA, Environmental Acts/ policies. **8 Hours**

UNIT - II

CONTENT OF EIA

Framework of impact assessment in developmental projects, environmental setting, EIA – objectives, contents, methodologies, techniques; Rapid and comprehensive EIA.

10 Hours

UNIT – III

ENVIRONMENTAL ATTRIBUTES

Assessment and prediction of attributes – Air, Water, Noise, Land, Ecology, Soil, Socio-economic environment **8 Hours**

UNIT - IV

PUBLIC PARTICIPATION IN EIA

Public participation in environmental decision making, practical consideration in preparing EIA and EIS, salient features of project activity, environment parameter – activity relationship matrices **10 Hours**

UNIT – V

EIA CASE STUDIES

EIA for construction project, power projects, mining projects. **8 Hours**

Course Outcomes:

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

1. Carry out screening and scoping for developmental projects.
2. Implement different methodologies for environmental impact assessment
3. Measure quantitatively environmental impact on major environments
4. Prepare environmental impact assessment reports.

TEXT BOOKS:

1. 1 Jain R. K., Henry C. Perkins, "Environmental Impact Analysis", McGraw Hill Ltd., 2006.
2. Y Anjeneyulu, Valli Manickam., "Environmental Impact Assessment Methodologies", BS Publications, 2012
3. Canter, R.L., "Environmental Impact Assessment", McGraw-Hill Inc., New Delhi, 2011

REFERENCE BOOKS:

1. Shukla, S.K. and Srivastava, P.R., "Concepts in Environmental Impact Analysis", Common Wealth Publishers, New Delhi, 1992.
2. John G. Rau and David C Hooten (Ed)., "Environmental Impact Analysis Handbook", McGraw-Hill Book Company, 1990.
3. "Guidelines for EIA of development projects", Ministry of Environment and Forests, GOI
4. Judith Petts, "Handbook of Environmental Impact Assessment Vol. I & II", Blackwell Science, 1999.

Course Articulation Matrix :

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1		L					L								L
CO2			M						M						
CO3		M				M									
CO4	M									H					

Note : Enter correlation Levels 1, 2 or 3 as defined below:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

L : Low M: Medium H : High

INDUSTRIAL POLLUTION CONTROL

Sub Code : 14ME8X08 **Credits : 03**
Hrs/Week : 3+0+0+0 **Total Hours : 39**

Course Learning Objectives:
This Course will enable students to

1. Know the Consequences of pollution, relationship between man and environment over the last few decades, necessity of modern awareness on pollution and how carbon audit can help in developing a carbon strategy.
2. Identify the Importance of Meteorology in pollution control and global warming, various types of plume dispersions and its effect; analyze various levels of plume height for different pollutants.
3. Distinguish Particulates and fly ash separation techniques such as cyclone separator, electrostatic precipitator efficiency calculations etc.
4. Illustrate Formation, measurement and control techniques for Smoke and gaseous pollutants.
5. Summarize the Effects of water, soil, plastics and odor pollution their control techniques, Different Pollution Control Acts, Legal aspects of pollution control and how these acts can help in bringing down the pollution rate.

UNIT - I

Introduction to Pollution, Man and the environment, environmental degradation due to energy generation, consequences of pollution, sustainable industrial growth, air water and soil pollution, carbon audit. Ill effects of different pollutants, permissible concentrations.

6 Hours

UNIT - II

Meteorology: Meteorology, Wind rose, Functions of Atmosphere, Lapse rate & Temperature Variation in the Atmosphere, plume dispersion studies & Numerical problems.

6 Hours

UNIT - III

Separation techniques: Principal of working of thermal power station , Particulates and fly ash separation techniques, Sources of Particulates Matter, Fly ash, Electrostatic precipitator **(Problems),** Theory of settling processes **(Design Problems),** Bag House fabric filter, Cyclone separator,vSpray Tower, Scrubbers & Venturi Scrubber **8 Hours**

UNIT - IV

Smoke and gaseous pollutants: Sources of smoke, T, T, T-O Principle of smoke, Measurement of stack smoke intensity (Ringlemann Chart and Smokescope), Bosch Smoke meter, Domestic and Industrial Incinerators- Design factors, Pollutant gaseous-Their sources, measurement and control (So2, Co, UBHC, Nox) **10 Hours**

UNIT - V

Water Pollution, Soil pollution, Noise Pollution, Plastic and odor pollution, Solid waste management, problems associated with nuclear reactors. Their control methods & Legal aspects of pollution. **9 Hours**

Course Outcomes:

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

1. List different pollutants, define Environmental pollution, know about sustainable industrial growth.
2. Outline the instruments for various Meteorological measurements, distinguish types of plume dispersions and its effect; analyze the concentration of various gaseous pollutants.
3. Recall about Particulates and fly ash separation techniques, compare and Interpret their efficiency.
4. Identify Formation, measurement and control techniques for Smoke and gaseous pollutants
5. Identify Effects of water, soil, plastics and odor pollution on environmental pollution, know about Legal aspects of pollution control.

Mapping of POs & COs:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
14ME 8X08.1	L	M	M	L	L	M	H	H	L	M	L	L
14ME 8X08.2	L	M	M	L	L	M	H	H	L	M	M	M
14ME 8X08.3	L	M	H	L	L	M	H	H	L	M	L	L
14ME 8X08.4	L	M	M	L	L	M	H	H	L	M	M	M
14ME 8X08.5	L	H	H	L	H	M	H	M	L	M	L	L

L: Low M: Medium H: High

TEXT BOOKS:

1. "Environmental Pollution Control Engineering, *Wiley Eastern Ltd.*,
2. "Introduction to Environmental Engineering & Science", Gilbert M Masters, PHI,1995
3. "Environmental Pollution Control Engineering, *C. S RAO New Age Int.*

REFERENCE BOOKS:

1. *"Air Pollution"*, Henry C. Perkins, Mc-Graw Hill, 1974.
2. *"Air Pollution control"*, W. L. Faith, *John Wiley*

MOOC/NPTEL Resources:

1. http://nptel.ac.in/courses/105106119/36

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NON-CONVENTIONAL ENERGY SYSTEMS

Sub Code : 14EE8X10	**Credits : 03**
Hrs /Week : 3+0+0+0	**Total Hours : 39**

Prerequisites
Basic Electrical Engineering (14EE105)

Course Learning Objectives:

1. To illustrate the principle of extraction of energy from conventional, nonconventional sources.
2. To demonstrate the working principle and applications of solar based thermal, electrical and PV systems
3. To justify the usage of energy storage techniques and Understand the process of design and implement of wind based energy conversion systems
4. To understand the process of design and implement of biomass based energy conversion systems.

UNIT – I

Energy Sources: Introduction, Importance of Energy Consumption as Measure of Prosperity, Per Capita Energy Consumption, Classification of Energy Resources; Conventional Energy Resources - Availability and their limitations; Non-Conventional Energy Resources – Classification, Advantages, Limitations; Comparison of Conventional and Non-Conventional Energy Resources; World Energy Scenario; Indian Energy Scenario. **5 Hours**

Solar Energy Basics: Introduction, Solar Constant, Basic Sun-Earth Angles – definitions and their representation, Solar Radiation Geometry (numerical problems), Estimation of Solar Radiation of Horizontal and Tilted Surfaces (numerical problems); Measurement of Solar Radiation Data – Pyrometer and Pyrheliometer. **3 Hours**

UNIT – II

Solar Thermal Systems: Principle of Conversion of Solar Radiation into Heat, Solar Water Heaters (Flat Plate Collectors), Solar Cookers – Box type, concentrating dish type, Solar driers, Solar Still, Solar Furnaces, Solar Green Houses. **4 Hours**

Solar Electric Systems: Solar Thermal Electric Power Generation – Solar Pond and Concentrating Solar Collector (parabolic trough, parabolic dish, Central Tower Collector). Advantages and Disadvantages; Solar Photovoltaic – Solar Cell fundamentals, characteristics, classification, construction of module, panel and array.
Solar PV Systems – stand-alone and grid connected; Applications – Street lighting, Domestic lighting and Solar Water pumping systems. **4 Hours**

UNIT – III

Energy Storage: Introduction, Necessity of Energy Storage, and Methods of Energy Storage (classification and brief description using block diagram representation only). **3 Hours**

Wind Energy: Introduction, Wind and its Properties, History of Wind Energy, Wind Energy Scenario – World and India. Basic principles of Wind Energy Conversion Systems (WECS), Classification of WECS, Parts of a WECS, Derivation for Power in the wind, Electrical Power Output and Capacity Factor of WECS, Wind site selection consideration, Advantages and Disadvantages of WECS. **5 Hours**

UNIT – IV

Biomass Energy: Introduction, Photosynthesis process, Biomass fuels, Biomass conversion technologies, Urban waste to Energy Conversion, Biomass Gasification, Biomass to Ethanol Production, Biogas production from waste biomass, factors affecting biogas generation, types of biogas plants – KVIC and Janata model; Biomass program in India. **7 Hours**

UNIT – V

Energy from Ocean: Tidal Energy – Principle of Tidal Power, Components of Tidal Power Plant (TPP), Classification of Tidal Power Plants, Estimation of Energy – Single basin and Double basin type TPP (no derivations. Simple numerical problems), Advantages and Limitation of TPP. Ocean Thermal Energy Conversion (OTEC): Principle of OTEC system, Methods of OTEC power generation – Open Cycle (Claude cycle), Closed Cycle (Anderson cycle) and Hybrid cycle (block diagram description of OTEC); Site-selection criteria, Biofouling, Advantages & Limitation of OTEC. **5 Hours**

Emerging Technologies: Fuel Cell, Small Hydro Resources, Hydrogen Energy, and Wave Energy. (Principle of Energy generation using block diagrams, advantages and limitations).

3 Hours

Course Outcomes:

At the end of the course student will be able to

1. Review various sources of energy their advantages and limitations and understand the solar energy basics
2. Explain the working principle and applications of solar based thermal, electrical and PV systems
3. Appreciate the importance of energy storage and wind energy systems
4. Illustrate the working principle and applications of biomass systems
5. Explain the process of design and implement of tidal, OTEC based energy conversion systems and comprehend the emerging technologies in the area of RES.

TEXT BOOK:

1. Rai, G. D., “Non-Conventional Sources of Energy”, 4th Edition, Khanna Publishers, New Delhi, 2007’

REFERENCE BOOKS:

1. Mukherjee, D., and Chakrabarti, S., “Fundamentals of Renewable Energy Systems”, New Age International Publishers, 2005.
2. Khan, B. H., “Non-Conventional Energy Resources”, TMH, New Delhi, 2006.

E Book /NPTEL / MOOC

1. https://online-learning.tudelft.nl/courses/sustainable-energy-design-a-renewable-future/
2. https://ocw.mit.edu/courses/energy-courses/
3. http://nptel.ac.in/courses/108108078/

LINEAR SYSTEMS THEORY

Sub Code	**: 14EE8X11**	**Credits**	**: 03**
Hrs /Week	**: 3+0+0+0**	**Total Hours**	**: 39**

Prerequisites

Basic course on Control Systems (8^{th} students of Mechanical and E&C Branch)

Course Objectives:

1. To illustrate the principle of extraction of energy from conventional, nonconventional sources.
2. To demonstrate the working principle and applications of solar based thermal, electrical and PV systems
3. To justify the usage of energy storage techniques and Understand the process of design and implement of wind based energy conversion systems
4. To understand the process of design and implement of biomass based energy conversion systems.

UNIT – I

State variable analysis & design: Introduction, concept of state, state variables & state model, state model of linear systems, linearization of state equations. State space representation using physical variables, phase variables & canonical variables. **7 Hours**

UNIT – II

Derivation of transfer function from state model, diagonalisation, eigen values, Eigen vectors, generalized Eigen vectors. **7 Hours**

UNIT – III

Solution of state equation, state transition matrix & its properties, computation using Laplace transformation, power series method, Cayley-Hamilton method. **8 Hours**

UNIT – IV

Concept of controllability & observability, methods of determining the same.
Pole placement techniques: stability improvements by state feedback, necessary & sufficient conditions for arbitrary pole placement. **9 Hours**

UNIT – V

Sign definiteness, Sylvesters criteria, Lyapunovs' stability criteria, Lyapunov stability theorem for systems represented in state variable form, Application Liapunov stability criteria, Liapunov functions, direct method of Liapunov& the linear system, Hurwitz criterion &Liapunov's direct method. **8 Hours**

Course Outcomes:

At the end of the course student will be able to

1. Apply the State variable analysis & design for the given control system problems
2. Illustrate the importance of Eigen values in control system.
3. Obtain the solution for the state equation for a given control system problems
4. Explain the concept of controllability & observability and apply Pole placement techniques
5. Illustrate the Liapunov stability criterion and apply it to control system problems.

TEXT BOOKS:

1. J. Nagarath and M.Gopal, "Control Systems Engineering", New Age International (P) Limited, Publishers, 5th edition – 2007
2. M. Gopal, "Control Systems – Principles and Design", 4TH EDITION,2012

REFERENCE BOOK:

1. K. Ogata, "Modern Control Engineering ", Pearson Education Asia/ PHI, 4th Edition, 2002.

E Book / MOOC /NPTEL

1. https://www.edx.org/course/introduction-control-system-design-first-mitx-6-302-0x
2. http://nptel.ac.in/courses/108103007/
3. http://www.nptelvideos.in/2012/11/advanced-control-system-design_27.html
4. https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-241j-dynamic-systems-and-control-spring-2011/index.htm
5. https://ocw.mit.edu/courses/mechanical-engineering/2-04a-systems-and-controls-spring-2013/index.htm

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INFORMATION AND ELECTRONIC COMMUNICATION TECHNOLOGY

Sub Code : 14EC8X12 **Credits : 03**
Hrs/ Week : 3+0+0+0 **Total Hours : 39**

Common elective from Electronics and Communication department - for the students of Other branches

Course Learning Objectives:

This course will enable students to

1. Understand the concepts of communication channel and related parameters.
2. Differentiate between different modulation schemes.
3. Encourage the concepts of channel access and technologies and cellular mobile technology.
4. Explain the microwave systems and the phenomenon associated with the propagation.
5. Distinguish various multiple access techniques of long distance communication.
6. Appreciate the concepts of optical fiber communication.
7. Explain the concepts of computer networking.

UNIT – I

Introduction: measure of information, information content, symbols, entropy, communication channel, noise and channel capacity, discrete channels, error control, codes. Noise & signal processing, AM/FM/PM..., sampling, PAM, TDM, PCM.., Concept of spread spectrum, multiple access, cells, mobility, inter-cell handshake. **15 Hours**

UNIT – II

Microwaves: microwave devices, microwave systems and antennas, propagations, reflections and refractions terrestrial communications, ground and space components, SNR, FDMA, TDMA Etc, satellite systems and services.

Optical fiber: optical devices, transmission networks, multiplexing, WDM, OTDM, n/w management, lasers. **16 Hours**

UNIT – III

Computers communications: OSI, TCP/IP, languages, adhoc networks, security, multimedia, audio/video compression, 3G/4G N/Ws, latest trends. **8 Hours**

Course Outcomes:

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

1. Have a reasonable understanding a few of the technologies discussed in Electronics that has contributed to the development of , what is now termed as ICT
2. Define information and its quantification, the codes and the need for them
3. Select suitable channels for communications, different modulation schemes
4. Understand the working of high frequency/ optical devices and their limitations
5. Appreciate the extent of use of computers in present communication systems.

Mapping of POs & COs:

POs COs	a	b	c	d	e	f	g	h	i	j	k	l
1.								H		L		
2.	L			M								
3.						H	M					
4.						H	M					
5.						H	M					

L: Low M: Medium H: High

REFERENCE BOOKS:

1. Abrahamson, **"Information Theory& Coding",** McGraw Hill.
2. KamiloFeher, **"Wireless Communication &Application",** PHI.
3. Faraouzan, **"Data Communication",** TMH.
4. Gerdkeiser, **"Optical Fiber Communication",** MGH.
5. Fred Halsall, **"Multimedia Communication",** Pearson Education.

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ROBOTICS

Sub Code : 14EC8X13 **Credits : 03**
Hrs/ Week : 3+0+0+0 **Total Hours : 39**

Common elective from Electronics and Communication department - for Students from other branches

Course Learning Objectives:

This course will enable the students to

1. Course introduces the principle of robotic arm kinetic and dynamics.
2. Covers wide ranges of sensors such as distance, proximity, touch , force etc used in the robotic Modules.
3. Introduces the new dimensions of using artificial intelligency in the robotic system.

UNIT – I

Introduction: Historical developments, arm kinematics and dynamics, manipulated trajectory, planning and control, sensing, robot languages, machine intelligence.
Robot arm kinematics: Direct kinematics problem and inverse kinematics solution.
Robot arm dynamics: Lagrange-Euler formulation, Newton -Euler formulation equation of motion.
Planning trajectories: General considerations, joint interpolated trajectories, planning Cartesian path trajectories. **16 Hours**

UNIT – II

Sensing: Range, proximity, touch, force and torque sensing.
Low level vision: Image acquisition, illumination, geometry pre processing.
High level vision: Segmentation, description, 3D structure recognition, interpretation.
Robot programming languages: Characteristics of robot languages, task languages.
16 Hours

UNIT – III

Robot intelligence: State space search, predicate logic, means-ends analysis, robot learning, task planning expert systems. **7 Hours**

Course Outcomes:

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

1. Apply the theory of robotic arm kinetic in the robotic design applications.
2. Understand the basics of planning trajectories.
3. Use different sensor modules and processor to control the working of robotic arm.
4. Understand the use of different Robot programming languages
5. Apply the artificial intelligence in to the robotic device in a feasible way.

Mapping of POs & COs:

POs COs	a	b	c	d	e	f	g	h	i	j	k	l
1	H	H	M	H	M	M	L	L	L	L	L	M
2	H	H	M	H	M	M	L	L	L	L	L	M
3	H	H	M	H	M	M	L	L	L	L	L	M
4	H	H	M	H	M	M	L	L	L	L	L	M
5	H	H	M	H	M	M	L	L	L	L	L	M

L: Low M: Medium H: High

TEXT BOOK:

1. Fu K S. et al, **"Robotics-Control, Sensing, Machine and Intelligence",** McGraw Hill.

REFERENCE BOOKS:

1. Mittal and Nagarath, **"Robotics and Control",** TMH, 2003.
2. Groover MP et al., **"Industrial Robotics",** TMH.

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PROGRAMMING WITH C++

Sub Code : 14CS8X14 **Credits : 03**
Hrs/Week : 3+0+0+0 **Total Hours : 39**

Course Learning Objectives:

This Course will enable students to

1. **Compare** and **contrast** the advantages and benefits of procedural and object oriented programming
2. **Describe** the various object oriented concepts and determine how these concepts can help to model real time data
3. **Choose** appropriate object oriented programming concepts to model a given problem statement
4. **Compare** the efficiency and privacy of data in object oriented programming compared to procedural programming
5. **Develop** algorithms and programs that use the concept of classes, objects, inheritance, polymorphism, operator overloading, function overloading

UNIT – I

Principles of object – oriented programming:
A look at Procedure Oriented Programming, object Oriented Programming Paradigm, Basic Concepts of OOP, Benefits of OOP, Object oriented languages ,Applications of OOP

3 Hours

Beginning with C++:
What is C++?, Applications of C++, Structure of C++ program, Basic Data types, derived data types, user defined data types, variables in C++, dynamic initialization of variables, reference variables, operators in C++, scope resolution operator, memory management operators, type cast operators, manipulators, namespace. **4 Hours**

UNIT – II

Functions in C++:
Function prototyping, Inline Functions, Default Arguments, Function Overloading

3 Hours

Classes and objects:
Introduction, C Structure Revisited, Specifying a Class, Defining Member Functions, Static Data Members, and Static Member Functions. Arrays of Objects, Objects as Functions Arguments, this pointer, Friend Functions, Returning Objects, Constant Member Functions.

5 Hours

UNIT – III

Constructors and Destructors
Introduction, Constructors, Parameterised Constructors, Multiple Constructors in a Class. Constructors with Default Arguments, Copy Constructors, Dynamic Constructors, Constant Objects, Destructors. **3 Hours**

Operator Overloading and Type Conversions
Introduction, Defining Operator Overloading, Overloading the Various Operators, Overloading the Increment and the Decrement Operators (Prefix and Postfix), Overloading the Unary Minus and the Unary Plus Operator, Overloading the Arithmetic Operators. Overloading the Relational Operators, Overloading the Assignment Operator, Overloading the Insertion and Extraction Operators, Rules for overloading operators. Type Conversions.

5 Hours

UNIT – IV

Inheritance
Introduction, Defining Derived Classes, Single Inheritance, Protected Access Specifier, Multilevel Inheritance, Multiple Inheritance, Hierarchical Inheritance, Hybrid Inheritance, Virtual Base Classes, Abstract Classes, Constructors in Derived Classes, Nesting of Classes.

4 Hours

Pointers, Virtual Functions and Polymorphism
Introduction, Pointers, Pointers to Objects, Pointers to Derived Classes, Virtual Functions, Pure Virtual Functions. **4 Hours**

UNIT – V

Templates and Exception Handling

Introduction, Function Templates, Class Templates, Overloading of Template Functions. Basics of Exception Handling, Exception Handling Mechanism, Limitation of Exception Handling. **4 Hours**

Working with files

Classes for Files Stream Operations, Opening and Closing a File, Error Handling during File Operations. **4 Hours**

Course Outcomes:

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

1. **Explain** basic concepts of object oriented programming
2. **Design** and **analyze** concepts of classes and objects
3. **Implement** and **apply** object oriented approaches like inheritance, polymorphism, operator overloading and function overloading
4. **Analyze** the working of files, generic programming using templates, and exception handling

Mapping of POs & COs:

POs / COs	a	b	c	d	e	f	g	h	i	j	k	l
1	H											L
2	H	H										M
3		H			M					L		M
4		H			M					L	L	H

H : High M: Medium L : Low

TEXT BOOK:

1. E.Balagurusamy: Object – Oriented Programming with C++, Third Edition, Tata McGraw Hill. (Chapters 1.3 to 1.8, 2.1, 2.2, 2.6, 3.5 to 3.7, 3.10 to 3.18, 4.3, 4.6 to 4.9, 5, 6, 7, 8, 9, 11, and 12)

REFERENCE BOOKS:

1. Robert Lafore: Object – Oriented Programming in Turbo C++, Fourth Edition, Sams Publishing
2. Herbert Schildt: C++ The Complete Reference, Third Edition, Mcgraw-Hill Osborne Media;
3. K.R. Venugopal, B. Rajkumar and T. Ravi Shankar: Mastering C++, Tata McGraw Hill, New Delhi, 1999; 25th Reprint, 2006

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ESSENTIALS OF INFORMATION TECHNOLOGY

Sub Code : 14CS8X15 **Credits : 03**
Hrs/Week : 3+0+0+1 **Total Hours : 39**

Course Learning Objectives:

This Course will enable students to

1. **Explain** the basics of IT, data structure and basic programming languages.
2. **Implement** algorithms using flowcharts, UML diagrams and **learn** problem solving techniques. Also **Explain** coding standards & best practices and **implement** code optimization
3. **Demonstration** of object oriented language and **perform** the various programming constructs. Also **Identify** and **apply** the basic concepts of Java programming, inheritance, packages & interfaces.
4. **Design** and **develop** databases using SQL and embedded SQL
5. **Identify** the basics of Software engineering and **analyze** the difference between software evolution, software costing and managing people.

INTRODUCTION TO COMPUTER SYSTEMS (SELF-STUDY)

Introduction to Computer Systems - Basics of computer systems - Various hardware components - Data storage and various Memory units - Central Processing Unit - Execution cycle - Introduce to software and its classifications

Problem Solving (Self-Study)

Problem Solving skills - Algorithm Representation using Psuedo Code - Psuedo code Testing- Dry Run - Algorithm Properties

UNIT – I

OBJECT ORIENTED PROGRAMMING USING JAVA - I

Data Structures - Linear Data Structures-Arrays, Linked List, Stacks, Queues - Non Linear Data Structure- Trees, Binary Search

Tree Programming in JAVA - Programming Constructs in JAVA - Type Casting - Control Structures

SDLC & UML - SDLC Overview and need for Object Oriented Approach - Object Oriented Concepts - Introduction to UML

Object Oriented Fundamentals & Implementation in JAVA - OO fundamentals - Coding Standards - Reference Variables & Objects in Memory - Methods- Pass by Values, Pass by References, Recursive Methods - this Reference **7 Hours**

UNIT – II

OBJECT ORIENTED PROGRAMMING USING JAVA - II

OO Constructs in JAVA in Java-I - Arrays-Revisit - Strings - Constructors: Default, Parameterized - Static - Command Line Arguments & Revisiting Main - Algorithm Design Techniques

OO Constructs in JAVA in Java-II - Method Overloading - Constructor Overloading -Types of Relationships - Inheritance - Aggregation - Association - Method Overriding - Dynamic Polymorphism - Abstract - Interfaces - Packages

Code Optimization, Tuning Techniques & Unit Testing - Code Optimization - Clean Code - Refactoring Techniques - Unit Testing **9 Hours**

UNIT - III

RELATIONAL DATABASE MANAGEMENT SYSTEM - I

RDBMS- Database Model - Relational Database Model - Keys in RDBMS - Database life Cycle - Database Design.

ER modeling concept –Notations – Extended ER features - Conversion of ER Diagram into Relational Schema

Logical database design - Normalization - Functional Dependency - 1NF - 2NF - 3NF **6 Hours**

UNIT – IV

RELATIONAL DATABASE MANAGEMENT SYSTEM - II

SQL – DDL statements - Create, Alter, Drop, Truncate – DML statements- Insert, Update, Delete, Select – DCL statements- Grant, Revoke - TCL statements-Commit, Rollback.

Joins - Sub queries – SQL Best Practices - Views - Transaction - Procedural Language SQL – Cursor Database design Issues **8 Hours**

UNIT – V

SOFTWARE ENGINEERING & USER INTERFACE

Introduction to UI Concepts & Web Technologies - Internet Basics - Types of Networks, Topologies, Connecting Devices, Network Architecture, IP Address - Web Fundamentals - HTML & CSS - Javascript - Introduction to DOM

Software Engineering - Definition & Elements - Need for SE - Process - SE Models/ Approaches - Requirements Development - Software Design & Construction - Software Testing - Introduction to User Experience - Project Categories & Project Management Phases - Quality Control & Assurance Activities - Configuration Management, Requirements Traceability & Defect Prevention - Software Metrics – Reuse **9 Hours**

INTEGRATED PROJECT

Project based on JAVA & RDBMS.

Course Outcomes:

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

1. **Identify** the solution to various problems using various problem solving techniques.
2. **Implement** Java program that contains inheritance, packages & interfaces concepts
3. **Design** and **apply** the object oriented programming construct using Java to build the front end of any application.
4. **Formulate** simple database models using Entity-Relationship Modeling. Also **Compose** and **develop** databases using SQL and embedded SQL**.** Also **apply** the same to build the back-end of any application.
5. **Practice** various Software engineering models while developing any software's.

Mapping of POs & COs:

POs / COs	a	b	c	d	e	f	g	h	i	j	k	l
1	H		H		H				H			
2		H			H				L		M	
3		H			H				L		M	
4		H	H		H				L		M	
5	H		H		H						H	

H : High M: Medium L : Low

TEXT BOOKS:

1. Alfred V.Aho, Ullman, Hopcroft, Data Structures and Algorithms, Addison-wesely.
2. The Complete Reference Java by Herbert Schildt, Seventh Edition, 2007, Tata McGraw-Hill.
3. Elmasri, Navathe, "Fundamentals of Database Systems", Third ed, Addison Wesley
4. Robert W.Sebesta , "Programming with World Wide Web", Fourth Edition, Pearson Education
5. Ian Sommerville, "Software Engineering", 8th Edition, Person Education Ltd., 2007.

REFERENCE BOOKS:

1. Andrew S. Tanenbaum , : Structured Computer Organization , PHI, 4th edition, 1999
2. John L. Hennessy, David Goldberg, David A. Patterson, Computer Architecture : A Quantitative Approach, 2nd Edition Published by Morgan Kaufman Publishers, 1996
3. Dromey, R.G., How to solve it by computers, Prentice Hall, 2005
4. Lipschutz, Seymour & G A V Pai, Data Structures, Tata McGraw – Hill
5. Baldwin, Douglas & Scragg, Greg W., Algorithms and Data Structures The Science of Computing, Dreamtech
6. Kernighan., Ritchie, ANSI C Language, Prentice Hall of India, New Delhi, 1992.
7. Yashwant Kanitker, Let Us C, by Yashwant Kanitker, Second Edition
8. Schaum series, Programming in C, Third Edition
9. Programming Pearls , by Jon Bentley, Pearson Education publication
10. Aho, Alfred V,Compiler Principles, Techniques and Tools,Pearson Education
11. Tharp Alan L, File Organization and Processing, John Willey and Sons
12. Henry F Korth, Abraham Silberschatz, “Database system concepts”, Second ed., McGraw-Hill International editions, Computer Science series, 1991
13. C.J.Date ,"An introduction to Database Systems", Sixth ed, Narosa Publications
14. Roger.S.Pressman, "Software Engineering-A Practitioners approach", 7th Edition,McGraw-Hill, 2007.

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CONSUMER ELECTRONICS

Sub Code : 14EC8X18 **Credits : 03**
Hrs/ Week : 3+0+0+0 **Total Hours : 39**

Common elective from Electronics and Communication department - for the students of other branches

Course Learning Objectives:

This course will enable the students to

1. Learn and design operating principles of "real world" electronic devices
2. Study broader view of key principles of electronic device's operation and presents a block circuit diagram.
3. Learn to integrate the many different aspects of emerging technologies and able to build unique mix of skills required for careers.

UNIT - I

SOUND: Properties of sound and its propagation, Transducers (Micro Phone, Loud Speakers), enclosures, mono-stereo, Amplifiers, Multiplexers, mixers, Synthesizers.
VISION: B/W TV, CTV concepts, B/W & Color Cameras, Displays. **15 Hours**

UNIT – II

RECORDING AND PLAYBACK: Discs, Magnetic tapes and discs, Optical discs; recording and playback, audio and video systems, Theatre Sound, Studios, Editing.
COMMUNICATIONS AND BROADCASTING: Switching Systems, Land lines, Modulation, Carrier, Fiber optics, Radio and TV broad casting
DATA SERVICES: Data services, mobiles, terrestrial & Satellite Systems, GPS, Computers, internet Services. **15 Hours**

UNIT – III

UTILITIES: Fax, Xerox, Calculators, Microwave ovens, Washing Machines, A/C & refrigeration, Dishwashers, ATMS, Set -Top boxes, Auto Electronics, Industrial Electronics, Robotics, Electronics in health / Medicine, nano- technologies. **9 Hours**

Course Outcomes:

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

1. Recall basics of sound.
2. Recall basics of television andcamera.
3. Explain basic working of Recording, storage devices,
4. Explain basics of communication and broadcasting.
5. Recall basic working of commonly used electronic gadgets

Mapping of POs & COs:

PO CO	a	b	c	d	e	f	g	h	i	j	k	l
1	L					L					M	M
2	L					L					M	M
3	L					L					M	M
4	L					L					M	M
5	L					L					M	M

L: Low M: Medium H: High

TEXT BOOKS:

1. Anand, **"Consumer Electronics",** Khanna publications, 2011.
2. Bali S. P., **"Consumer Electronics",** Pearson Education, 2005.

REFERENCE BOOK:

1. Gulati R. R., **"Modern Television Engineering",** Wiley Eastern

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OPTO ELECTRONIC DEVICES

Sub Code : 14PH8X19 **Credits : 03**
Hrs/week : 3+0+0+0 **Total Hours : 39**

Course Learning Objectives:

1. To understand the basic principles of construction, working and applications of various opto electronic devices.
2. Study of sources of radiation like lasers and LED, their specific properties and hence their use for applications.
3. Study of radiation detectors like semiconductor detector, diode as detector and photo multiplier.
4. Exploring the ways of harnessing solar energy and assessing the efficiency of solar energy converters.
5. Understanding the fabrication and applications of optical fibers, optical modulators and waveguides for optical communication.

PART A
UNIT - I

Display devices

Elements of optical phenomena in Semiconductors- fundamentals of Fermi-Dirac distribution, band structure, direct and indirect band gap semiconductors, generation-recombination mechanisms, absorption and emission processes.

Display devices- cathode ray tube, liquid crystal display, charge coupled devices, plasma display. **8 Hours**

UNIT – II

Lasers and optical fibers

Lasers- basic principles, optical resonator-types, modes and quality factor, practical lasers-ruby, Nd-YAG, He-Ne, applications.

Optical fibers- types of fibers, modes of propagation, attenuation and losses, optical fiber communication system, advantages. **7 Hours**

PART B
UNIT – III

Optical sources and detectors

Light emitting diode- electroluminescence in p-n junction, LED characteristics, efficiency and responsivity, surface emitting and edge emitting LEDs, double heterojunction LED.

Semiconductor laser- basic structure, laser action, heterojunction laser, quantum well laser, distributed feedback laser.

Photo detectors- photo conductor detector, junction photo diode, p-i-n photo diode, avalanche photo diode. Photo multiplier tube. **8 Hours**

UNIT - IV

Solar cells

Principle of operation of a solar cell, efficiency and spectral response, fill factor and power extraction efficiency, solar radiation, air mass notation, losses in radiation absorption and conversion.

Homo and hetero junction solar cells, thin film solar cells, Schottky barrier solar cells, cascade hetero junction solar cells, temperature and radiation effects, optical concentration, device fabrication. **8 Hours**

UNIT – V

Integrated optics and modulators

Modulation of light- direct and external modulation, phase modulation, magneto-optic and acousto-optic modulation, Kerr effect and Pockels effect.

Waveguides- device structure, passive and active waveguide devices, phase modulator, interferometric modulator, directional coupler switch, active waveguide devices based on acousto-optic effect, magneto-optic effect and thermo-optic effect, waveguide coupling, opto electronic integrated circuits. **8 Hours**

Course Outcomes:

1. Ability to choose the appropriate device to meet the requirement of a particular application.
2. Making modifications to device structures by understanding the factors affecting their performance.

3. Attempting better efficiency and utility through an understanding of the principles of performance.
4. Use the technical knowledge acquired to troubleshoot and rectify devices and circuits.
5. Explore the possibility of designing devices with better characteristics.

TEXT BOOK :

1. P.R.Sasikumar 'Photonics – an introduction', PHI Learning Pvt. Ltd.,New Delhi, 2012 edition.

REFERENCE BOOKS:

1. J.Wilson and J.Haukes 'Opto electronics- an introduction', Prentice Hall of India, New Delhi.
2. Jasprit Singh 'Opto electronics- an introduction to Materials and Devices' McGraw Hill international ed., 1998.
3. A.Ghatak and Thyagarajan 'Introduction to opto electronics' New Age International Publication.

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CHEMISTRY OF NATURAL PRODUCTS

Sub Code	**: 14CH8X21**	**Credits**	**: 03**
Hrs/Week	**: 3+0+0+0**	**Total Hours**	**: 39**

Course Learning Objectives:

This course will enable students to

1. Identify the structure of terpenoids and their biosynthesis.
2. Elucidate the structure of β-carotene, haemoglobin and chlorophyll.
3. Understand the chemistry underlying steroids and sex hormones.
4. Get introduced to the different types of prostaglandins as well as theory and chemistry behind natural dyes.
5. Gain knowledge on general methods of structural determination of some of the important alkaloids.

UNIT – I

TERPENOIDS

Introduction and classification, isoprene rules, general methods of determination of structure of terpenoids. Structure elucidation of the following terpenoids-geraniol, α-pinine, camphene and farnesol. Biosynthesis of terpenoids. **8 Hours**

UNIT - II

CAROTENOIDS

Introduction and classification of carotenes. Structural elucidation of β-carotene.

PORPHYRINS

Introduction to porphyrins, structure and degradation products of haemoglobin and chlorophyll. **7 Hours**

UNIT - III

STEROIDS

Introduction, Dile's hydrogenation. Chemistry of cholesterol, Blanc's rule, Barbier-Wielman degradation, Oppenuer oxidation. Constitution of bile acids.

Sex hormones: Chemistry of oestrone, progesterone, androsterone and testosterone.

8 Hours

UNIT – IV

PROSTAGLANDINS

Introduction, nomenclature, classification, and biological role of prostagladins. Structure elucidation of PGE_1, Biosynthesis of PGE_2 and $PGF_{2\alpha}$.

NATURAL DYES

Introduction, Witt's theory of colour, methods of dyeing, chemical constitution of alizarin.

8 Hours

UNIT – V

ALKALOIDS

Definition, Classification and isolation of alkaloids. General methods of structural determination of alkaloids. Detailed study of structure elucidation of the following alkaloids- papaverine, cinchonine and nicotine. **8 Hours**

Course Outcomes:

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

1. Elucidate the structure of terpenoids like geraniol, a-pinine, camphene and farnesol.
2. Explain the structural chemistry of carotenoids and porphyrins.
3. State the basic reactions governing steroids and sex hormones.
4. Explain the biological role and structure of prostaglandins and state the methods employed for dyeing.
5. Apply the general methods of structural determination to elucidate the structure of alkaloids like papaverine, cinchonine and nicotine.

TEXT BOOK:

1. Organic Chemistry of Natural Products, Vol.-I & Vol.-II, O.P. Agarwal (Goel Publishing House) 2014.

REFERENCE BOOKS:

1. Natural Products Chemistry, Vol. I & II, K. Nakanishi, T. Goso, S. Ito, S. Natori and S. Nozoe, Academic Press, Ny, 1974.
2. Organic Chemistry of Natural Products, Vol. I & II- Gurudeep R. Chatwal (Himalaya Publishing House) 2013.
3. An Introduction to Alkaloids- G.A. Swal (Backwell Scientific Publications) 1967.
4. Hand book of naturally occurring Compounds, Vol. II, terpenes, T.K. Davon, A.I. Scott, Academic Press, Ny, 1974.

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ESSENTIALS OF IT SERVICE INDUSTRY

Sub Code : 14CS8X22 **Credits : 03**

This subject is offered as open elective and is taught at the campus of Span InfoTech at Bangalore as a part of the industry internship program.

Security Testing	Performance Testing
1. Basic HTML 2. HTTP Protocol 3. Types of Authentication 4. Browsers 5. Types of Sessions, Cookies, Cache 6. Basics of OSI Model 7. Three Way Handshaking 8. How Web Application Works 9. HTTP request and response 10. Proxies 11. Input Validation and Bypassing same 12. Basic JavaScript 13. Analyzing web page source 14. OWASP ASVS - Overview 15. Web Applications Components 16. Common Web Application Threats 17. Web Application Attack 18. Basic Encoding and Decoding 19. Types of Encryption techniques 20. Basics of Cryptography 21. Different between Malware, Trojan, Spyware etc 22. Web Application Penetration Testing Methodologies 23. Query Strings 24. User Enumeration 25. Un-validated Input 26. Directory Traversal 27. Cross-Site Scripting (XSS) 28. Types of XSS 29. Testing for XSS 30. Injection Flaws 31. Different Types of Injection Flaws 32. Error-based SQL injection - 33. Union query type 34. Blind SQL Injections 35. Boolean-based blind injections. 36. Authentication Flaws 37. Direct Object Reference Vulnerability 38. Missing Function Level Access Control 39. Unvalidated Redirects and Forwards	**Basic Performance Testing** 1. Web and N-Tier Architecture 2. Communication protocols - HTTP/HTTPS, TCP 3. HTML basics 4. Caching 5. HTTP response codes 6. HTTP methods 7. Web Server concepts 8. Application Server concepts 9. Database server concepts 10. LESS Approach (Load, Endurance, Stress and Spike) 11. Performance Testing Life Cycle **Unit 2: Front End Performance Testing** 12. Web Browser Basics 13. HTTP Watch tool 14. Yslow tool and Parameters • Minimize HTTP Requests • Use a Content Delivery Network • Avoid empty src or href • Add an Expires or a Cache-Control Header • Gzip Components • Put StyleSheets at the Top • Put Scripts at the Bottom • Avoid CSS Expressions • Make JavaScript and CSS External • Reduce DNS Lookups • Minify JavaScript and CSS • Avoid Redirects • Remove Duplicate Scripts • Configure ETags • Make AJAX Cacheable • Use GET for AJAX Requests • Reduce the Number of DOM Elements • No 404s • Reduce Cookie Size

40. Malicious file upload
41. Business logic bypass
42. Sensitive Data Exposure
43. Cross-Site Request Forgery
44. Using Components with Known Vulnerabilities
45. Phishing attack
46. Heartbleed vulnerability
47. DOS and DDOS
48. MITM
49. Tool - Burp Proxy, Tamper data
50. Brute force attacks
51. SSL Encoding/Decoding
52. Basic of OSI Model
53. UDP versus TCP
54. DNS

- Use Cookie-Free Domains for Components
- Avoid Filters
- Do Not Scale Images in HTML
- Make favicon.ico Small and Cacheable

Unit 3: Scripting and Load Testing using VSTS

15. Performance Testing Tools overview
16. Introduction to VSTS
17. Recording
18. Scripting
19. Script Enhancements
20. Scripting Standards
21. Creating a Test Scenario and Run Time settings
22. Load Testing
23. Analysis
24. Reporting

Unit 4: Perfmon and PAL

25. System Counters in Perfmon (CPU/Memory/Disk(Physical and Logical)/Network)
26. Understanding General Statistics
27. Interpreting results and graphs
28. PAL Analysis and Report

Unit 5: Statistics

29. 90th Percentile calculation
30. Finding standard deviation using "Actual Mean Method"

Java
Core Java (Basic and Advanced)
Maven build
HTML & CSS/Styles
Servlet and JSP
Springs
DBOverview and Query writing
MySQL Overview
Hibernate

Basic JSF
Rest WebServices
JAXB
Junit
Java Script (Basic and Advanced)
Coding Standard
Advanced JQuery

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PROFESSIONAL & COGNITIVE COMMUNIQUÉ

Sub Code : 14HU8X24 **Credits : 03**
Hrs/Week : 3+0+0+0 **Total Hours : 39**

Course Learning Objectives:

This Course will enable students to

Students should be able to:

1. Understand how to think critically and apply emotional intelligence in workplace
2. Understand manners, etiquettes and cultural sensitivity required for career life
3. Understand the gender perspectives in online and offline spaces
4. Understand how human body is comprehended in social and virtual spaces
5. Understand the different ways to read and write

UNIT – I

Commonsense and Emotional Intelligence

Common Sense: The Terms: Common Sense, Commonsensical Consensus, and Critical Thinking. Unsettling Commonsensical Consensus. Role of Language in Common Sense and Critical Thinking.

Emotional Intelligence: Nature, Function and Types; Emotion, Intelligence and Creativity; Growth and Development of Emotional Intelligence. (Case Studies- Tomiya, Pig and Bitch, Cookies) **8 Hours**

UNIT – II

Manners and Etiquettes

Manners and Etiquettes: What is Etiquette? Work Place Etiquette, Workplace Readiness Skills, Physical and Psychological Working Conditions.

Workplace: Significance of Cross Cultural Understanding; Cultural Sensitivity, Impact of Social Media, Self-Representation. **8 Hours**

UNIT – III

Social Media and Gender Perspectives

Social Media and its Impacts: Emergence of Social Media, Impact on Gender and Self Representation, Regulatory and Liberatory aspects of Social Media, Offline Norms and Online Behaviour.

Gender Perspectives: Gender and Sex, Genderization, Homogeneity and Heterosexuality, Gender Expressions, Gender schooling **8 Hours**

UNIT - IV

Body and Panopticisim

Body: Representation of Body, Commodification, Gender Perspectives of Body

Panopticism: Ways of Seeing, Discipline and Punishment, ISA and RSA **7 Hours**

UNIT - V

Writing and Reading
Writing: Creative Writing, Formal Writings / Informal Writing, Plagiarism
Reading: Styles of Reading, Scanning, Skimming, Detailed Reading **8 Hours**

Course Outcomes:

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

1. Think critically
2. Comprehend etiquttes and manners in different situatuions
3. Be gender sensitive in both offline and online behaviour
4. Exhibit better comprehension of the socil implications of human body
5. Understand the inportance of reading and writing skills

REFERENCE BOOKS:

1. Geetha.V. *Gender*. Kolkatta: WebImpressions, 2009.
2. Bailey, Jane, et al. "Negotiating With Gender Stereotypes On Social Networking Sites: From "Bicycle Face" to Facebook." *Journal of Communication Enquiry* 37.2 (2013): 91-112.
3. Barry, Peter. *Beginning Theory*. New Delhi: Viva Books, 2010.
4. Berger, John. *Ways of Seeing.* London: Penguin Books, 1977.
5. Cranny-Francis, Anny, et al. *Gender Studies:Terms and Debates.* New York: Palgrave Macmillan, 2003.
6. Gauntlett, David. *Media, Gender and Identity: An Introduction.* London: Routledge, 2008
7. Pilcher, Jane, and Imelda Whelehan. *50 Key Concepts in Gender Studies.* London: Sage, 2004.Print.
8. Jeanne, Haraway Donna. *Simians, Cyborgs, and Women.* London: Free Association Books, 1991.Web.
9. Koskela, Hille. "Webcams, TV Shows and Mobile Phones: Empowering Exhibitionism." *Surveillance Society* 2.3 (2004): 199-215.Web.

Important Links:

http://www.cyberpsychology.eu
http://www.surveillance-and-society.org/articles2(2)/webcams.pdf
http://eprints.rclis.org

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FUNDAMENTALS OF OPERATING SYSTEM

Sub Code : 14IS8X27 **Credits : 03**
Hrs/Week : 3+0+0+0 **Total Hours : 39**

Course Learning Objectives

This Course will enable students to

1. Summarize the general concepts of an operating system related to process and threads.
2. Demonstrate the process scheduling algorithms, detecting and avoiding deadlocks.
3. Summarize the process synchronization and memory management concepts of an operating system.
4. Discuss the file implementation in operating system
5. Explain secondary storage concepts of an operating system

UNIT - I

INTRODUCTION AND SYSTEM STRUCTURES
Operating system definition; Operating System operations; Different types of operating system –Distributed systems, Real time systems
OPERATING SYSTEM SERVICES; User - Operating System interface; Operating System structure.
PROCESS MANAGEMENT: Process concept; Process scheduling;
MULTI-THREADED PROGRAMMING: Overview; Multithreading models. **7 Hours**

UNIT - II

PROCESS SCHEDULING
Basic concepts; Scheduling criteria; Scheduling algorithms;
DEADLOCKS
System Model, Deadlock Characterization, Methods for Handling Deadlocks, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection, Recovery from Deadlock. **8 Hours**

UNIT - III

PROCESS SYNCHRONIZATION
The Critical section problem; Semaphores; Classical problems of synchronization; Monitors.

MEMORY MANAGEMENT
Memory Management Strategies: Background; Swapping; Contiguous memory allocation; Paging; Structure of page table; Segmentation. **8 Hours**

UNIT – IV

VIRTUAL MEMORY MANAGEMENT
Background; Demand paging; Page replacement; Allocation of frames.

FILE SYSTEM
File System: File concept; Access methods; Directory structure; **8 Hours**

UNIT - V

IMPLEMENTING FILE SYSTEM

File system structure; File system implementation; Directory implementation; Allocation methods;

SECONDARY STORAGE STRUCTURES, PROTECTION

Disk structure; Disk attachment; Disk scheduling; Disk management; Swap space management. **8 Hours**

Course Outcomes:

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

Sl. No.	Course Outcome (CO)	Bloom's Taxonomy Level (BTL)
C8X27.1	Discuss the operating system structure and management of process	2
C8X27.2	Apply the process scheduling algorithms , deadlock prevention and avoidance concepts of operating system	3
C8X27.3	Discuss synchronization of process and memory management concepts	2
C8X27.4	Describe the file implementation in operating system	2
C8X27.5	Explain the secondary storage structure and management	2

Mapping of POs & COs:

POs / COs	PO a	PO b	PO c	PO d	PO e	PO f	PO g	PO h	PO i	PO j	PO k	PO l	PO m	PO n
C8X27.1	**M**				**L**				**L**					
C8X27.2	**M**	**M**			**M**				**M**					
C8X27.3	**M**	**M**			**M**				**M**					
C8X27.4	**M**								**M**					
C8X27.5	**M**	**M**			**M**				**M**					

TEXT BOOK:

1. Abraham Silberschatz, Peter Baer Galvin, Greg Gagne: Operating System Principles, 7 ed Wiley-India, 2006

REFERENCES BOOKS:

1. William Stallings,"Operating System Internals and Design Principles",5ed,Pearson Education,Asia,2005.
2. Gary Nutt," Operating System"3 ed, Pearson Education,2004
3. D.M Dhamdhere: Operating systems - A concept based Approach, 2ed, Tata McGraw- Hill, 2002.
4. P.C.P. Bhatt: Operating Systems, 2 ed, PHI, 2006.

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OPERATIONS MANAGEMENT & ENTREPRENEURSHIP

Sub Code : 14ME8X28 **Credits : 03**
Hrs/Week : 3+0+0+0 **Total Hours : 39**

Course Learning Objectives:

1. Define production/operations management, Classify Production and service system and different type of production systems, Understand the importance of CRM and ERP
2. Appreciate the importance of Quality tools and methods in operations management
3. Analyze the data draw variable process control charts and determine process capability; Understand salient issues concerning reliability
4. Understand the issues related to entrepreneurship, characteristics of an entrepreneur and different studies carried out during project appraisal.
5. Identify and differentiate the different national and state level funding agencies.

UNIT - I

Introduction to Production/ Operations Management: Concept of production, Classification of production systems, Production Management, Concept of operations, Distinction between Manufacturing Operations and Service Operations, Objectives of Operations Management (Customer Service and Resource utilization/ Competitive advantage through Quality-Delivery-Cost), Scope of Operations Management. Introduction to Customer Relationship Management (CRM) and Enterprise Resource Planning (ERP).

7 Hours

UNIT - II

Introduction to Quality Concepts: The Meaning of Quality and Quality Improvement, Key dimensions of Quality, Concept of cost of quality. Customers' perception of quality.

TOTAL Quality Management: Definition, Principles of TQM, Gurus of TQM, Benefits of TQM.

Managing Quality: Quality circles, Continuous Improvement- Juran's Trilogy, PDSA cycle, Kaizen, 7 QC tools,

Philosophy of statistical process control and modeling process quality: Normal distribution tables, Finding the Z score, Central limit theorem, Chance and assignable causes of variation, Statistical Basis of the Control Charts (basic principles, choices of control limits, significance of control limits, warning limits) **9 Hours**

UNIT - III

Control charts for variables: Control Charts for X-Bar and R- Charts, Type I and Type II errors, Simple Numerical Problems,

Process capability: The foundation of process capability, Natural Tolerance limits, c_p – process capability index, c_{pk}, p_p – process performance index, summary of process measures. Numerical problems. Concept of Six sigma.

Introduction to reliability, Mean time to failure, Mean time between failures, Bath tub curve, Reliability of series and parallel systems, Numerical problems on the above topics.

8 Hours

UNIT – IV

ENTREPRENEURSHIP: Concept of Entrepreneurship, Stages in entrepreneurial process, Role of entrepreneurs in Economic Development, Barriers to Entrepreneurship, Meaning of Entrepreneur, Functions of an Entrepreneur, Types of Entrepreneurs, Intrapreneur - an emerging Class.

Identification of business opportunities: Market Feasibility Study; Technical Feasibility Study; Financial Feasibility Study & Social Feasibility Study.

Application of Operations Management concepts in Facility/ Business Location: General procedure for making locations decisions, Numerical Problems on application of Breakeven analysis and Transportation method to make location decisions.

8 Hours

UNIT - V

SMALL SCALE INDUSTRIES: Definition; Characteristics; Need and rationale; Objectives; Scope; role of SSI in Economic Development. Advantages of SSI, Steps to start and SSI, Government policy towards SSI; Different Policies of SSI, Impact of Liberalization, Privatization, Globalization on SSI. Effect of WTO/GATT on SSI, Supporting Agencies of Government for SSI, Ancillary Industry and Tiny Industry (Definition Only)

INSTITUTIONAL SUPPORT: Different Schemes; TECKSOK; KIADB; KSSIDC; KSIMC; DIC Single Window Agency; SISI; NSIC; SIDBI; KSFC.

7 Hours

Course Outcomes :

At the end of the course the students should be able to

1. Define production/operations management, Classify Production and service system and different type of production systems, Understand the importance of CRM and ERP
2. Appreciate the importance of Quality tools and methods in operations management
3. Analyze the data draw variable process control charts and determine process capability; Understand salient issues concerning reliability
4. Understand the issues related to entrepreneurship, characteristics of an entrepreneur and different studies carried out during project appraisal.
5. Identify and differentiate the different national and state level funding agencies.

Course Articulation Matrix (CO – PO MAPPING):

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
C-14ME8X28.1	M	M	H	M	L	L	M	M	H	M	M	M	L	L
C-14ME8X28.2	H	M	M	H	L	L	L	L	H	M	M	M	L	L
C-14ME8X28.3	H	M	H	H	L	L	L	L	H	M	H	M	M	M
C-14ME8X28.4	M	M	M	H	L	L	L	L	H	H	H	M	M	M
C-14ME8X28.5	M	M	M	H	L	L	M	L	H	H	H	M	M	M

L: Low M: Medium H: High

TEXT BOOKS:

1. **Production / Operations Management**, Joseph G Monks, McGraw Hill Books
2. **Production and Operations Management**, William J Stevenson, Tata McGraw Hill, 8th Edition.
3. **Statistical Quality Control**: RC Gupta, Khanna Publishers, New Delhi, 2005.
4. **Total Quality Management**: Dale H. Besterfield, Pearson Education, 2003.
5. **Dynamics of Entrepreneurial Development & Management** – Vasant Desai – Himalaya Publishing House
6. **Entrepreneurship Development** – Poornima.M.Charantimath – Small Business Enterprises – Pearson Education – 2006 (2 & 4).

REFERENCE BOOKS:

1. **Statistical Quality Control:** E.L. Grant and R.S. Leavenworth, 7th edition, McGraw- Hill publisher.
2. **Statistical Process Control and Quality Improvement:** Gerald M. Smith, Pearson Prentice Hall. ISBN 0 – 13-049036-9.
3. **Statistical Quality Control for Manufacturing Managers:** W S Messina, Wiley & Sons, Inc. New York, 1987
4. **Statistical Quality Control:** Montgomery, Douglas, 5th Edition, John Wiley & Sons, Inc. 2005, Hoboken, NJ (ISBN 0-471-65631-3).
5. **Principles of Quality Control:** Jerry Banks, Wiley & Sons, Inc. New York.
6. **Entrepreneurship Development** – S.S.Khanka – S.Chand & Co.

MOOC/NPTEL Resources:

1. http://nptel.ac.in/courses/110105067/
2. https://www.edx.org/course/operations-management-iimbx-om101-1x

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PHYSICS OF SEMICONDUCTOR DEVICES

Sub Code : 14PH8X29	**Credits : 03**
Hrs/Week : 3+0+0+0	**Total Hours : 39**

Course Learning Objectives:

1. To understand the basic principles of construction, working and applications of various semiconductor devices.
2. Study of basic electronic devices, their specific properties and hence their use for applications.
3. Study of radiation detectors like semiconductor detector, diode as detector and photo multiplier.
4. Exploring the ways of harnessing solar energy and assessing the efficiency of solar energy converters
5. To study the use of semiconductor devices in optical and microwave communication.

UNIT - I

Semiconductors – Band picture, Fermi-Dirac statistics, Basic properties. p-n junction – basic fabrication steps, abrupt and graded junctions, applications.

Bipolar transistor, static characteristics, amplifier, frequency response and switching.

8 Hours

UNIT - II

Field effect transistor – JFET fabrication, characteristics, applications.
Uni-junction transistor – fabrication, characteristics, comparison with JFET,
Applications- relaxation oscillator, diode pump.
SCR – construction, two transistor model, operation, applications. **8 Hours**

UNIT - III

MESFET : Metal-semiconductor junctions – ohmic and rectifying, energy band diagrams, applications.

MOSFET fabrication, MOS structures – implanted and induced channels, energy band diagrams, applications. **8 Hours**

UNIT - IV

Hetero-junctions – fabrication, comparison with homo-junctions, advantages, HBTs-materials and characteristics.

Microwave diodes – Tunnel diode, IMPATT diode, transferred electron devices,

quantum devices, hot electron devices. **7 Hours**

UNIT - V

Photonic devices – Light emitting diodes, visible and infra-red LEDs, organic LED, semiconductor laser, photo-detector – Photo conductor as a detector, p-n junction, double hetero-junction detector, p-i-n junction, Avalanche photo diode, solar cells. **8 Hours**

Course Outcomes:

1. Ability to choose the appropriate device to meet the requirement of a particular application.
2. Making modifications to device structures by understanding the factors affecting their performance.
3. Attempting better efficiency and utility through an understanding of the principles of performance.
4. Use the technical knowledge acquired to troubleshoot and rectify devices and circuits.
5. Explore the possibility of designing devices with better characteristics.

REFERENCE BOOKS:

1. Sze S.M : Semiconductor Devices – Physics and Technology, John Wiley Publication 2012
2. Nandita & Amitava Das Gupta : Semiconductor Devices, PHI Learning Publication 2011

****

INTRODUCTION TO GEOINFORMATICS

Course code : **14CV 8X30** Credits: **03**
Hrs/Week : L-T-P: **3-0-0** Teaching Hours: **39**

Course Learning Objectives (CLO):

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

1. ***Define and Describe*** the basics of Photogrammetry, physics of RS, GPS & GIS and Image interpretation techniques.
2. ***Describe*** the visual and digital image processing and interpretation techniques.
3. ***Explain and Appraise*** Maps and Overlays, data structures, process and operation of GIS and GPS.
4. ***Identify and Explain*** the application and significance of GEOINFORMATICS in various fields of Engineering practices.

UNIT I

Remote sensing and its Principles: Physical basis of Remote sensing, Remote sensing model, EM spectrum, Blackbody concept, atmospheric windows, ranges of sensing systems, spectral response of common earth features., Platforms and Sensors: Ground, Aircraft, Spacecraft platforms, hyper spectral remote sensing, Photographic sensors, scanners, radiometers, radar, thermal infrared imagery, mission planning, Mission planning, Indian satellites and sensors, capabilities, data products. **8 Hours**

UNIT II

Image Interpretation and Analysis techniques: Photogrammetry -basic principles and photo interpretation, Interpretation and Analysis techniques: Multispectral, Multitemporal, Multisensoral, Multistage concepts, Photo-interpretation techniques for aerial photos and satellite imagery, Visual & Digital Image interpretation, Interpretation elements, False Colour Composites (FCC). **8 Hours**

UNIT III

Digital Image Processing and Analysis: pre-processing and processing (DIP), image restoration/enhancement procedures, information extraction, pattern recognition concepts, post processing procedures. **7 Hours**

UNIT IV

Geographic Information System -concept and spatial models: Fundamentals of GIS, spatial and non-spatial data, vector and raster GIS, GIS Hardware and software, georeferencing, digitization, thematic maps, Overlay Analysis, Operation of GIS, Co-ordinate systems and map projections, Map scale, data display and cartography. **8 Hours**

UNIT V

Geoinformatics and Virtual GIS: Modern Surveying and Geoinformatics, GPS, **GIS Functionality**: Introduction, data acquisition, preliminary data processing, data storage and retrieval, spatial search and analysis, graphics and interaction, Virtual GIS and Real world applications. **8 Hours**

Course Outcomes (CO):

At the end of the course, upon successful completion, each student will be able to:

1. ***Define, Describe, Distinguish and Explain*** the principles and Physical basis of remote sensing, Photogrammetry, RS & GIS techniques, various types of platforms, sensors & resolutions in RS with a special reference on Indian satellites and data products.
2. ***Define, Describe, Distinguish, Explain and Analyse*** Photogrammetry, its basic principles, photo interpretation, ***Compare and Contrast*** the Visual & Digital Image interpretation and ***Appraise*** its application in related disciplines.
3. ***Define, Describe, Explain and*** **Analyze** digital image formats, different stages involved in Digital Image Processing, and **Apply and Classify** the information extracted for various purposes.
4. ***Define, Describe, Explain, Distinguish, Illustrate and Appraise*** Maps and Overlays- its components, preparation and projections, Geographic Information System- its components, data structures, process and operation, and GPS.
5. ***Identify, Describe, Explain, Assess, Analyze, Appraise and Evaluate*** the applications and significance of geospatial technology or GEOINFORMATICS (Photogrammetry, RS, GIS & GPS) in various fields of Engineering practices.

Course Articulation Matrix:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO 1	M	H					H				H		M	H	
CO 2	H	H	H	H	H	H	H				H	H	H	H	
CO 3	H	H	H	H	H	H	H				H	H	H	H	
CO 4	H	H	H	H	H	H	H				H	H	H	H	
CO 5	H	H	H	H	H	H	H				H	H	H	H	

L: Slight (Low) M: Moderate (Medium) H: Substantial (High)

TEXT BOOKS

1. Anji Reddy, M. (2012) ***Text Book of Remote Sensing and Geographical Information Systems***, Fourth Edition, BS Publication, Hyderabad

2. Lillesand, T.M., Kiefer, R.W and Chipman, J.W. (2015) ***Remote sensing and Image Interpretations,*** 7th edition, John Wiley and sons, New Delhi

REFERENCE BOOKS

1. Anji Reddy, M. and Hari Shankar, Y. (2006) ***Digital Image Processing***, BS Pub., Hyd.

2. Bernhardsen, Tor (2002) ***Geographic Information Systems-3rd*** Ed., Wiley India, Delhi

3. Canada Centre for Remote Sensing **(2011)** ***Fundamentals of Remote sensing-Tutorial***

4. Chang, Kang-tsung (2008) ***Introduction to Geographic Information Systems*** 4th Ed., Tata McGraw Hill Publishing Company Limited, New Delhi
5. Korte, George B. (2001), ***The GIS Book***, Onword Press, Thomson Learning Inc.,USA
6. Kumar, S. (2008) ***Basics of Remote sensing and GIS*** Laxmi Publications (P) Ltd., Delhi
7. Longler, Paul A., Goodchild, Michael F., Maguire, David J., Rhind. David W., (2004) ***Geographic Information Systems and Science*** John Wiley & Sons Ltd., ESRI Press
8. Sabins, F.L.(1997) ***Remote Sensing: Principles and Interpretation*** 3rd edn. WH Freeman and Company, New York, 494p.

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CORROSION SCIENCE

Sub Code :	**14CH8X31**	**Credits :**	**03**
Hrs/Week :	**3+0+0+0**	**Total Hours :**	**39**

Course Learning Objectives:

1. To understand the electrochemistry and material science related to corrosion.
2. To understand the types of corrosion metal and its preventions.
3. To gain knowledge on corrosion science and its applications for the engineering materials.
4. To provide methodologies for measuring the corrosion rate of materials
5. To identify practice for the prevention/remediation of the corrosion.

UNIT – I

FUNDAMENTALS OF CORROSION

Definition, cost of corrosion, Corrosion Damage and consequences, Classification of corrosion, Electrochemical Aspects of corrosion, Electrochemical reactions, Different Environmental aspects, polarization and passivity, Corrosion Rate Expression, Determination. Standard electrode potential, EMF and Galvanic series, Potential-pH (Roubaix Diagram).

9 Hours

UNIT – II

FORMS OF CORROSION

Uniform corrosion and Atmospheric corrosion, Galvanic corrosion, Crevices corrosion, Filiform corrosion, Pitting corrosion, Inter granular corrosion, Selective leaching, Erosion corrosion, Cavitation damage, Stress corrosion , Impingement attack, Inlet tube corrosion, Corrosion fatigue, Hydrogen blistering, Hydrogen embrittlement. Corrosion of mineral acids-corrosion of steel, stainless steel, Cu and Al. **8 Hours**

UNIT – III

CORROSION AT ELEVATED TEMPERATURE

High temperature materials, Metal oxides, Pilling bed worth rule, oxide defect structure, Hot corrosion. **8 Hours**

UNIT – IV

CORROSION RATE DETERMINATION

Weight loss method, Tafel extrapolation test, linear polarization test and AC impedance method **7 Hours**

UNIT – V

CORROSION PREVENTION METHODS

Design, Materials selections, Change of the environments:, Changing medium, Inhibitors, Cathodic and Anodic protection, Protective coatings. **7 Hours**

Course Outcomes:

1. Knowledge of single electrode potential, cell potential, over potential, polarization, exchange current density.
2. Understanding current density, vis-a-vis corrosion rate.
3. Knowledge types of corrosion. The factors affecting the corrosion rate and mechanisum. Selction of material for given medium.
4. Familiarization of corrosion rate measurement techniques
5. Knowledge of corrosion control methods.

TEXT BOOK:

1. Corrosion Engineering; Mars G Fontana; 3rd Edition; TATA McGRAW-HILL EDITION.

REFERENCE BOOK:

1. Corrosion; Chamberlian and K. Trethway, Longman scientific and technical published by John Wiley and Sons.

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APPLICATION OF SIGNAL PROCESSING

Sub Code : 14EC8X32 **Credits : 03**
Hrs/Week : 3+0+0+0 **Total Hours : 39**

Course Learning Objectives:

This course will enable students:

1. To understand the concept of Analog and Digital Frequency and Sampling Theorem.
2. To understand Discrete Time Signals, Systems ,and Analyse Discrete Time Linear Time Invariant (LTI) systems
3. To understand Z transform.
4. To understand Convolution (Linear and Circular) and Correlation.

5. To understand the DFT and Fast Fourier Transform (FFT) using Radix 2 Decimation In Time, and Decimation In Frequency FFT Algorithms.
6. To Design and Analyze the characteristics of Analog filters.
7. To Design IIR filter using Bilinear transformation
8. To design FIR filter using Windowing techniques.
9. To design Linear Phase FIR filters using frequency sampling technique.
10. To implement Digital filters using various structures.
11. To understand Speech coding, Speech enhancement, Noise cancellation and Speech recognition.

UNIT - I

SIGNALS AND SYSTEMS:
Basic elements of DSP – Concepts of frequency in Analog and Digital Signals , Sampling theorem , Discrete Time Signals, Systems , Analysis of Discrete Time Linear Time Invariant (L.T.I.) systems ,Z transform ,Convolution (Linear and Circular), Correlation.

FREQUENCY TRANSFORMATIONS:
Introduction to Discrete Fourier Transform (DFT), Properties of DFT, Filtering methods based on DFT, Fast Fourier Transform (FFT) using Radix 2 Decimation In Time, and Decimation In Frequency FFT Algorithms. **14 Hours**

UNIT – II

IIR FILTER DESIGN:
Analog filter design , Infinite Impulse Response (IIR) filter from analog filter using Bilinear transformation, High pass,Band pass,and Band reject filter design using frequency translation, Structures of IIR filter.

FIR FILTER DESIGN:
Linear phase Finite Impulse Response (FIR)Filter design using Windowing chniques, Frequency sampling techniques, Structures of FIR filter . **14 Hours**

UNIT – III

APPLICATIONS:
Speech coding, Speech enhancement, Noise cancellation, Speech recognition. **11 Hours**

Course Outcomes:

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

1. Explain Sampling Theorem and Analyse Discrete Time Linear Time Invariant (LTI) systems and to comprehend Z transform, Convolution (Linear and Circular) and Correlation.
2. Compute the DFT and Fast Fourier Transform (FFT) using Radix 2 Decimation In Time, and Decimation In Frequency FFT Algorithms.
3. Design Analog filter, IIR filter
4. Design FIR filter.
5. Interpret Speech coding, Speech enhancement, Noise cancellation and Speech recognition

Mapping of PO's & CO's:

PO CO	a	b	c	d	e	f	g	h	i	j	k	l
1	H	H	H	M	M	M	L					
2	H	H	H	M	M	M	L					
3	H	H	H	M	M	M	L					
4	H	H	H	M	M	M	L					
5	H	H	H	M	M	M	L					

L: Low M: Medium H: High

TEXT BOOKS:

1. John G. Proakis & Dimitris G.Manolakis, **"Digital Signal Processing – Principles,Algorithms & Applications"**, Fourth edition, Pearson education / Prentice Hall, 2007.
2. Emmanuel C. Ifeachor, & Barrie.W.Jervis, **"Digital Signal Processing"**, Second edition, Pearson Education / Prentice Hall, 2002.

REFERENCE BOOKS:

1. Alan V.Oppenheim, Ronald W. Schafer & Hohn. R.Back, **"Discrete Time Signal Processing"**, Pearson Education, 2nd edition, 2005.
2. Andreas Antoniou, **"Digital Signal Processing"**, Tata McGraw Hill, 2001.

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HUMAN RESOURCE MANAGEMENT

Sub Code : 14ME8X33 **Credits : 03**
Hrs/Week : 3+0+0+0 **Total Hours : 39**

Course Learning Objectives:

1. To develop a meaningful understanding of HRM theory, functions and practices.
2. To apply HRM concepts and skills across various types of organizations.
3. To understand the concepts of e-HRM.

UNIT - I

Human Resource Management & HRP:
Introduction, meaning, nature, scope of HRM. Major functions of HRM, Personnel Management vs Human Resource Management, job design, job evaluation, job analysis, job specification, job enlargement, job enrichment. Role of HR Manager.HR Planning.Process HRP. **8 Hours**

UNIT – II

Recruitment: Definition, Sources and Methods of Recruitment
Selection: Definition and Process of Selection. Cost benefit analysis of selection.
Placement: Meaning, Induction/Orientation, Internal Mobility, Transfer, Promotion, Demotionand Employee Separation. Performance Appraisal methods

8 Hours

UNIT – III

Training and development: Training v/s development, stages in training, Training Methods, Executive Development, Methods and Development of Management Development, Career and Succession Planning.
Compensation: employee remuneration, rewards, Wage and Salary Administration, Bonus, fringe benefits.
Internal Mobility, External Mobility, Trade union Act (Amendment) 2001.

7 Hours

UNIT - IV

Employee Grievances: Employee Grievance procedure. Discipline procedure
Collective bargaining; Characteristics, Necessity, Forms
Safety & Health; Industrial accidents, Safety
Quality circle; Meaning, Structure **8 Hours**

UNIT - V

IHRM. Managing IHRM. e-HR Activities, Global recruitment, selection, expatriates

e-HRM; Aspects of e-HRM,e-Job design & Analysis, Ethical issues in employment

8 Hours

Course Outcomes:

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

1. Understand the concept of HRM and its implementation
2. Understand the knowledge about recruitment.
3. Understand the need of training of development
4. Use the HRM skills across various types of organizations.
5. Understand the concepts of e-HRM.

Course Articulation matrix:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO	
													1	2
C14ME8X33.1	L	M	L	L	L	M	L	M	L	L	L	M	L	L
C14ME8X33.2	M	L	L	L	L	M	L	H	L	L	L	L	L	L
C14ME8X33.3	L	L	L	L	L	M	L	M	L	L	L	L	L	L
C14ME8X33.4	M	L	L	L	L	L	L	M	M	L	L	L	L	L
C14ME8X33.5	M	L	L	L		L	L	M	L	M	L	L	L	L

L : Low M: Medium H : High

TEXT BOOK:

1. Essentials of Human Resource Management & Industrial relations-P Subba Rao, Third Revised Edition

REFERENCE BOOKS:

1. Human Resource Management - John M. Ivancevich, 10/e, McGraw Hill.
2. Human Resource Management-Flippo
3. Human Resource Management - Lawrence S. Kleeman, Biztantra , 2012.
4. Human Resource Management – Aswathappa K HPH

MOOC/NPTEL Resources:

1. http://edx.nimt.ac.in/courses/course-v1:nimtX+PGDM1212+2017_H1/about
2. http://nptel.ac.in/courses/122105020/

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