With Effect from the Academic Year 2019 – 2020

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (A)

AICTE MODEL CURRICULUM

B.E. (PRODUCTION ENGINEERING)

SEMESTER – VII to SEMESTER - VIII

With effect from academic year 2021-2022

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (A)

AICTE MODEL CURRICULUM SCHEME

B.E. (PRODUCTION ENGINEERING)

SEMESTER – VII

S. No.	Course Code	Title of the Course	Scheme of instruction			Scheme of examination			Credits
			Hours per week			Duration in Hours	Maximum Marks		
			L	T	P/D		CIE	SEE	
THEORY									
1	18ME C22	Metrology and Instrumentation	3	--	--	3	30	70	3
2	18ME C23	Operations Research	3	--	--	3	30	70	3
3	18PE C11	Additive Manufacturing Technologies	3	--	--	3	30	70	3
4		Core Elective – VI	3	--	--	3	30	70	3
5		Open Elective – I	3	--	--	3	30	70	3
PRACTICALS									
6	18ME C25	Metrology and Instrumentation Lab	--	--	3	3	25	50	1.5
7	18PE C12	Additive Manufacturing Lab	--	--	3	3	25	50	1.5
8	18PE C13	Project: Part - 1	--	--	4	--	50	--	2
		TOTAL	**15**	--	**10**	--	**250**	**450**	**20**

L: Lecture T: Tutorial D: Drawing P: Practical
CIE - Continuous Internal Evaluation SEE – Semester End Examination

Core Elective – VI (3/3)			**Open Elective – I (3/3)**		
SNO	**Subj. Code**	**Name of the Subject**	**SNO**	**Subj. Code**	**Name of the Subject**
1	18ME E21	Power Plant Engineering	1	18IT O01	Object Oriented Programming using JAVA
2	18ME E22	Engineering Research Methodology	2	18PY O01	History of Science & Technology
3	18ME E23	Data Analytics	3	18EG O02	Gender Sensitization
4	18ME E24	Innovations and Interlliectual Property rights	4	18IT O03	Principles of Internet of Things
5	18PE E12	Supply Chain Management	5	18CS O09	Basics of Artificial Intelligence

With Effect from the Academic Year 2021 – 2022

18ME C22

METROLOGY AND INSTRUMENTATION

Instruction	3Hours per week
Duration of SEE	3 Hours
SEE	70Marks
CIE	30Marks
Credits	3

Objectives:

1. To familiarize with limits, fits & tolerances and fundamental concepts of linear and angular measurements.
2. To have adequate skill in the usage of various precision measuring instruments and the concepts of limit gauges.
3. To learn the importance of Geometric form and how to measure form errors.
4. To have knowledge in the concepts of classification of instrument errors and their characteristics.
5. To understand the working principles of various instruments used for the measurement of displacement, pressure and temperature.

Outcomes: At the end of the course, students are able to

1. Understand the need, accuracy and associated concepts of measurements.
2. Select appropriate gauges for inspection and design.
3. Calculate surface roughness by using appropriate instruments.
4. Analyze and interpret the types of errors, strain measurement and instrument characteristics.
5. Evaluate measuring methods and devices for displacement, pressure & temperature.

UNIT-I

Limits, Fits and Tolerances: Interchangeability, nominal size, limits , tolerances, allowance, fundamental deviation, unilateral and bilateral tolerances, types of fits, alpha numeric designation of limits/fits, hole and shaft basis systems, selective assembly.

Linear and angular measurement: Line and end standards, slip gauges, Tomlinson gauges and sine bar.

UNIT-II

Design of limit gauges: Taylor's Principle for plan limit gauges, design of GO and NO GO gauges, use of plug, ring and snap gauges.

Comparators: Introduction, dial indicator, sigma mechanical comparator, back pressure type pneumatic comparator.

Optical measuring instruments: Optical projector principle and its uses, tool maker's microscope principle and its uses, interferometry.

UNIT-III

Straightness, Flatness and Roundness Measurement: Definitions, measurement by beam comparator, straight edge, spirit level, and bench centers.

Surface roughness measurements: Roughness and waviness, numerical assessment of surface roughness, surface roughness measurement by profilometer, Taylor Hobson Talysurf, ISI symbols for indication of surface finish.

UNIT-IV

Screw thread metrology: Basic terminology of screw thread, measurement of effective diameter by 2 wire and 3 wire methods, best wire size.

Gear tooth metrology: Spur gear nomenclature, gear tooth thickness measurement by gear tooth vernier.

Instrumentation: Static and dynamic characteristics of instruments, types of errors, strain measurement with strain gauges, gauge factor, rosette Gauges.

UNIT-V

Transducers: Displacement measurement by L.V.D.T, pressure measurement by bourdon pressure gauge, bulk modulus pressure gauge, pirani gauge, temperature measurement by thermo couples, laws of thermo electricity, types of materials used in thermocouples.

Text Books:

1. R.K. Jain, “Engineering Metrology”, Khanna Publications, 1996.
2. Doeblin, "Measurement Systems Application and Design", TMH, 5/e., 2004.
3. Beckwith, Buck, Lienhard, "Mechanical Measurements", PEA, 3rd Indian Reprint, 2001.

Suggested Reading:

1. RegaRajendra,"Principles of Engineering Metrology", Jaico Publishing House, Mumbai, 2008.
2. B.C. Nakra& K.K. Chaudhary , "Instrumentation Measurement and Analysis", 3/e, McGrawhill, 2014 .

With Effect from the Academic Year 2021 – 2022

18ME C23

OPERATIONS RESEARCH

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Objectives:

1. Students will come to know the formulation of LPP models.
2. Students will understand the Algorithms of Graphical and Simplex Methods.
3. Students will understand the Transportation and Assignment techniques.
4. Students will come to know the procedure of Project Management along with CPM and PERT techniques.
5. Students will understand the concepts of sequencing and queuing theory.

Outcomes: At the end of the course, the students are able to

1. Understand the concepts of linear programming problems.
2. Solve the given transportation problem.
3. Develop optimum pair of operations and resources by using Assignment technique.
4. Analyze project management techniques like CPM and PERT to plan and execute projects successfully.
5. Apply sequencing and queuing theory concepts for industry applications. (

UNIT-I

Introduction: Definition and scope of operations research.

Linear programming: Introduction, formulation of linear programming problems, graphical method of solving LP problem, simplex method, degeneracy in simplex, duality in simplex.

UNIT-II

Transportation models: Finding an initial feasible solution - north west corner method, least cost method, Vogel's approximation method, finding the optimal solution, special cases in transportation problems - unbalanced transportation problem, degeneracy in transportation, profit maximization in transportation.

UNIT-III

Assignment techniques: Introduction, Hungarian technique of assignment techniques, unbalanced problems, problems with restrictions, maximization in assignment problems, travelling salesman problems.

UNIT-IV

Project management: Definition, procedure and objectives of project management, differences between PERT and CPM, rules for drawing network diagram, scheduling the activities, Fulkerson's rule, earliest and latest times, determination of ES and EF times in forward path, LS & LF times in backward path, determination of critical path, duration of the project, free float, independent float and total float, crashing of network.

UNIT-V

Sequencing models: Introduction, General assumptions, processing 'n'jobs through two machines, processing
'n' jobs through three machines.

Queuing theory: Introduction, Kendall's notation, single channel - Poisson arrivals-exponential service times.

Text Books:

1. Hamdy A. Taha, "Operations Research-An Introduction", 10/e, Pearson education India, 2017.
2. S.D. Sharma, "Operations Research", Kedarnath, Ramnath& Co., Meerut,2009.
3. V.K. Kapoor, "Operations Research", S. Chand Publishers, New Delhi, 2004.

Suggested Reading:

1. R. PaneerSelvam, "Operations Research", 2/e, PHI Learning Pvt. Ltd., New Delhi,2008.
2. Nita H. Shah, Ravi M. Gor, HardikSoni, "Operations Research", PHI Learning Private Limited,2013.

With Effect from the Academic Year 2021 – 2022

18PE C11

ADDITIVE MANUFACTURING TECHNOLOGIES

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Objectives:

1. To introduce to students the basics of Additive Manufacturing, its advantages and limitations and concept of mass customization.
2. To familiarize students with various Additive Manufacturing processes.
3. To teach students about STL file issues and familiarize them with various AM softwares.
4. To demonstrate various post processing techniques and rapid tooling concept.
5. To demonstrate the applications of rapid prototyping in various fields

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

1. Explain the process chain of Additive manufacturing and their classification, advantages and disadvantages
2. Critically explore and compare the technologies used for additive manufacturing in terms of their material, parameters, applications and limitations
3. Analyse various software issues for rapid prototyping and related operations for STL file and features of various slicing softwares.
4. Identify different post processing techniques involved in enhancing the properties of the 3d printed components, understand rapid tooling
5. Understand applications of Additive Manufacturing in various fields

UNIT - I

Introduction to AM: Customization and mass customization, types of mass customization. Classification of fundamental fabrication processes (additive/subtractive/formative), Difference between AM and CNC. Process chain for Additive Manufacturing(AM) processes. Classification of additive (layered) Manufacturing processes. Advantages and Limitations of AM

UNIT - II

AM Techniques: Photopolymerization, Stereolithography (SLA) , Fused Deposition Modeling (FDM), Solid Ground Curing(SGC) , Shape deposition manufacturing(SDM) - Working principles and their applications, advantages and disadvantages. Laser sintering based technologies (SLA and DMLS) and their related details.

UNIT - III

Pre-processing in AM: Pre-processing of CAD model- STL conversion, STL error diagnostics, STL file Repairs: Generic Solution. Newly Proposed Formats. Support generation, transformations, slicing, surface preparation of materials, pre-heating of powders.
Rapid Prototyping Softwares: Features of various RP softwares - Magics, Mimics, Solid View, Rhino.

UNIT - IV

Post processing in AM: Post processing equipment, Support material removal , Surface texture improvement, Accuracy improvement, Aesthetic improvement, Preparation for use as a pattern, Property enhancements using Non–thermal and Thermal techniques.
Rapid Tooling: Introduction to Rapid Tooling (RT), Conventional Tooling Vs RT, Rapid Tooling Classification: Indirect Rapid Tooling Methods: Arc Spray Metal Deposition, Investment Casting, 3D Keltool process. Direct Rapid Tooling: Direct AIM , LOM Tools, EOS Direct Tool Process.

UNIT - V

AM Applications: Application in Design, Engineering, Analysis & Planning. Application in Aerospace Industry, Automotive Industry, Jewelry Industry, Coin Industry..
RP in Medical and Bioengineering Applications: Planning and simulation of complex surgery, Forensic Science.

Text Books:

1. Gibson, DW. Rosen and B.Stucker; "Additive manufacturing methodologies : Rapid prototyping to direct digital manufacturing ", Springer, 2010.
2. Chee Kai Chua, Kah Fai Leong, "3D printing and additive manufacturing : principles and application" , 4/e of rapid prototyping.
3. PK. Venuvinod, "Rapid prototyping – Laser based and other technologies", Kluwer, 2004.

Suggested Reading:

1. Jacob, Paul, "Rapid tooling : Technologies and industrial applications"
2. Andreas Gebhanrdt, "Understanding Additive anufacturing", Hanses, 2012.

3. Alain Brnard, Georges Talliander, “Additive Manufacturing”, Wiley, 2014.

18ME E21

POWER PLANT ENGINEERING

(Core Elective - VI)

Instruction	3	Hours Per Week
Duration of SEE	3	Hours
SEE	70	Marks
CIE	30	Marks
Credits	3	

Objectives:

1. Different types of power plants and their site selection criteria
2. Operation of thermal power plant
3. About hydraulic power plants, dams and spillways
4. Different types of nuclear power plants including Pressurized water reactor, Boiling water reactor, Liquid metal fast breeder reactor and Gas cooled reactor
5. The power plant economics, environmental and safety aspects of power plant operation.

Outcomes: At the end of the course, the students are able to

1. Select the suitability of site for a power plant in the context of environment.
2. Discuss ash handling and coal handling methods in thermal power plants.
3. Understand the importance of site selection for a hydro-power plant in the context of societal and environment.
4. Explain the safety aspects of nuclear waste disposal.
5. Estimate the economic factors and pollutant formation from power plants.

UNIT – I

Introduction: Power plant, classification of power plants, conventional and non-conventional power plants, merits and demerits of conventional and non-conventional power plants.

Steam power plant: Selection of site for steam power plant, plant layout, formation and types of coal, stages in coal handling, working of coal handling equipment – belt conveyors, screw conveyors, bucket elevators and grab bucket conveyors, general layout of ash handling and dust collection system, uses of ash and dust, ash handling systems – mechanical, pneumatic, steam jet and hydraulic systems of ash handling.

UNIT- II

Combustion process in steam power plant: Stoker firing, overfeed stokers - travelling grate stokers and spreader stokers, underfeed stokers - single retort and multi-retort underfeed stokers, elements of pulverized fuel burning system, advantages and disadvantages of pulverized fuel burning system, pulverized fuel burners – long flame, short flame, tangential and cyclone burners, fluidized bed combustion (FBC), benefits and disadvantages of FBC.

UNIT- III

Hydro electric power plant: Hydrological cycle, hydrograph, flow/mass duration curve, selection of site for hydro-electric plant, advantages and disadvantages of hydro-electric plants, elements (flow-sheet) of hydro-electric power plant, types and working of hydroelectric power plants, storage and pondage, parts and terminology of a dam, selection of site for dams, classification and working of different types of dams, spillways, necessity and location of spillways, classification and working of different types of spillways.

UNIT - IV

Nuclear power plant: Nuclear fuel, breeding and fertile materials, distinction between fissionable, fissile and fertile materials, advantages and disadvantages of nuclear power, components of nuclear reactor, types of nuclear reactors, working of pressurized water reactor, boiling water reactor, sodium-graphite reactor, fast breeder reactor and gas cooled reactors – radioactive (nuclear) waste disposal methods.

UNIT - V

Power plant economics and environmental considerations: Definition and related exercises on connected load, demand (load), maximum demand (peak load), demand factor, average load, load factor, diversity factor, utilization factor, plant capacity factor and plant use factor, fixed cost and variable cost, methods to find depreciation cost and related numerical problems, economics in plant selection, effluents from power plants and impact on environment, pollutants, pollution control.

Text Books:

1. R.K. Rajput, "A Text Book of Power Plant Engineering", 4/e, Laxmi Publications (P) Ltd., New Delhi, 2015.
2. P.K. Nag, "Power Plant Engineering", 4/e, McGraw-Hill Education (India) Private Limited, New Delhi, 2014.
3. P.C. Sharma, "A Text Book of Power Plant Engineering", S.K. Kataria& sons, 2019

Suggested Reading:

1. R. Yadav, "Fundamentals of Power Plant Engineering", Central Publishing House, Allahabad, 2012.
2. S.C. Arora and S. Domkundwar, "A Course in Power Plant Engineering", DhanpatRai& Sons, New Delhi, 2005.

18ME E22

ENGINEERING RESEARCH METHODOLOGY

(Core Elective - VI)

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Objectives:

1. To make the students to formulate the research problem.
2. To identify various sources for literature review and data collection.
3. To prepare the research design.
4. To equip the students with good methods to analyze the collected data.
5. To explain how to interpret the results and report writing.

Outcomes: At the end ofthe course, the students are able to

1. Define researchproblem.
2. Review and assess the quality of literature from varioussources.
3. Understand and develop various research designs.
4. Analyze problem by statistical techniques: ANOVA, F-test, Chi-square.
5. Improve the style and format of writing a report for technical paper/ Journalreport.

UNIT – I

Research methodology: Objectives and motivation of research, types of research- descriptive vs. analytical, applied vs. fundamental, quantitative vs. qualitative, conceptual vs. empirical, research approaches, significance of research, research methods vs. methodology, research process, criteria of good research, problems encountered by researchers in India, technique involved in defining aproblem.

UNIT–II

Literature survey: Importance of literature survey, sources of information-primary, secondary, tertiary, assessment of quality of journals and articles, information through internet.

UNIT – III

Research design: Meaning of research design, need of research design, feature of a good design important concepts related to research design, different research designs, basic principles of experimental design, steps in sample design.

UNIT – IV

Data collection: Collection of primary data, Secondary data, measures of central tendency-mean, mode, median, measures of dispersion- range, mean deviation, standard deviation, measures of asymmetry (skewness), important parametric tests -z, t, F, Chi-Square, ANOVA significance.

UNIT – V

Research report formulation and presentation: Synopsis, dissertation, technical paper and journal paper, writing research grant proposal, making presentation with the use of visual aids,writing a proposal for research grant.

Text Books*:*

1. C.R Kothari, “Research Methodology Methods & Technique”, New Age International publishers, 2004.
2. R. Ganesan, “Research Methodology for Engineers”, MJP Publishers,2011.
3. Vijay Upagade and AravindShende, “Research Methodology”, S. Chand &Company Ltd., NewDelhi, 2009.

Suggested Reading:

1. G. NageswaraRao, “Research Methodology and Quantitative methods”, BS Publications, Hyderabad, 2012.
2. Naval Bajjai, “Business Research Methods”, Pearson Education, 2011.

18ME E23

DATA ANALYTICS

(Core Elective - VI)

Instruction	3Hours per Week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Objectives:

1. To familiarise the students with the concept of descriptive and inferencial statistics.
2. To make the students to understand the concept of machine learning.
3. To make the students to understand various techniques of supervised learning.
4. To make the students to learn the concepts of unsupervised learning.
5. To make the students to learn the prescriptive analytics.

Outcomes: At the end of the course, the students are able to

1. Solve the problems using statistics, regression analysis and ANOVA.
2. Understand the concept of machine learning.
3. Apply various supervised learning techniques to a given problem.
4. Understand unsupervised learning and problems in big data analysis.
5. Demonstrate prescriptive analytics methods to the given data.

UNIT-I

Introduction: Introduction to data and analytics ,taxonomy of data analytics, typical data challenges (data quality, enrichment, integration of ERP & PLM data) ,preparing data for analytics (techniques to improve data quality, integration - ETL).

Descriptive and inferential statistics: Descriptive statistics: introduction, probability distributions, inferential statistics, inferential statistics through hypothesis tests permutation & randomization test, regression & ANOVA.

UNIT-II

Machine Learning: Introduction and concepts, differentiating algorithmic and model based frameworks, regression, ordinary least squares, K nearest neighbours regression & classification.

UNIT-III

Supervised learning with regression and classification techniques: Model validation approaches, discriminantanalysis, quadratic discriminant analysis, regression and classification trees, support vector machine.

Ensemble Methods: Neural networks, deep learning.

UNIT-IV

Unsupervised learning and challenges for big data analytics: Clustering, associative rule mining, challenges for big data analytics.

UNIT-V

Prescriptive analytics: Creating data for analytics through designed experiments, creating data for analytics through active learning, creating data for analytics through reinforcement learning.

Text Books:

1. Hastie, Trevor, "The elements of statistical learning", Vol. 2. No.1.New York, springer, 2009.
2. Montgomery, Douglas C., and George C. "Ranger.Applied statistics and probability for engineers", John Wiley & Sons, 2010
3. Christopher Tong and D. Sriram, "Artificial Intelligence in Engineering Design:Knowledge acquisition, commercial systems, and integrated environments", Boston : Academic Press,1992.

Suggested Reading:

1. Anil Maheswari, “Data Analytics”, McGraw-Hill,2017.
2. V.K.Jain “Data Science and Analytics (with Python, R and SPSS Programming)”, Khanna Publishers, 2018.

18ME E24

INNOVATION AND INTELLECTUAL PROPERTY RIGHTS

(Core Elective - VI)

Instruction 3 Hours per Week	
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Objectives:

1. Fundamental aspects of IP
2. Aspects of IPR acts.
3. Awareness of multi disciplinary audience.
4. Awareness for innovation and its importance.
5. The changes in IPR culture and techno-business aspects of IPR.

Outcomes: At the end of the course, the students are able to

1. Understand the evolution of Intellectual property, working of organization's at global level to protect and promote intellectual property.
2. Apply the patent filing process at national and international level.
3. Derive logical conclusion of research, innovation and patent filing.
4. Compare different kinds of Intellectual property and their patenting system.
5. Understand the techno-legal-business angle of Intellectual property, infringement and enforcement Mechanismsfor protection.

UNIT-I

Overview of IPR: Introduction and the need for intellectual property rights (IPR), IPR in India– genesis and development, IPR abroad, some important examples of IPR, importance of WTO, TRIPS agreement, international conventions and PCT.

Patents: Macro economic impact of the patent system, patent and kind of inventions protected by a patent,patent document, how to protect your inventions, granting of patent, rights of a patent, how extensive is patent protection, why protect inventions by patents, searching a patent, drafting of a patent, filing of a patent, the different layers of the international patent system, (national, regional and international options), compulsory licensing and licensers of right & revocation, utility models, differences between a utility model and a patent, trade secrets and know-how agreements.

UNIT-II

Industrial designs: What is an industrial design, protection of industrial design, kind ofprotection available, term of protection of industrial design and need for protection.

UNIT-III

Trademarks: Definition oftrademarks, types of trademarks and functions of a trademark, registration of Trademark, benefits of registration of trademark, procedure for registration of trademark and term of validity of trademark, infringement and passing off.

UNIT-IV

Copyright: What is copyright, what is covered by copyright, term of enforcement of copyright and need for copyright protection, copyright and related rights, copyrights in computer programming.

UNIT-V

Geographical indications: Introduction, definition, difference between GI and trademark, difference between GI and appellation of origin, GI as factors of rural development, developing a geographical indication and protection

Enforcement of intellectual property rights: Infringement of intellectual property rights enforcement measures emerging issues in intellectual property protection, case studies of patents and IP protection.

Unfair competition: What is unfair competition, relationship between unfair competition and intellectual property laws.

Text Books:

1. AjitParulekar and Sarita D' Souza, "Indian Patents Law – Legal & Business Implications"; Macmillan India ltd, 2006.
2. B. L.Wadehra;" Law Relating to Patents, Trade Marks, Copyright, Designs & Geographical Indications"; Universal law Publishing Pvt. Ltd., India 2000.
3. P. Narayanan; "Law of Copyright and Industrial Designs"; Eastern law House, Delhi 2010.

Suggested Reading:

1. Cronish W.R, "Intellectual Property; Patents, copyright, Trademarks and allied rights", Sweet & Maxwell, 1993.
2. P. Narayanan, "Intellectual Property Law", Eastern Law Edn, 1997.

18PE E12

SUPPLY CHAIN MANAGEMENT

(Core Elective - VI)

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Objectives:

1. The awareness about transportation and warehouse management systems.
2. The designing supply chain networks.
3. The concept of demand and supply and integrating it with supply chain management.
4. The planning and managing inventories.
5. The pricing and revenue management.

Outcomes: At the end of the course, the students are able to

1. Understand fundamentals of supply chain and its key concepts.
2. Design an effective supply chain network.
3. Understand the essence of demand and supply and associated gaps.
4. Apply inventory management techniques.
5. Evaluate pricing and revenue management systems.

UNIT-I

Concept of SCM: Supply chain definition, stages of supply chain, objectives, drivers of SCM-facilities, inventory, transportation, information, sourcing and pricing, decision phases in Supply chain, pull and push processes introduction to logistics management.

UNIT-II

Designing the supply chain network: Role of distribution in supply chain and factors influencing its network design and decisions, types of distribution networks – manufacturer storage with direct shipping, manufacturer storage with direct shipping and in transit merge, distributor storage with package carrier delivery, distributor storage with last mile delivery, manufacturer/distributor storage with customer pickup, retail storage with customer pick up, framework for network design decisions-supply chain strategy, regional facility configuration, desirable sites and location choices.

UNIT-III

Planning supply and demand: Planning demand & supply in a supply chain, demand forecasting- moving averages, exponential smoothing, trend and seasonality, aggregate planning, master scheduling, materials requirement planning, time phased order plan, critical ratio, product tree structures.

UNIT-IV

Planning & managing inventories in a supply chain: Inventory control, objectives of inventory management in supply chain, deterministic inventory and probabilistic inventory control, economic order quantity, quantity discounts, Reorder point, basics of ABC analysis, FNSD analysis, VED analysis.

UNIT-V

Sourcing, pricing, coordination and IT in supply chain: Sourcing decisions, key sourcing related processes, In-house or outsource, pricing & revenue management, differential pricing strategies, coordination in supply chain, bullwhip effect, information technology and supply chain, supply chain macro processes- CRM, ISCM, SRM, TMF.

Text Books:

1. Sunil Chopra & Peter Meindl, “Supply Chain Management – Strategy, Planning and Operation”, Pearson
Education, Inc., Upper Saddle River, New Jersey, 2003.
2. N. J. Kumar &Mukesh Bhatia, “Supply Chain Management”, Neha publishers & Distributors, 2010.
3. Michael H. Hugos, “Essentials of Supply Chain Management”, 3/e, John Wiley & Sons, Inc, Hoboken, New
Jersy, 2011.

Suggested Reading:

1. Martin Christopher, “Logistics & Supply Chain Management”, 5/e, Financial Times Series, 2010.
2. Dobler Donald. W, David.N.Burt, “Purchasing & supply Management Text & Cases”, McGraw-Hill, 1996.

18IT O01

OBJECT ORIENTED PROGRAMMINGUSING JAVA

(Open Elective)

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:

1. To familiarize with fundamentals of object-oriented programming paradigm.
2. To impart the knowledge of string handling, interfaces, packages and inner classes.
3. To facilitate learning Exception handling and Multithreading mechanisms.
4. To gain knowledge on collection framework, stream classes.
5. To familiarize with event driven GUI programming and Database connectivity.

Outcomes: Upon completing this course, students are able to:

1. Understand Object-Oriented concepts.
2. Create Java applications using sound OOP practices e.g. Inheritance, Interfaces, Packages, and Inner Classes.
3. Implement Exception Handling and Multithreading concepts in java programs.
4. Develop programs using the Java CollectionAPI and Stream classes.
5. Design and Develop GUI applications with the integration of event handling, JDBC.

Modified Course Outcomes:

1. Understand the concepts of Object-Oriented Programming and class concept in Java.
2. Apply concepts of OOP such as Inheritance, Interfaces, Packages and Inner classes.
3. Handle exceptions and demonstrate the concepts of Multithreading and Generic classes.
4. Develop programs using Java Collection API and Stream classes.
5. Design and Develop GUI applications with JDBC.

UNIT-I

OOP concepts - Data abstraction, encapsulation, inheritance, benefits of inheritance, polymorphism, classes and objects, Procedural and object oriented programming paradigms.

Introduction to Java: Java's Magic: The Byte code, The Java Buzzwords, Simple Java Programs, Java Primitive Types, Arrays: How to create and define arrays, Basic Operators, Control statements.

Introducing Classes: Declaring objects, methods, Constructors, this keyword, Method Overloading and Constructor Overloading, Objects as parameters, Returning objects, Use of static and final keywords.

UNIT-II

Inheritance: super and subclasses,Member access rules ,super keyword**,** Method overriding, Dynamic method dispatch , Abstract classes, using final with inheritance , Introduction to Object class.

Packages: Defining, Creating and Accessing a Package, Understanding CLASSPATH, importing packages.

Interfaces : Defining and implementing interfaces, Nested Interfaces.

Strings Handling: String &StringBuffer classes, StringTokenizer class and Wrapper classes and conversion between Objects and primitives.

Inner classes in Java: Types of inner classes, Creating static / non-static inner classes, Local and anonymous inner classes.

UNIT-III

Exception Handling in Java: what areExceptions? Exception types**,** Usage of try, catch, throw, throws and finally clauses, writing your own exception classes.

Multithreading in Java: The java Thread Model, How to create threads, Thread class in java, Thread priorities, Thread synchronization.

Generics: What are Generics? Generic classes, bounded types, Generic methods and interfaces.

UNIT-IV

Collections Framework: Overview of Collection Framework, Commonly used Collection classes – ArrayList, LinkedList, HashSet, LinkedHashSet, TreeSet, Collection Interfaces –Collection, List, Set, SortedSet, Accessing a collection via an Iteration,Storing user-defined classes in collections, Map Interfaces and Classes, Using a comparator. Legacy classes – Vector, Hashtable, The Enumeration interface.
Input/Output : How to read user input (from keyboard) using scanner class,Stream classes, InputStream, OutputStream, FileInputStream, FileOutputStream, Reader and Writer, FileReader, FileWriter cl asses. File class.

UNIT-V
GUI Design and Event Handling: Component, Container, window, Frame classes. Working with Frame windowGUI Controls, Layout Managers, Introduction to Swings, Delegation Event Model, Event Classes, Source of Events, Event Listener Interfaces, Handling button click events, Adapter classes. Writing GUI Based applications.
Database Handling in Java: Java Database Connectivity (JDBC) using MySQL.

Text Books:

1. Herbert Schildt, "Java: The Complete Reference", 8th Edition, Tata McGraw Hill Publications, 2011.
2. Cay S. Horstmann, Gary Cornell, "Core Java, Volume I, Fundamentals", 8th Edition, Prentice Hall, 2008.

Suggested Reading:

1. E Balagurusamy "Programming with JAVA", 6th Edition , Tata McGraw-Hill Publishing company Ltd,2019.
2. Sachin Malhotra & Saurabh Choudhary, "Programming in Java", 2nd Edition, Oxford University Press, 2014.
3. C. Thomas Wu, "An introduction to Object-oriented programming with Java", 4th Edition, Tata McGraw-Hill Publishing company Ltd., 2010.
4. Kathy Sierra, Bert Bates, "Head First Java: A Brain-Friendly Guide" 2nd Edition, O'Reilly,2005

Web Resources:

1. https://www.cse.iitb.ac.in/~nlp-ai/javalect_august2004.html.
2. http://nptel.ac.in/courses/106106147/
3. https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-092-introduction-to-programming-in-java-january-iap-2010/lecture-notes/

18 PY O01

HISTORY OF SCIENCE AND TECHNOLOGY
(Open Elective)

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: The objectives of the course is to make the student

1. Gains the knowledge about origin of science in the Stone Age and its progress during Antiquity period.
2. Familiar with scientific views in the Medieval period and during the Industrial revolution..
3. Aware of modern scientific developments from 19th century onwards.

Course Outcomes: After completion of the course, the students will be able to:

1. Demonstrate the process of beginning of science and civilization, knowledge acquisition and philosophical approach of science and its advancements in the Stone Ages and Antiquity period.
2. Illustrate the advancements in science and technology in the medieval period across Asia and Arab countries and decline and revival of science in Europe.
3. Explain the scientific approach and its advances of the Europeans and how the role of engineer during the industrial revolution and the major advancements.
4. Make use of the advancements in the field of science and technology by adopting new philosophies of 19th and first half of 20th century in finding ethical solutions to the societal problems.
5. Interpret the changes in specializations of science and the technology and build the relation between information and society from second half of 20th century onwards.

UNIT-I

Science - The Beginning (through 599 BCE): The Stone Ages, Knowledge among hunter gatherers, Agricultural Revolution and other revolutions, Civilization, Major advances.

Science in Antiquity (600 BCE- 529 CE): Philosophy- a precursor to science, Hellenistic world and the Roman Empire, Other cultures of the period, Major advances.

UNIT-II

Medieval Science (530 CE - 1452 CE): The decline of science in Europe, Science in China, Science and mathematics in India, Arab science, Revival of science in Europe, Technology revolution of the Middle ages, Major advances.

The Renaissance and the Scientific Revolution (1453 CE – 1659 CE): Renaissance, Scientific Revolution, Technology, Major advances.

UNIT-III

Scientific Method: Measurement and Communication (1660 CE – 1734 CE): European domination,The scientific method, Major advances.

The Industrial Revolution (1735 CE – 1819 CE): Industrial Revolution, Rise of the engineer, Major Advances.

UNIT-IV

Science and Technology in the 19th Century (1820 CE – 1894 CE): Philosophical basis of 19th-century science,Science and the public, Science and technology, Major advances.

Rise of Modern Science and Technology (1895 CE – 1945 CE): The growth of 20thcentury science, Newphilosophies, Quantum reality, Energy sources, Electricity: a revolution intechnology, Majoradvances.

UNIT-V

Big Science and the Post-Industrial Society (1946 CE – 1972 CE): Big science, Specialization and changing categories, Technology changes society, Major advances.

The Information Age (1973 CE – 2015 CE): Information and society, Globalization, The post-

industrial society,Problems of the Information age, Major Advances

Text Books:

1. Bryan Bunch and Alexander Hellemans, “The History of Science and Technology”, Houghton Mifflin Company (New York), 2004
2. JD Bernal, “Science in History”, 4 Volumes, Eklavya Publishers, 2012

Suggested Readings:

1. “The 100 Most Influential Scientists of All Time”, Edited by Kara Rogers, Britannica Educational Publishing, 2010
2. Alberto Hernandez, “A Visual History of Science and Technology”, The Rosen Publishing Group, 2016

18EG O 02

GENDER SENSITIZATION
(Open Elective)

Instruction	3 Periods per week
Duration of SEE Examination	3 Hours
SEE Examination	60 Marks
CIE	40 Marks
Credits 3	

Objectives: This course will introduce the students to:

1. Sensibility regarding issues of gender in contemporary India.
2. A critical perspective on the socialization of men and women.
3. Popular debates on the politics and economics of work while helping them reflect critically on gender violence.

Outcomes: After completion of the course the students are able to

1. Understand the difference between "Sex" and "Gender" and be able to explain socially constructed theories of identity.
2. Recognize shifting definitions of "Man" and "Women" in relation to evolving notions of "Masculinity" and "Femininity".
3. Appreciate women's contributions to society historically, culturally and politically.
4. Analyze the contemporary system of privilege and oppressions, with special attention to the ways gender intersects with race, class, sexuality, ethnicity, ability, religion, and nationality.
5. Demonstrate an understanding of personal life, the workplace, the community and active civic engagement through classroom learning.

UNIT – I
Understanding Gender:
Gender: Why Should We Study It? (Towards a World of Equals: Unit -1)
Socialization: Making Women, Making Men (Towards a World of Equals: Unit -2) Introduction. Preparing for Womanhood. Growing up Male. First lessons in Caste. Different Masculinities.

UNIT – II
Gender And Biology:
Missing Women: Sex Selection and Its Consequences (Towards a World of Equals: Unit -4) Declining Sex Ratio. Demographic Consequences.
Gender Spectrum: Beyond the Binary (Towards a World of Equals: Unit -10) Two or Many? Struggles with Discrimination.

UNIT – III
Gender and Labour:
Housework: the Invisible Labour (Towards a World of Equals: Unit -3) "My Mother doesn't Work." "Share the Load."
Women's Work: Its Politics and Economics (Towards a World of Equals: Unit -7) Fact and Fiction. Unrecognized and Unaccounted work. Additional Reading: Wages and
Conditions of Work.

UNIT-IV
Issues Of Violence
Sexual Harassment: Say No! (Towards a World of Equals: Unit -6) Sexual Harassment, not Eve-teasing- Coping with Everyday Harassment- Further Reading: "Chupulu".
Domestic Violence: Speaking Out (Towards a World of Equals: Unit -8) Is Home a Safe Place? -When Women Unite [Film]. Rebuilding Lives. Additional Reading: New Forums for Justice. Thinking about Sexual Violence (Towards a World of Equals: Unit -11) Blaming the Victim-"I Fought for my Life…." - Additional Reading: The Caste Face of Violence.

UNIT – V

Gender: Co - Existence

Just Relationships: Being Together as Equals (Towards a World of Equals: Unit -12) Mary Kom and Onler. Love and Acid just do not Mix. Love Letters. Mothers and Fathers. Additional Reading: Rosa Parks- The Brave Heart.

Textbook:

1. A. Suneetha, Uma Bhrugubanda, DuggiralaVasanta, Rama Melkote,VasudhaNagaraj, AsmaRasheed, GoguShyamala, DeepaSreenivas and Susie Tharu **"Towards a World of Equals: A Bilingual Textbook on Gender"** published by Telugu Akademi, Hyderabad, Telangana State, **2015**.

Suggested Reading:

1. Menon, Nivedita. Seeing like a Feminist. New Delhi: Zubaan-Penguin Books, 2012
2. Abdulali Sohaila. **"I Fought For My Life…and Won."**Available online at: http://www.thealternative.in/lifestyle/i-fought-for-my-lifeand-won-sohaila-abdulal/

Web Resources:

1. https://aifs.gov.au/publications/gender-equality-and-violence-against-women/introduction
2. https://theconversation.com/achieving-gender-equality-in-india

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Note: Since it is an Interdisciplinary Course, Resource Persons can be drawn from the fields of English Literature or Sociology or Political Science or any other qualified faculty who has expertise in this field from engineering departments.

18ITO03

PRINCIPLES OF INTERNET OF THINGS

(Open Elective)

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:

1. To provide an overview of Internet of Things, building blocks of IoT andreal-world applications.
2. To explore various IOT enabling technologies.
3. To facilitate students, understand Python scripts for IoT platform.
4. To identify steps in IOT design Methodology.
5. To introduce about the Raspberry Pi device, its interfaces and Django Framework.

Outcomes: Upon completing this course, students are able to:

1. Comprehend the terminology, protocols and communication modelsof IoT.
2. Define the various IoT enabling technologies and differentiate between M2M and IoT.
3. Acquire the basics of Python Scripting Language used in developing IoT applications.
4. Describe the steps involved in IoT system design methodology.
5. Design simple IoT systems using Raspberry Pi board and interfacing sensors with Raspberry Pi.

Modified Course Outcomes:

1. Outline the terminology, protocols, Communication models and Communication APIs of IoT.
2. Define the various IoT enabling technologies, Levels, Domain Specific applications and differentiation between M2M and IoT.
3. Make use the basics of Python Scripting Language for developing IoT applications.
4. Infer the steps involved in IoT system design methodology with Home Automation case study.
5. Examine IoT systems using the Raspberry Pi board and interfacing sensors.

UNIT-I

Introduction & Concepts: Introduction to Internet of Things- Definitions & Characteristics ofIoT, Physical Design of IOT-Physical Layer, Network Layer, Transport Layer, Application Layer, Things in IoT, IoT Protocols, Logical Design of IOT-IoTFunctional Blocks, IoT Communication Models-Request-reponse,Publisher-Subscriber,Push-Pull,Exclusive Pair, IoT Communication APIs-REST API, Websocket API,

UNIT-II

IOT Enabling Technologies: Wireless Sensor Networks, Cloud Computing, Big Data Analytics,Communication Protocols, Embedded Systems, IOT Levels & Deployment Templates. Differences and similarities between IOT and M2M, Domain Specific IoT's – IoT applications for Home Automation, Cities, Environment, Energy,Retail, Logistics, Agriculture, Industry, health and Lifestyle.

UNIT-III

Introduction to Python–Motivation for using Python for designing IoT systems, Languagefeatures of Python, Data types- Numbers, Strings, Lists, Tuples, Dictionaries, Type Conversions,Data Structures: Control of flow-if, for, while, range, break/continue, pass, functions, modules,packaging, file handling, data/time operations, classes, Exception handling,

UNIT-IV

IoT Platforms Design Methodology: Introduction, IoT Design Methodology Steps-Purpose andRequirements Specification, Process Specification, Domain Model Specification, InformationModel Specification, Service Specifications, IoT Level Specification, Functional ViewSpecification, Operational View Specification, Device and Component Integration, ApplicationDevelopment, Case Study on IoT System for Weather Monitoring.

UNIT-V

IoT Physical Devices and End Points: Basic building blocks of an IoT device, RaspberryPi abouttheRaspberry Pi board, Raspberry Pi interfaces-Serial, SPI,I2C, Other IoTDevicespcDuino,BeagleBone Black, Cubieboard.Python Web Application Framework: Django Framework-Roles of Model, Template and View.

Text Books:

1. ArshdeepBahga and Vijay Madisetti, "Internet of Things - A Hands-on Approach, Universities Press, 2015.
2. Getting Started with Raspberry Pi, Matt Richardson & Shawn Wallace, O'Reilly (SPD), 2014.

18CSO 09

BASICS OF ARTIFICIAL INTELLIGENCE
(Open Elective)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Pre-requisites: Basic Mathematics.

Course Objectives: The main objectives of this course are:

1. To Provide fundamental concepts in Artificial Intelligence.
2. Discuss the various paradigms involved in solving an AI problems which involve perception, reasoning and learning
3. Apply the AI concepts to build an expert system to solve the real-world problems.

Course Outcomes: On Successful completion of this course, student will be able to

1. Identify various search strategies to solve problems.
2. Compare and contrast knowledge representation schemes.
3. Apply Bayesian Networks and Dempster Shafer theory for reasoning
4. Explain the role of agents and interaction with the environment
5. Determine different learning paradigms.
6. Explain robotic architectures and expert systems.

UNIT - I

Introduction: Definition, history, applications. Problem Solving: AI problems, AI Technique, Defining problem as a State-Space Search, Problem Characteristics. Heuristic Search Techniques: Generate–and–test, Hill Climbing, Constraint Satisfaction.

UNIT - II

Knowledge Representation (Logic): Representing facts in logic, proposition logic, predicate logic, resolution and unification. Knowledge Representation (Structured): Declarative representation, Semantic nets, procedural representation, frames.

UNIT - III

Reasoning: Probability and Bayes theorem, Certainty factors and Rule based systems, Bayesian Networks, Dempster-Shafer Theory. Planning: Components, goal stack planning, nonlinear planning, hierarchical planning.

UNIT - IV

Learning: Introduction, Rote learning, learning by taking advice, learning in problem solving and learning from examples: Decision tree. Intelligent Agents: Classification, Working of an agent, single agent and multi agent systems, multi agent application.

UNIT - V

Expert System: Representing and Using Domain Knowledge, Expert systems shells, Explanation, Knowledge Acquisition. Perception and Action: Real Time Search, Vision, Speech Recognition, ACTION: Navigation, Manipulation, Robot architectures.

Text Books:

1. Elaine Rich, Kevin Night, Shivashankar B Nair, “Artificial Intelligence”, 3rd Edition, 2008
2. Russell Norvig, “Artificial Intelligence-Modern Approach”, 3rd edition, 2010.

Suggested Reading:

1. Saroj Kaushik, “Artificial Intelligence”, Cengage Learning India, 2012.
2. Nelson M. Mattos, “An Approach to Knowledge Base Management”, Springer Berlin Heidelberg, 1991.

Online Resources:

1. http://nptel.ac.in/courses/106106126/
2. http://nptel.ac.in/courses/106105077/

18ME C25

METROLOGY AND INSTRUMENTATION LAB

Instruction	3Hours per week
Duration of SEE	3 Hours
SEE	50Marks
CIE	25 Marks
Credits	1.5

Objectives:

1. To choose the proper measuring instrument for the precise measurement of length, height and diameter.
2. To classify the different measuring instruments used for the angular measurement.
3. To develop gear & screw thread parameters using optical projector and tool maker's microscope.
4. To analyze the limits, fits and tolerances for selection and design of gauges.
5. To determine the working principles in the measurement of Flatness, Roundness and Surface roughness.

Outcomes: At the end of the course, the students are able to

1. Measure the linear dimension by using appropriate method & device.
2. Demonstrate the knowledge of angular measurementsand use measuring instruments as per requirements.
3. Determine the gear and screw thread parameters using profile projector and tool makers' microscope.
4. Design and test plain limit gauges for a given specimen.
5. Evaluate and estimate the measurement of flatness, roundness and surface roughness.

Experiments:

1. Measurement with inside, outside and depth micrometers.
2. Measurement with height gauges, height masters.
3. Measurement of linear and angular dimensions with Tool maker's microscope – diameter of thin wire and single point cutting tool angle.
4. Measurement with dial indicator and its calibration.
5. Measurement of angles with sine bar and clinometers.
6. Measurement of roundness errors with bench centers.
7. Measurement of flatness errors of a surface plate with precision spirit level.
8. Measurement with optical profile projector.
9. Design of plugand snap gauges for a given component.
10. Surface roughness measurement by Taylor Hobson -Talysurf.
11. Measurement of gear tooth thickness by gear tooth vernier.
12. Displacement measurement with LVDT.
13. Analyze, assess, measure and document all Measuring attributes of a selected component by using appropriate methods and devices.

Note: Student should complete a minimum of 10 experiments including experiment number 13 which is compulsory.

Text Books:

1. R.K. Jain, "Engineering Metrology", Khanna Publications, 1996.
2. Doeblin, "Measurement Systems Application and Design", TMH, 5/e., 2004.
3. Beckwith, Buck, Lienhard, "Mechanical Measurements", PEA, 3rd Indian Reprint, 2001.

Suggested Reading:

1. RegaRajendra," Principles of Engineering Metrology", Jaico Publishing House, Mumbai, 2008.
2. B.C. Nakra& K.K. Chaudhary , "Instrumentation Measurement and Analysis", 3/e, McGraw-Hill, 20

18ME
C27

PROJECT: PART - 1

Instruction	4 Hours per week
Duration of SEE	----
SEE	----
CIE	50 Marks
Credits	2

Objective: The objectiveof Project Part -1 is to enable the student take up investigative study in the broad field of Engineering / Technology, either fully theoretical/practical or involving both theoretical and practical work to be assigned by the Department on an individual basis or two/three students in a group, under the guidance of a supervisor. This is expected to provide a good initiation for the student(s) towards R&D.

Outcomes: At the end of the course, the students are able to

1. Identify a topic in advanced areas of Mechanical / Allied fields of Engineering.
2. Review literature to identify the gaps, define the objectives and scope of the work.
3. Generate innovative ideas for societal benefit and Nation building.
4. Develop prototypes/models, experimental setup and software systems necessary to meet the objectives.
5. Prepare a technical report and present before the departmental committee

The work shall include:

1. Survey and study of published literature on the assigned topic.
2. Working out a preliminary Approach to the Problem relating to the assigned topic.
3. Conducting preliminary Analysis/Modelling/Simulation/Experiment/Design/Feasibility.
4. Preparing a Written Report on the Study conducted for Presentation to the Department.
5. Final Seminar, as oral Presentation before a departmental Committee.

Guidelines for the award of marks:

Evaluation by	Maximum Marks	Evaluation Criteria / Parameter
Supervisor	20	Project Status / Review
	5	Report
Departmental Committee	5	Relevance of the Topic
	5	PPT Preparation
	5	Presentation
	5	Question and Answers
	5	Report Preparation

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (A)

AICTE MODEL CURRICULUM

B.E. (PRODUCTION ENGINEERING)

SEMESTER – VIII

S. No.	Course Code	Title of the Course	Scheme of instruction			Scheme of examination			Credits
			Hours per week			Duration in Hours	Maximum Marks		
			L	T	P/D		CIE	SEE	
THEORY									
1		Open Elective – II	3	--	--	3	30	70	3
2		Open Elective – III	3	--	--	3	30	70	3
PRACTICALS									
3	18PE C14	Technical Seminar (On the latest trends and other than Project)	--	--	2	--	50	--	1
4	18PE C15	Project: Part - 2	10	--	--	--	100	100	10
		TOTAL	**16**	--	**2**	--	**210**	**240**	**17**

L: Lecture T: Tutorial D: Drawing P: Practical
CIE - Continuous Internal Evaluation SEE – Semester End Examination

Open Elective – II (3/3)			**Open Elective – III (3/3)**		
SNO	**Subj. Code**	**Name of the Subject**	**SNO**	**Subj. Code**	**Name of the Subject**
1	18EC O01	Remote Sensing and GIS	1	18EG O01	Technical Writing Skills
2	18MT O01	Decision Theory	2	18BT O01	Basics of Biology
3	18EE O03	Energy Auditing	3	18CE O02	Disaster Mitigation and Management
4	18CS O04	Basics of Cyber Security	4	18EE O05	Waste Management
5	18EC O05	MEMS and its Applications	5	18EC O07	Systems Automation & Control

With Effect from the Academic Year 2019 – 2020

18EC O01

REMOTE SENSING AND GIS

(Open Elective)

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:

This course aims to:

1. Explain the fundamental concepts of remote sensing and digital imaging techniques.
2. Make the students to understand the principles of thermal and microwave remote sensing.
3. Make the students understand the significance of GIS and the process of GIS.

Course Outcomes:

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

1. Demonstrate the understanding of basic concepts of remote sensing and interpret energy interactions.
2. Choose an appropriate technique for a given scenario by appreciating the types of remote sensing.
3. Distinguish the principle behind the working of microwave and LiDAR sensing.
4. Apply an appropriate data model from the acquired knowledge of the basics of GIS.
5. Explain the procedure for encoding data and geospatial data analysis.

UNIT-I

Concept of Remote Sensing: Remote sensing definition, data, process, EM bands used in remote sensing, Interactions and recording of energy: interaction with atmosphere, interaction with earth surface features (soil, water, vegetation), recording of energy by sensors, Transmission, reception and processing, Image interpretation and analysis, Applications, Advantages and limitations of Remote sensing, Orbits of Remote sensing satellites, Indian remote sensing satellites.

UNIT-II

Digital Imaging: Types of Remote sensing, Sensor resolutions, Digital Image, Sensor components, Principle of a long-track and across-track scanning, Hyperspectral Imaging, Thermal Remote Sensing.

UNIT-III

Microwave Remote Sensing: Active and Passive Microwave Remote Sensing, Radar Imaging: Key components of imaging radar, viewing geometry, spatial resolution, principle of RAR, SAR and their range resolution, Satellite Radar Imaging, LIDAR.

UNIT-IV

Concept of Geographic Information Systems: Key components of GIS, joining spatial and attribute data, functions, advantages and applications of GIS, Spatial data model, Raster data model, Vector data model.

UNIT-V

Process of GIS and Geospatial analysis: Data sources, encoding raster data, encoding vector data, encoding attribute data, linking spatial and attribute data, Geospatial data analysis methods database query, geospatial measurement, overlay operations, network analysis and surface analysis. Integration of GIS and remote sensing.

Text Books:

1. Basudeb Bhatta, “Remote Sensing and GIS”, 2/e, Oxford University Press, 2012.

2. Lillesand T.M., and Kiefer R.W. “Remote Sensing and Image Interpretation”, 6/e, John Wiley &Sons, 2000.

Suggested Reading:

1. James B. Campbell and Randolph H. Wynne, “Introduction to Remote Sensing”, the Guilford Press, 2011.
2. Michael N DeMers, “Fundamentals of GIS”, 2/e, John Wiley, 2008.

18MTO 01

DECISION THEORY
(OPEN ELECTIVE)

Instruction	3L Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:

1. To explain procedure of LPP
2. To discuss various methods to get optimum solution.
3. To analyse the optimum solution by Hungarian method.
4. To demonstrate the algorithm for job sequencing.
5. To discuss method of finding solution of Dynamic programming problem..

Course Outcomes:

On the successful completion of this course, the student shall be able to

1. Calculate the optimum values for given objective function by LPP
2. Solve the solution for maximise the profit with minimum cost by Transportation problem.
3. Determine the optimum feasible solution for sequencing the Jobs
4. Arrange the jobs for different Machines to get optimum values
5. Measure the solution of dynamical system problems

UNIT-I: Introduction to Operations Research: Basics definition, scope, objectives, phases, models and limitations of Operations Research, Linear Programming Problem-Formulation of LPP, Graphical solution of LPP, Simplex Method, Artificial variables, big-M method.

UNIT-II: Transportation problems, Formulation, solution, unbalanced transportation problems, finding basic feasible solutions-Northwest corner rule, least cost method and Vogel's approximations method, Optimality test: the stepping stone method and MODI method.

UNIT-III: Assignment model, formulation, Hungarian method for optimal solution, solving unbalanced problem, Traveling salesman problem and assignment problem

UNIT IV: Sequencing models, solution of sequencing problem-processing n jobs through 2 Machines-processing n jobs through 3 Machines-processing 2 jobs through m machines-processing n jobs through m machines.

UNIT-V: Dynamic Programming, Characteristics of dynamic programming, Solution of LPP by dynamic programming and Network scheduling by PET/CPM.

Text Books:

1. P.SankaraIyer, "Operations Research", Tata McGraw-Hill, 2008.
2. A.M.Natarajan, P.Balasubramani, A.Tamilarasi, "Operations Research", Pearson Educairons, 2005.

Suggested Reading:

1. J K Sharma, "Operations Research Theory & Applications, 3e", Macmillan India Ltd, 2007.
2. P.K.Gupta and D.S.Hira, "Operations Research", S.Chand& Co, 2007.
3. Kranti Swarup , P.K.Gupta and Man Mohan "Operations Research", Sultan Chand & Sons, 2019.

18EE O 03

ENERGY AUDITING

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course objectives:

1. To know the concept of Energy auditing
2. To understand the formulation of efficiency for various engineering systems
3. To explore the different ways to design various technologies for efficient engineering systems.

Outcomes: After completion of this course, students are able to:

1. Know the current energy scenario and importance of energy auditing.
2. Understand the concepts of energy auditing.
3. Evaluate the performance of existing engineering systems
4. Explore the methods of improving energy efficiency in different engineering systems
5. Design different energy efficient devices.

UNIT-I

Basics of Energy and its various forms: Overview of engineering, elements Solar energy, electricitygeneration methods using solar energy, PV cell, elements of wind energy, electricity generation using wind energy, elements of bio energy, bio mass energy conservation, elements of geothermal energy, sources of geothermal energy, sources of chemical energy, fuel cells, Energy Scenario in India

UNIT-II

Energy Auditing-1: Introduction : Need for energy audit, directions for the study of energy auditing,inclusions for energy auditing, types of energy audit: preliminary audit, general/mini audit, investment-grade/ comprehensive audit. Major energy consuming equipments and systems, energy audit team, energy auditing methodology: preliminary and detailed. Process flow diagram, energy audit report format

UNIT-III

Energy Auditing-2: For buildings: Energy auditing instruments, energy efficiency, energy auditing forbuildings: stages in programs, surveying, measurements and model analysis. Energy audit form of commercial buildings, checklist for energy saving measures

UNIT –IV

Energy Efficient Technologies-I: Importance of energy efficiency for engineers, Energy efficient technology
in mechanical engineering: Heating, ventilation and air-conditioning, boiler and steam distribution systems Energy efficient technology in civil engineering: future of roads, harnessing road and transport infrastructure;

UNIT-V

Energy Efficient Technologies-II : Energy efficient technology in electrical engineering: Electricity billing,electrical load management and maximum demand control, power factor improvement and its benefit, selection and location of capacitors; Energy efficient technology in chemical engineering: green chemistry, low carbon cements, recycling paper

Text Books:

1. Umesh Rathore, 'energy management', Kataria publications, 2nd ediiton, 2014.
2. Guide books for National Certification Examination for Energy Manager / Energy Auditors Book-1, General Aspects
3. Hargroves, K., Gockowiak, K., Wilson, K., Lawry, N., and Desha, C. (2014) An Overview of Energy Efficiency Opportunities in Mechanical/civil/electrical/chemical Engineering, The University of Adelaide and Queensland University of Technology.

Suggested reading:

1. Success stories of Energy Conservation by BEE, New Delhi (www.bee-india.org)

18CSO 07

BASICS OF CYBER SECURITY
(Open Elective)

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Pre-requisites: Operating System, Computer Network, Cryptography.

Course Objectives: The main objectives of this course are:

1. To Identify and present indicators that a cybercrime has occurred and understand methods and tools used in cybercrimes.
2. To collect, Process, Analyze and Present Computer Forensics Evidence.
3. To understand the legal perspectives and Organizational implications of Cyber Security

Outcomes: On Successful completion of this course, student will be able to

1. Listthe different types of cybercrimes and analyze legal frameworks to handle cybercrimes.
2. Identify the Tools and Methods used in cybercrimes.
3. Analyze and resolve cyber security issues and laws governing Cyberspace.
4. Describe the need of Digital Forensics and the importance of digital evidence in prosecution.
5. Interpret the commercial activities in the event of significant information security incidents in the Organization.
6. Discuss the vulnerabilities in networking protocols and their mitigation techniques.

UNIT - I

Introduction to Cyber Crime: Cyber Crime: Definition and Origins of the Word, Cyber crime and Information Security, Classification of Cyber Crimes, Cyber Crime: The Legal Perspective, Cyber Crime: An Indian Perspective, A Global Perspective of Cyber Crime.

UNIT - II

Cyber Offenses: Introduction, How Criminals plan the Attacks, Social Engineering, Cyber stalking, Cyber cafe and Cybercrimes, Botnets: The Fuel for Cybercrime, Attack Vector.

Tools and Methods Used in Cybercrime: Introduction, Proxy Servers and Anonymizers, Phishing, Password Cracking, Keyloggers and Spywares, Virus and Worms, Trojan Horse and Backdoors, Steganography, DoS and DDoS attacks, SQL Injection, Buffer Overflow.

UNIT - III

Cyber Security: The Legal Perspectives: Cyber Crime and the Legal Landscape around the World, Need of Cyber laws: the Indian Context, The Indian IT Act, Challenges to Indian Law and Cyber Crime Scenario in India, Digital Signatures and the Indian IT Act, Cyber Crime and Punishment, Cyber Law, Technology and Students: The Indian Scenario.

UNIT - IV

Understanding Cyber Forensics: Introduction ,Digital Forensics Science, Need for Computer Forensics, Cyber Forensics and Digital Evidence, Forensics Analysis of Email, Digital Forensics Life Cycle, Chain of Custody Concept, Network Forensics, Approaching a Cyber Forensics Investigation, Challenges in Computer Forensics.

UNIT - V

Cyber Security: Organizational Implications: Introduction, Cost of Cybercrimes and IPR issues, Web threats for Organizations, Security and Privacy Implications, Social media marketing: Security Risks and Perils for Organizations, Social Computing and the associated challenges for Organizations.

Text Books:

1. Sunit Belpre and Nina Godbole, “Cyber Security: Understanding Cyber Crimes, Computer Forensics And Legal Perspectives”, Wiley India Pvt.Ltd, 2011.
2. Kevin Mandia, Chris Prosise, “Incident Response and computer forensics”, Tata McGraw Hill, 2006.

Suggested Reading:

1. Alfred Basta, Nadine Basta, Mary Brown, Ravinder Kumar, “Cyber Security and Cyber Laws”, Paperback – 2018.
2. Mark F Grady, Fransesco Parisi, “The Law and Economics of Cyber Security”, Cambridge university press, 2006.

Online Resources:

1. https://www.edx.org/learn/cybersecurity
2. https://www.coursera.org/courses?query=cyber%20security
3. https://swayam.gov.in/course/4002-cyber-law

18EC O05

MEMS AND ITS APPLICATIONS
(Open Elective)

Instruction	3 L Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:
This course aims to:
1. Provide knowledge of semiconductors, various materials used for MEMS.
2. Introduce various Electrostatic and Thermal Sensors and Actuators.
3. Educate on the applications of MEMS to various disciplines.

Course Outcomes:
Upon completion of this course, students will be able to:
1. Understand various materials used for MEMS.
2. Design the micro devices and systems using the MEMS fabrication process.
3. Analyze the operation of different Sensors and Actuators.
4. Interpret the micro devices and systems using Polymer MEMs.
5. Apply different MEMS devices in various disciplines.

UNIT- I
Introduction: The History of MEMS Development, The Intrinsic Characteristics of MEMS: Miniaturization, Microelectronics Integration, Parallel Fabrication with Precision, Devices: Sensors and Actuators- Energy Domains and Transducers, Sensors Considerations, Sensor Noise and Design Complexity: Actuators Considerations.

UNIT- II
Introduction to Micro Fabrication: Overview of Micro fabrication, Overview of Frequently used Micro fabrication Processes: Photolithography, Thin Film Decomposition, Thermal Oxidation of Silicon, Wet Etching, Silicon Anisotropic Etching, Plasma Etching and Reactive Etching, Doping, Wafer Dicing, Wafer Bonding, Microelectronics Fabrication Process Flow, Silicon based MEMS Processes, Packaging and Integration, Process Selection and Design.

UNIT- III
Electrostatic Sensing and Actuation: Introduction to Electrostatic Sensors and Actuators, Parallel: Plate Capacitor, Applications of Parallel Plate Capacitors, Interdigitated Finger Capacitors, Applications of Combo Drive Devices: Inertia Sensors, Actuators. Thermal Sensing and Actuation: Introduction to Thermal Sensors, Thermal Actuators, Fundamentals of Thermal Transfer, Sensors and Actuators Based on Thermal Expansion, Thermal Couples, Thermal Resistors, Applications- Inertia Sensors, Flow Sensors, Infrared Sensors.

UNIT- IV
Piezo resistive Sensors: Origin and Expression of Peizo resistivity, Piezo resistive Sensor Materials: Metal Strain Gauges, Single crystal Silicon, Polycrystalline Silicon, Applications of Piezo resistive Sensors: Inertial sensors, Pressure Sensors, Tactile Sensors, flow Sensors. Piezoelectric Sensors: Introduction, Properties of Piezoelectric Materials, Applications- Inertia Sensors, Acoustic Sensors, Tactile Sensors, Flow Sensors.

UNIT- V

Polymer MEMS: Introduction, Polymers in MEMS- Polyimide, SU-8, Liquid Crystal Polymer(LCP), Representative Applications- Acceleration Sensors, Pressure Sensors, Flow Sensors, Tactile Sensors. Case Studies of Selected MEMS Products: Blood Pressure (BP) Sensor, Microphone, Acceleration Sensor and Gyros.

Text Books:

1. Chang Liu, "Foundations of MEMS", 2/e, Pearson Education Inc., 2012.
2. Tai Ran Hsu, "MEMS & Micro Systems Design and Manufacture", Tata McGraw Hill, 2002.

Reference Books:

1. P. Rai Choudary, "MEMS and MEMS Technology and Applications", PHI publications, 2009.
2. Mohamed Gad-el-Hak, "The MEMS Handbook", CRC press, 2001.

18EG O01

TECHNICAL WRITING SKILLS
(Open Elective)

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	60 marks
CIE	40 marks
Credits	3

Objectives : The course will introduce the students to:

1. Process of communication and channels of communication in general and technical writing.
2. Technical Writing and also contextual use of technology specific words.
3. Business letters and technical articles.
4. Technical reports and technical proposals.
5. Transferring data from verbal to graphic and vice versa and making technical presentations.

Outcomes : After successful completion of the course students are able to:

1. Understand the channels of communication and define nature and aspects of Technical communication
2. Compare and contrast technical communication to that of general communication while constructing error free sentences applying features of technical writing.
3. Analyze data, draw inferences to write Journal articles and conference papers and to compose business letters.
4. Evaluate data to draft technical reports and technical proposals.
5. Design a technical presentation by understanding the nuances of presentation skills and also transfer data from verbal to graphic and vice versa.

Unit I

Communication – Nature and process.

Channels of Communication – Downward, upward and horizontal and lateral communication; Barriers to communication.

Technical Communication – Definition ; oral and written communication. Importance and need for Technical communication. Nature of Technical Communication; Aspects and forms of Technical communication. Technical communication Skills – Listening, Speaking, Reading & Writing.

Unit II

Technical Writing – Techniques of writing. Selection of words and phrases in technical writing. Differences between technical writing and general writing. Abstract and specific words. Sentence structure and requisites of sentence construction. Paragraph length and structure.

Unit III

Business correspondence – Sales letters, letters of Quotation; Claim and Adjustment letters.

Technical Articles: Nature, significance and types of technical articles. Writing an abstract. Journal articles and Conference papers. Elements of technical articles.

Unit IV

Technical Reports : Types, significance, structure, style and writing of reports. Routine reports, Project reports.

Technical Proposals : Definition, types, characteristics, structure and significance.

Unit V

Information Transfer – Graphic to verbal (written) and verbal to graphic.

Technical Presentations : Important aspects of oral and visual presentations.

Text Book :

1. Meenakshi Raman & Sangeeta Sharma, **"Technical Communications-Principles and Practice",** Oxford University Press, Second Edition, 2012.
2. 1.M Ashraf Rizvi, **"Effective Technical Communication",** Tata McGraw Hill Education Pvt Ltd, 2012.

Suggested Reading :

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1. .Kavita Tyagi & Padma Misra, **"Basic Technical Communication",** PHI Learning Pvt Ltd, 2012.
2. R.C Sharma & Krishna Mohan, **"Business Correspondence and Report Writing",** Tata McGraw Hill, 2003

Web Resources:

1. **https://onlinecourses.nptel.ac.in/noc18_mg13/preview**
2. **https://www.technical-writing-training-and-certification.com/**
3. **https://academy.whatfix.com/technical-writing-skills**

18BT O01

BASICS OF BIOLOGY
(Open Elective-I)

Instruction	3LHoursperWeek
DurationofSEE	3Hours
SEE	70Marks
CIE	30Marks
Credits	3

Course Objectives: This course aims to:

1. Impart knowledge of origin and evolution of biological organisms.
2. Understand the structure and functions of humanorgan systems.
3. Understand theprinciples behind medicaldevices for diagnosis of human health and environment protection.
4. Give an insight of biological information, relationship and genome sequencing of various organisms.

Course Outcomes: Afterthe completion of this course, the student will be able to:

1. Explain the theories of origin and evolution of life.
2. Describe the anatomical structure and physiological functions of thehuman organ systems.
3. Outline the principle and applications of medical devises.
4. Discussthe technology advancements in improving human health and environment
5. Explain the biological information, sequencing and evolutionary relationship among organisms.

UNIT-I

IntroductiontoBiology: ClassicalVsModernBiology;ImportanceofBiological Science and Historical developments; Origin of Life, UreyMillerExperiment, Spontaneous Generation Theory; Three Domains of Life; Principle and ApplicationsofMicroscope(LightandElectronMicroscope),Prokaryoticand Eukaryotic Cell-Structure and their differences.

UNIT-II

Humanorgansystemsandtheirfunctions -I:Introduction to various organ systems of humanbody and their functions; SkeletalSystem-Bones,Tendon,Ligaments,principleandapplicationsinknee replacement; Nervous System - Structure of Brain, Spinal Cord, Neuron, Neurotransmitters,Synapse,Alzheimer's-acasestudy,principleandapplications ofImagingTechniques(CT&MRIscans);CirculatorySystem-Heartstructureand functions, principle and applications of cardiac devices (Stent and Pacemaker), Artificial heart, blood components and typing, haemocytometer.

UNIT-III

HumanAnatomyandFunctions-II: RespiratorySystems-Lungstructureand function, principle and applications of Peak FlowMeter,ECMO(ExtraCorporeal Membrane Oxygenation); Excretory Systems-Kidney structure and function, principleandapplicationsofDialysis;Prenataldiagnosis;Assistedreproductive techniques-IVF,Surrogacy.

UNIT-IV

Medical Biotechnology and Bioremediation: Cells of Immune System, Etiology of cancer, Cancer treatment (Radiation Therapy); Stem Cells and its Clinical applications; Scaffolds and 3D printing of organs; Bio sensors and their applications; Parts of bioreactor and its types; Bioremediation.

UNIT-V

Bioinformatics: Nucleic acid composition, Genetic Code, Amino acid, Polypeptide, Levels of protein

structure, Homolog, Ortholog and Paralog, Phylogenetics, Genome Sequencing, Human GenomeProject, Next generation sequencing.

TextBooks:

1. Campbell,N.A.,Reece,J.B.,Urry,Lisa, Cain,M,L.,Wasserman,S.A.,Minorsky,P.V.,Jackson,R.B. "Biology: A Global Approach", 11th edition,Pearson EducationLtd. 2017
2. Shier,David,Butler,Jackie, Lewis,Ricki., "Hole'sHumanAnatomy&Physiology", 13th edition, McGrawHill2017.
3. Dubey RC " A Text book of Biotechnology" 5th Edition, S Chand and Company limited, 2014.
4. Bernard R. Glick, T. L. Delovitch, Cheryl L. Patten, "Medical Biotechnology", 1st edition, ASMPress,2014.

18CE O02

DISASTER MITIGATION AND MANAGEMENT (M)

(Open Elective)

Instruction	3 L Hours per Week
End Examination	3 Hours
Semester End Examination	70 Marks
Continuous Internal Evaluation	30 Marks
Credits	3

Course Objectives: This course aims to,

1. Equip the students with the basic knowledge of hazards, disasters, risks and vulnerabilities.
2. Impart knowledge in students about the nature, causes, consequences and mitigation measures of the various Hydro-meteorological disasters.
3. Introduce the concepts of causes, consequences and mitigation measures of the various Geographical disasters.
4. Enable the students to understand risks, vulnerabilities and human errors associated with human induced disasters.
5. Equip the students with the knowledge of the impacts of disaster, chronological phases in a disaster management cycle and to create awareness about the disaster management framework and legislations in the context of Central and State Level Authorities.

Course Outcomes: Upon completion of this course, the student will be able to,

1. Identify and understand the fundamental terminologies in disaster management.
2. Distinguish between the Hydro-meteorological disasters and apply the concepts of structural and non-structural mitigation measures.
3. Categorize different Geographical Disasters and apply the knowledge in utilizing the early warning systems.
4. Analyze various mechanisms and consequences of human induced disasters.
5. Develop an awareness of disaster management phases and formulating effective disaster management plans, ability to understand various participatory roles of stakeholders- Central and State Government bodies at different levels.

UNIT- I:

Introduction: Basic definitions- Hazard, Disaster, Vulnerability, Risk, Resilience, Mitigation, Management; classification of types of disaster- Natural and manmade; Introduction to Disaster management cycle; International Decade for natural disaster reduction (IDNDR); International strategy for disaster reduction (ISDR), National disaster management authority (NDMA).

UNIT- II:

Natural Disasters:

Hydro meteorological disasters:

Causes, Early warning systems- monitoring and management, structural and non-structural measures for floods, drought and Tropical cyclones; Applications. Case studies related to various hydro-meteorological disasters.

UNIT- III:

Geographical based disasters: Causes, zoning, Early warning systems- monitoring and management, structural and non-structural mitigation measures for earthquakes, tsunami, landslides, avalanches and forest fires. Case studies related to various geographical based disasters.

UNIT- IV:

Human Induced Disasters: Chemical disaster- Causes, impacts and mitigation measures for chemical accidents, Risks and control measures in a chemical industry, chemical disaster management; Case studies related to various chemical industrial hazards eg: Bhopal gas leakage; Management of chemical terrorism

disasters and biological disasters; Case studies related to power break downs, fire accidents, traffic accidents, oil spills and stampedes, building failure disasters.

UNIT- V:

Concept of Disaster Impacts and Management:

Disaster impacts- environmental, physical, social, ecological, economical, political, etc.; health, psycho-social issues; demographic aspects, gender, age, special needs; hazard locations; global and national disaster trends; climate change and urban disasters.

Disaster management cycle and its phases, risk analysis, vulnerability and capacity assessment; Post-disaster environmental response water, sanitation, food safety, waste management, disease control; Roles and responsibilities of government, community, local institutions, NGOs and other stakeholders; Policies and legislation for disaster risk reduction, DRR programmes in India and the activities of National Disaster Management Authority.

Text Books:

1. Pradeep Sahni, "Disaster Risk Reduction in South Asia", Prentice Hall, 2003.
2. B. K. Singh, "Handbook of Disaster Management: Techniques & Guidelines", Rajat Publication, 2008.

Suggested Reading:

1. Ministry of Home Affairs, Government of India, "National Disaster Management Plan, Part I and II",
2. K. K. Ghosh, "Disaster Management", APH Publishing Corporation, 2006.
3. http://www.indiaenvironmentportal.org.in/files/file\disaster_management_india1.pdf
4. http://www.ndmindia.nic.in/ (National Disaster management in India, Ministry of Home Affairs)
5. Hazards, Disasters and your community: A booklet for students and the community, Ministry of Home Affairs.
6. Disaster Medical Systems Guidelines, Emergency Medical Services Authority, State of California, EMSA no.214, June 2003.
7. Inter Agency Standing Committee (IASC) (Feb. 2007). IASC Guidelines on Mental Health and Psychosocial Support in Emergency Settings, Geneva: IASC.
8. http://ndma.gov.in/ (Home page of National Disaster Management Authority)

19EEO 101

WASTE TO ENERGY

(Open Elective)

Instruction		3 Theory Hours perweek
DurationofSemesterEndExamination		3 Hours
SEE	70Marks	
CIE	30Marks	
Credits		3

Objectives:

1. To know the various forms ofwaste
2. To understand the processes of BiomassPyrolysis.
3. To learn the technique of BiomassCombustion.

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

1. Understand the concept of conservation, and Identify the devices for conservation
2. Classify the different forms ofwastage
3. Explain the process of Gasification, and Demonstrate the design and operation of Gasifiers
4. Explain the process of Combustion, and Demonstrate the construction and operation of various combustors
5. Describe the process of biomass conversion, and to Differentiate biomass, biogas, biochemical and biodiesel plants

UNIT - I

IntroductiontoEnergyfromWaste:Classificationofwasteasfuel–Agrobased, Forest residue, Industrial waste - MSW – Conversion devices – Incinerators, gasifiers,digestors

UNIT – II

Biomass Pyrolysis: Pyrolysis – Types, slow, fast – Manufacture of charcoal – Methods - Yields and application – Manufacture of pyrolytic oils and gases, yields and applications.

UNIT – III

BiomassGasification:Gasifiers–Fixedbedsystem–Downdraftandupdraft gasifiers–Fluidizedbedgasifiers–Design,constructionandoperation–Gasifier burner arrangement for thermal heating – Gasifier engine arrangement and electricalpower–Equilibriumandkineticconsiderationingasifieroperation.

UNIT–IV

BiomassCombustion:Biomassstoves–Improvedchullahs,types,someexotic designs,Fixedbedcombustors,Types,inclinedgratecombustors,Fluidizedbedcombustors,Design,constructionandoperation-Operationofalltheabove biomasscombustors.

UNIT – V

Biogas: Properties of biogas (Calorific value and composition) - Biogas plant technologyandstatus-Bioenergysystem-Designandconstructionalfeatures

- Biomass resources and their classification - Biomass conversion processes - Thermo chemical conversion - Direct combustion - biomass gasification - pyrolysisandliquefaction-biochemicalconversion-anaerobicdigestion-Types ofbiogasPlants–Applications-Alcoholproductionfrombiomass-Biodiesel production-Urbanwastetoenergyconversion-Biomassenergyprogrammein India.

Text Books:

1. V.AshokV.,"NonConventionalEnergy",Desai,WileyEasternLtd., 1990.
2. K.C.KhandelwalandMahdi,S.S.,"BiogasTechnology-APractical HandBook"-Vol.I&II,TataMcGrawHillPublishingCo.Ltd.,1983.

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Suggested Readings:

1. D.S.Challal,"Food,FeedandFuelfromBiomass",IBHPublishingCo. Pvt. Ltd.,1991.
2. C. Y. WereKo-Brobby and E. B. Hagan, "Biomass Conversion and Technology",JohnWiley&Sons,1996.

18EC O07

SYSTEM AUTOMATION AND CONTROL

(Open Elective)

Instruction	3 L Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: This course aims to:

1. Learn the concepts industrial control systems
2. Learn how to measure the physical parameters in industry
3. Learn the applications of Robots in industry.

Course Outcomes: After completion of this course, students are able to:

1. Understand the features of various automatic and process control systems.
2. Define and analyze various measuring parameters in the industry.
3. Compare performance of various controllers (P, PD, PI, and PID).
4. Illustrate the role of digital computers in automation.
5. Develop various robot structures for different applications.

UNIT-I

Introduction to Automatic Control Systems: Purpose of Automatic Control, How an Industrial Control System is implemented, Introduction to Automatic Control theory.

Sensors: Sensor definition, Different types of Sensors: Motion, Position, Force, Level sensors, and Thermo couples.

UNIT-II

Theory of Measurements: Measurement goals and concepts, Scale factor, Linearity, accuracy, Range, Resolution, Precision and repeatability.

Measurement Techniques and Hardware: Typical Sensor outputs, Bridge measurements: General equation for bridge balance, Resistance balanced Wheatstone bridge, Variable voltage type measurements, Frequency type measurements.

UNIT-III

Process Controllers: What is a Controller, uses of Controllers, Open loop and closed loop Control, proportional, PD, PI, PID Controllers, Analog and Digital methods of Control.

Controller Hardware: Analog and Digital Controllers.

UNIT-IV

Digital Computers as Process Controllers: Use by Digital Computer for process control, Information required by the computer, Information required by the process, Computer Interface electronics, Digital Computer input-output, computer processing of data, Digital Process control computer design, Computer programming.

Actuators: Electro mechanical - Linear motion and rotary motion solenoids, DC motors, AC motors and Stepped motors.

UNIT-V

Robots: What are robots, Robots and process Control systems, Degrees of freedom, factories of the future, Delivery, Disposal and transport systems, Sensing elements, Robot Classifications and Applications. Trouble shooting System failures: Preliminary steps and other troubleshooting aids.

Text Books:

1. Ronald P. Hunter, "Automated process control systems – concepts and Hardware", 2/e, PHI, 1987.
2. Norman A. Anderson, "Instrumentation for process measurement and Control", 3/e, CRC Press, 2005.

Suggested Reading:

1. Kuo B. C, “Automatic Control Systems”, 9th edition
2. A.K Sawhney,“A course on Electrical and Electronic Measurements and Instrumentation”.

18PE C14

TECHNICAL SEMINAR

Instruction	2 Hours per week
Duration of Semester End Examination	----
SEE	----
CIE	50 Marks
Credits	1

The goal of a seminar is to introduce students to critical reading, understanding, summarizing, explaining and preparing report on state of the art topics in a broad area of his/her specialization. Seminar topics may be chosen by the students with advice from the faculty members and the student shall read further relevant articles in the domain.

The seminar must be clearly structured and the power point presentation shall include following aspects:

1. Introduction to the field
2. Literature survey
3. Consolidation of available information
4. Summary and Conclusions
5. References

Each student is required to:

1. Submit a one page synopsis of the seminar talk for display on the notice board.
2. Deliver the seminar for a maximum duration of 30 minutes, where the presentation should be for 20 minutes in PowerPoint, followed by Question and Answers session for 10 minutes.
3. Submit the detailed report of the seminar in spiral bound in a précised format as suggested by the department.

Seminars are to be scheduled from 3rd week to the last week of the semester and any change in schedule shall be discouraged.

For the award of sessional marks students are judged by three (3) faculty members and are based on oral and written presentations as well as their involvement in the discussions during the oral presentation.

Note: Topic of the seminar shall be preferably from any peer reviewed recent journal publications.

Guidelines for awarding marks		
Sl No.	Description	Max Marks
1.	Contents and relevance	10
2.	Presentation skills	10
3.	Preparation of PPT slides	05
4.	Questions and answers	05
5.	Report in a prescribed format	20

18PE C15

PROJECT: PART - 2

Instruction	10 Hours per week
Duration of Semester End Examination	----
SEE	100 Marks
CIE	100 Marks
Credits	10

The object of 'Project: Part-2' is to enable the student extend further the investigative study taken up, either fully theoretical/practical or involving both theoretical and practical work, under the guidance of a Supervisor from the Department alone or jointly with a Supervisor drawn from R&D laboratory/Industry. This is expected to provide a good training for the student(s) in R&D work and technical leadership. The assignment to normally include:

1. In depth study of the topic assigned;
2. Review and finalization of the Approach to the Problem relating to the assigned topic;
3. Preparing an Action Plan for conducting the investigation, including team work;
4. Detailed Analysis/Modelling/Simulation/Design/Problem Solving/Experiment as needed;
5. Final development of product/process, testing, results, conclusions and future directions;
6. Preparing a paper for Conference presentation/ Publication in Journals, if possible;
7. Preparing a Dissertation in the standard format for being evaluated by the Department.
8. Final Seminar presentation before Departmental Committee.

Guidelines for the award of marks in CIE: (Max. Marks: 100)

Evaluation by	Max .Marks	Evaluation Criteria / Parameter
Department Review Committee	10	Review 1
	15	Review 2
	25	Submission
Supervisor	10	Regularity and Punctuality
	10	Work Progress
	10	Quality of the work which may lead to publications
	10	Report Preparation
	10	Analytical / Programming / Experimental Skills

Guidelines for awarding marks in SEE: (Max. Marks: 100)

Evaluation by	Max .Marks	Evaluation Criteria / Parameter
External and Internal Examiners together	20	Power Point Presentation
	40	Thesis Evaluation
	20	Quality of the project • Innovations • Applications • Live Research Projects • Scope for future study • Application to society
	20	Viva-Voce