8. Pre-requisite: Knowledge of Computer Architecture and Microprocessors
9. Objective: This course will provide understanding of the Neural networks and its applications

10. Detail of Course:

S.No.	Contents	Contact Hours
1.	Overview of Embedded Systems: Characteristics of Embedded Systems. Comparison of Embedded Systems with general purpose processors. General architecture and functioning of micro controllers. PIC and 8051 micro controllers : Architecture, memory interfacing , interrupts, instructions, programming and peripherals .	8
2.	ARM : Architecture, memory interfacing , interrupts, instructions and Assembly Language programming. Exception processing and pipeline architecture and applications.	12
3.	Digital Signal Processors: DSP Architecture, DSP applications, algorithms, data path, memory, addressing modes, peripherals. TI and Sharc family of DSP processors.	4
4.	System On Chip : Evolution, features, IP based design, TI OMAP architecture and peripherals. Digital Multimedia processor: Architecture and peripherals.	4
5.	SRAM, DRAM working and organization. Interfacing memory with ARM 7. Elements of Network Embedded Systems	4
6.	RTOS : RT-Linux introduction, RTOS kernel, Real-Time Scheduling Bus structure: Time multiplexing, serial, parallel communication bus structure. Bus arbitration, DMA, PCI, AMBA, I2C and SPI Buses.	10
	TOTAL	42

11. Suggested Books

S.No.	Name of Books / Authors/ Publishers	Year of Publication/ Reprint
1.	Computers as components: Principles of Embedded Computing System Design, Wayne Wolf, Morgan Kaufman Publication	2000
2.	ARM System Developer's Guide: Designing and Optimizing System Software, Andrew N. Sloss, Dominic Symes, Chris Wright, , Morgan Kaufman Publication	2004
3.	Design with PIC Microcontrollers, John B. Peatman, Pearson Education Asia	2002
4.	The Design of Small-Scale embedded systems, Tim Wilmshurst, Palgrav	2003
5.	Embedded System Design, Marwedel, Peter, Kluwer Publishers	2004

DRAFT SCHEME OF STUDY
(Year 2,3,4 B. Tech Program

University Elective Courses

CO351 ENTERPRISE & JAVA PROGRAMMING

1. Subject Code: CO351   Course Title: Enterprise & Java programming

2. Contact Hours: L: 3   T: 0   P: 0

3. Examination Duration (ETE)(Hrs.):   Theory 3 Hrs   Practical 0

4. Relative Weightage: CWS   25   PRS 0   MTE   25   ETE   50   PR   0

5. Credits: 3

6. Semester: ODD

7. Subject Area: UEC

8. Pre-requisite: Nil

9. Objective: To introduce fundamentals of Enterprise Java Programming, concepts of program development using beans.

10. Details of Course

Unit No.	Contents	Contact Hours
1.	**Collections :** Collection Interfaces, Concrete Collections, Collections Framework. **Multithreading :** Creating and running thread, Multiple thread synchronization, Thread communication, Thread group, Thread priorities, Daemon Thread, Life Cycle ofThread.	5
2.	**Fundamentals in Networking:** Sockets in Java - Internet Addressing - DNS – Ipv4,IPv6- URL class - TCP/IP and Datagram. **The interfaces and classes for networking :**Interfaces and classes of java.net package; InetAddress class : IP address scope - Host name resolution - Methods of InetAddress class; Program to look up the IP addresses for a hostname - Factory methods - Creating and using Sockets : Socket class - constructors and methods of Socket class. **Creating TCP servers &clients :** TCP/IP server sockets - Constructors and methods of ServerSocket class - Program to create a TCP/IP server and client. **Handling URL:** URL class - constructors and methods of URL class - URLConnection class - fields of URLConnection class - methods of URLConnection class. **Working with Datagrams:** DatagramPacket - Constructors for DatagramPacket class - Methods of DatagramPacket class - creating Datagram server and client.	6
3.	**JDBC Package :**JDBC – JDBC versus ODBC – Types of JDBC drivers – Connection – Statement – PreparedStatement.**ResultSet :**Fields of ResultSet – Methods of ResultSet – Executing a query - ResultSetMetaData – DatabaseMetaData. **Datatypes in JDBC :** Basic datatypes in JDBC – Advanced datatypes in JDBC – fields of Statement – methods of Statement – CallableStatement Interface – BatchUpdates	6
4.	**Servlets :** Using Servlets - Servlet Package - Servlet lifecycle - init() method - service() method , doGet() method, doPost() method and destroy() method . **Classes and interfaces of Servlet:** Servlet - GenericServlet - ServletConfig - ServletContext - ServletException - ServletInputStream - ServletOutputStream - ServletRequest – ServletResponse. **Classes and interfaces of HttpServlet:** HttpServlet - HttpServletRequest - HttpServletResponse - Reading HTML form data from Servlets - Response Headers - Response Redirection. **Handling Servlets :** Servlet Chaining - HttpUtils - Database access with JDBC inside servlet. **State and Session management :** Cookies - HttpSession - Server Side includes - Request forwarding – RequestDispatcher.	7
5.	**Concepts of Java Beans:** Java Beans - Advantage of Java Beans - Reflection and Introspection - Customizers – Persistence. **Developing Java Beans :** Bean Developer Kit (BDK) - Creating a Java Bean - Creating a Bean Manifest file - Creating a Bean JAR file. **Controls and Properties of a Bean :** Adding controls to Beans - Giving Bean Properties - BeanInfo interface - SimpleBeanInfo class. **Types of Properties:** Design pattern for Properties: Simple properties -	9

	Indexed Properties; Descriptor Classes - Giving Bean methods - Bound and Constrained Properties - Property Editors.	
6.	**Components of EntrepriseBeans :** Distributed Multitiered Applications -J2EE components: J2EE clients, Web components, J2EE containers. **Developing an Enterprise Bean :** Packaging - Enterprise JavaBeans Technology - Enterprise Bean - Contents of an Enterprise Bean. **Session Bean :** Stateful session bean – life cycle of stateful session bean - Stateless session bean – life cycle of stateless session – ejbCreate methods – Business methods – Home interface – Remote interface – Running the session bean. **Entity Bean :** Persistence - Bean managed Persistence - Container Managed Persistance - Shared Access - Primary key – Relationships. **Message Driven Bean :** life cycle of message driven bean – onMessage method.	9
	TOTAL	42

11. Suggested Books

S. No.	Name of Books / Authors/ Publishers
Text Books	
1.	Java 2 Programming Black Book - Steven Holzner dreamTech Press(ISBN-9788177226553), 2005
2.	JavaBeans Programming from the GroundUp - Joseph O'Neil, TMGH, New Delhi(ISBN- 007463786X), 2001
Reference Books	
3	Head first EJB-O'Reilly (ISBN: 8173665265), 2003
4.	"Beginning Java™ EE 6 Platform with GlassFish 3 From Novice to Professional" by Antonio Goncalves– Apress publication(ISBN: 9781430219545), 2009

CO353 E-COMMERCE AND ERP

1. Subject Code: CO353   Course Title: E-Commerce and ERP

2. Contact Hours: L: 3   T: 0   P: 0

3. Examination Duration (ETE)(Hrs.):   Theory 3 Hrs   Practical 0

4. Relative Weightage: CWS 25   PRS 0   MTE   25 ETE   50   PR   0

5. Credits: 3

6. Semester: ODD

7. Subject Area: UEC

8. Pre-requisite: Nil

9. Objective: To introduce E-Commerce and ERP

10. Details of Course

Unit No.	Contents	Contact Hours
1.	Introduction: Definition of Electronic Commerce, E-Commerce: technology and prospects, incentives for engaging in electronic commerce, needs of E-Commerce, advantages and disadvantages, framework, Impact of E-commerce on business, E-Commerce Models.	7
2.	Network Infrastructure for E- Commerce: Internet and Intranet based E-commerce- Issues, problems and prospects, Network Infrastructure, Network Access Equipments, Broadband telecommunication (ATM, ISDN, FRAME RELAY). Mobile Commerce: Introduction, Wireless ApplicationProtocol, WAP technology, Mobile Information device.	7
3.	Web Security: Security Issues on web, Importance ofFirewall, components of Firewall, Transaction security, Emerging client server, Security Threats, Network Security, Factors to consider in Firewall design, Limitation of Firewalls.	6
4.	Electronic Payments: Overview, The SET protocol, Payment Gateway, certificate, digital Tokens, Smart card, credit card, magnetic strip card, E-Checks, Credit/Debit card based EPS, online Banking. EDI Application in business, E- Commerce Law, Formsof Agreement, Govt. policies and Agenda.	6
5.	ERP Introduction, Benefits, Origin, Evolution and Structure:Conceptual Model of ERP, The Evolution of ERP, The Structure of ERP. Business Process Reengineering, Data ware Housing, Data Mining, Online Analytic Processing(OLAP), Product Life Cycle Management(PLM),LAP, Supply chain Management.	8
6.	ERP Marketplace and Marketplace Dynamics:Market Overview, Marketplace Dynamics, The Changing ERP Market. ERP- Functional Modules: Introduction, Functional Modules of ERP Software, Integration of ERP, Supply chain and Customer Relationship Applications. ERP Implementation Basics, ERP Implementation Life Cycle, Role of SDLC/SSAD, Object Oriented Architecture, Consultants, Vendors and Employees, ERP & E-Commerce, Future Directives- in ERP, ERP and Internet.	8
	TOTAL	42

11. Suggested Books

S.No.	Name of Books / Authors/ Publishers
1.	Goel, Ritendra "E-commerce", New Age International,2007
2.	Ravi Kalakota, Andrew Winston, "Frontiers of Electronic Commerce", Addison- Wesley. 1996
3.	Vinod Kumar Garg and Venkitakrishnan N K, "Enterprise Resource Planning – Concepts and Practice", PHI 2004
4.	Rahul V. Altekar "Enterprise Resource Planning", Tata McGraw Hill, 2004
5.	Alexis Leon, "ERP Demystified", Tata McGraw Hill, 2014

CO355 CRYPTOGRAPHY AND INFORMATION SECURITY

1. Subject Code: CO355   Course Title: Cryptography and Information Security

2. Contact Hours: L: 3   T: 0   P: 0

3. Examination Duration (ETE)(Hrs.): Theory 3 Hrs   Practical 0

4. Relative Weightage: CWS 25   PRS 0   MTE   25   ETE 50   PR   0

5. Credits: 3

6. Semester: ODD

7. Subject Area: UEC

8. Pre-requisite: NIL

9. Objective: To study various cryptographic techniques, mathematics related to cryptography and some network security protocols.

10. Details of Course

Unit No.	Contents	Contact Hours
1.	**Introduction:** Need for security, Introduction to security attacks, services and mechanism, introduction to cryptography, Conventional Encryption: Conventional encryption model, classical encryption techniques- substitution ciphers and transposition ciphers, cryptanalysis, stereography, stream and block ciphers, Intruders, Viruses and related threads.	6
2.	**Modern Block Ciphers:** Block ciphers principals, Shannon's theory of confusion and diffusion, Fiestal structure, data encryption standard(DES), strength of DES, crypt analysis of DES, block cipher modes of operations, triple DES, IDEA encryption and decryption, strength of IDEA, key distribution.	6
3.	Introduction to graph, ring and field, prime and relative prime numbers, modular arithmetic, Fermat's and Euler's theorem, primarily testing, Euclid's Algorithm, Chinese Remainder theorem, discrete logarithms, Principals of public key crypto systems, RSA algorithm, security of RSA, key management, Diffle-Hellman key exchange algorithm, introductory idea of Elliptic curve cryptography, Elganel encryption	8
4.	**Message Authentication and Hash Function:** Authentication requirements, authentication functions, message authentication code (MAC), hash functions, security of hash functions and MACS, MD5 message digest algorithm, Secure hash algorithm(SHA), Public Key Infrastructure(PKI): Digital Certificate, private key management, Digital Signatures: Digital Signatures, authentication protocols, digital signature standards (DSS), proof of digital signature algorithm.	6
5.	**Authentication Applications:** Kerberos and X.509, directory authentication service, password, challenge-response, biometric authentication, electronic mail security-pretty good privacy (PGP), S/MIME.	8
6.	**IP Security:** Architecture, Authentication header, Encapsulating security payloads, combining security associations, key management. **Web Security:** Secure Socket Layer(SSL) and transport layer security, TSP, Secure Electronic Transaction (SET), Electronic money, WAP security, firewall design principals, Virtual Private Network (VPN) security.	8

		TOTAL	42

11. Suggested Books

S.No.	Name of Books / Authors/ Publishers
1.	William Stallings, "Cryptography and Network Security: Principals and Practice", Prentice Hall, New Jersy. 2016
2.	Atul Kahate, "Cryptography and Network Security", TMH. 2009
3.	Behrouz A. Forouzan, "Cryptography and Network Security", TMH.2007
4.	Johannes A. Buchmann, "Introduction to Cryptography", Springer-Verlag. 2004
5.	Bruce Schiener, "Applied Cryptography". 2015

CO357 OPERATING SYSTEM

1. Subject Code: CO357   Course Title: Operating System
2. Contact Hours: L: 3   T: 0   P: 0
3. Examination Duration (ETE)(Hrs.): Theory 3 Hrs   Practical 0
4. Relative Weightage: CWS   25   PRS 0   MTE   25   ETE 50   PR   0
5. Credits: 3
6. Semester: ODD
7. Subject Area: UEC
8. Pre-requisite: NIL

9. Objective: To familiar with the fundamental principles of the operating system, its services and functionalities, the concepts of processes, synchronization and scheduling, memory management and need for protection in computer systems

10. Details of Course

Unit No.	Contents	Contact Hours
1.	**Introduction:** Operating system and function, Evolution of operating system, Batch, Interactive, Time Sharing and Real Time System, System protection. **Operating System Structure:** System Components, System structure, Operating System Services.	4
2.	**Concurrent Processes:** Process concept, Principle of Concurrency, Producer Consumer Problem, Critical Section problem, Semaphores, Classical problems in Concurrency, Inter Process Communication, Process Generation, Process Scheduling. **CPU Scheduling:** Scheduling Concept, Performance Criteria of Scheduling Algorithm, Evolution, Multiprocessor Scheduling.	9

3.	**Deadlock:** System Model, Deadlock Characterization, Prevention, Avoidance and Detection, Recovery from deadlock combined approach.	8
4.	**Memory Management:** Base machine, Resident monitor, Multiprogramming with fixed partition, Multiprogramming with variable partition, Multiple base register, Paging, Segmentation, Virtual memory concept, Demand paging, Performance, Paged replacement algorithms, Allocation of frames, Thrashing, Cache memory organization, Impact on performance.	9
5.	**I/O Management & Disk Scheduling:** I/O devices and organization of I/O function, I/O Buffering, DISK I/O, Operating System Design Issues. **File System:** File Concept, File Organization and Access Mechanism, File Directories, File Sharing, Implementation Issues	9
6.	**Case Studies:** Windows, Linux and Unix	3
	TOTAL	42

11. Suggested Books

S.No.	Name of Books / Authors/ Publishers
Text Books	
1.	Silbersachatz and Galvin, "Operating System Concepts", Pearson, 5th Ed, 2001
2.	Tannenbaum, "Operating Systems", PHI, 4th Edition, 2000
Reference Books	
3.	Milenekovic, "Operating System Concepts", McGraw Hill 2001
4.	Dietel, "An introduction to operating system", Addison Wesley 1983

CO359 INTELLECTUAL PROPERTY RIGHTS

1. Subject Code: CO359 Course Title: Intellectual Property Rights

2. Contact Hours: L: 3 T: 0 P: 0

3. Examination Duration (ETE)(Hrs.): Theory 3Hrs Practical 0

4. Relative Weightage: CWS 25 PRS 0 MTE 25 ETE 50 PR 0

5. Credits: 3

6. Semester: ODD

7. Subject Area: UEC

8. Pre-requisite: Nil

9. Objective:To familiarize the students with basic concepts in each type of IPR together with historical developments in the subject & its importance in modern times.

10. Details of Course

Unit No.	Contents	Contact Hours
1.	Introduction: Concept of IPR, Historical development , kinds of IPR,brief description of patent, trademark, copyright ,industrial design, importance of IPR, IPR authorities.	5
2.	PATENTS :Introduction, Indian Patent Act 1970 &2002, Protectable subject matter--patentable invention, Procedure for obtaining patent, Provisional and complete specification Rights conferred on a patentee, transfer of patent, Revocation and surrender of patents, Infringement of patents, Action for infringement, Patent agents, Patent in computer programs.	8
3.	Trademark: Introduction, Statutory authorities, principles of registration of trademarks, rights conferred by registration of trademarks, Infringement of trademarks and action against infringement, procedure of registration and duration,licensing in trademark	7
4.	Copyright: Introduction, Author and ownership of copyright, rights conferred by copyright,term of copyright, assignment/licence of copyright, Infringement of copyright ,remedies against infringement of copyright, registration of copyright, copyright enforcement and societies	7
5.	Industrial design: The design act-2000, registerability of a design, procedure of registration of a design, piracy of a registered design, Case law on designs	6
6.	International IPR & case laws: World intellectual property organization, WCT, WPPT, TRIPS, Copyright societies, international IPR dispute resolution mechanism. Case laws.	9
	TOTAL	42

11. Suggested Books

S.No.	Name of Books / Authors/ Publishers
	Textbooks:
1.	Law Relating to Intellectual property, fourth edition by B.L.Wadehra .Universal law publishing co. pvt. Ltd , 2007. ISBN 978-81-7534-588-1
Reference books:	
2.	Intellectual property: Patents, copyright ,trademarks and allied rights. Fifth edition by W.R. Cornish. Sweet & Maxwell publisher, 2003. ISSN 9780421781207
3	Law and practice of intellectual property in India by VikasVashishth, 2006 **ISBN:** 81-7737-119-3
4	Patents ,copyrights, trade marks and design by B L Wadhera, 2014
5	Dr. B. L. Wadhera, "Intellectual Property Law Handbook". Universal Law Publishing, 2002.

CO361 DATABASE MANAGEMENT SYSTEM

1. Subject Code: CO361 Course Title: Database Management System
2. Contact Hours: L: 3 T: 0 P: 0
3. Examination Duration (ETE)(Hrs.): Theory 3 Hrs Practical 0
4. Relative Weightage: CWS 25 PRS 0 MTE 25 ETE 50 PR 0
5. Credits: 3
6. Semester: ODD
7. Subject Area: UEC
8. Pre-requisite: NIL
9. Objective: To provide knowledge about the principles, concepts and applications of Database Management System.
10. Details of Course

Unit No.	Contents	Contact Hours
1.	**Introduction:** Data base system concepts and its architecture, Data models schema and instances, Data independence and data base language and interface, Data definition languages, DML. Overall data base structure. **Data modeling using Entity Relationship Model:** E.R. model concept, notation for ER diagrams mapping constraints, Keys, Concept of super key, candidate key, primary key generalizations, Aggregation, reducing ER diagrams to tables, extended ER model.	7
2.	**Relational Data Model and Language:** Relational data model concepts, integrity constraints, Keys domain constraints, referential integrity, assertions, triggers, foreign key relational algebra, relational calculus, domain and tuple calculus, SQL data definition queries and updates in SQL.	7
3.	**Data Base Design:** Functional dependencies, normal forms, 1NF, 2NF, 3NF and BCNF, multi-valued dependencies fourth normal forms, join dependencies and fifth normal forms. Inclusion dependencies, loss less join decompositions, normalization using FD, MVD and JDs, alternatives approaches to database design.	6
4.	**File Organization, Indexing and Hashing** Overview of file organization techniques, Indexing and Hashing- Basic concepts, Static Hashing, Dynamic Hashing, Ordered indices, Multi-level indexes, B-Tree index files, B+- Tree index files, Buffer management **Transaction processing concepts:** Transaction processing system, schedule and recoverability, Testing of serializability, Serializability of schedules, conflict & view serializable schedule, recovery from transaction failures, deadlock handling.	8
5.	**Concurrency Control Techniques:** Locking Techniques for concurrency control, time stamping protocols for concurrency control, concurrency control in distributed systems. multiple granularities and multi-version schemes.	8
6	**Case Studies:** Commercial databases, Oracle, Postgress, MySQL	6
	TOTAL	42

11. Suggested Books

S.No.	Name of Books / Authors/ Publishers
Text Books	

1	Elmasri, Navathe,"Fundamentals of Database systems", Addision Wesley, 2016
2	Korth, Silberchatz, Sudarshan,"Data base concepts", McGraw-Hill. 2010

Reference Books	
1.	Ramakrishna, Gehkre, "Database Management System", McGraw-Hill 2014
2.	Date C.J.,"An Introduction to Database systems" 2006

EC351 MECHATRONICS

1. Subject Code: EC351   Course Title: Mechatronics
2. Contact Hours: L: 3   T: 1   P: 0
3. Examination Duration (ETE)(Hrs.): Theory 3 Hrs   Practical 0
4. Relative Weightage: CWS 25   PRS 0   MTE 25   ETE 50   PR   0
5. Credits: 4
6. Semester: V
7. Subject Area: UEC
8. Pre-requisite: Nil
9. Objective: To introduce fundamentals of Mechatronics
10. Details of Course

Unit No.	Contents	Contact Hours
1.	Introduction : Basic Definitions and key elements of Mechatronics, Mechatronic Design Approach: Functions of Mechatronic Systems, Ways of Integration, Information Processing Systems (BasicArchitecture and hardware and Software trade-offs, Concurrent Design Procedure for Mechatronic Systems	6
2.	System Interfacing, Instrumentation,and Control Systems: Input and output Signals of a Mechatronic System, Signal Conditioning and microprocessor control, Microprocessor-Based Controllers and Microelectronics, Programmable Logic Controllers	6
3.	Introduction to Micro- and Nanotechnology, Micro-actuators, Micro-sensors, Nanomachines. Modeling Electromechanical Systems: Models for Electromechanical Systems, Rigid Body Models, Basic Equations of Dynamics of Rigid Bodies, Simple Dynamic Models, Elastic System Modeling, Dynamic Principles for Electric and Magnetic Circuits, Earnshaw's Theorem and Electromechanical Stability	10
4.	The Physical Basis of Analogies in Physical System Models: The Force-Current Analogy: Across and Through Variables, Maxwell's Force-Voltage Analogy:Effort and Flow Variables, A Thermodynamic Basis for Analogies	6
5.	Introduction to Sensors and Actuators: Characteristics of Sensor and Actuator Time and Frequency Measurement, The Role of Controls an modelling in Mechatronics: Integrated Modeling, Design, and Control Implementation, Special Requirements of Mechatronics that Differentiate from Classic Systems and Control Design, Modeling as Part of the Design Process, Modeling of Systems and Signals	6
6.	Design Optimizationof Mechatronic Systems: Optimization Methods, Principles of Optimization : ParametricOptimization, General Aspects of the OptimizationProcess, Types of Optimization Methods, Selection of aSuitable Optimization Method, Optimum Design of Induction Motor (IM), IM Design Introduction : Classical IM Design, Use of a Neuron Network for the Identification ofthe Parameters of a Mechanical dynamic system, Mechatronics and Computer Modelingand Simulation, Mechatronics and the Real-Time useof Computers,	8

	Communications andComputer Networks,Control withEmbedded Computersand ProgrammableLogic Controllers	
	TOTAL	42

11. Suggested Books

S.No.	Name of Books / Authors/ Publishers
1.	Mechatronics : an introduction by Robert H Bishop, Taylor & Francis, 2005
2	Introduction to Mechatronics by KK AppuKuttan Oxford University Press, 2007

EC353 COMPUTER VISION

1. Subject Code: EC-353 Course Title: Computer Vision
2. Contact Hours: L: 3 T: 1 P: 0
3. Examination Duration (ETE)(Hrs.): Theory 3 Hrs Practical 0
4. Relative Weightage: CWS 25 PRS - MTE 25 ETE 50 PR 0
5. Credits: 4
6. Semester: V
7. Subject Area: UEC
8. Pre-requisite: Nil
9. Objective: To introduce fundamentals of Computer Vision and algorithms for object detection, recognition and tracking.
10. Details of Course

Unit No.	Contents	Contact Hours
1.	Introduction to computer vision: Role of Artificial intelligence and image processing in Computer Vision, Industrial Machine Vision applications, System architecture. Visual Sensors: Camera sensors: RGB, IR, Kinect sensor, Camera interfaces and video standards, Characteristics of camera sensors commercially available cameras. Camera Calibration: Interior, exterior calibration and rectification using Tsai's Calibration method.	5
2.	Basics of image processing – Pixel representations histograms ,transforms, colour filters, noise removal, Geometry: Math methods -linear algebra, vectors, rotations, Stereo – Epi-polar geometry, correspondence, triangulation ,Disparity maps . Basics of video processing – Background subtraction techniques – frame differencing, Gaussian Mixture Modelling (GMM), Object localization and processing:- Contours, edges, lines, skeletons.	7
3.	Image representation: Local Wavelet basis (multiscale), Global Fourier basis(Frequency), Adaptive basis (PCA and ICA) , Adaptive basis(discriminants) Basics of Object detection – Template matching, Cascade classifiers.	8
4.	Object Recognition : Object Modeling, Bayesian Classification, Feature Selection and Boosting, Scene and Object Discrimination.	6
5.	Motion and Tracking: Motion detection and tracking of point features, optical flow, SURF, SIFT. Tracking- Kalman filter, Particle Filter, Comparison of deterministic and probabilistic methods condensation, tracking humans, multi-frame reconstruction under affine and perspective projection geometry.	8
6.	Introduction to Computer Vision programming libraries: MATLAB/OpenCV. advantages and disadvantages of each .	8
	TOTAL	42

11. Suggested Books

S. No.	Name of Books / Authors/ Publishers
1.	Computer Vision: A Modern Approach (2nd Edition) **2nd Edition** by David A. Forsyth (Author), Jean Ponce (Author), 2002
2.	Learning OpenCV: **Computer Vision with the OpenCVLibrary** Gary Bradski, Adrian Kaehler, 2008

EC355 EMBEDDED SYSTEM

1. Subject Code: EC- 355   Course Title: Embedded Systems
2. Contact Hours: L: 3   T: 1   P: 0
3. Examination Duration (ETE)(Hrs.):   Theory 3 Hrs   Practical   0
4. Relative Weightage: CWS   25   PRS   0   MTE   25   ETE   50   PR   0
5. Credits: 4
6. Semester: V
7. Subject Area: UEC
8. Pre-requisite: Knowledge of Computer Architecture and Microprocessors
9. Objective: To introduce fundamentals of 16 and 32 bit Microcontrollers, assembly language programming. The course also focuses on interfacing of different interrupt driven peripherals. It also covers in detail Real Time Operating Systems, Bus architecture, Digital Signal Processors and System On-Chip.
10. Details of Course

Unit No.	Contents	Contact Hours
1.	Overview of Embedded Systems: Characteristics of Embedded Systems. Comparison of Embedded Systems with general purpose processors. General architecture and functioning of micro controllers. PIC and 8051 micro controllers : Architecture, memory interfacing , interrupts, instructions, programming and peripherals .	8
2.	ARM : Architecture, memory interfacing , interrupts, instructions and Assembly Language programming. Exception processing and pipeline architecture and applications.	12
3.	Digital Signal Processors: DSP Architecture, DSP applications, algorithms, data path, memory, addressing modes, peripherals. TI and Sharc family of DSP processors.	4
4.	System On Chip : Evolution, features, IP based design, TI OMAP architecture and peripherals. Digital Multimedia processor: Architecture and peripherals.	4
5.	SRAM, DRAM working and organization. Interfacing memory with ARM 7. Elements of Network Embedded Systems	4
6.	RTOS : RT-Linux introduction, RTOS kernel, Real-Time Scheduling Bus structure: Time multiplexing, serial, parallel communication bus structure. Bus arbitration, DMA, PCI, AMBA, I2C and SPI Buses.	10
	TOTAL	42

11. Suggested Books

S.No.	Name of Books / Authors/ Publishers
1.	Computers as components: Principles of Embedded Computing System Design, Wayne Wolf, Morgan Kaufman Publication, 2000
2.	ARM System Developer's Guide: Designing and Optimizing System Software, Andrew N. Sloss, Dominic Symes, Chris Wright, , Morgan Kaufman Publication, 2004
3.	Design with PIC Microcontrollers, John B. Peatman, Pearson Education Asia, 2002
4.	The Design of Small-Scale embedded systems, Tim Wilmshurst, Palgrav, 2003
5.	Embedded System Design, Marwedel, Peter, Kluwer Publishers, 2004

EC357 DIGITAL IMAGE PROCESSING

1. Subject Code: EC 357   Course Title: Digital Image Processing
2. Contact Hours: L: 3   T: 1   P: 0
3. Examination Duration (ETE) (Hrs.):   Theory 3Hrs   Practical 0
4. Relative Weightage: CWS 25   PRS 0   MTE   25   ETE   50   PR   0
5. Credits: 4
6. Semester: V
7. Subject Area: UEC
8. Pre-requisite: Signals and Systems
9. Objective: To introduce the fundamentals of visual information, representation of 2-D and 3-D information, enhancement of information, retrieval of information, and various colour models.
10. Details of Course

Unit No.	Contents	Contact Hours
1.	Introduction to Image processing, fundamental steps in DIP, concept of visual information, image formation model, image sampling and quantization, digital image representation, spatial and gray level resolution, relationship between pixels, application of image processing system.	6
2.	Introduction to Multidimensional signals and systems, 2D-Signals, 2D systems, classification of 2D system, 2D convolution, 2D Z-transform, Image Transform: 2D-DFT, discrete cosine, discrete sine, Haar, Walsh, Hadamard, Slant, KL, SVD, Hough, Radon, Ridgelet.	8
3.	Image enhancement; Spatial domain: linear transformation, image negative, grey level shifting, non-linear transformation, logarithmic transformation, exponential transformation, grey level slicing, bit plane slicing, image averaging, mask processing, histogram manipulations, histogram thresholding, histogram stretching, histogram equalization, noise removing filters, smoothing filters, sharpening filters. Enhancement in Frequency Domain; ideal low pas filter, Butterworth low pass filter, ideal high pass filters, Butterworth high pass filter, band pass filter, Gaussian filters, Homomorphic filtering.	10
4.	Image restoration: degradation model, noise models, restoration in presence of noise, periodic noise removal in frequency domain, notch filters, inverse filtering, Wiener filtering.	6
5.	Introduction to Morphological Image Processing operations, dilation and erosion, opening and closing, hit-or-miss transformation, boundary extraction, region filling,	6

	extraction connected components, convex hull, thinning, thickening, skeletons, pruning.	
6.	Introduction to various colour models: RGB, CMY, CMYK, HSI, HSV, and YCbCr. Concept of image compression, Image Segmentation: detection of discontinuities, edge linking and boundary detection, thresholding, region based segmentation, use of motion in segmentation.	6
	TOTAL	42

11. Suggested Books

S.No.	Name of Books / Authors/ Publishers
1.	Digital Image Processing/ Gonzalez and Woods/ Pearson Education, 2008/Third Edition
2.	Fundamentals of Digital Image Processing/ A.K. Jain/ PHI, Indian Edition
3.	Digital Image Processing using MATLAB/ Gonzalez, Woods, and Eddins/ McGraw Hill, Second/ 2013
4.	Digital Image Processing/ K.R. Castleman/ Pearson, 2014
5.	Digital Image Processing Algorithms and Applications/I. Pitas/John Wiley, 2002
6.	Image Processing, Analysis, and Machine Vision/Milan Sonka, Vaclav Hlavac, Roger Boyale/ Cengage Learning, 4th Edition

EC359 VLSI DESIGN

1. Subject Code: EC -359   Course Title: VLSI Design
2. Contact Hours: L: 3 T: 1 P: 0
3. Examination Duration (ETE) (Hrs.): Theory   3 Hrs   Practical 0
4. Relative Weightage: CWS 25   PRS 0   MTE 25   ETE 50   PR 0
5. Credits: 4
6. Semester: V
7. Subject Area: UEC
8. Pre-requisite: Nil
9. Objective: To give the student an understanding of the different design steps required to carry out a complete digital VLSI (Very-Large-Scale Integration) design in silicon.
10. Details of Course

Unit .No.	Contents	Contact Hours
1.	Introduction to VLSI, Manufacturing process of CMOS integrated circuits, CMOS n-well process design rules, packaging integrated circuits, trends in process technology. MOS transistor, Energy band diagram of MOS system,MOS under external bias, derivation of threshold voltage equation, secondary effects in MOSFETS	6
2.	MOSFET scaling and small geometry effects, MOScapacitances, Modeling of MOS transistors using SPICE, level I II and equations, capacitance models. The Wire: Interconnect parameters: capacitance, resistanceand inductance. Electrical wire models: The ideal wire, the lumpedmodel, the lumped RC model, the distributed RC model, the transmission line model, SPICE wire models.	6
3.	MOS inverters: Resistive load inverter, inverter with n-type MOSFET load, CMOS inverter: Switching Threshold, Noise Margin, Dynamic behavior of CMOS inverter, computing capacitances, propagation delay, Dynamic power consumption, static	8

	power consumption, energy, and energy delay product calculations, stick diagram, IC layout design and tools.	
4.	Designing Combinational Logic Gates in MOS and CMOS: MOS logic circuits with depletion MOS load. Static CMOS Design: Complementary CMOS, Ratioedlogic, Pass transistor logic, BiCMOS logic, pseudo nMOS logic, Dynamic CMOS logic, clocked CMOS logic CMOS domino logic, NP domino logic, speed and power dissipation of Dynamic logic, cascading dynamic gates.	8
5.	Designing sequential logic circuits: Timing matrices for sequential circuits, classification of memory elements, static latches and registers, the bistability principle, multiplexer based latches , Master slave Edge triggered register , static SR flip flops, dynamic latches and registers, dynamic transmission gate edge triggered register, the C2MOS register	8
6.	Pulse registers, sense amplifier based registers, Pipelining, Latch verses Register based pipelines, NORA-CMOS. Two-phase logic structure; VLSI designing methodology –Introduction, VLSI designs flow, Computer aided design technology: Design capture and verification tools, Design Hierarchy Concept of regularity, Modularity & Locality, VLSI design style, Design quality.	6
	TOTAL	42

11. Suggested Books

S.No.	Name of Books / Authors/ Publishers
1.	Digital integrated circuits a design perspective byJan M Rabaey, Anantha Chadrakasan Borivoje Nikolic, Pearson education, 2011.
2.	CMOS digital integrated circuits by Sung MO KangYusuf Leblebici, Tata McGraw Hill Publication, 2002
3.	Principle of CMOS VLSI Design by Neil E Weste and Kamran Eshraghian, Pearson education, 2000.

EE351 POWER ELECTRONIC SYSTEMS

1. Subject Code: EE-351   Course Title: Power Electronic Systems

2. Contact Hours   : L: 3 T: 0   P: 0

3. Examination Duration (Hrs.)   :   Theory: 3   Practical: 0

4. Relative Weight   CWS: 25 PRS: 0   MTE: 25   ETE: 50   PRE: 0

5. Credits: 3

6. Semester: VIII

7. Subject Area: UEC

8. Pre-requisite: EE-203, EE-301

9. Objective:To familiarize the students with power electronics and its applications.

10. Details of Course:

Unit No.	Contents	Contact Hours
1.	Solid State Power Devices: Principle of operation of SCR, dynamic characteristic of SCR during turn ON and turn OFF, parameters of SCR, dv/dt and di/dt protection, snubber circuit, commutation circuits; Principle of operation ofMOSFET, IGBT, GTO, MCT, SIT, SITH, IGCT, their operating characteristics.	8
2.	Single-phase Converter: Half wave converter, 2-pulse midpoint converter, half controlled and fully controlled bridge converters, input current and output voltage waveforms, effect of load and source impedance, expressions for input power factor, displacement factor, harmonic factor and output voltage, effect of free-wheeling diode, triggering circuits. Three-phase Converter: Half wave, full wave, half controlled and fully controlled bridge converters, effect of load and source impedance, expressions for input power factor, displacement factor, harmonic factor and output voltage,	8
3.	AC-AC Converters: Principle of operation of cycloconverter, waveforms, control technique; Introduction of matrix converter.	4
4.	DC-DC Converters: Principle of operation of single quadrant chopper, continuous and discontinuous modes of operation; Voltage and current commutation, design of commutating components; Introduction to SMPS.	4
5.	Inverters: Voltage source and current source inverters, Principle of operation of single-phase half bridge and full bridge voltage source inverters, voltage and current waveforms; Three-phase bridge inverter, 120^0 and 180^0 modes of operation, voltage and current waveforms with star and delta connected RL load; Voltage and frequency control of inverters; PWM techniques-single pulse, multiple pulse, selective harmonic elimination, sinusoidal PWM.	8
6.	Applications: FACTS Technology: Reactive power control in power systems, transmission system compensation, static series and shunt compensation, static shunt and series compensators- SVC, STATCOM, TCSC, SSSC and their working principles and characteristics. Combined series-shunt compensators –UPFC and its applications and characteristic. VSC-HVDC Systems: Principles and applications	10
	Total	42

11. Suggested Books:

S. No.	Name of Authors /Books / Publishers
1.	Mohan N., Undeland T. M. and Robbins W. P., "Power Electronics-Converters, Applications and Design", 3rd Ed., Wiley India, 2002.
2.	Rashid M. H., "Power Electronics Circuits Devices and Applications", 3rd Ed., Pearson Education, 2004.
3.	N.G. Hingorani and L. Gyugyi, "Understanding FACTS", IEEE Press, 2000

4.	[K.R. Padiyar](), "Facts Controllers In Power Transmission and Distribution", New Age publishers, 2013
5.	HVDC power transmission system, K.R.Padiyar, NewAge Publishers,2011

EE353 ELECTRICAL MACHINES AND POWER SYSTEMS

1. Subject Code: EE-353   Course Title: Electrical Machines and Power Systems

2. Contact Hours: L: 3   T: 0   P: 0

3. Examination Duration (Hrs.):   Theory: 3   Practical: 0

4. Relative Weight: CWS: 25   PRS: 0   MTE: 25   ETE: 50   PRE: 0

5. Credits: 3

6. Semester: VIII

7. Subject Area: UEC

8. Pre-requisite: EE-208, EE-303, EE-304

9. Objective:To familiarize the students with electrical machines and power systems.

10. Details of Course:

Unit No.	Contents	Contact Hours
1	Transformers : constructional features, types, Special constructional features – cruciform and multiple stepped cores, cooling methodology, conservators, breather, Buchholz relay, voltage, current and impedance relationships, equivalent circuits andphasor diagrams at no load and full load conditions,voltage regulation, losses and efficiency, all day efficiency, auto transformer and equivalent circuit, parallel operation and load sharing.	8
2	Asynchronous machines: General constructional features of poly phase asynchronous motors, concept of rotating magnetic field, principle of operation, phasor diagram, Equivalent circuit, torque and power equations, torque-slip characteristics, losses and efficiency.	8
3	Synchronous machines : General constructional features, armature winding, emf equation, effect of distribution and pitch factor,flux and mmf relationship, phasor diagram, non-salient pole machine, equivalent circuit, determination of equivalent circuit parameters by open and short circuit tests, voltage regulation using synchronous impedance method, power angle characteristics	9
4	Single line diagram of power system, brief description of power system elements, synchronous machine, transformer, transmission line, bus bar, circuit breaker and isolator. Supply System:different kinds of supply system and their comparison, choice of transmission voltage. Transmission Lines:configurations, types of conductors, resistance of line, skin effect	9
5	Transmission lines: Calculation of inductance and capacitance of single phase, three phase, single circuit and double circuit ,transmission lines, representation and	8

	performance of short, medium and long transmission lines, Ferranti effect,surge impedance loading.	
	Total	42

11.Suggested Books

S. No.	Name of Authors /Books / Publishers
1	Fitzgerald. A.E., Charles KingselyJr, Stephen D.Umans, 'Electric Machinery', Tata McGraw Hill, 2006.
2	M.G. Say, 'Performance and Design of Alternating Current Machines', CBS Publishers, New Delhi, 2008
3	Nagrath I. J and Kothari D.P. 'Electric Machines', Tata McGraw Hill Publishing Company Ltd, 2010.
4	Power System Analysis, J. Grainger and W.D. Stevenson, TMH, 2006.
5	Electrical Power Systems,C. L.Wadhwa, New age international Ltd. Third Edition, 2010
6	Electric Power Generation, Transmission&Distribution,S.N.Singh, PHI Learning, 2008.

EE-355 INSTRUMENTATION SYSTEMS

1. Subject Code: EE-355   Course Title: Instrumentation Systems

2. Contact Hours: L: 3   T: 0   P: 0

3. Examination Duration (Hrs.):   Theory: 3   Practical: 0

4. Relative Weight: CWS: 25   PRS: 0   MTE: 25   ETE: 50   PRE: 0

5. Credits: 3

6. Semester: VIII

7. Subject Area: UEC

8. Pre-requisite: EE-203, EE-313

9. Objective:To familiarize the students with instrumentation systems.

10. Details of Course:

Unit No.	Contents	Contact Hours
1	Transducers-I:Definition, advantages of electrical transducers, classification, characteristics, factors affecting the choice of transducers, strain gauges, resistance thermometer, thermistors, thermocouples, LVDT, RVDT	8
2	Transducers-II:Capacitive, piezoelectric, Hall effect and opto electronic transducers. measurement of motion, force, pressure, temperature flow and liquid level.	8
3	Telemetry:General telemetry system, land line & radio frequency telemetering system, transmission channels and media, receiver & transmitter. Data Acquisition	8

	System:A/D and D/A converters, analog data acquisition system, digital data acquisition system, modern digital data acquisition system and signal conditioning.	
4	Display Devices and RecordersDisplay devices, storage oscilloscope, DSO, spectrum analyzer, digital recorders.RecentDevelopments:Introduction to virtual and intelligent instrumentation, fibre optic transducers, smart sensors, smart transmitters, process instrumentation diagrams.	8
5	Programmable Logic Controllers :Evolution of PLC-sequential and programmable controllers, architecture and programming of PLC, relay logic and ladder logic, functional blocks, communication networks for PLC, field bus, profi-bus, mod-bus	10
	Total	42

11. Suggested Books:

S. No.	Name of Authors /Books / Publishers
1	Electronic Instrumentation and Measurement Techniques, W.D. Cooper and A.D. Helfrick, Prentice Hall International, 2009.
2	Measurement Systems Application and Design Ernest Doebelin, McGraw- Hill Higher Education, 5th edition , 2003
3	Instrumentation, Measurement and Analysis, B.C. Nakra& K. Chaudhry, Tata McGraw Hill, 2nd Edition, 2001.
4	Advanced Measurements and Instrumentation, A.K. Sawhney, DhanpatRai& Sons, 2010
5	Process Control Instrumentation Technology, Curtis D. Johnson, Pearson, 6th edition, 1999
6	Programmable Logic Controllers, Frank D. Petruzella McGraw-Hill Higher Education, 4th edition, 2010

EE357 UTILIZATION OF ELECTRICAL ENERGY

1. Subject Code: EE-357   Course Title: Utilization of Electrical Energy

2. Contact Hours: L: 3   T: 0   P: 0

3. Examination Duration (Hrs.):   Theory: 3   Practical: 0

4. Relative Weight: CWS: 25   PRS: 0   MTE: 25   ETE: 50   PRE: 0

5. Credits: 3

6. Semester: VIII

7. Subject Area: UEC

8. Pre-requisite: EE-208, EE-303

9. Objective: To familiarize the students with the concept of electrical power, energy and its utilization.

10. Details of Course:

Unit No.	Contents	Contact Hours
1.	Illumination: Definition:- Luminous flux, solid angle, luminous intensity, illumination, luminous efficiency, depreciation factor, coefficient of utilization, space to height ratio, reflection factor, glare, shadow, lux. Nature of light, visibility spectrum curve of relative sensitivity of human eye and wave length of light, Review of laws of illumination, Different types of lighting sources and their use in domestic, street and industrial lighting, Energy considerations. LED's and their driving circuits.	10
2	Electric Heating : Advantages of electrical heating, Heating methods: Resistance heating – direct and indirect resistance heating, properties of resistance heating elements, Induction heating; principle of core type and coreless induction furnace, Electric arc heating; direct and indirect arc heating, construction, working and applications of arc furnace, Dielectric heating, applications in various industrial fields, Infra-red heating and its applications, Microwave heating	08
3.	Electric Welding: Introduction to electric welding, Welding methods, Principles of resistance welding, types – spot, projection seam and butt welding and welding equipment used, Principle of arc production, electric arc welding, characteristics of arc, Design of Power supply and welding control circuit, comparison between AC and DC arc welding, welding control.	08
4.	Electrolytic Processes: Need of electro-deposition laws of electrolysis, process of electro-deposition - clearing, operation, deposition of metals, polishing, buffing equipment and accessories for electroplating factors affecting electro-deposition , principle of galvanizing and its applications, anodising and its applications, electroplating on non-conducting materials, manufacture of chemicals by electrolytic process, electrolysis for water purification	08
5.	Refrigeration and Air Conditioning and Water Coolers: Principle of air conditioning, vapour pressure, refrigeration cycle, eco-friendly refrigerants, description of electrical circuit used in a) refrigerator, b) air-conditioner, and c) water cooler, variable speed drive for compressors, high speed compressors, insta-chill, Peltier effect, thermoelectric cooling, sterling engines, solar concentrator heating and cooling,	08
	Total	42

11. Suggested books:

S. No.	Name of Authors /Books / Publishers
1.	Dubey G. K., "Fundamentals of Electric Drives", 2nd Ed., Narosa Publishing House,2007.
2.	Taylor E. O., "Utilization of Electric Energy (in SI units)", Orient Longman, Revised in S.I. units by Rao, V.V.L,1999
3.	Hancock N. N., "Electric Power Utilisation", Wheelers,1979.

EE-359 NON-CONVENTIONAL ENERGY SYSTEMS

1. Subject Code: EE-359   Course Title: Non-conventional Energy Systems

2. Contact Hours: L: 3   T: 0   P: 0

3. Examination Duration (Hrs.): Theory: 3 Practical: 0

4. Relative Weight: CWS: 25 PRS: 0 MTE: 25 ETE: 50 PRE: 0

5. Credits: 3

6. Semester: VIII

7. Subject Area: UEC

8. Pre-requisite: EE-301, EE-303

9. Objective: To familiarize the students with the non-conventional sources of energy and their integration to the grid.

10. Details of Course:

Unit No.	Contents	Contact Hours
1	Introduction to Non Conventional Energy Systems Various non-conventional energy resources Introduction, availability, classification, relative merits and demerits. Solar Cells: theory of solar cells, solar cell materials, solar cell array, solar cell power plant, limitations. Solar Thermal Energy: solar radiation, flat plate collectors and their materials, applications and performance, focusing of collectors and their materials, applications and performance, solar thermal power plants, thermal energy storage for solar heating and cooling, limitations.	10
2	Geothermal Energy Resources of geothermal energy, thermodynamics of geo-thermal energy conversion, electrical conversion, non-electrical conversion, environmental considerations. Magneto-hydrodynamics (MHD): principle of working of MHD power plant, performance and limitations.	8
3	Fuel Cells: Basic principle of working, various types of fuel cells, performance and limitations.	8
4	Thermo-electrical and thermionic conversions Principle of working of thermo-electrical and thermionic conversions, performance and limitations. Wind energy: wind power and its sources, site selection criteria, momentum theory, classification of rotors, concentrations and augments, wind characteristics, performance and limitations of wind energy conversion systems.	8
5	Energy from Bio-mass, Ocean Thermal, Wave and bio-waste Availability of bio-mass and its conversion principles, ocean thermal energy conversion principles, performance and limitations, wave and tidal energy conversion principles, performance and limitations, bio-waste recycling power plants.	8
		42

11. Suggested books:

S. No.	Name of Authors /Books / Publishers
1	Renewable Energy Resources, John Twidell, Tony Weir, Taylor and Francis, 2nd edition,2005.
2	Solar Engineering of Thermal Processes,John A. Duffie, William A. Beckman, John Wiley & Sons, 4th edition,2013.
3	Biofuels, Solar and Wind as Renewable Energy Systems: Benefits and Risks,D. Pimentel, Springer,1st edition,2010.
4	Solar Photovoltaic Technology and Systems: A Manual for Technicians, Trainers and Engineers,Chetan Singh Solanki, PHI Learning,2013.
5	Non Conventional Energy Resources, D.S. Chauhan, New Age International Pvt Ltd.,2006

EE-361 EMBEDDED SYSTEMS

1. Subject Code: EE-361   Course Title: Embedded Systems

2. Contact Hours: L: 3   T: 0   P: 0

3. Examination Duration (Hrs.):   Theory: 3   Practical: 0

4. Relative Weight: CWS: 25   PRS: 0   MTE: 25   ETE: 50   PRE: 0

5. Credits: 3

6. Semester: VIII

7. Subject Area: UEC

8. Pre-requisite: EE-306, EE-427

9. Objective:To familiarize the students with the concepts of embedded systems.

10. Details of Course:

Unit No.	Contents	Contact Hours
1.	Embedded Processing – Evolution, Issues and Challenges;	1
2	System and Processor Architecture : von Neumann, Harvard and their variants	2
3	Memory Architecture and Devices; Input-Output Devices and Mechanisms	5
4	Instruction Set and Addressing Modes, Interfacing of Memory and Peripheral Devices – Functional and Timing Issues	6
5	Application Specific Logic Design using Field Programmable Devices and ASICs	2
6	Analog to Digital and Digital to Analog Converters	2
7	Bus I/O and Networking Considerations, Bus and Wireless Protocols	4
8	Embedded Systems Software : Constraints and Performance Targets	2
9	Real-time Operating Systems : Introduction, Scheduling in Real-time Operating Systems	4
10	Memory and I/O Management : Device Drivers	2

11	Embedded Software Development : Flow, Environments and Tools	2
12	System Specification and Modelling	2
13	Programming Paradigms	2
14	System Verification	2
15	Performance Analysis and Optimisation : Speed, Power and Area Optimisation, Testing of Embedded Systems	4
	Total	42

11. Suggested Books:

S. No.	Name of Authors /Books / Publishers
1.	S. Heath, "Embedded Systems Design", Elsevier India,2005
2.	M. Ben-Ari, "Principles of Concurrent and Distributed Programming", Pearson,2005
3.	Jane Liu, "Real Time Systems", Pearson,2002

EN-351 ENVIRONMENTAL POLLUTION AND E –WASTE MANAGEMENT

1. Subject Code: EN-351   Course Title: Environmental Pollution & E- Waste Management

2. Contact Hours: L: 3   T: 0   P: 0

3. Examination Duration (ETE) (Hrs.):   Theory: 3 Hrs.   Practical: 0

4. Relative Weightage: CWS   25   PRS 0   MTE   25   ETE   50   PR   0

5. Credits: 3

6. Semester:VI

7. Subject Area: UEC

8. Pre-requisite: Nil

9. Objective: The overall aims of the course are for students to acquire understanding of the new and emerging contaminants from various industrial processes and their transformation products. Studying emerging environmental issues related to newer methods of manufacture of industrial products.

10. Details of Course

Unit No.	Contents	Contact Hours
1	UNIT-I New and emerging pollutants and related transformation products, Effects & risks of emerging contaminants on ecosystems and humans, Persistent pollutants.	9

		Analytical methods for identifying emerging pollutants and the products of their transformation	
2	UNIT-II Micro pollutants- Pesticides, Pharmaceutical - Veterinary and human drugs, personal care products, Surfactants and surfactant metabolites, Flame retardants, Industrial additives and agents.Emerging pollutants' toxicity, and their water-related characteristics (degradability, solubility, sorption…)	9
3	UNIT-III Emerging Issues - E-waste, Hazardous Waste, Nuclear Waste, Nano pollution, Thermal Pollution, pollutant emission and treatment	8
4	UNIT-IV Emerging pollutants' emergence and fate in surface and ground water, as well as mathematical modelling, Sustainable Development, Risk mitigation	8
5	UNIT-V Transformation Products of Emerging Contaminants in the Environment, Removal of emerging contaminants from water, soil and air, methods and preventive measures.	8

Course Outcome:

1. Introduction to new and emerging contaminants and their transformation products.
2. Study of pollutants from manufacturing of goods.
3. Emerging area in environmental pollution.
4. Study of life cycle of a contaminant, modeling and mitigation.

11.Suggested Books:

S. No.	Name of Authors /Books / Publishers
1.	G. Buttiglieri, T.P. Knepper, (2008), Removal of emerging contaminants in Wastewater Treatment: Conventional Activated sludge Treatment, Springer-Verlag Berlin Heidelberg, HdbEnvChem, vol. 5, Part S/2:1-35, DOI: 10.1007/698_5_098
2.	Alok Bhandari; Rao Y. Surampalli; Craig D. Adams; Pascale Champagne; Say Kee Ong; R. D. Tyagi; and Tian Zhang, Eds., (2009) Contaminants of Emerging Environmental Concern, American Society of Civil Engineers, ISBN (print): 978-0-7844-1014-1, ISBN (PDF): 978-0-7844-7266-8
3.	Dimitra A. Lambropoulou, Leo M. L. Nollet Eds. () Transformation Products of Emerging Contaminants in the Environment: Analysis, Processes, Occurrence, Effects and Risks, 1st Edition, Wiley, ISBN-13: 978-1118339596, ISBN-10: 1118339592

EN353 OCCUPATIONAL HEALTH AND SAFETY MANAGEMENT

1. Subject Code: EN- 353   Course Title: Occupational Health and Safety Management
2. Contact Hours: L: 3   T: 0   P: 0
3. Examination Duration (ETE) (Hrs.):   Theory   3 Hrs
4. Relative Weightage: CWS 25   PRS 0   MTE 25   ETE 50   PR 0
5. Credits: 3
6. Semester: V

7. Subject Area: UEC   8.

8. Prerequisite: Nil

9. Course Objectives:

    1.   Introduction about occupational health and related issues.
    2.   To give a basic idea about environmental safety management, industrial hygiene.
    3. To introduce about training cycle, chemical hazards and control measures.
    4. To aware and provide knowledge about ergonomics and different disorders.
    5. To provide knowledge about different standards related to safety and health.

10. Detail of Course:

Unit no.	Contents	Contact Hours
1	UNIT –I Definition of Occupational Health as per WHO/ILO. Occupational Health and Environmental Safety Management – Principles practices. Common Occupational diseases: Occupational Health Management Services at the work place. Pre-employment, periodic medical examination of workers, medical surveillance for control of occupational diseases and health records.	8
2	UNIT –II Occupational Health and Environment Safety Management System, ILO and EPA Standards. Industrial Hygiene: Definition of Industrial Hygiene, Industrial Hygiene: Control Methods, Substitution, Changing the process, Local Exhaust Ventilation, Isolation, Wet method, Personal hygiene, housekeeping and maintenance, waste disposal, special control measures.	8
3	UNIT –III Element of training cycle, Assessment of needs. Techniques of training, design and development of training programs. Training methods and strategies types of training. Evaluation and review of training programs. Chemical Hazard: Introduction to chemical hazards, dangerous properties of chemical, dust, gases, fumes, mist, Vapours, Smoke and aerosols. Evaluation and control of basic hazards, concepts of dose response relationship, bio-chemical action of toxic substances. Concept of threshold, limit values.	9
4	UNIT –IV Occupational Health Hazards, Promoting Safety, Safety and Health training, Stress and Safety, Exposure Limit. Ergonomics-Introduction, Definition, Objectives, Advantages. Ergonomics Hazards. Musculoskeletal Disorders and Cumulative Trauma Disorders. Physiology of respiration, cardiac cycle, muscle contraction, nerve conduction system etc. Assessment of Workload based on Human physiological reactions. Permissible limits of load for manual lifting and carrying. Criteria or fixation limits.	9

| 5 | UNIT –V
Bureau of Indian standards on safety and health 14489 - 1998 and 15001 – 2000, OSHA, Process Safety Management (PSM) as per OSHA, PSM principles, OHSAS – 18001, EPA Standards, Performance measurements to determine effectiveness of PSM. Importance of Industrial safety, role of safety department, Safety committee and Function. | 8 |

Course Outcomes:

1. The student will be able to understand the basics of occupational health and related issues.
2. Understanding of the fundamental aspects of safety, industrial hygiene along with learning theory to safety training methodology.
3. Considerate about hazardous materials, emergency management, ergonomics and human factors
4. Able to understand the adverse effects of hazards and develop control strategies for hazardous conditions and work practices
5. Learn about Indian standards of health and safety and able to apply applicable standards, regulations and codes.

11. Suggested Books:

S. No.	Name of Authors /Books / Publishers
1.	Handbook of Occupational Health and Safety, NIC, Chicago, 1982.
2.	Encyclopedia of Occupational Health and Safety, Vol. I and II. International Labour Organisation, Geneva, 1985.
3.	Accident Preventional Manual, NSC Chicago, 1982.
4.	Henrich, H.W., Industrial Accident Prevention, McGraw Hill, 1980.

EN-355 GIS & REMOTE SENSING

1. Subject Code: EN-355   Course Title: GIS & Remote Sensing

2. Contact Hours: L: 3   T: 0   P: 0

3. Examination Duration (ETE) (Hrs.):   Theory   3 Hrs

4. Relative Weightage: CWS   25   PRS 0   MTE   25   ETE   50   PRE   0

5. Credits: 3

6. Semester:V

7. Subject Area: UEC

8. Prerequisite: Nil

9. Course Objectives:

1) Introduce GIS and its significance in engineering and science.
2) To familiarize students with GIS data and its applications.
3) To familiarize students about the basics of remote sensing and its multi concepts.

4) To disseminate knowledge about sensors and different kind of resolution in the area of remote sensing.
5) To familiarize students about the diverse applications of remote sensing.

10. Detail of Course:

Unit no.	Contents	Contact Hours
1	Unit-1: Geographic Information System Introduction, Definition of GIS, Components of GIS, Input data for GIS, Geographical concepts	7
2	Unit-2:GIS Data GIS data types, Data representation, Data sources, Geo-referencing of GIS data, GIS database, Database Management System, Data analysis terminology, GIS software packages, GIS application	9
3	Unit-3:Remote Sensing Introduction to Remote Sensing and Remote Sensing System, Multi concept of remote sensing, Advantages and disadvantages of remote sensing, Electromagnetic radiation, Polarisation, Thermal radiation	8
4	Unit-4:Remote Sensing Platforms Important remote sensing satellites, Classifications of sensors and platforms, Passive and Active sensors, Major remote sensing sensors, Spatial resolution, Spectral resolution, Radiometric resolution, Temporal resolution, Glopal Positioning System	9
5	Unit-5:Application of Remote Sensing Digital Image Processing, Application of Remote Sensing in Land use and Land cover mapping, Ground water mapping, Urban growth studies, Wasteland mapping, Disaster management, Agriculture, Forestry application	9

Course Outcomes:

1. The Student will learn about basics of GIS and its significance.
2. The Student will be able to understand the utility of GIS data as well as Data Management System.
3. The Student will learn the fundamentals of remote sensing.
4. The unit of Remote Sensing Platform will generate a clear cut understanding among students about the satellites, their functioning and Global Positioning System. Geographical information system, its components, DMS and its various applications in real life.
5. The Student will be able to attain thorough knowledge about the application of remote sensing in different areas.

11.Suggested Books:

S. No.	Name of Authors /Books / Publishers

1.	Fundamentals of Remote Sensing – George Joseph, University Press, Hyderabad, India.
2.	Remote Sensing and Geographical Information System – AM Chandra & SK Ghosh Narosa Publishing House, New Delhi.
3.	Concepts and Techniques of Geographic Information Systems – C. P. Lo & Albert K.W. Yeung, PHI Learning Private Limited, New Delhi.
4.	Geographic Information System – Kang Tsung Chang, Tata Mc Graw hill, Publication Edition, 2002.

EP351 PHYSICS OF ENGINEERING MATERIALS

1. Subject code: EP351   Course title: Physics of Engineering Materials
2. Contact Hours: L: 3   T: 0   P: 0
3. Examination Duration (Hrs):   Theory: 3   Practical: 0
4. Relative Weight: CWS: 25 PRS: 0   MTE: 25 ETE: 50 PRE: 0
5. Credits: 3
6. Semester: ODD
7. Subject area: UEC
8. Pre-requisite: NIL
9. Objective: To familiarize the fundamentals /basic concepts and advances of the different materials keeping in view of the engineering applications. There is ample opportunity to become involved in cutting edge Materials Science and Engineering Research

10. Detail of Course:

Unit No.	Contents	Contact Hours
1.	**Crystallography:** Introduction to crystal physics,Space lattice, Basis and the Crystal structure, Bravais lattices; Miller indices, simple crystal structures,Interplanar spacing, Intra and Intermolecular bonds (Ionic, Covalent, Metallic, Van der Waals and Hydrogen Bond), Defects in crystals, Basics of X- ray diffraction and its applications	**10**
2.	**Semiconductors:** Band theory of solids, Intrinsic and Extrinsic semiconductors, Statistics of electrons and holes in intrinsic semiconductor, Hall effect, Effect of temperature on conductivity, Generation and recombination, drift and diffusion current, Einstein relation, Applications of Semiconducting Materials.	**10**
3.	**Dielectric and Magnetic Materials** *Dielectric Materials:* Dielectric polarization and dielectric constant, Various polarization processes, Applications of Dielectric Materials	**07**

	Magnetic Materials: Concept of Magnetism, Classification of dia-para, Ferro, Antiferro and Ferrimagnetism, ferrites, soft and hard magnetic materials, Applications of Magnetic Materials		
4.	**Superconductivity:** Introduction and historical developments; General properties of super conductors, Meissner effect and its contradiction to the Maxwell's equation; Types of Superconductors, London equations, Penetration depth, High Temperature Superconductors, Applications of superconductors.	**07**	
5.	**Advanced Engineering Materials:** Introduction, Synthesis, characterization and applications of Photonic glasses, Phosphors and Nanophosphors, other selective topics in advanced materials.	**08**	
	Total	**42**	

11.Suggested Books:

S. No.	Name of Books/ Authors
1.	Introduction to Solid State Physics, by C. Kittel, 1996/ John Wiley & sons
2.	Solid State Physics, by S. O. Pillai, 2010/ New Age International (P) Ltd.
3.	Materials Science and Engineering by V. Raghavan, 2009/PHI Learning Pvt. Ltd.
4.	Solid State Physics, N. W. Ashcroft and N. D. Mermin, 1976/ HBC Publication
5.	Engineering Materials Science by Milton Ohring, 1995/Academic Press
6.	Material Science and engineering: An Introduction By W. D. Callister Junior, 2007/ John Wiley & Sons, Inc
7.	Handbook of Electronic and Photonic Materials by SafaKasap, Peter Capper (Eds.), 2006/Springer

EP353 NUCLEAR SECURITY

1. Subject code: EP353   Course title: Nuclear Security
2. Contact Hours: L: 3   T: 1   P: 0

3. Examination Duration (Hrs):   Theory: 3   Practical: 0

4. Relative Weight: CWS: 25, PRS:--, MTE: 25, ETE: 50, PRE: --

5. Credits: 4

6. Semester: EVEN/ODD

7. Subject area: UEC

8. Pre-requisite: Basic knowledge of Nuclear Physics

9. Objective: This course will provide basic understanding of Nuclear Security which is essential for establishing nuclear culture in the society

10. Detail of Course: 5th/6th Semester

S. No.	Contents	Contact Hours
1.	Introduction to nuclear security: Basics of nuclear security, Practice and culture, Background, Objective, Scope, Structure, Nuclear security and safety culture: Characteristics of nuclear security culture	**08**
2.	Nuclear security regime, Importance of human factor and management leadership in nuclear security, Nuclear security threats: Threat informed security, The design basis threat	**07**
3.	System characterization, PPS requirements and objectives: Facility characterization, Target identification, Consequence analysis, PPS performance objectives	**06**
4.	Physical protection system technologies: Intrusion detection, Exterior and Interior Sensors, Access control, Contraband detection, Field detection sensors at borders/major public Events, Alarm assessment, Communication and display, Access delay, Response and neutralization, Response strategies and impact of On and Off site response, Cyber security.	**09**
5.	Security system design and evaluation: Adversary path analysis and Multi path optimization, Scenario development, Insider analysis, Transportation, Design approaches and vulnerability assessments, System design at major public events, Design of security systems to interrupt illicit trafficking, Analysis of quantitative risk assessment methods.	**08**
6.	Consequence mitigation and event response: Consequence management following nuclear events, Analysis of deterrence value of security measures, Roles and responsibilities of institutions and individuals	**04**
	Total	**42**

11. Suggested Books

S. No.	Name of Books/ Authors
1.	Nuclear security briefing book, by Wyn Bowen, Matthew Cottee, Chris Hobbs, Luca Lentini and Matthew Moran, 2014/King's College, London, UK
2.	IAEA Nuclear Security Series No. 13, Nuclear Security recommendations on physical protection of nuclear material and nuclear facilities by IAEA, 2011/International Atomic Energy Agency (IAEA)
3.	The International Legal Framework of Nuclear Security: IAEA International law series No. 4 by IAEA, 2011/International Atomic Energy Agency (IAEA)

4.	Seeking Nuclear Security Through Greater International Cooperation by Jack Boureston and Tanya Ogilvie-White, 2010/Council on Foreign Relations (CFR's) International Institutions
5.	Book Review: South Asia's Nuclear Security by Bhumitra Chakma , 2015/Oxon, UK, Routledge

HU351 ECONOMETRICS

1. Elective Paper - Econometrics

During	Subject Code	Open for Branches	Per week- L-T-P	During semester
Odd semester	351	MC, CE, EN, BT, EP, PS	3-0-1	5 th
Even semester	352	EE, EL, CO, SE, AE, ME, PE	3-0-1	6 th

(Note: i. History of this subject in DTU is different from other subjects. This subject was demanded by the students in final year. It is supported by the placement data also that number of non-technical companies visiting campus for recruitment is increasing over year.

2. Examination Duration: 3 Hrs.

3. Relative Weightage- will be decided at University level

4. Credits: 3 (Four)

5. Semester: Fifth and Sixth Semester

6. Subject Area: UEC Economics (Social Science)

7. Pre-requisite- Nil

8. Details of Course
Syllabus   Hours (Total - 56)

Unit	Contents	Contact Hrs
1	Introduction	
	1.1 What is Econometrics? Why a separate discipline? How it is different from Mathematical Economics, Type of Data, Sources of data 1.2 Estimating Economic Relationship, Methodology of Econometrics 1.3 Matrix and its Economic Application	6
2	Review of Calculus	12
	2.1 Differential Calculus and its application in Economics- Elasticity of demand- Price and Cross; Profit maximization under Perfect Competition, Monopoly, Oligopoly and Monopolistic Competition 2.2 Integral Calculus and its application in Economics - Capital Formation, Compound Interest; Capital value and Flow Value; Consumer surplus under pure competition and monopoly; Producers Surplus 2.3 Differential Equation and its application in Economics – Market Price Function; Dynamic Multiplier;	
3.	Review of Statistics	14

	3.1	Basic Ingredients of an Empirical study- Formulating a Model; Gathering data Descriptive Statistics and its use in Business- Measure of Central Tendency: AM, GM and HM, Median, Mode, Dispersion, Range, Quartile, standard Deviation, Skewness, Kurtosis,	
	3.2	Probability - Discrete and Continuous; Probability Distribution: Binomial and Poison distribution	
	3.3	Sampling techniques, Estimation and Hypothesis Testing, Interpreting the results	

Mid semester			
4.	Regression		8 Hours
	Statistical verses Deterministic Relationships, Regression verses Causation; Two variable Regression Analysis; Population Regression Function (PRG), Stochastic specification of PRF; The Significance of the Stochastic Term; stochastic disturbance Term; the sample regression Function (SRF); Method of Ordinary Least Squares; Properties of Least Square Estimators: The Gauss-Markov Theorem, Coefficient of determination r^2: A Measure of "goodness of fit"; Monto Carlo Experiments		
5.	Classical Normal Linear Regression Mode (CNLRM)		4 Hours
	The Probability distribution of Disturbances (meu); Normality Assumption, Method of Maximum Likelihood Multiple regression Analysis: The Problem of estimation; The problem of Inference Cobb-Douglas Production function; Polynomial Regression Model; Testing for structural or Parametric stability of regression Models; the Chow test		
6.	Dummy Variable (DV)		6 Hours
	Nature; ANOVA models; Regression with a mixture of Quantitative and Qualitative regressors: The ANCOVA Models; DV alternative to the Chow Test; Interaction effects using Dummy Variable; Use of DV in seasonal Analysis		
7.	Presentation on Application of Mathematics, Statistics, Operational Research , Computer Science or any other related subject to discuss any Aspect of Economics		6 hrs.

11.Suggested books

S.No.	Name of Books, Authors, Publishers
1.	Wooldridge Jeffrey , Introductory Econometrics, Cencage Learning- ISBN-13-978-81-315-1673-7; ISBN-1081-315-1673-3,2014
2.	Damodar N. Gujrati, Basic Econometrics, Mcgraw Hill Education (India) Limited, Fifth Edition,2013 ISBN-978-0-07-133345-0; ISBN; 0-07-133345-2
3.	Ramu Ramanathan, Introductory Econometrics with Applications, Harcourt Brace Jovanovich Publishers, Latest USA ISBN-

MA351 HISTORY CULTURE & EXCITEMENT OF MATHEMATICS

1. 1 Subject code: MA351   Course title: History Culture and Excitement of Mathematics
2. Contact Hours: L-3   T-0   P-0
3. Examination Duration (Hrs)   Theory: 3hrs
4. Relative weightage: CWS: 25, PRS: -MTE: 25 ETE: 50 PRE: 0
5. Credits: 3
6. Semester   Odd
7. Subject Area: UEC
8. Pre requisite   --
9. Objective: To be capable in learning the history and culture on the Mathematics subjects

Unit No.	Contents	Contact Hours
1.	Ancient, Medieval and Modern Indian Mathematics: Aryabhata, Brahmagupta, Bhaskar, Lilavati, Ramanujan	7
2	Introduction to Ancient books of Indian Mathematicians: Sidhantas, Sulvasutras, Vedic Mathematics	7
3	Contribution of Indian Mathematicians in the field of Mathematics: Value of Pi, The symbol zero, Number theory, Trigonometry, and Mensuration, Hindu Multiplication, Long Division, Indeterminate equation	7
4	Mathematicians Around the world: Newton, Leibnitz, Cauchy, Lagrange in the field of Geometry, Calculus, Algebra, Probability	7
5	Algebra in the Renaissance: Solution of cubic equation, Ferrari's Solution in the quartic equation, Irreducible Cubics and complex numbers	7
6	Paradoxes, Fallacies and Pitfalls of Mathematics	7
	Total	42

11.Suggested books

S.No.	Name of Books, Authors, Publishers
1.	History of Mathematics, by carl B Boyer, Wiley International edition, 1968.
2.	Mathematics of Music, Susan Kelly, UW-L Journal of under graduate research, Vol-XIV, 2011.

ME 351 POWER PLANT ENGINEERING

1. Subject Code: ME 351   Course Title: Power Plant Engineering

2. Contact Hours: 42   L: 3   T: 0   P: 0

3. Examination Duration (Hrs.):   Theory: 3   Practical: 0

4. Relative Weight: CWS: 25   PRS: 0   MTE: 25   ETE: 50   PRE: 0

5. Credits: 3

6. Semester: V

7. Subject Area: UEC

8. Pre-requisite: NIL

9. Objective: To familiarize the students with thermodynamic cycles and various components of power plants.

10. Details of Course:

S. No.	Contents	Contact Hours
1	Indian energy scenario, Indian coals: formation, properties, analysis, benefication and heating value calculation of coals; coking and non-coking coals, fuel handling systems; coal gasification. Classification of power plants, base load and Peak load power stations, co-generated power plant, captive power plant, and their fields of application & selection criteria,.	7
2	**Steam Generators:** High pressure utility boiler, natural and forced circulation, coking and non-coking coal, coal benefication, coal pulverization, pulverized fuel firing system, combustion process, need of excess air, cyclone furnace, fluidized bed boiler, electrostatic precipitators and wet scrubbers, boiler efficiency calculations, water treatment.	7
3	**Combined Cycle Power Plants:** Binary vapour cycles, coupled cycles, gas turbine- steam turbine power plant, gas pipe line control, MHD- Steam power plant.	7
4	**Other power plants:** Nuclear power plants - working and types of nuclear reactors, boiling water reactor, pressurized water reactor, fast breeder reactor, controls in nuclear power plants, hydro power plant -classification and working of hydroelectric power plants, tidal power plants, diesel and gas power plants.	7
5	**Instrumentation and Controls in power plants:** Important instruments used for temperature, flow, pressure, water/steam conductivity measurement; flue gas analysis, drum level control, combustion control, super heater and re-heater temperature control, furnace safeguard and supervisory system (FSSS), auto turbine run-up system(ATRS).	7
6	**Environment Pollution and Energy conservation:** Economics of power generation: load duration curves, power plant economics, pollution from power plants, disposal/management of nuclear power plant waste, concept of energy conservation and energy auditing.	7
	Total	**42**

Suggested Books:

S. No.	Name of Authors /Books / Publishers
1	**Power Plant Engineering** by M.M. Elwakil, Tata McGraw Hill, ISBN- 0070662746.
2	**Power Plant Engineering** by P.K Nag, Tata McGraw Hill, ISBN- 0070435993.
3	**Steam and Gas turbines** by A Kostyuk and V Frolov, MIR Publishers, ISBN- 9785030000329.
4.	**Modern Power Plant Engineering** by J Wiesman and R Eckart, Prentice hall India Ltd, ISBN- 97801359725.
5.	**Planning Fundamentals of thermal Power Plants** by F.S Aschner, John Wiley, ISBN- 07065159X.
6.	**Applied Thermodynamics** by T.D Eastop and McConkey, Longman Scientific and Technical, ISBN- 0582305351.
7.	**CEGB volumes on power plant, Cwntral Electricity Generation Board, ISBN- 0080155680.**
8.	**NTPC/NPTI publications on Power plants**, ISBN- 9788132227205.

ME353 RENEWABLE SOURCES OF ENERGY

DRAFT EP-102

1. Subject Code: ME 353   Course Title: Renewable Sources of Energy

2. Contact Hours: 42   L: 3   T: 0   P: 0

3. Examination Duration (Hrs.):   Theory: 3   Practical: 0

4. Relative Weight: CWS: 25   PRS: 0   MTE: 25   ETE: 50   PRE: 0

5. Credits: 3

6. Semester: V

7. Subject Area: UEC

8. Pre-requisite: NIL

9. Objective: To familiarize the students with renewable energy sources like solar, geothermal, wind and tidal.

10. Details of Course:

Unit No.	Contents	Contact Hours
1	Man and Energy, world production and reserve of conventional energy sources, Indian production and reserves, Energy alternatives	7
2	Solar radiation: Origin, nature and availability of solar radiation, estimation of solar radiation. Photovoltaic cells. Design consideration and performance of different types of solar cells. Flat plate, focusing collectors. Effects of receiving surface location and orientation.	7
3	Devices for solar thermal collection and storage. Energy storage devices such as water storage systems, packed Bed storage systems, phase change storage systems. Heat transfer considerations relevant to solar energy. Characteristics of materials and surfaces used in solar energy absorption.	7
4	Application systems for space heating, solar water pumps, solar thermal pond, Solar Thermal Power plants, solar distillation, Solar Refrigeration and solar air conditioning, other solar energy utilization.	7
5	Solar PV systems. Fuel Cell Technologies. Generation and utilization of biogas, design of biogas plants, Wind energy systems.	7
6	Geothermal Energy Systems. Tidal energy systems. Oceanic power generation. Design considerations, Installation and Performance Evaluation. MHD power generations. Role of the nonconventional energy sources in power planning.	7
	Total	**42**

11. Suggested Books:

S. No.	Name of Authors /Books / Publishers
1	G. D. Rai, "Energy Technolgy", Khanna Publishers, ISBN- 97881740907438.
2	S.P. Sukhatme, " Solar Energy", Tata-Mcgraw hill, New Delhi, ISBN- 0074624531.
3	"Solar Energy thermal process" JADuffie and W.A. Beckman, John Wiley& sons, New York, ISBN- 1118418123.
4	Solar energy, Frank Kaieth& Yogi Goswami, Taylor and Francis, ISBN- 1560327146.
5	Treatise of Solar Energy, H.P. Garg, John Willey & sons, ISBN- 9027719306.

ME355 COMBUSTION GENERATED POLLUTION

1. Subject Code: ME 355   Course Title: Combustion Generated Pollution

2. Contact Hours: 42   L: 3   T: 0   P: 0

3. Examination Duration (Hrs.):   Theory: 3   Practical: 0

4. Relative Weight: CWS: 25   PRS: 0   MTE: 25   ETE: 50   PRE: 0

5. Credits: 3

6. Semester: V

7. Subject Area: UEC

8. Pre-requisite: NIL

9. Objective: To introduce the students to different types of fuels, emissions from various engines, exhaust treatment of various engines and instruments used for measuring emissions.

10. Details of Course:

Unit No.	Contents	Contact Hours
1	Engine fundamentals: Fuels, alternative fuels for IC engines, Type of hydro carbons. Gasoline specifications. Effect of Engine parameters on performance, fuel injection for SI engines, Engine vehicle road performance, road performance and fuel economy.	7
2	Emissions and air pollution: Automotive Emissions and their role in air pollution. Photo-chemical smog. Chemistry of smog formation. Combustion in Homogeneous mixtures, emission formation. Incomplete combustion, formation of hydro-carbons, Carbon monoxide and oxides of nitrogen, Aldehyde emissions.	7
3	Influence of design and operating variables on gasoline engine exhaust emissions. Hydrocarbon Evaporative Emissions: Various sources and methods of their control. Canisters for controlling evaporative emissions. Emission control systems for gasoline engines: Blow by control closed PCV system design.	7
4	Exhaust treatment devices: Air injection into exhaust system.	7
5	Thermal reactors, Catalytic convertor. Stratified charge engines. Honda CVCC engine. Diesel engine combustion Emissions: Sources of emissions during combustion. Effect of air fuel ratio, speed, injection timing on performance and emission formation. D.I and I.D.I engine emissions.	7
6	Methods of reducing emissions, exhaust gas recirculation, smoke emission from diesel engines. Emission Instruments: Non- dispersive Infrared analyzer, Gas chromatograph, flame ionization detector, chemiluminescent analyzer	7
	Total	**42**

11.Suggested Books:

S. No.	Name of Authors /Books / Publishers
1	Combustion generated air pollution, Earnest S Starkman, Springer, ISBN- 9780306305302.
2	Fundamentals of Air pollution engineering, Richard C. Hagan, Prentice Hall, ISBN- 0133325371.
3	Air pollution threat & response, David Alym, Addison-Wesley Publication, ISBN- 0201043556.

ME357 THERMAL SYSTEM

1. Subject Code: ME 357   Course Title: Thermal System

2. Contact Hours: 42   L: 3 T: 0 P: 0

3. Examination Duration (Hrs.):   Theory: 3   Practical: 0

4. Relative Weight: CWS: 25   PRS: 0   MTE: 25   ETE: 50   PRE: 0

5. Credits: 3

6. Semester: V

7. Subject Area: UEC

8. Pre-requisite: NIL

9. Objective: To familiarise the students with the process of thermodynamic analysis of engineering systems and to enhance critical thinking and provide them with a wider view to handle engineering problems.

10. Details of Course:

S. No.	Contents	Contact Hours
1	**Fundamentals**: properties of pure substance in Solid, Liquid and Vapour Phases, PVT Behavior of simple compressible system, T-S and H-S diagram, Steam Tables, determination of quality of steam, Throttling Calorimeter, Combined Separating & Throttling Calorimeter, Maxwell and other thermodynamics relations, mixture of non reactive ideal gases, Real gases, Compressibility chart, Law of corresponding state, Air water vapor mixture, calculation of properties of air water vapour mixture.	7
2	**Rankine Cycle And Analysis**: Rankine cycle and its representation on T-S and H-S diagrams; Effect of low backpressure and high entry pressure and temperature and its limitations; necessity of re-heating, ideal and actual regenerative feed water heating cycle and its limitations. Typical feed water heating arrangements for various capacity power plants.	7
3	**Introduction To Boilers**: Classification of Boilers, Boiler mountings and accessories; draft systems, circulation system; Combustion and its calculations, and Boiler performance.	7
4	**Steam Nozzles**: Types of Nozzles, Flow of steam through nozzles; Condition for maximum discharge through nozzle; Nozzle efficiency. Effect of friction and Supersaturated flow through nozzle.	7
5	**Steam Turbines** : Working principle and types of steam turbines; Velocity diagrams for impulse and reaction turbines, compounding of impulse turbines; Optimum velocity ratio and maximum efficiency. Comparison of impulse and reaction turbines. Condition line and reheat-factor, losses in steam turbines; governing of steam turbines.	7
6	**Condensers and Cooling towers**: Types and working of condensers, types and performance of cooling towers.	7
	Total	**42**

11. Suggested Books:

S. No.	Name of Authors /Books / Publishers
1	**Engineering Thermodynamics** by P.K.Nag, Tata McGraw Hill Publishing Company Limited, ISBN – 1259062562, 2013.
2	**Engineering Thermodynamics**byRogers, Pearson Education, ISBN- 631197036.
3	**Thermodynamics** by Kenneth Wark, Mcgraw-hill Book Company, 5th edition, ISBN- 0070682860, 1988.
4.	**Engineering Thermodynamics: work and heat transfer** by Gordon Rogers and Yon Mayhew, Longman, 4th edition, ISBN – 0471861731, 1992.
5.	**Fundamentals of Classical Thermodynamics** by Van Wylen and Sonntag, John Wiley & Sons Inc., 3rd edition, ISBN – 0471861731, 1986.
6.	**Fundamentals of Engineering Thermodynamics** by Moran and Shaprio, **John Wiley & Sons, Inc., 7th edition, ISBN – 0470917687, 2010.**
7.	**Thermodynamics: An Engineering Approach** by Cengel and Boles, The McGraw-Hill Companies, 8th edition, ISBN: 0073398179, 2014.
8.	**Applied Thermodynamics for Engineering Technologists**byT.D. Eastop, Prentice Hall, 5th edition, ISBN-

9.	**Treatise on Heat Engineering** by V. P.Vasandani and D.S. Kumar, Metropolitan Book Co. (p) Ltd., ISBN-810003500.

05820919344, 1993.

ME359 REFRIGERATION & AIR CONDITIONING

1. Subject Code: ME 359   Course Title: Refrigeration and Air Conditioning

2. Contact Hours: 42   L: 3   T: 0   P: 0

3. Examination Duration (Hrs.):   Theory: 3   Practical: 0

4. Relative Weight: CWS: 25   PRS: 0   MTE: 25   ETE: 50   PRE: 0

5. Credits: 3

6. Semester: V

7. Subject Area: UEC

8. Pre-requisite: NIL

9. Objective: To learn properties of different refrigerants, and thermodynamic cycles of refrigeration.To understand comfort parameters and air conditioning.

10. Details of Course:

Unit No.	Contents	Contact Hours
1	**Introduction to Refrigeration**: Necessity and applications, unit of refrigeration and C.O.P., types of Ideal cycles of refrigeration, air-refrigeration, bell coleman cycle, open and dense air systems, actual air-refrigeration system problems, refrigeration needs of aircrafts, actual refrigeration system	7
2	**Vapour Compression Refrigeration**: Working principle and essential components of the plant, simple vapour compression refrigeration cycle - COP, Representation of cycle on T-S and p-h charts - effects of sub cooling and super heating - cycle analysis - Actual cycle, Influence of various parameters on system performance – necessity of multistaging, multistage compression system, and their analysis, necessity and working of cascading system	10
3	**Refrigerants and Absorption Refrigeration:** Desirable properties of refrigerants, classification of refrigerants used, nomenclature, ozone depletion, global warming, vapor absorption system, calculation of max COP.	4
4	**Air Conditioning**: Psychometric properties & processes, comfort air-conditioning, summer and winter air-conditioning, cooling & dehumidification systems, load calculation and applied psychrometry.	7
5	**Human Comfort:** Requirements of human comfort and concept of effective temperature, comfort chart, comfort air-conditioning, requirements of industrial air-conditioning, air-conditioning load calculations.	7

6	**Control:** Refrigeration and air-conditioning control, air handling, air distribution and duct design	7
	Total	**42**

11.Suggested Books:

S. No.	Name of Authors /Books / Publishers
1	**Refrigeration and Air Conditioning** by C. P. Arora, Tata McGraw Hill, ISBN- 9788120339156.
2	**Refrigeration and Air Conditioning** by A. R .Trott and T. C. Welch, Butterworth- Heinemann, ISBN- 9780080540436.
3	**Refrigeration and Air ConditioningTechnology** by Whitman, Jhonson and Tomczyk, Thomson Delmer Learning, ISBN- 1111644470.
4	**Refrigeration and Air Conditioning** by Abdul Ameen, Prentice Hall of India Ltd, ISBN- 9789303206560..
5	**Basic Refrigeration and Air Conditioning** by P. N. Ananthanarayan, Tata McGraw Hill, ISBN- 9789383286560.
6	**Refrigeration and Air Conditioning** by Wilbert F. Stoecker and Jerold W. Jones, Tata McGraw Hill, ISBN- 007061623X.
7	**Refrigeration and Air Conditioning by** Richard Charles Jordan, Gayle B. Priester, Prentice hall of India Ltd, ISBN-9780406269313.
8	**ASHRAE Handbook – Refrigeration 2010,** ISBN- 9781933742922.

ME361 INDUSTRIAL ENGINEERING

1. Subject Code: ME361   Course Title: Industrial Engineering

2. Contact Hours: 42   L: 3   T: 0   P: 0

3. Examination Duration (Hrs.):   Theory: 3   Practical: 0

4. Relative Weight: CWS: 25   PRS: 0   MTE: 25   ETE: 50   PRE: 0

5. Credits: 4

6. Semester: V

7. Subject Area: UEC

8. Pre-requisite: NIL

9. Objective: To make students aware of industrial engineering concepts of work study and measurement, quality control and reliability etc.

10. Details of Course:

Unit No.	Contents	Contact Hours
1	**Introduction** Introduction, Definition and objectives of Industrial Engineering, Scope of Industrial Engineering, Production systems and their classifications; Productivity-Total and partial productivity, Reasons and remedy for poor productivity	7
2	**Job analysis and Work Measurement Systems** Work System Design: Taylor's scientific management, Gilbreth's contributions; method study, micro-motion study, principles of motion economy; work measurement - stop watch time study, micro motion and memo motion, work sampling, standard data, PMTS; ergonomics; job evaluation, merit rating, incentive schemes, and wage administration; business process	7

	reengineering	
3	**Production Planning and Control** Types and characteristics of production systems Objective and functions of Production, Planning & Control, Routing, Scheduling and Operations scheduling, production scheduling, job shop scheduling problems, sequencing problems, scheduling tools and techniques, Loading, Dispatching and its sheets & Gantt charts	7
4	**Quality Engineering** Quality concept and costs; statistical quality control, Concept of specification limits, statistical control limits, process capability, Process control and control charts for both attributes and variable data. Acceptance Sampling- Single and double sampling	7
5	**Reliability and Maintenance** Reliability, availability and maintainability; distribution of failure and repair times; determination of MTBF and MTTR, reliability models; system reliability determination; Maintenance management and its objectives, Various types of Maintenance Planning, House Keeping, 5S concepts	7
6	**Material Handling** Principles, functions, and objectives of Material Handling; Selection and classification of Material Handling Equipments; Relation of material handling with plant layout	7
	Total	**42**

11.Suggested Books

S. No.	Name of Authors /Books / Publishers
1	Industrial Engineering and Management; B. Kumar, Khanna Publication, ISBN- 8174091963, 2011.
2	Introduction to work Study, International Labour Office, Geneva, 3rd edition, Oxford and IBH publishing Co. Pvt. Ltd, New Delhi, ISBN- 8120406028, 2008.
3	Industrial Engineering and Management, Pravin Kumar, Pearson Education, 1st edition, ISBN- 9789332543560, 2015.

<u>ME363 PRODUCT DESIGN & SIMULATION</u>

1. Subject Code: ME363   Course Title: Product Design & Simulation

2. Contact Hours: 42   L: 3   T: 0   P: 0

3. Examination Duration (Hrs.):   Theory: 3   Practical: 0

4. Relative Weight: CWS: 25   PRS: 0   MTE: 25   ETE: 50   PRE: 0

5. Credits: 3

6. Semester: V

7. Subject Area: UEC

8. Pre-requisite: NIL

9. Objective: To familiarize the students with the process of product design and development.

10. Details of Course:

Unit No.	Contents	Contact Hours
1	**Stages in design process:** Introduction to various stages of the design process: Formulation of problem, Generate alternatives, Evaluation, Guided Redesign. Case study.	5

2	**Product life cycle:** New product introduction: early introduction, increased product life. Life cycle management tool, System integration, QFD, House of quality, Pugh's method, Pahl and Beitz method. Case studies	5
3	**Value engineering:** Introduction, nature and measurement of value. Value analysis job plan. Creativity. Value analysis test. Case studies	5
4	**Concurrent/ reverse engineering:** Introduction, basic principles, components, benefits of concurrent engineering. Concept of reengineering	5
5	**Material selection:** Materials in design. The evolution of engineering materials. Design tools and material data. Material selection strategy, attribute limits, selection process, material selection. Case studies	5
6	**Process selection:** Introduction. Process classification: shaping, joining and finishing. Systematic process selection, process cost. Computer – aided process selection	5
7	**Design for manufacture and assembly:** Design for Manufacture and Assembly (DFMA). Reasons for not implementing DFMA. Advantages of DFMA with case studies. Design features and requirements with regard to assembly, Design for Manufacture in relation to any two manufacturing processes: machining and injection molding. Need, objectives	4
8	**System Simulation**: Techniques of simulation, Monte Carlo method, Experimental nature of simulation, Numerical computation techniques, Continuous system models, Analog and Hybrid simulation, Feedback systems, Computers in simulation studies, Simulation software packages	4
9	**Simulation of Mechanical Systems**: Building of Simulation models, Simulation of translational and rotational mechanical systems, Simulation of hydraulic systems	4
	Total	42

11. Suggested Books:

S. No.	Name of Authors /Books / Publishers
	TEXT BOOKS:
1	David G Ullman, "The Mechanical Design Process." Publisher- McGrawhillIncSingapore, ISBN-13: 9780072975741, 1992.
2	Kevin Otto & Kristin Wood Product Design: "Techniques in Reverse Engineering and new Product Development." 1 / e 2004 , Publisher- Pearson Education New Delhi , ISBN-13: 9780130212719,
3	L D Miles "Value Engineering."Publisher- McGraw-Hill, 1972
4	Karl T Ulrich, Steven D Eppinger , " Product Design &Development."Publisher- Tata McGrawhill New Delhi, ISBN-13: 9780078029066, 2003
5	Hollins B & Pugh S "Successful Product Design." Publisher- Butter worths London, ISBN 9780408038614.
6	N J M Roozenberg , J Ekels , N F M Roozenberg " Product Design Fundamentals and Methods ."Publisher- John Willey & Sons, ISBN-13: 9780471954651, 1995.

ME365 COMPUTATIONAL FLUID DYNAMICS

1. Subject Code: ME 365   Course Title: Computational Fluid Dynamics (CFD)

2. Contact Hours: 42   L: 3   T: 0   P: 0

3. Examination Duration (Hrs.):   Theory: 3   Practical: 0

4. Relative Weight: CWS: 25   PRS: 0   MTE: 25   ETE: 50   PRE: 0

5. Credits: 3

6. Semester: V

7. Subject Area: UEC

8. Pre-requisite: NIL

9. Objective: To provide basic concepts of CFD in terms of comprehensive theoretical study and its computational aspects.

10. Details of Course:

Unit No.	Contents	Contact Hours
1	Introduction to CFD, Historical background, Impact of CFD	3
2	The Governing Equations of Fluid Dynamics Derivation, Discussion of physical meanings and Presentation of forms particularly suitable to CFD.	7
3	Mathematical Behavior of Partial Differential Equations: Impact on CFD	6
4	Basic Aspects of Discretization: Introduction to Finite Difference, Finite Elements and Finite Volume Methods. Detailed treatment of Finite Difference method, explicit and implicit methods, errors and stability analysis.	12
5	Grids with Appropriate Transformations Adaptive grids and unstructured meshes. Lift reduction, down force generation and drag reduction. An introduction to the aerodynamics of airflows for cooling.	7
6	Commercial codes (e.g. FLUENT etc.). Grid generation, techniques and application. Basic principles and concepts and the characteristics of wings and diffusers	7
	Total	**42**

11. Suggested Books:

S. No.	Name of Authors /Books / Publishers
1	Computational Fluid Dynamics",John Anderson," McGraw- Hill Ltd.
2	Computational Fluid Dynamics",Tu, Elsevier.
3	Introduction to Computational Fluid Dynamics,Niyogi, Pearson Education, Delhi

ME367 FINITE ELEMENT METHODS

1. Subject Code: ME 367   Course Title: Finite Element Methods

2. Contact Hours: 42   L: 3   T: 0   P: 0

3. Examination Duration (Hrs.):   Theory: 3   Practical: 0

4. Relative Weight: CWS: 25   PRS: 0   MTE: 25   ETE: 50   PRE: 0

5. Credits: 3

6. Semester: V

7. Subject Area: UEC

8. Pre-requisite: NIL

9. Objective: To enable students to apply Galerkin method and virtual work principle to problems in solid mechanics. To teach them numerical solution of differential equations with finite element method.

10. Details of Course:

Unit No.	Contents	Contact Hours
1	Fundamental concepts of the Finite Element Method. One Dimensional Problem(Bar of uniform and variable cross sections), The Galerkin Approach, The potential –Energy Approach, shape Functions, Derivation of stiffness matrix and load vector for the element and for the entire domain. Evaluation of displacement, stresses and reaction forces.	12
2	**Trusses**:-. Introduction, Plane Trusses, Local and Global coordinate Systems, Element Stiffness Matrix and Stress calculations	3
3	Two –Dimensional problem using Constant strain triangles(CST), Two-dimensional isoparametric elements and numerical integration ,element stiffness matrix, Force vector.	6
4	Applications of finite element method to heat transfer.	4
5	Application of finite element method to electrical systems.	10
6	**Dynamic analysis**:- Element mass matrices,Evaluation of Eigenvalues and Eigenvectors. Use of Softwares such as MAT LAB/ABAQUS/ANSYS/ NASTRAN/IDEAS. Basic feature of these softwares.	7
	Total	42

11.Suggested Books:

S. No.	Name of Authors /Books / Publishers
1	Finite Element Procedures, K.J. Bathe, Prentice Hall of India.
2	Finite Elements in Engineering by Chandrupatla and Belegundu.
3	Finite element Method by J.N.Reddy.
4.	Finite element Method,O.C. Zienkiewicz& R.A. Taylor
5.	Finite element Analysis,C.S. Krishnamurthy
6.	Finite element Method, Kenneth H. Hubener
7.	Finite Element Method, Desai & Abel

ME369 TOTAL LIFECYCLE MANAGEMENT

1. Subject Code: ME 369   Course Title: Total Lifecycle Management

2. Contact Hours: 42   L: 3   T: 0   P: 0

3. Examination Duration (Hrs.):   Theory: 3   Practical: 0

4. Relative Weight: CWS: 25   PRS: 0   MTE: 25   ETE: 50   PRE: 0

5. Credits: 3

6. Semester: V

7. Subject Area: UEC

8. Pre-requisite: NIL

9. Objective: To familiarize the students with the concept of Total Life Cycle, and applying life cycle thinking to define tradeoffs. This course also introduces to sustainability and use of renewable resources.

10. Details of Course:

Unit No.	Contents	Contact Hours
1	**Introduction:** Extensive definition of Concurrent Engineering (CE), CE design methodologies, Review of CE techniques like DFM (Design for manufacture), DFA (Design for assembly), QFD (Quality function deployment), RP (Rapid prototyping), TD (Total design), for integrating these technologies, Organizing for CE, CE tool box, Collaborative product development	8
2	**Use of Information Technology:** IT support, Solid modeling, Product data management, Collaborative product Commerce, Artificial Intelligence, expert systems, Software hardware component design.	8
3	**Design Stage:** Lifecycle design of products, Opportunities for manufacturing enterprises, Modality of concurrent engineering design, automated analysis, Idealization control, CE in optimal structural design, Real time constraints	8
4	**Need for PLM:** Importance of PLM, Implementing PLM, Responsibility for PLM, Benefits to different managers ,Components of PLM, Emergence of PLM, Lifecycle problems to resolve, Opportunities to seize	9
5	**Components of PLM:** Components of PLM, Product lifecycle activities, Product organizational structure, Human resources in product lifecycle, Methods, techniques, Practices, Methodologies, Processes, System components in lifecycle, slicing and dicing the systems, Interfaces, Information, Standards	9
	Total	42

11.Suggested Books:

S. No.	Name of Authors /Books / Publishers
1	Integrated Product Development M.M. Anderson and L Hein IFS Publications
2	Design for Concurrent Engineering J. Cleetus CE Research Centre, Morgantown
3	Concurrent Engineering Fundamentals: Integrated Product Development Prasad Prentice hall India
4	Concurrent Engineering in Product Design and Development I Moustapha New Age International
5	Product Lifecycle Management John Stark Springer-Verlag, UK
6	Product Lifecycle Management Michael Grieves McGraw Hill
7	Concurrent Engineering: Automation tools and Technology Andrew Kusiak Wiley Eastern

DRAFT SCHEME OF STUDY
(Year 2,3,4 B. Tech Program

ME371 VALUE ENGINEERING

1. Subject Code: ME 371   Course Title: Value Engineering

2. Contact Hours: 42   L: 3   T: 0   P: 0

3. Examination Duration (Hrs.):   Theory: 3   Practical: 0

4. Relative Weight: CWS: 25 PRS: 0 MTE: 25 ETE: 50 PRE: 0

5. Credits: 3

6. Semester: V

7. Subject Area: UEC

8. Pre-requisite: NIL

9. Objective: To understand the concept and approaches of value analysis and engineering with an emphasis on case studies.

10. Details of Course:

Unit No.	Contents	Contact Hours
1	An Overview Of Value Engineering-Concepts and approaches of value analysis and engineering - importance of value, Function - identity, clarify – analysis	8
2	Evaluation of VE-Evaluation of function, Problem setting system, problem solving system, setting and solving management - decision - type and services problem, evaluation of value	8
3	Results accelerators, Basic steps in using the systems	8
4	Understanding the decision environment, Effect of value analysis on other work in the business- Life Cycle Cost (LCC), Case studies	9
5	VE Level Of Effort-VE Team, coordinator, designer, different services, definitions, construction management contracts, value engineering case studies, Effective organization for value work, function analysis system techniques- FAST diagram, Case studies	9
	Total	**42**

11. Suggested Books:

S. No.	Name of Authors /Books / Publishers
1	Parker, D.E., "Value Engineering Theory", Sundaram publishers, 1990
2	Miles, L.D., "Techniques of Value Engineering and Analysis", McGraw Hill Book Co., 2nd End., 1972
3	Khanna, O.P., "Industrial Engineering and Management", Dhanpat Rai and Sons, 1999.

MG351 FUNDAMENTALS OF FINANCIAL ACCOUNTING AND ANALYSIS

1. Subject Code : MG351   Course Title: Fundamentals of Financial Accounting and Analysis

2. Content Hours   L: 3   T: 0   P: 0

3. Examination Duration (ETE)(Hrs.):   Theory 3 Hrs   Practical 0

4. Relative Weightage: CWS: 25   PRS   MTE: 25   ETE : 50   PR

5. Credits: 3

6. Semester: V (ME+AE+PE+CE+ENE+BT+MC+AP+PT)/ VI   (COE+IT+SE+EC+ EE+EEE)

7. Subject Area: UEC Management

8. Pre-requisite: Nil

9. Objective: Familiarizing the students with the financial environment of business, especially the financial markets and acquaint them with accounting mechanics, process and system.

10. Details of Course:

Unit No.	Detail Contents	No. Of Hrs.
1	**Introduction to Management** :Basic concepts of management, management process, principles of management, functions, levels, managerial roles and skills, managerial ethics and corporate social responsibility	8
2	**Introduction to Financial Environment and accounting:** Financial Markets - Capital Markets, Basics of capital market mechanism, instruments, financing and rating institutions. Importance, Objectives and Principles of Accounting, Accounting Concepts and conventions, and the Generally Accepted Accounting Principles (GAAP) Overview of the Accounting Process. Accounting standards as Issued by Institute of Chartered Accountants of India (ICAI).	10
3	**Overview of Business Activities and Principal Financial Statements:** Observe the types of information provided by the three principal financial statements and how firms might use this information in managing and evaluating a business. Understand the rationale and the information value of the statements of Balance Sheet, Profit and Loss statement, cash flows.	8
4	**Financial Analysis-I:** Distinction between cash profits and book profits. Understanding the cash flow statement and the funds flow statement.	8
5	**Financial Analysis –II**: Importance, objectives and concept of Ratio Analysis- Liquidity, leverage, solvency and profitability ratios.	8
	Total	**42**

11. Suggested Books

S. No.	Name of Books / Authors/ Publishers
1	Fundamental of Management, Stephen P. Robbins, David A. De Cenzo and Mary Coulter, Pearson Education,2011, ISBN- 978-0273755869
2	Introduction to Accountancy, 10 ed., T.S. Grewal, S. Chand and Company (P) Ltd., New Delhi,2009, ISBN- 9788121905695
3	Advance Accounts by M.C Shukla and T.S Grewal and SC Gupta, S. Chand and Company (P) Ltd., New Delhi,1997, ISBN- 9788121902786

4	Financial Accounting, 4 ed, S.N. Maheshwari and S.K. Maheshwari, Vikas Pulication,2005, ISBN- 8125918523
5	Financial Accounting Reporting & Analysis, Cengage, 7/e, W Albrecht Stice & James Stice, Cengage Learning,2010, ISBN- 0538746955

MG353 FUNDAMENTALS OF MARKETING

1. Subject Code :MG353   Course Title : Fundamentals of Marketing
2. Content Hours   L: 3   T: 0   P: 0
3. Examination Duration (ETE)(Hrs.):   Theory: 3 Hrs   Practical 0

4. Relative Weightage: CWS:25 PRS   MTE:25ETE:50PR

5. Credits: 3

6. Semester: Third (ME+AE+PE+CE+ENE+BT+MC+AP+PT)/ Fourth   (COE+IT+SE+EC+ EE+EEE)

7. Subject Area: UEC Management

8. Pre-requisite: Nil

9. Objective: The basic objective of this paper is to make students aware of   fundamental concepts of marketing necessary for making decisions in complex   business situations by managers and start up entrepreneurs.

10. Details of Course:

Unit No.	Detail Contents	No. Of Hrs.
1	**Basic concepts of management**: management process, principles of management, functions, levels, managerial roles and skills, managerial ethics and corporate social responsibility	8
2	**Introduction to marketing**: nature and scope of marketing, marketing mix, marketing vs. sales, role of marketing in society, interface of marketing with other departments in organization, Customer Life Time Value, ethical issues in marketing Concept of market segmentation: consumer and industrial, targeting and positioning, sales forecasting	9
3	**Product mix decisions:** new product development process, test marketing, concept of Product Life Cycle, product packaging decisions	8
4	**Pricing decisions** : consideration in setting price, major pricing strategies, promotional mix decisions: advertising, sales promotion, personal selling, publicity, opportunities and avenues of online promotion	9
5		9

	Promotion and distribution decisions :design and management of distribution channel for physical products and services, reasons of channel conflict, handling strategies, basic challenges in supply chain management of e-commerce firms	
	Total	**42**

11. Suggested Books

Unit No.	Name of Books / Authors/ Publishers
1	Fundamental of Management, Stephen P. Robbins, David A. De Cenzo and Mary Coulter, Pearson Education, 2011, ISBN-978-0273755869
2	Marketing Management, 14th ed., Philip Kotler , Kevin Lane Keller, Abraham Koshy and MithileswarJha, Pearson Education, New Delhi, 2013,(**ISBN-10:** 9788131767160)
3	Marketing, 14th ed., Etzel, Bruce J Walker, William J Stanton and Ajay Pandit, Mc Graw Hill Education, 2009, ISBN -9780070151567
4.	MKTG, Charles W Lamb, Joe F Hair, Carl NcDaniel and Dheeraj Sharma, Cengage Learning,2012, ISBN- 9788131517086
5.	Marketing Management, RajanSaxena, Tata Mc Graw Hill Education, 2005, ISBN-9780070599536

MG355 HUMAN RESOURCE MANAGEMENT

1. Subject Code : MG355   Course Title : Human Resource   Management

2. Content Hours   L: 3   T: 0   P: 0

3. Examination Duration (ETE)(Hrs.):   Theory: 3 Hrs   Practical 0

4. Relative Weightage: CWS:25   PRS   MTE:25   ETE:50   PR

5. Credits: 3

6. Semester: Third (ME+AE+PE+CE+ENE+BT+MC+AP+PT)/ Fourth   (COE+IT+SE+EC+EE+EEE)

7. Subject Area: UEC Management

8. Pre-requisite: Nil

9. Objective: To develop necessary understanding in design and execution of human resource strategies for the achievement of organization goals.

10. Details of Course**:**

Unit No.	Content	Contact hours

1.	**Basic concepts of management:** management process, principles of management, functions, levels, managerial roles and skills, managerial ethics and corporate social responsibility	8
2.	**Introduction:** Concept, nature, scope, objectives and importance of HRM; Evolution of HRM; Environment of HRM; Personnel Management vs HRM. Acquisition of Human Resources: HR Planning; Job analysis – job description and job specification; recruitment – sources and process; selection process – tests and interviews; placement and induction. Job changes – transfers, promotions/demotions, separations.	9
3.	**Training and Development:** Concept and importance of training; types of training; methods of training; design of training programme; evaluation of training effectiveness; executive development – process and techniques; career planning and development.	8
4.	**Performance Appraisal:** Performance appraisal – concept and objectives; traditional and modern methods, limitations of performance appraisal methods.	8
5.	**Compensation and Maintenance:** Compensation: job evaluation – concept, process and significance; components of employee remuneration – base and supplementary; maintenance: overview of employee welfare, health and safety, social security.	9
	Total	42

11.Suggested Books

S. No	Name of the book /Authors /Publishers
1	Fundamental of Management, Stephen P. Robbins, David A. De Cenzo and Mary Coulter, Pearson Education, 2011, ISBN-978-0273755869
2	**Human Resource Management, G. Dessler, B. Varkkey, Pearson prentice Hall, 2011, (ISBN – 978-81-317-5426-9)**
3	International HRM a cross cultural approach, T. Jackson, Sage publications, London, 2002, (ISBN – 0-7619-7404-0)
4	HRM and Performance: Achievements and Challenges, D. E. Guest, J .Paauwe, P. Wright, John Wiley and sons, UK, 2013, (ISBN – 978-1-118-48261-2)
5	A Handbook of Human Resource Management Practice, M. Armstrong, Kogan Page Limited, UK, 2007 ,(ISBN – 978–0–7494–4631-4)

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MG357 KNOWLEDGE AND TECHNOLOGY MANAGEMENT

1. Subject Code :MG 357   Course Title : Knowledge and Technology Management
2. Content Hours   L: 3   T: 0   P: 0
3. Examination Duration (ETE)(Hrs.):   Theory: 3 Hrs   Practical 0

4. Relative Weightage: CWS:25   PRS   MTE:25   ETE:50   PR

5. Credits: 3

6. Semester: Third (ME+AE+PE+CE+ENE+BT+MC+AP+PT)/ Fourth   (COE+IT+SE+EC+ EE+EEE)

7. Subject Area: UEC Management

8. Pre-requisite: Nil

9. Objective: Preparing the students to understand how the new age organizations are leveraging on the power of knowledge and technology. Acquiring the knowledge to address the issues faced by the corporate world for a deeper understanding.

10. Details of Course:

Unit No.	Contents	Contact Hours
1.	**Basic concepts of management**, management process, principles of management, functions, levels, managerial roles and skills, managerial ethics and corporate social responsibility	8
2.	Introduction to Knowledge Management: Data, Information, Knowledge Management (KM), Knowledge Society, Knowledge Economy, Types of Knowledge, Tacit knowledge and explicit knowledge, Essential components of KM model Building Knowledge Assets: Various knowledge assets, Tools of Knowledge, Knowledge Audit, AAR (After Action Review), Analyzing current knowledge state.	9
3.	Creating Strategies for Success: KM strategy, Codification, Personalization, Knowledge Management Implementation, Generating a KM-specific vision, Integrating organizational and business goals with KM, Choosing the right KM techniques, Relevant case studies in this area.	9
4.	Understanding Technology: Definition, Key concepts, Need for technology, History of technological developments, Role and importance of technology in 21st century, Recent developments in the field of technology.	8
5.	Technology-Management integration: Management as a concept, Technology management, Life cycle approach to technology management, Innovation, Creativity, Technology innovation process.	8
	Total	**42**

11. Suggested Books

S. No.	Name of Books /Authors/Publishers
1.	Fundamental of Management, Stephen P. Robbins, David A. De Cenzo and Mary Coulter, Pearson Education,2011, ISBN-978-0273755869
2	Knowledge Management in Organizations: A Critical Introduction, Donald Hislop, Oxford University Press,2013, ISBN: 9780199691937.
3	The Knowledge-Creating Company: How Japanese Companies Create the Dynamics of Innovation, IkujiroNonaka and Hirotaka Takeuchi, Oxford University Press,1995, ISBN: 0195092694.

| 4 | Hitotsubashi on Knowledge Management (Hardcover), Hirotaka Takeuchi and IkujiroNonaka, John Wiley and Sons, 2004, ISBN: 0470820748. |
| 5 | Management of Technology: The Key to Competitiveness and Wealth Creation, Tarek Khalil and Ravi Shankar, McGraw Hill Education (India) Private Limited, 2nd Edition, 2012, ISBN: 9780070677371. |

PE351 ADVANCED MACHINING PROCESS

1. Subject Code: PE-351   Course Title: Advanced Machining Process

2. Contact Hours: L: 3   T: 0   P: 0

3. Examination Duration (Hrs.):   Theory: 3   Practical: 0

4. Relative Weight: CWS: 25   PRS: 0   MTE: 25   ETE: 50   PRE: 0

5. Credits: 3

6. Semester: V

7. Subject Area: UEC

8. Pre-requisite: NIL

9. Objective: To understand basic principles of various processes and their applications. State various parameters influencing the machining process.

10. Details of Course:

Unit No.	Contents	Contact Hours
1	Introduction, need of advanced machining processes, hybrid processes, microelectro mechanical system, (MEMS), nano electromechanical systems(NEMS),Ultrasonic micro machining - mechanics of cutting, parametric analysis, process capabilities, applications.	7
2	Abrasive jet machining: Introduction, set ups, gas propulsion system, abrasivefeeder, machining chamber, AJM nozzle, abrasive parametric analysis, processcapabilities, applications, abrasive micro machining, Water jet machining:Introduction, process characteristics, process performance, applications, Abrasive Water jet machining: Abrasive finishing process: Working principle, parametric analysis, process variables, process performance and applications,	8
3	Abrasive flow machining- Working principle, parametric analysis, process variables, process performance and applications, Magnetorheological abrasive flow finishing- Working principle, parametric analysis,process variables, process performance and applications, Magnetic float polishing,Magnetic abrasive finishing- Working principle, parametric analysis, processvariables, process performance and applications	10
4	Electro discharge machining (EDM): Introduction, Working principle, parametricanalysis, process variables, process characteristics, applications, hybrid processessuch as electro discharge grinding, diamond grinding, wire EDM, Electrodischargemicro grinding,	7

5	Laser beam machining- production of laser, working principle, types of laser, processcharacteristics and applications. Electron beam machining: Working principle,process parameter, process characteristics, and applications. Ion beam machining:Working principle, process parameter, process characteristics, and applications.	8
6	Plasma arc machining: Working principle, Plasma arc cutting system, applications.	2
Total		**42**

11. Suggested Books:

S. No.	Title, Author, Publisher and ISBN No.
1	Advanced machining process, Dr.V.K.Jain, Allied publisher, **ISBN**:978-81-7319-915-8.
2	Non traditional methods of manufacturing, Shan&Pandey, **ISBN**, 0070965536

PE353 SUPPLY CHAIN MANAGEMENT

1. Subject Code: PE-353   Course Title: Supply Chain Management

2. Contact Hours: L: 3   T: 0   P: 0

3. Examination Duration (Hrs.):   Theory: 3   Practical: 0

4. Relative Weight: CWS: 25   PRS: 0   MTE: 25   ETE: 50   PRE: 0

5. Credits: 3

6. Semester: V

7. Subject Area: UEC

8. Pre-requisite: NIL

9. Objective: To understand the key considerations at the various stages involved in the supply of product in order to maintain the smooth flow from source to the point of consumption so that overall organizational performance may improve.

10. Details of Course:

Unit No.	Contents	Contact Hours
1	**Introduction:**Perspective of Supply Chain Management, Managing uncertainty, Key issue in supply chain management.	6
2	**Inventory Management and Risk Pooling:** Inventory management, Classification of inventory, Centralized versus Decentralized Warehousing and Risk pooling, Value of Information, Quantification of Bullwhip effect, Causes and remedies of Bullwhip effect.	8

3	**Resource planning:** Aggregate Production Planning- Chase and leveling strategies, MRP, MRP-II, Agile manufacturing Systems	6
4	**Procurement and Outsourcing strategies:**Introduction, outsourcing benefits and risks, Make/Buy decision, e-procurement, Vendor selection and quota allocation.	7
5	**Strategic Alliances:** Introduction, Third party logistics, Demand driven strategies, Distribution strategies- direct shipment, cross docking, transshipment, Supplier relationships management, Customer relationship management.	8
6	**International Issues in Supply Chain Management:** Concepts in Globalization, Globalization forces, Risks and Advantages of International supply chains, Issues in International supply chain management, Regional differences in logistics.	7
	Total	**42**

11. Suggested Books:

S. No.	Title, Author, Publisher and ISBN No.
1.	Simchi-Levi, Kaminsky, Philip K. and 'Designing and Managing the Supply Chain: Concepts, Strategic and Case Studies', McGraw-Hill/Irwin, (ISBN, 10: 0072357568, 13: 978-0072357561).
2	Supply Chain Management by Chopra and Mendle, **ISBN**: 9780132743952
3	Supply Chain Management: Text and Cases by JannatSah.,**ISBN**-10: 8131715175.

PE355 WORK STUDY DESIGN

1. Subject Code: PE-355   Course Title:Work Study Design

2. Contact Hours: L: 3   T: 0   P: 0

3. Examination Duration (Hrs.):   Theory: 3   Practical: 0

4. Relative Weight: CWS: 25   PRS: 0 MTE: 25   ETE: 50   PRE: 0

5. Credits: 3

6. Semester: V

7. Subject Area: UEC

8. Pre-requisite: NIL

9. Objective: To provide basic understanding to the students about the concept and significance of work study and ergonomics. To impart thorough knowledge to the students about various techniques of work-study for improving the productivity of an organization.

10. Details of Course:

Unit No.	Contents	Contact Hrs
1	Productivity: Definition, reasons for low productivity, methods to improve productivity, Work-study and productivity	4
2	Human factor in work-study: Relationship of work-study man with management, supervisor & workers, qualities of a work-study man.	5
3	Method-study: Definition, objectives, step-by-step procedure, questioning techniques, charts and diagrams for recording data. Like outline process charts, flow process charts, multiple activity charts, two handed process chart, string diagram, travel chart, cycle graph, Chrono-cycle graph, therbligs, micro motion study and film analysis, Simo chart, principles of motion economy. Development and installation of new method..	9
4	Work-Measurement: Definition, various techniques of work-measurement work-sampling, stopwatch time study & its procedure, Job selection, Equipment and forms used for time study, rating, methods of rating, allowances and their types, standard time, numerical problems, predetermined - time standards and standard data techniques. Incentive: Meaning, objectives of an incentive plan, various types of incentive plans	9
5	Ergonomics: Introduction, history of development, man-machine system and its components. Introduction to structure of the body- features of the human body, stress and strain, metabolism, measure of physiological functions- workload and energy consumption, biomechanics, types of movements of body members, strength and endurance, speed of movements. NIOSH lifting equation, Lifting Index, Maximum acceptable Weights and Forces, Distal upper extremities risk factors, Strain Index, RULA, REBA.	8
6	Applied anthropometry - types, use, principles in application, design of work surfaces and seat design. Visual displays for static information, visual displays of dynamic information, auditory, tactual and olfactory displays and controls. Assessment of occupational exposure to noise, heat stress and dust .Effect of vibration/ noise, temperature, illumination and dust on human health and performance	7
Total		42

11. Suggested Books:

S. No.	Title, Author, Publisher and ISBN No.
1.	Barnes Ralph M., "Motion & Time study: Design and Measurement of Work", Wiley Text Books, **ISBN-10:** 8126522178, 2009.

2	Marvin E, Mundel& David L, "Motion & Time Study: Improving Productivity", Pearson Education,**ISBN-10:** 0136030440, 2000.
3	Benjamin E Niebel and FreivaldsAndris, "Methods Standards & Work Design", McGraw Hill,**ISBN-10**1259064840, 1997.
4	International Labour organization, "Work-study", Oxford and IBH publishing company Pvt. Ltd., N.Delhi, **ISBN-10** 8120406028, 2001

PE357 PRODUCT DESIGN & SIMULATION

1. Subject Code: PE-357   Course Title: Product Design & Simulation

2. Contact Hours: L: 3   T: 0   P: 0

3. Examination Duration (Hrs.):   Theory: 3   Practical: 0

4. Relative Weight**:**   CWS: 25   PRS: 0   MTE: 25   ETE: 50   PRE: 0

5. Credits: 3

6. Semester: V

7. Subject Area: UEC

8. Pre-requisite: NIL

9. Objective: To allow students to develop the technical, analytical, and managerial skills necessary to perform the tasks successfully.

10. Details of Course:

Unit No.	Content	Contact Hours
1	**Stages in design process:** Introduction to various stages of the design process: Formulation of problem, Generate alternatives, Evaluation, Guided Redesign. Case study.	6
2	**Product life cycle:** New product introduction: early introduction, increased product life. Life cycle management tool, System integration, QFD, House of quality, Pugh's method, Pahl and Beitz method. Case studies.	6
3	**Value engineering:**Introduction, nature and measurement of value. Value analysis, job plan. Creativity and techniques of creativity. Value analysis test. Case studies. **Material selection:**Materials in design. The evolution of engineering materials. Design tools and material data. Functional material, shape and process. Material selection strategy, attribute limits, selection process, common methods of material selection. Case studies.	6

4	**Concurrent/ reverse engineering:** Introduction, basic principles, components, benefits of concurrent engineering. Concept of reengineering. **Process selection:** Introduction. Process classification: shaping, joining and finishing. Systematic process selection, Ranking, process cost. Computer – aided process selection.	6
5	**Design for manufacture and assembly:** Design for Manufacture and Assembly (DFMA). Reasons for not implementing DFMA. Advantages of DFMA with case studies. Design features and requirements with regard to assembly, product Design for Manufacture in relation to any two manufacturing processes: machining and injection molding. Need, objectives.	8
6	**System Simulation**: Techniques of simulation, Monte Carlo method, Experimental nature of simulation, Numerical computation techniques, Continuous system models, Analog and Hybrid simulation, Feedback systems, Computers in simulation studies, Simulation software packages. **Simulation of Mechanical Systems**: Building of Simulation models, Simulation of translational and rotational mechanical systems, Simulation of hydraulic systems.	10
	Total	**42**

11. Suggested Books:

S. No.	Title, Author, Publisher and ISBN No.
1	**Product Design and Development**, "Karl T. Ulrich, Steven D. Eppinger" Mc GrawHill.**ISBN:**9780072296471
2	**Integrated Product and Process Development**, "John M. Usher, Utpal Roy and H. R. Parasaei.ISBN: 978-0-471-15597-3
3	**Product Design for Manufacture and Assembly**, "G. Boothroyd, P. Dewhurst and W. Knight" MarceDaker.ISBN:978-1420089271
4.	**Engineering Design and Design for Manufacturing**: A structured approach, "John R. Dixon and CPoli" Field Stone Publishers, USA. ISBN: 9780964527201
5.	**Material Selection in Mechanical Design**, "M. F. Ashby"Elsevier. ISBN: 9780080419077

PE359 TOTAL LIFE CYCLE MANAGEMENT

1. Subject Code: PE359 Course Title: Total Life Cycle Management

2. Contact Hours: L: 3   T: 0   P: 0
3. Examination Duration (Hrs.): Theory: 3   Practical: 0

4. Relative Weight**:**   CWS: 25   PRS: 0   MTE:25   ETE:50   PRE: 0

5. Credits: 3

6. Semester: V

7. Subject Area: UEC

8. Pre-requisite: NIL

9. Objective: To familiarize the students with the concept of Total Life Cycle, management of old vehicles, applying life cycle thinking to define tradeoffs. This course also introduces to sustainability, use of renewable resources.

10. Details of Course:

S. No.	Contents	Contact Hours
1	**Introduction :** Definition of Total Life Cycle (TLC) – Conceptof TLC - Life Cycle Impacts - Integrating Life Cycle Technologies- Products and Processes Within TLC - TLC Methodology- TLC AccessementData to Complex Products – ResultantImprovement for Product	8
2	**Vehicles End of Life** : Design for End of Old VehicleManagement - Problems of Old Vehicles in EmergingMarkets - Recovery and Economic Feasibility of MaterialsSuch As Plastic, Rubber, Aluminium, Steel, etc.	8
3	**Trade-offs :** Applying Life Cycle Thinking to Define TradeoffsAlong the Supply, Manufacture - Use and End of Life Chain- Effects on the Customer - Expectation of the Customer -Evaluate Product Cost on Fuel Consumption, Emission,Durability, Environment and Health	10
4	**Sustainability:**What Is Sustainability - Use of RenewableResources - View to Design Horizon.	8
5	**Harmonization of Environmental Goals:** TLC for Emerging Vs Developed Markets - Rules and Regulations to Guide Designers - International Common Practices for End of LifeVehicles.	8
	Total	**42**

11. Suggested Books:

S. No.	Name of Authors /Books / Publishers
1	Life Cycle Management Case Study of an Instrument Panel /SAE, 1997/
2	Accident Reconstruction: Automobiles, Tractor-semitrailers, Motorcycles, and Pedestrians /Society of Automotive Engineers, 1987 /0898834546, 9780898834543.

PE361 TOTAL QUALITY MANAGEMENT

1. Subject Code: PE-361   Course Title: Total Quality Management

2. Contact Hours: L: 3   T: 0   P: 0

3. Examination Duration (Hrs.):   Theory: 3   Practical: 0

4. Relative Weight: CWS: 25   PRS: 0   MTE: 25   ETE: 50   PRE: 0

5. Credits: 3

6. Semester: V

7. Subject Area: UEC

8. Pre-requisite: NIL

9. Objective: To understand the philosophy and core values of Total Quality Management (TQM); determine the voice of the customer and the impact of quality on economic performance and long-term business success of an organization;

10. Details of Course:

Unit No.	Content	Contact Hours
1	**Introduction to Quality-** Definition of Quality- product, user, value, and manufacturing based perspectives, Dimensions of Quality, Quality Planning, Quality costs- optimization of quality costs, seven tools of quality control;Philosophies of Quality Gurus- Deming, Juran, Crosby, Feigenbaum, Ishikawa, Taguchi. Comparison of Quality Philosophies.	9
2	**Statistical Process Control-**Introduction to Quality characteristics- variables and attributes, Types and causes of variations, Control Charts for variables and attributes, Process capability.	8
3	**Acceptance Sampling-**Sampling process and lots formation; Advantages and applications of acceptance sampling; characteristics of O.C. Curve; Single, double, multiple, sequential sampling; ASN, ATI, AOQL, AOQ, AQL, LQL, Producer's and Consumer's risks.	7
4	**Six Sigma and ISO 9000:2000-** Principles of Six Sigma, Statistical basis, Tools and techniques, DMAIC principle, application of six sigma in manufacturing and service organizations, structure of ISO standards, Factors leading to ISO, Implementation and registration, Benefits of ISO.	6
5	**Life Testing-Reliability-**Life testing: objective, failure data analysis, MTTF, MTBF, hazard rate, exponential and Weibull models, system reliability-series, parallel and mixed configurations, Markov model.	6
6	**Reliability Design and Allocation-** Design for reliability, reliability improvement techniques, active redundancy and standby redundancy, K-out-of-N redundancy and maintenance policies.	6
	Total	**42**

S. No.	Title, Author, Publisher and ISBN No.
1.	Evans JR, Lindsay WM, "The Management and Control of Quality", Cengage learning, India, **ISBN-10:** 8131501361, 2011
2	BediKanishka, "Quality Management", Oxford University Press India, **ISBN-10:** 0195677951, 2006
3	Besterfield, "Total Quality Management", Pearson Education, **ISBN-10:** 9332534454, 2015
4	Gryna FM, Chua RCH, Defeo JA, "Juran"s Quality Planning and Analysis for Enterprise Quality", McGraw Hill Education (India) Private Limited, **ISBN-10:** 0070618488, 2006

PT361 HIGH PERFORMANCE POLYMERS

1. Subject Code: PT361   Course Title: High Performance Polymers
2. Contact Hours: L: 03   T: 00   P: 00
3. Examination Duration (Hrs.):   Theory: 03   Practical: 00
4. Relative Weight: CWS: 25 PRS: 00 MTE: 25 ETE: 50 PRE: 00
5. Credits: 03
6. Semester: ODD-V
7. Subject Area: UEC
8. Pre-requisite: NIL
9. Objective: To impart knowledge about heat resistant polymers, liquid crystalline polymers, conducting and other special polymers.

10. Details of Course

S. No.	Contents	Contact Hours
1	Heat resistant polymers: Requirements for heat resistance, Determination of heat resistance, Synthesis, Structure-property relationships, Applications of heat resistant polymers like polyamides, polyimides and its derivatives, polyquinolines, polyquinoxalines, PBT, PBO, PBI, PPS, PPO, PEEK, engineering plastic blends.	9
2	Liquid crystalline polymers, Concept of liquid crystalline phase, Theories of liquid crystallinity, Characteristics of LC state and LCPs, Rheology of liquid crystalline polymers, Blends of LCPs, Self reinforced composites, Applications.	9
3	Conducting polymers, Conduction mechanism, semi-conductors and conducting polymers, Band theory, Doping of polymeric systems, Processing and testing of conducting polymers, Applications and recent advances in conducting polymers.	9
4	Synthesis and applications of photosensitive polymers, Curing reactions.	6
5	Polymers in specialty applications: Polymers in agricultural applications, Green houses, Mulches, Control release of agricultural chemicals, Seed coatings, Polymers in construction and building applications.	9

11. Suggested Books

S. No.	Name of Books/Authors/Publisher
1	Encyclopedia of Polymer science and Engineering Vol.1-17/ J.I. Kroschwitz, 2007
2	Additive for coatings/ John Bieleman/ Wiley-VCH, 2000.
3	Fire Properties of Polymeric Composites Materials/ A.P. Mouritz, A G. Gibson/ Springer, 2006.
4	Modern Biopolymers science: Bridging the divide between fundamentals treatise and industrial application/S. Kasapis, I.T. Nortan, J.B. Ubbink/ Elsevier 2009

PT363 SEPARATION TECHNOLOGY

1. Subject Code: PT363   Course Title: Separation Technology
2. Contact Hours: L: 03   T: 00   P: 00
3. Examination Duration (Hrs.):   Theory: 03   Practical: 00
4. Relative Weight: CWS: 25 PRS: 00 MTE: 25 ETE: 50 PRE: 00
5. Credits: 03
6. Semester: ODD-V
7. Subject Area: UEC
8. Pre-requisite: NIL
9. Objective:
10. Details of Course

Unit No.	Contents	Contact Hours
1	Separation factors and its dependence on process variables, classification and characterization, thermodynamic analysis and energy utilization, kinetics and mass transport, Theory of cascades and its applications.	7
2	Membrane Separations, Merits and demerits, Commercial, pilot plant polarization of membrane processes and laboratory membrane permeators, Dialysis, Reverse osmosis, Ultrafiltration, Membrane operations, Design controlling factors.	7
3	Separation by Sorption Techniques, Types and choice of adsorbents, chromatographic techniques, Retention theory mechanism, Design controlling factors, ion exchange chromatography equipment and commercial processes, recent advances in sorption technology.	7
4	Ionic Separations: Theory, mechanism and equipments for electrophoresis, dielectrophoresis and electro dialysis, Controlling factors, Applications, Design considerations.	7
5	Thermal Separation: Thermal diffusion, Rate law, Theories of thermal diffusion for gas and liquid mixtures, Equipments design and applications, Zone melting, Equilibrium diagrams, Controlling factors, Apparatus and applications.	7
6	Other Techniques: Adductive crystallization, Molecular addition compounds, Clathrate compounds and adducts, Equipments, Applications, Economics and commercial processes. Foam Separation: Surface adsorption, Nature of foams, Apparatus, Applications and Controlling factors.	7

11. Suggested Books

S. No.	Name of Books/Authors/Publisher
1	New Chemical Engineering Separation Techniques/ Schoen/ Wiley Interscience, New York, 1972.
2	Separation Processes/ C.J. King/ Tata McGraw Hill, New Delhi,1982.
3	Bioseparations – Principles and Techniques/ B. Sivasankar/ Prentice Hall of India Pvt. Ltd, New Delhi, 2005.
4	Separation process Principles/ Seader, Henley and Roper/ John Wiley & Sons 2010
5	Membrane Separation processes/ Kaushik Nath/ PHI , 2008.

PT365 NON-CONVENTIONAL ENERGY

1. Subject Code: PT365   Course Title: Non-Conventional Energy
2. Contact Hours: L: 03   T: 00   P: 00
3. Examination Duration (Hrs.):   Theory: 03   Practical: 00
4. Relative Weight: CWS: 25 PRS: 00 MTE: 25 ETE: 50 PRE: 00
5. Credits: 03
6. Semester: ODD-V
7. Subject Area: UEC
8. Pre-requisite: NIL
9. Objective: To make student aware about the fundamentals and applications of non-conventional energy.
10. Details of Course

Unit No.	Contents	Contact Hours
1	Renewable and non-renewable energy sources, trends in energy consumption, Global and National scenarios, Prospects of renewable energy sources, Energy Management.	6
2	Solar Energy: Solar radiation - beam and diffuse radiation, solar constant, earth sun angles, measurement of solar radiation, flat plate collectors, concentrating collectors, Solar air heaters-types, solar driers, Storage of solar energy-thermal storage, Photo voltaics - solar cells & its applications.	6
3	Wind Energy: Basic system principles, Assessment of wind available, Design principles, Manufactured designs, Sizing and storage of energy, System efficiency, Overview of wind industry.	4
4	Energy from Biomass: Calorific value of Biomass samples, Pyrolysis, Biomass conversion technologies, Biogas generation plants, classification, advantages and disadvantages, constructional details, site selection, digester design consideration, filling a digester for starting, maintaining biogas production, Fuel properties of bio gas, utilization of biogas.	6
5	Geothermal Energy: Estimation and nature of geothermal energy, geothermal sources and resources like hydrothermal, geo-pressured hot dry rock, magma. Advantages, disadvantages, and application of geothermal energy.	4
6	Ocean Energy: Ocean Thermal Electric Conversion systems like open cycle, closed cycle, Hybrid cycle. Energy from tides, basic principle of tidal power, single basin and double basin tidal power plants, advantages, limitation and scope of tidal energy. Wave energy and power from wave, wave energy conversion devices, advantages and disadvantages of wave energy.	4

7	Magnetohydrdynamic Power Generation: Principle of MHD power generation, MHD system, Design problems and developments, gas conductivity, materials for MHD generators and future prospects.	4
8	Fuel Cells: Design principle and operation of fuel cell, Types of fuel cells, conversion efficiency of fuel cell, applications of fuel cells.	4
9	Hydrogen Energy: Hydrogen Production methods, Hydrogen storage, hydrogen transportation, utilization of hydrogen gas, hydrogen as alternative fuel for vehicles.	4

11. Suggested Books

S. No.	Name of Books/Authors/Publisher
1	Principles of Sustainable Energy Systems, Second Edition/ Frank Kreith, Susan Krumdieck/ CRC Press, 2013.
2	Non-conventional energy sources/ G.D. Rai/ Khanna Publishers, 2004.
3	Solar Energy: Fundamentals and Applications/ H.P. Garg & Jai Prakash/ Tata McGraw Hill, 2000
4	Solar Engineering of Thermal Processes/ Duffic and Beckman/ John Wiley, 2013
5	Non Conventional Energy Resources/ Saeed and Sharma/ S.K. Kataria& Sons ,2013

PT367 POLYMER WASTE MANAGEMENT

1. Subject Code: PT367   Course Title: Polymer Waste Management

2. Contact Hours: L: 03   T: 00   P: 00
3. Examination Duration (Hrs.):   Theory: 03   Practical: 00
4. Relative Weight: CWS: 25   PRS: 00   MTE: 25   ETE: 50   PRE: 00
5. Credits: 03
6. Semester: ODD-V
7. Subject Area: UEC
8. Pre-requisite: NIL
9. Objective: To impart knowledge about polymer waste and their management.

10. Details of Course

Unit No.	Contents	Contact Hours
1	Polymer and Plastics Waste: Definition of plastics waste and the associated problems, Identification, collection methods and separation. Integrated waste management – source reduction, recycling, energy recovering process through thermal and biological destruction, Land filling and composting.	8
2	Plastics waste management: Source reduction, reuse, repair, recycling, and incineration with examples. Plastics recycling: Classification, Code of practice, Primary, secondary, territory and quaternary recycling with examples, Waste plastics as fillers.	8
3	Recycling and degradation of plastics: Recycling and sustainability correlation, Basic principles and recovery, recycling and resource conservation.	9

4	Recycling of plastics by surface refurbishing, Application of a coating, polishing, Plastics, Environmental and Thermal ageing, Chemical degradation, Wear and erosion, Biodegradable plastics – an overview.	9
5	Environmental issues, policies and legislation in India.	8

11. Suggested Books

S. No.	Name of Books/Authors/Publisher
1	Plastics Recycling – Products and Processes/ Ehrig (Ed.)/ Hanser Publication, 1993
2	Recycling and recovery of plastics/ Brandrup/ Hanser Publishers, New York, 1996
3	Handbook of Plastics Recycling/ By Francesco La Mantia/ Rapra Tech Ltd , 2002
4	Introduction to Plastics Recycling/ By VannessaGoodship/ Rapra Tech Ltd ,2007

PT369 NANOTECHNOLOGY IN POLYMERS

1. Subject Code: PT369 Course Title: Nanotechnology in Polymers
2. Contact Hours: L: 03 T: 00 P: 00
3. Examination Duration (Hrs.): Theory: 03 Practical: 00
4. Relative Weight: CWS: 25 PRS: 00 MTE: 25 ETE: 50 PRE: 00
5. Credits: 03
6. Semester: ODD-V
7. Subject Area: UEC
8. Pre-requisite: NIL
9. Objective: To make student aware about the applications of nanopolymers in various fields.

10. Details of Course

S. No.	Contents	Contact Hours
1	Concepts of nanotechnology, Time and length scale in structures, Nanosystems, Dimensionality and size dependent phenomena, Surface to volume ratio-Fraction of surface atoms, Surface energy and surface stress, surface defects, Properties at nanoscale (optical, mechanical, electronic, and magnetic).	8
2	Nano-materials, Classification based on dimensionality, Quantum Dots, Wells and Wires, Carbon-based nano-materials, Metal based nano-materials, Nanocomposites, Nanopolymers, Nanoglasses, Nanoceramics, Biological nanomaterials.	8
3	Synthesis of nanopolymers, Chemical Methods, Metal Nanocrystals by Reduction, Solvothermal Synthesis, Photochemical Synthesis, Sonochemical Routes, Chemical Vapor Deposition, Metal Oxide - Chemical Vapor Deposition, Physical Methods such as ball Milling, electrodeposition, spray pyrolysis, flame pyrolysis, DC/RF magnetron sputtering, Molecular beam epitaxy.	9
4	Nanofabrication, Photolithography and its limitations, Electron beam lithography, Nanoimprint, Soft lithography patterning, Characterization with Field Emission Scanning Electron Microscopy, Environmental Scanning Electron Microscopy, High Resolution Transmission Electron Microscope, Scanning Tunneling Microscope, Surface enhanced Raman spectroscopy, X-ray Photoelectron Spectroscopy, Auger electron spectroscopy, Rutherford back scattering spectroscopy.	9
5	Applications of nanomaterials, Solar energy conversion and catalysis, Molecular electronics and printed electronics, Nanoelectronics, Polymers with aspecial	8

architecture, Applications in displays and other devices, Nanomaterials for data storage, Photonics, Plasmonics, Nanomedicine, Nanobiotechnology and Nanotoxicology.

11. Suggested Books

S. No.	Name of Books/Authors/Publisher
1	Organic and Inorganic Nanostructures/ Nabok/ Artech House, 2005.
2	Nanoscience: Nanotechnologies and Nanophysics/ Dupas, Houdy, Lahmani/ Springer-Verlag Berlin Heidelberg ,2007
3	Nanostructured Materials and Nanotechnology/ H.S. Nalwa/ Academic Press , 2002
4	A Textbook of Nanoscience and Nanotechnology/ Pradeep/ Tata McGraw Hill Education Pvt. Ltd. , 2012

PT371 APPLICATIONS OF POLYMER BLENDS AND COMPOSITE

1. Subject Code: PT371   Course Title: Applications of Polymer Blends and Composite
2. Contact Hours: L: 03   T: 00   P: 00
3. Examination Duration (Hrs.):   Theory: 03   Practical: 00
4. Relative Weight: CWS: 25 PRS: 00 MTE: 25 ETE: 50 PRE: 00
5. Credits: 03
6. Semester: ODD-V
7. Subject Area: UEC
8. Pre-requisite: NIL
9. Objective: To make student aware about the applications of polymers, blends and composites.

10. Details of Course

Unit No.	Contents	Contact Hours
1	Concepts of polymer blends, Advantages of blends over conventional polymers, Significance of polymer blend technology, Different steps involved in designing of a blend, Different methods of blending, Characterization of polymer blends.	8
2	Compatibilization and Phase Morphology, Role of compatibilizers in blend technology, techniques of compatibilization, Phase structure development in polymer blends, Factors affecting morphology of polymer blends, Properties of polymer blends.	8
3	Reinforcements, Properties and applications of Glass, Carbon, Kevlar, polyethylene, boron, ceramic and natural fibers. Concepts of matrix material, Thermoset matrix materials like - epoxy, polyester, vinyl esters, phenolic resin, polyimides, Thermoplastic matrix materials like - polyolefins, polyether ether ketones, polyphenylene sulfide, thermoplastic polyimides.	9
4	Concept of composites, particulate and fibrous composites, Properties of composites, Fabrication of continuous and short fiber composites and particulate composites, mechanical and physical properties	9
5	Applications of blends and composites for civil, aerospace, automobiles etc	8

11. Suggested Books

S. No.	Name of Books/Authors/Publisher
1	Fibre Reinforced composites/ P. K. Malik/ Marcel Deckar, 1988.
2	Composites Manufacturing: Materials, Product, and Process Engineering/ S.K. Mujumdar/ CRC press ,2002
3	Fibre-glass Reinforced Plastics/ N. P. Cheremisinoff (Ed)/ Noyce Pub, 1988.
4	Design Data for Reinforced Plastics/ N. L. Hancex, R. M. Mayer/ Chapman Hall, 1994.
5	Reinforced Plastics: Properties and Applications/ Raymond Seymour/ The Materials Information Society, 1991.

IT351 ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

NAME OF DEPTT: Information Technology

1. Subject Code: IT351   Course Title: Artificial Intelligence and Machine Learning

2. Contact Hours: L: 3   T: 0   P: 0

3. Examination Duration (ETE)(Hrs.):   Theory 3 Hrs Practical 0

4. Relative Weightage: CWS 25   PRS 0   MTE 25   ETE 50   PR 0

5. Credits: 3

6. Semester: ODD

7. Subject Area: UEC

8. Pre-requisite: Discrete Mathematics

9. Objective: The student should be able to understand the different supervised, unsupervised and reinforcement learning algorithms and choose the appropriate machine learning tool for different real world examples.

10. Details of Course

S.No.	Contents	Contact Hours
1.	**Introduction** to Artificial Intelligence and Machine learning, State Space representation of problems, Concept of Search, overview of different tasks: classification, regression, clustering, control.	6
2.	**Heuristic Search Techniques:** Generate and Test, Hill Climbing, Best-first search, Branch and bound, A* algorithm, Game playing.	6
3.	**Knowledge Representation:** Propositional logic, Predicate Logic, semantic nets, frames	8
4.	**Supervised Learning:** Decision trees, nearest neighbors, linear classifiers and kernels, neural networks, linear regression; Support Vector Machines.	8

5.	**Unsupervised Learning:** Clustering, Expectation Maximization, Dimensionality Reduction, Feature Selection, PCA, factor analysis, manifold learning.	8
6.	**Applications &Research Topics**: Applications in the fields of web and data mining, text recognition, speech recognition	6
	TOTAL	42

11. Suggested Books

S.No.	Name of Books / Authors/ Publishers	Year of Publication/ Reprint
Text Book		
1.	Artificial Intelligence by Elaine Rich, K. Knight, McGrawHill	2009
1.	Introduction to Machine Learning, Alpaydin, E., MIT Press, 2004	
2.	Machine Learning, Tom Mitchell, McGraw Hill, 1997.	1997
3.	Elements of Machine Learning, Pat Langley Morgan Kaufmann Publishers, Inc. 1995. ISBN 1-55860-301-8	1995
Reference Book		
4.	The elements of statistical learning, Friedman, Jerome, Trevor Hastie, and Robert Tibshirani. Vol. 1. Springer, Berlin: Springer series in statistics, 2001.	2001
5.	Machine Learning: A probabilistic approach, by David Barber.	2006
6	Pattern recognition and machine learning by Christopher Bishop, Springer Verlag, 2006	2006

IT353 DATA STRUCTURES AND ALGORITHMS

NAME OF DEPTT: Information Technology

1. Subject Code: IT353   Course Title: Data Structures and Algorithms

2. Contact Hours: L: 3   T: 0   P: 0

3. Examination Duration (ETE) (Hrs.):   Theory 3 Hrs   Practical 0

4. Relative Weightage: CWS 25   PRS 0   MTE 25   ETE 50   PR 0

5. Credits: 3

6. Semester: ODD

7. Subject Area: UEC

8. Pre-requisite: Nil

9. Objective: The objective of the course is to familiarize students with basic data structures and their use in fundamental algorithms.

10. Details of Course

S.No.	Contents	Contact Hours
1.	**Introduction:** Introduction to Algorithmic, Complexity- Time-Space Trade off. Introduction to C programming through Arrays, Stacks, Queues and Linked lists.	8
2.	**Trees:** Basic Terminology, Traversals, Binary search trees, optimal and average BST's. 2-4 trees, Applications of Binary search Trees, Complete Binary trees, Extended binary trees.	7
3.	**Introduction to algorithms:** Concept of algorithmic efficiency, run time analysis of algorithms, Asymptotic Notations. Growth of Functions, Master's Theorem, **Searching and Searching:** Linear Search, Binary search, Insertion Sort, Quick sort, Merge sort, Heap sort, Radix Sort.	9
4.	**Graphs:** Terminology and Representations, Graphs & Multi-graphs, Directed Graphs, Representation of graphs, Breadth first search and connected components. Depth first search in directed and undirected graphs and strongly connected components.	8
5.	**Spanning trees:** Prim's and Kruskal's algorithm, union-find data structure. Dijkstra's algorithm for shortest paths, shortest path tree. Directed acyclic graphs: topological sort and longest path. **Dynamic programming**: Principles of dynamic programming. Applications: Matrix multiplication, Travelling salesman Problem.	10
		42

11. Suggested Books

S.No.	Name of Books / Authors/ Publishers	Year of Publication/ Reprint
Text Books:		
1.	Horowitz and Sahni, "Fundamentals of Data structures", Galgotia publications	1983
2.	Tannenbaum, "Data Structures", PHI	2007(Fifth Impression)
3.	T .H . Cormen, C . E . Leiserson, R .L . Rivest "Introduction to Algorithms", 3rd Ed., PHI.	2011 (reprint)
4.	E. Horowitz, S. Sahni, and S. Rajsekaran, "Fundamentals of Computer Algorithms," Galgotia Publication	

	Reference Books	
1.	R.L. Kruse, B.P. Leary, C.L. Tondo, "Data structure and program design in C", PHI	2009(Fourth Impression)
2.	Aho ,Ullman "Principles of Algorithms "	

IT355 COMMUNICATION AND COMPUTING TECHNOLOGY

NAME OF DEPTT: Information Technology

1. Subject Code: IT355   Course Title: Communication and Computing Technology

2. Contact Hours: L: 3   T: 0   P: 0

3. Examination Duration (ETE) (Hrs.): Theory 3 Hrs   Practical 0

4. Relative Weightage: CWS   25   PRS 0   MTE   25   ETE   50   PR   0

5. Credits: 3

6. Semester: ODD

7. Subject Area: UEC

8. Pre-requisite: Operating systems, Algorithm Design and Analysis and data structures

9. Objective: To introduce the concept of Communications in Computer networks

10. Details of Course

S.No.	Contents	Contact Hours
1.	**Introduction** to Goals and Applications of Networks, Network structure and architecture, The TCP/IP reference model, services, Network Topology.	6
2.	**Data Link Layer and Medium Access sub layer** - Channel Allocations, LAN protocols -ALOHA protocols - Overview of IEEE standards - FDDI. - Elementary Data Link Protocols, Sliding Window protocols.	6
3.	**Network Layer**: Routing, Congestion control, Internetworking -TCP / IP, IP packet, IP address, IPv6 and Mobile IP.	8
4.	**Transport Layer:** Design issues, TCP and UDP, connection management, Congestion control, Leaky bucket, Token bucket algorithm. QoS.	8
5.	**Application Layer:** File Transfer, Access and Management, Electronic mail, Virtual Terminals, Internet and Public Networks, Firewalls	6
6.	**Information and Web security**: IP Security, Architecture, Authentication header, Encapsulating security payloads, combining security associations, Secure Socket Layer(SSL) and transport layer security, TSP, Secure Electronic Transaction (SET), Electronic money.	8
	TOTAL	42

11. Suggested Books

S.No.	Name of Books / Authors/ Publishers	Year of Publication/ Reprint
Text Book		
1.	S. Tananbaum, "Computer Networks", 3rd Ed, PHI	1999
2.	U. Black, "Computer Networks-Protocols, Standards and Interfaces", PHI	1996
3.	W. Stallings, "Computer Communication Networks", PHI	1999
3.	Data Communications and Networking, Behrouz A. Forouzan 5/e	2013
Reference Book		
4.	William Stallings, "Cryptography and Network Security: Principals and Practice", Prentice Hall, New Jersy.	2001
5.	Behrouz A. Forouzan, "Cryptography and Network Security", TMH.	2006

IT357 INTERNET AND WEB PROGRAMMING

NAME OF DEPTT:　　　Information Technology

1. Subject Code:　　　IT357　　　　Course Title:　　Internet and Web Programming

2. Contact Hours:　　　L: 3　　T: 0　　P: 0

3. Examination Duration (ETE) (Hrs.):　Theory 3 Hrs　　Practical 0

4. Relative Weightage: CWS　25　　PRS　0　　MTE　25　　ETE　50　　PR　0

5. Credits: 3

6. Semester: ODD

7. Subject Area: UEC

8. Pre-requisite: Nil

9. Objective: To introduce the concept of internet and web programming

10. Details of Course

S.No.	Contents	Contact Hours
1.	**Internet and WWW:** Internet basic, Introduction to internet and its applications, E-mail, telnet, FTP, e-commerce, video conferencing, e-business. Internet service providers, domain name server, internet address World Wide Web (WWW): World Wide Web and its evolution, uniform resource locator (URL), browsers - internet explorer, netscape navigator, opera, firefox, chrome, mozilla. Search engine, web saver - apache, IIS, proxy server, HTTP protocol.	6

2.	**WEBSITES BASIC ANDWEB 2.0**: Web 2.0: Basics-RIA Rich Internet Applications - Collaborations tools - Understanding websites and web servers: Understanding Internet – Difference between websites and web server-Internet technologies Overview – Understandig the difference between internet and intranet; HTML and CSS: HTML 5.0 , XHTML, CSS 3.	6
3.	**E-MAIL SECURITY & FIREWALLS** : PGP - S/MIME - Internet Firewalls for Trusted System: Roles of Firewalls - Firewall related terminology- Types of Firewalls - Firewall designs - SET for E-Commerce Transactions, intellectual property: copyright, patents, trademarks, cyber laws	8
4.	**SERVELETS AND JSP**: JSP Technology Introduction-JSP and Servelets- Running JSP Applications Basic JSP- JavaBeans Classes and JSP-Tag Libraries and Files-Support for the Model- View- Controller Paradigm- Case Study- Related Technologies.	8
5.	**XML**: Introduction to XML, uses of XML, simple XML, XML key components, DTD and Schemas, Well formed, using XML with application.XML, XSL and XSLT. Introduction to XSL, XML transformed simple example, XSL elements, transforming with XSLT	6
6.	**PHP:** Starting to script on server side, Arrays, function and forms, advance PHP, Basic command with PHP examples, Connection to server, creating database, selecting a database, listing database, listing table names creating a table, inserting data, altering tables, queries, deleting database, deleting data and tables, PHP my admin and database bugs.	8
	TOTAL	42

11. Suggested Books

S.No.	Name of Books / Authors/ Publishers	Year of Publication/ Reprint
	Text Books	
1.	Internet and Web Technologies by Raj Kamal, Tata McGraw Hill edition. (ISBN: 9780070472969)	2002
2.	An Introduction to Search Engines and Web Navigation, Mark Levene, Pearson Education. (ISBN: 978047052684)	2010
3.	Modeling the Internet and the Web,PierreBaldi,PaoloFrasconi, Padhraic Smyth, John Wiley and Sons Ltd. (ISBN: 978-0-470-84906-4)	2003
	Reference Books	
4.	HTML: A Beginner's Guide by Wendy Willard, Tata McGraw-Hill (ISBN: 9780070677234)	2009
5.	PHP and MySQL for Dynamic Web Sites, Ullman, Larry, Peachpit Press.1 (ISBN: 978-0-321-78407-0)	2012

IT359 JAVA PROGRAMMING

NAME OF DEPTT: Information Technology

1. Subject Code: IT359   Course Title: Java Programming

2. Contact Hours: L: 3   T: 0   P: 0

3. Examination Duration (ETE) (Hrs.):   Theory 3 Hrs   Practical 0

4. Relative Weightage: CWS 25   PRS 0   MTE   25   ETE 50   PR   0

5. Credits: 3

6. Semester: ODD

7. Subject Area: UEC

8. Pre-requisite: Nil
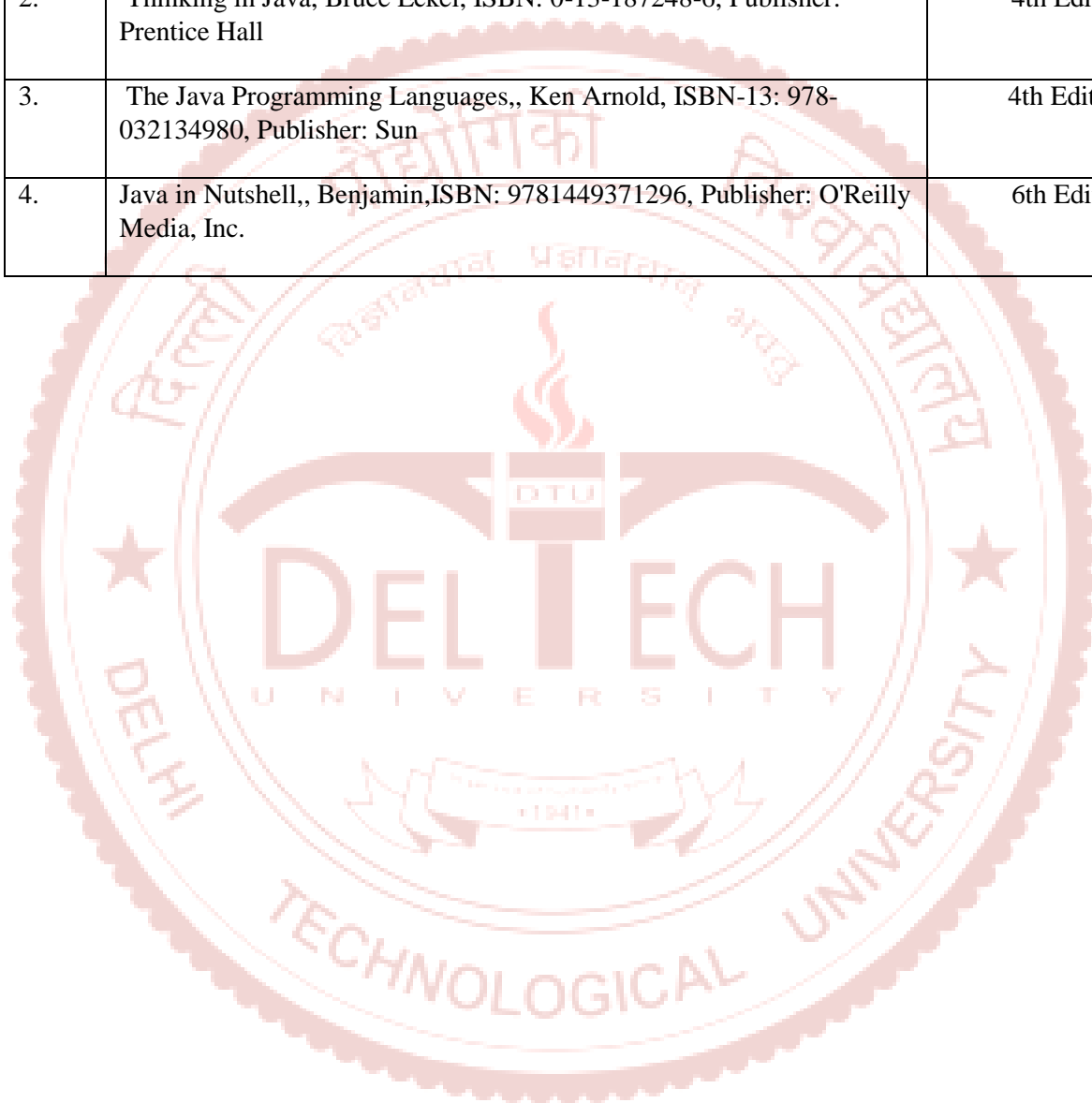
9. Objective: To introduce the concept of java programming

10. Details of Course

S.No.	Contents	Contact Hours
1.	**Introduction to Java**: Programming language Types and Paradigms, Computer Programming Hierarchy, How Computer Architecture Affects a Language? , Why Java?, Flavors of Java, Java Designing Goal, Role of Java Programmer in Industry, Features of Java Language, JVM –The heart of Java , Java's Magic Byte code.	6
2.	**The Java Environment:** Installing Java, Java Program Development, Java Source File Structure, Compilation, Executions. Lexical Tokens, Identifiers, Keywords, Literals, Comments, Primitive Datatypes, Operators Assignments.	6
3.	**Object Oriented Programming**: Class Fundamentals , Object & Object reference, Object Life time & Garbage Collection, Creating and Operating Objects , Constructor & initialization code block, Access Control, Modifiers, methods Nested , Inner Class &Anonymous Classes, Abstract Class & Interfaces Defining Methods, Argument Passing Mechanism, Method Overloading, Recursion, Dealing with Static Members, Finalize() Method, Native Method.	8
4.	**Extending Classes and Inheritance**: Use and Benefits of Inheritance in OOP, Types of Inheritance in Java, Inheriting Data members and Methods, Role of Constructors in inheritance, Overriding Super Class Methods, Use of "super", Polymorphism in inheritance, Type Compatibility and Conversion Implementing interfaces.	8
5.	**Package**: Organizing Classes and Interfaces in Packages, Package as Access Protection, Defining Package, CLASSPATH Setting for Packages, Making JAR Files for Library Packages Import and Static Import Naming Convention For Packages.	6
6.	**GUI Programming**: Designing Graphical User Interfaces in Java, Components and Containers, Basics of Components, Using Containers, Layout Managers, AWT Components, Adding a Menu to Window, Extending GUI Features Using Swing Components, Java Utilities (java.util Package) The Collection Framework: Collections of Objects, Collection Types, Sets , Sequence, Map, Understanding Hashing, Use of Array List & Vector.	8
	TOTAL	42

11. Suggested Books

S.No.	Name of Books / Authors/ Publishers	Year of Publication/

		Reprint
	Text Books	
1.	The Complete Reference Java,, Herbert Schildt, ISBN: 978-0-07163177-8, Publisher: McGraw Hill	7th Edition
2.	Thinking in Java, Bruce Eckel, ISBN: 0-13-187248-6, Publisher: Prentice Hall	4th Edition
3.	The Java Programming Languages,, Ken Arnold, ISBN-13: 978-032134980, Publisher: Sun	4th Edition,
4.	Java in Nutshell,, Benjamin,ISBN: 9781449371296, Publisher: O'Reilly Media, Inc.	6th Edition