GEETHANJALI INSTITUTE OF SCIENCE AND TECHNOLOGY
(AUTONOMOUS)
NELLORE–524137(A.P) INDIA

B.TECH Electrical and Electronics Engineering
Course Structure (RG22)

Semester-7(Theory-6,Lab-1, SC -1)							
Sl. No.	Category	Course Code	Course Title	Hours per week			Credits
				L	T	P	C
1	PEC		**Professional Elective-III:**	3	0	0	3
2	PEC		**Professional Elective-IV:**	3	0	0	3
3	PEC		**Professional Elective-V**:	3	0	0	3
4	OEC		**Open Elective-III** :	3	0	0	3
5	OEC		**Open Elective-IV**:	3	0	0	3
6	HSSE		**Humanities and Social Science Elective**	3	0	0	3
7	SC	22A0509P	Object Oriented Programming through JAVA	1	0	2	2
8	PC	22A0243P	Industrial/Research Internship 6-8Weeks (Mandatory) after third year (to be evaluated during VII Semester)	0	0	0	3
Total credits							**23**

Professional Elective:

Sl. No.	Category	Course Code	CourseTitle
1	**Professional Elective-III:**	22A0234T 22A0235T 22A0236T	1. Utilization of Electrical Energy 2. Energy Auditing & Demand side Management 3. Hybrid electric vehicles.
2	**Professional Elective-IV:**	22A0237T 22A0238T 22A0239T	1. Electrical Distribution Systems 2. Power System Operation& Control 3. Advanced Control Theory
3	**Professional Elective-V**:	22A0240T 22A0241T 22A0242T	1.Advanced Power System Protection 2. Smart grid 3. Switched Mode Power Converters

Humanities and Social Science Elective

Sl. No.	Category	Course Code	CourseTitle
1	**Humanities and Social Science Elective**	22A0023T 22A0024T 22A0025T 22A0026T	1. Management Science 2. Entrepreneurship& Innovation 3. Business Environment 4. Human Resource Management

Open Elective Course – III

S.No	Course Code	Course Name	Offered by the Dept.
1	22A0151T	Disaster Management	CE
2	22A0432T	Basic VLSI Design	ECE
3	22A0529T	Cloud Computing	CSE
4	22A0329Tc	Measurements and Mechatronics	ME
5	22A0330Tc	Unconventional Machining Processes	

Open Elective Course – IV

S.No	Course Code	Course Name	Offered by the Dept.
1	22A0152T	Construction Management	CE
2	22A0433T	Industrial Electronics	ECE
3	22A0534Ta	Cyber Security	CSE
4	22A0332Tb	Non-Destructive Evaluation	ME
5	22A0327Ta	Renewable Energy Sources	

Category	Credits
Professional Elective Courses(PEC)	9
Humanities and Social Science Course (HSC)	3
Open Elective Courses (OEC)	6
Skil Advanced Course (SC)	2
Industrial/Research Internship	3
Total	**23**

BOS Chairman **Dean of Academics** **Principal**

UTILIZATION OF ELECTRICAL ENERGY
(EEE) (Professional Elective-III)

Course Code	L:T:P	Credits	Exam marks	Exam Duration	Course Type
22A0234T	3:0:0	3	CIE:30 &SEE:70	3 Hours	PEC

Course Objectives:

The objectives of the course are to make the students learn about:

- The laws of illumination and their application for various lighting schemes.
- Principles and methods for electric heating and welding.
- Systems of electric traction, study of traction equipment, mechanics of train movement and associated calculations.

Syllabus — **Total Hours: 48Hrs**

UNIT-I	ILLUMINATION	10Hrs

Definition –Laws of Illumination–Polar Curves – Calculation of MHCP and MSCP. Lamps: Incandescent Lamp, Sodium Vapor Lamp, Fluorescent Lamp, CFL and LED.
Requirement of Good Lighting Scheme – Types, Design and Calculation of Illumination. Street Lighting and Factory Lighting – Numerical Problems

UNIT-II	ELECTRIC HEATING & WELDING	10Hrs

Electrical Heating: Advantages. Methods of Electric Heating – Resistance, Arc, Induction and Dielectric Heating. Electric Welding: Types – Resistance, Electric Arc, Gas Welding. Ultrasonic, Welding Electrodes of Various Metals, Defects in Welding.

UNIT -III	ELECTRIC TRACTION – I	10Hrs

Introduction – Systems of Electric Traction. Comparison Between A. C. and D. C.
Traction – Special Features of Traction Motors - The Locomotive – Wheel arrangement and Riding Qualities – Transmission of Drive – Characteristics and Control of Locomotives and Motor Coaches for Track Electrification – DC Equipment – AC Equipment – Electric Braking with DC Motors and with AC Motors – Control Gear – Auxiliary Equipment.

UNIT -IV	ELECTRIC TRACTION - II	8Hrs

Mechanics of Train Movement. Speed-Time Curves of Different Services – Trapezoidal and quadrilateral Speed-Time Curves – Numerical Problems. Calculations of Tractive Effort, Power, and Specific Energy Consumption - Effect of Varying Acceleration and Braking Retardation, Adhesive Weight and Coefficient of Adhesion – Problems.

UNIT -V	ECONOMIC ASPECTS OF UTILISING ELECTRICAL ENERGY	10Hrs

Power Factor Improvement, Load Factor improvement, Off Peak Loads- Use of Exhaust Steam, Waste Heat recovery, Pit Head Generation, Diesel Plant, General Comparison of Private Plant and Public Supply- Initial Cost and Efficiency, Capitalization of Losses, Choice of Voltage.

Course Outcomes(CO):

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

- Develop a lighting scheme for a given practical case.
- To study the basic principles of illumination and its measurement.
- Analyze the performance of Heating and Welding methods.
- Make all numerical calculations associated with electric traction.
- To understand the basic principle of electric traction including speed-time curves of different traction services.
- Assess the economic aspects in utilization of electrical energy.

Textbooks:

1. Utilization of Electric Energy, E. Openshaw Taylor and V. V. L. Rao, Universities Press, 2009.
2. Art & Science of Utilization of electrical Energy, Partab, Dhanpat Rai & Co., 2004

Reference Books:
1. Generation, distribution and utilization of electrical energy, C.L Wadhwa, Wiley Eastern Limited,1993 2. .Electrical Power, S. L. Uppal, Khanna pulishers,1988

ENERGY AUDITING AND DEMAND SIDE MANAGEMENT (EEE)
(Professional Elective-III)

Course Code	L:T:P	Credits	Exam marks	Exam Duration	Course Type
22A0235T	3:0:0	3	CIE:30& SEE:70	3 Hours	PEC

Course Objectives:

The objectives of the course are to make the students learn about:

- This subject deals with the energy auditing, conservation, management techniques, and measurements in energy audits.
- Information about how to improve the power factor & efficiency of electrical equipment's.
- To deals with DSM programme to improve financial performance and customer relations.

Syllabus		Total Hours: 48Hrs
Unit-I	**INTRODUCTION**	**10Hrs**

Energy situation – world and India, energy consumption, conservation, Codes, standards and Legislation.

Unit-II	**ENERGY AUDITING**	**9 Hrs**

Energy audit- definitions, concept, types of audit, energy index, cost index, pie charts, Sankey diagrams, load profiles, Energy conservation schemes. Measurements in energy audits, presentation of energy audit results.

Unit -III	**ENERGY EFFICIENT MOTORS**	**10Hrs**

Energy efficient motors , factors affecting efficiency, loss distribution , constructional details , characteristics - variable speed , variable duty cycle systems, RMS hp- voltage variation-voltage unbalance- over motoring- motor energy audit.

Unit -IV	**LIGHTING AND ENERGY INSTRUMENTS**	**10Hrs**

Good lighting system design and practice, lighting control ,lighting energy audit - Energy Instruments- watt meter, data loggers, thermocouples, pyrometers, lux meters, tongue testers ,application of PLC's

Unit -V	**DEMAND SIDE MANAGEMENT**	**9Hrs**

Introduction to dsm, concept of dsm, benefits of dsm, different techniques of dsm, load management, load priority technique, peak clipping, peak shifting, valley filling, strategic conservation, energy efficient equipment. Management and organization of energy conservation awareness programs

Course Outcomes(CO):

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

- Acquire the knowledge of fundamentals of energy auditing
- Conduct energy audit and present the result
- Select the energy efficient motors
- Use different instruments for cost effective lighting
- Determine the location and size of capacitor for power factor improvement
- Understand different techniques in demand side management and create awareness on energy conservation

Textbooks:

1. Industrial Energy Management Systems, Arry C. White, Philip S.
2. Schmidt, David R. Brown, Hemisphere Publishing Corporation,
1. New York.
2. Fundamentals of Energy Engineering - Albert Thumann, Prentice
3. Hall Inc, Englewood Cliffs, New Jersey.
4. Electrical Power distribution, A S. Pabla, TMH, 5th edition, 2004
5. Demand Side Management, Jyothi Prakash, TMH Publishers.

Reference Books:

- Energy management by W.R. Murphy & G. Mckay Butter worth,Heinemann publications.
- Energy management by Paul o' Callaghan, Mc-graw Hill Bookcompany-1st edition, 1998
- Energy efficient electric motors by John .C. Andreas, MarcelDekker Inc Ltd-2nd edition, 1995-
- Energy management hand book by W.C.Turner, John wiley andsons

- Energy management and good lighting practice : fuel efficiencybooklet12-EEO
- Recent Advances in Control and Management of Energy Systems,D.P.Sen, K.R.Padiyar, Indrane Sen, M.A.Pai, Interline Publisher,Bangalore, 1993.
- Energy Demand – Analysis, Management and Conservation, AshokV. Desai, Wiley Eastern, 2005.
- Hand book on energy auditing - TERI (Tata Energy ResearchInstitute)

Web References:

1. https://www.researchgate.net
2 https://www.facstaff.bucknell.edu/
3. https://www.electrical4u.com
4. https://www.gist.edu.in

E-Text Books:

1 .https://www.jntubook.com/
2. https://www.freeengineeringbooks.com

HYBRID ELECTRIC VEHICLES
(Professional Elective-III)

Course Code	L:T:P	Credits	Exam marks	Exam Duration	Course Type
22A0236T	3:0:0	3	CIE:30 &SEE:70	3 Hours	PEC

Course Objectives:

The objectives of the course are to make the students learn about:

- Understand to Provide good foundation on hybrid and electrical vehicles.
- Understand To address the underlying concepts and methods behind power transmission in hybrid and electrical vehicles
- Familiarize energy storage systems for electrical and hybrid transportation
- Design and develop basic schemes of electric vehicles and hybrid electric vehicles

Syllabus — **Total Hours: 48Hrs**

UNIT-I	**ELECTRIC VEHICLE PROPULSION AND ENERGY SOURCES**	**10Hrs**

Introduction to electric vehicles, vehicle mechanics - kinetics and dynamics, roadway fundamentals propulsion system design - force velocity characteristics, calculation of tractive power and energy required, electric vehicle power source - battery capacity, state of charge and discharge, specific energy, specific power, Ragone plot. battery modeling - run time battery model, first principle model, battery management system- soc measurement, battery cell balancing. Traction batteries - nickel metal hydride battery, Li-Ion, Lipolymer battery.

UNIT-II	**ELECTRIC VEHICLE POWER PLANT AND DRIVES**	**10Hrs**

Introduction electric vehicle power plants. Induction machines, permanent magnet machines, switch reluctance machines. Power electronic converters-DC/DC converters - buck boost converter, isolated DC/DC converter. Two quadrant chopper and switching modes. AC drives PWM, current control method. Switch reluctance machine drives - voltage control, current control.

UNIT -III	**HYBRID AND ELECTRIC DRIVE TRAINS**	**8Hrs**

Introduction hybrid electric vehicles, history and social importance, impact of modern drive trains in energy supplies. Hybrid traction and electric traction. Hybrid and electric drive train topologies. Power flow control and energy efficiency analysis, configuration and control of DC motor drives and induction motor drives, permanent magnet motor drives, switch reluctance motor drives, drive system efficiency.

UNIT -IV	**ELECTRIC AND HYBRID VEHICLES - CASE STUDIES**	**10Hrs**

Parallel hybrid, series hybrid -charge sustaining, charge depleting. Hybrid vehicle case study – Toyota Prius, Honda Insight, Chevrolet Volt. 42 V system for traction applications. Lightly hybridized vehicles and low voltage systems. Electric vehicle case study - GM EV1, Nissan Leaf, Mitsubishi Miev. Hybrid electric heavy duty vehicles, fuel cell heavy duty vehicles.

UNIT -V	**ELECTRIC AND HYBRID VEHICLE DESIGN**	**10Hrs**

Introduction to hybrid vehicle design. Matching the electric machine and the internal combustion engine. Sizing of propulsion motor, power electronics, drive system. Selection of energy storage technology, communications, supporting subsystem. Energy management strategies in hybrid and electric vehicles - energy management strategies- classification, comparison, implementation.

Course Outcomes(CO):

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

- Understand the working of hybrid and electric vehicles
- Apply a suitable drive scheme for developing an hybrid and electric vehicles depending on resources
- e Develop the electric propulsion unit and its control for application of electric vehicles.
- Understand the proper energy storage systems for vehicle applications
- Design and develop basic schemes of electric vehicles and hybrid electric vehicles

Textbooks:

6. 1. Iqbal Hussein, "Electric and Hybrid Vehicles: Design Fundamentals", 2nd edition, CRC Press, 2003.
7. 2. Amir Khajepour, M. Saber Fallah, Avesta Goodarzi, "Electric and Hybrid Vehicles: Technologies, Modeling and Control - A Mechatronic Approach", illustrated edition, John Wiley & Sons, 2014.
3. Mehrdad Ehsani, YimiGao, Sebastian E. Gay, Ali Emadi, "Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design", CRC Press, 2004

Reference Books:

1. James Larminie, John Lowry, “Electric Vehicle Technology”, Explained, Wiley, 2003.
2. John G. Hayes, G. Abas Goodarzi, “Electric Powertrain: Energy Systems, Power Electronics and Drives for Hybrid, Electric and Fuel Cell Vehicles”, 1st edition, WileyBlackwell, 2018.

ELECTRICAL DISTRIBUTION SYSTEMS
(Professional Elective-IV)

Course Code	L:T:P	Credits	Exam marks	Exam Duration	Course Type
22A0237T	3:0:0	3	CIE:30& SEE:70	3 Hours	PEC

Course Objectives:

The objectives of the course are to make the students learn about:

- The student has to acquire knowledge about:
- The classification of distribution systems
- The technical aspects and design considerations in DC and AC distribution systems and their comparison
- Technical issues of substations such as location, ratings and bus bar arrangements
- The causes of low power factor and methods to improve power factor
- The principles in Distribution automation.

Syllabus **Total Hours:48**

Unit-I	INTRODUCTION & GENERAL CONCEPTS	9Hrs

Introduction to Distribution Systems, Load Modelling and Characteristics. Coincidence Factor, Contribution Factor Loss Factor - Relationship between the Load Factor and Loss Factor. Classification of Loads (Residential, Commercial, Agricultural and Industrial) and Their Characteristics.

Unit-II	CLASSIFICATION OF DISTRIBUTION SYSTEMS	9Hrs

Classification of Distribution Systems - Comparison of DC vs AC and Under-Ground vs Over - Head Distribution Systems- Requirements and Design Features of Distribution Systems. Design Considerations of Distribution Feeders: Radial and Loop Types of Primary Feeders, Voltage Levels, Feeder Loading, Basic Design Practice of the Secondary Distribution System. Voltage Drop Calculations (Numerical Problems) In A.C. Distributors for The Following Cases: Power Factors Referred to Receiving End Voltage and With Respect to Respective Load Voltages.

Unit -III	SUBSTATIONS	10Hrs

Location of Substations: Rating of Distribution Substation, Service Area within Primary Feeders. Benefits Derived Through Optimal Location of Substations. Classification of Substations: Air Insulated Substations - Indoor & Outdoor Substations: Substation Layout showing the Location of all the Substation Equipment. Bus Bar Arrangements in the Sub-Stations: Simple Arrangements Like Single Bus Bar, Sectionalized Single Bus Bar, Main and Transfer Bus Bar Double Breaker – One and Half Breaker System With Relevant Diagrams.

Unit -IV	POWER FACTOR IMPROVEMENT	10Hrs

Voltage Drop and Power-Loss Calculations: Derivation for Voltage Drop and Power Loss in Lines, Manual Methods of Solution for Radial Networks, Three Phase Balanced Primary Lines. Causes of Low P.F -Methods of Improving P.F -Phase Advancing and Generation of Reactive KVAR Using Static Capacitors-Most Economical P.F. for Constant KW Load and Constant KVA Type Loads, Numerical Problems. Capacitive Compensation for Power-Factor Control - Effect of Shunt Capacitors (Fixed and Switched), Power Factor Correction- Economic Justification - Procedure to Determine the Best Capacitor Location.

Unit -V	INTRODUCTION TO DISTRIBUTION AUTOMATION	10Hrs

Distribution automation, distribution management systems, distribution automation system functions, Basic SCADA system, outage management

Course Outcomes(CO):

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

- Compute the various factors associated with power distribution
- Make voltage drop calculations in given distribution networks
- Learn principles of substation maintenance
- Compute voltage drop for a given system and load
- Compute power factor improvement for a given system and load

- Understand implementation of SCADA for distribution automation

Textbooks:

1. Electric Power Distribution Engineering, Turan Gonen, CRC Press, 3rd Edition, 2014.
2. Electric Power Distribution, A.S. Pabla, Tata Mc Graw Hill (India) Pvt. Ltd., 6th Edition, 2011.

Reference Books:

1. Electric Power Distribution Automation, Dr. M. K. Khedkar and Dr. G. M. Dhole, University Science Press, 2010.
2. Electrical Power Distribution Systems, V. Kamaraju, Jain Book Depot. 2012.
3. Electrical Power Systems for Industrial Plants, Kamalesh Das, JAICO Publishing House, 200

POWER SYSTEM OPERATION AND CONTROL(EEE)

(Professional Elective-IV)

Course Code	L:T:P	Credits	Exam marks	Exam Duration	Course Type
22A0238T	3:0:0	3	CIE:30& SEE:70	3 Hours	PEC

Course Objectives:

Student will be able to

- To know about economic load dispatch problems with and without losses in Power Systems
- To distinguish between hydro-electric and thermal plants and coordination between them
- To understand about optimal power flow problems and solving using specified method
- To understand about Automatic Generation Control problems and solutions in Power Systems
- To understand necessity of reactive power control, compensation under no-load and load operation of transmission systems
- To understand about deregulation aspects in Power Systems

Syllabus — **Total Hours:48**

Unit-I	ECONOMIC OPERATION OF POWER SYSTEMS	10Hrs

Brief description about electrical power systems, introduction to power system operation and control, Characteristics of various steam units, combined cycle plants, cogeneration plants, Steam units economic dispatch problem with & without considering losses and its solutions, B Matrix loss formula – Numerical problems

Unit-II	HYDRO-THERMAL COORDINATION AND OPTIMAL POWER FLOW COMMITMENT	10Hrs

Hydro-thermal Coordination: Characteristics of various types of hydro-electric plants and their models, Introduction to hydro-thermal Coordination, Scheduling energy with hydrothermal coordination, Short-term hydro-thermal scheduling.

Optimal Power Flow: Optimal power flow problem formulation for loss and cost minimization, Solution of optimal power flow problem using Newton's method – Numerical problems

Unit–III	AUTOMATIC GENERATION CONTROL	8Hrs

Speed governing mechanism, modeling of speed governing mechanism, models of various types of thermal plants (first order), definitions of control area, Block diagram representation of an isolated power system, Automatic Load Frequency control of single area system with and without control, Steady state and dynamic responses of single area ALFC loop, Automatic Load-frequency control of two area system, Tie-line bias control of two area and multi-area system, Static response of two-area system – Numerical examples

Unit -IV	REACTIVE POWER CONTROL	10Hrs

Passive and active compensators, Uniformly distributed fixed compensation, Passive shunt compensation, Control of open circuit voltage by shunt reactance, Reactance of shunt reactors, Principle of operation of thyristor controlled reactor, Thyristors switched capacitor. Series Capacitors

Unit–V	POWER SYSTEM OPERATION IN COMPETITIVE ENVIRONMENT	10Hrs

Introduction – Restructuring models – Independent System Operator (ISO) – Power Exchange - Market operations – Market Power – Standard cost – Transmission Pricing– Congestion Pricing – Management of Inter zonal/Intra zonal Congestion – Electricity Price Volatility Electricity Price Indexes – Challenges to Electricity Pricing –Construction of Forward Price Curves – Short-time Price Forecasting

Course Outcomes(CO):

On completion of this course, student will be able to

- Design an optimal operation setup of power system which minimizes operation costs and meet desired needs.
- Illustrate about thermal and hydro power plants operation in meeting the load demand optimally.
- Discuss single area load frequency control and two area load frequency control.
- Apply the techniques to control power flows, frequency and voltage
- Differentiate pricing mechanism of electric energy and trading of power under deregulated environment.
- Assess the significance of power system restructuring and learn the Security Analysis, Contingency Analysis.

Text books:

1Allen J. Wood and Bruce F. Wollenberg, "Power Generation, Operation and Control", 2nd edition, John Wiley & Sons, Inc., New York, 1996.
2. D P Kothari and I J Nagrath, "Power System Engineering", McGraw Hill Education India Pvt. Limited, Chennai, 3e, 2019

Reference Books:

1. Power System Analysis and Design, J. Duncan Glover and M.S.Sharma, Thomson, 3rd Edition, 2008.
2. Electric Energy System Theory: An Introduction, OlleIngemar Elgerd, Tata Mc Graw Hill, 2nd Edition, 1982.
3. Power System Stability and Control, P Kundur, Tata Mc Graw Hill, 1994, 5th Reprint, 2008

Web References:

https://archive.nptel.ac.in/courses/108/104/108104052/#download_transcripts

ADVANCED CONTROL THEORY
(Professional Elective-IV)

Course Code	L:T:P	Credits	Exam marks	Exam Duration	Course Type
22A0239T	3:0:0	3	CIE:30& SEE:70	3 Hours	PEC

Course Objectives:

Student will be able to

- Concepts of state vector, State transition matrix and solution of state equations.
- Importance of controllability and observability concepts.
- Pole placement, state estimation using observers
- Lyapunov criterion for stability analysis
- Types of nonlinearities, their effect on system performance

Syllabus — **Total Hours:48Hrs**

Unit-I	**STATE VARIABLE DESCRIPTION AND SOLUTION OF STATE EQUATION**	**10Hrs**

Concept of State – Derivation of State Space models for Linear Continuous time Systems from Schematic Models, Differential equations, Transfer functions and block diagrams – Non uniqueness of state model – State diagrams for continuous time state models – Solution of state equations – State transition matrix. Complete response of continuous time systems.

Unit-II	**CONTROLLABILITYAND OBSERVABILITY**	**10Hrs**

Tests for controllability and observability for continuous time systems – Time varying case, minimum energy control, time invariant case, Principle of Duality, Controllability and observability of state models in Jordan canonical form and other canonical forms. Effect of state feedback on controllability and observability.

Unit -III	**STATE FEEDBACK CONTROLLERS AND OBSERVERS**	**8Hrs**

Design of State Feedback Controllers through Pole placement. Full-order observer and reduced-order observer. State estimation through Kalman Filters.

Unit -IV	**ANALYSIS OF NONLINEAR SYSTEMS -1**	**10Hrs**

Introduction to nonlinear systems, Types of nonlinearities, Concept of describing functions, Derivation of describing functions for Dead zone, Saturation, backlash, relay with dead zone and Hysteresis - Jump Resonance.

Unit -V	**ANALYSIS OF NONLINEAR SYSTEMS -2**	**10Hrs**

Introduction to phase-plane analysis, Method of Isoclines for Constructing Trajectories, Singular points, Phaseplane analysis of nonlinear control systems.

Course Outcomes(CO):

On completion of this course, student will be able to

- Model a given dynamic system in state space and obtain the solution for the state equation
- Test whether a given system is controllable and/or observable
- Design a state feedback controller for pole placement
- Design an observer for state estimation
- Apply Lyapunov criterion and determine stability of a given system
- Analyze nonlinear systems.

Textbooks:

1. Modern Control Engineering, Katsuhiko Ogata, Prentice Hall, 5th Edition, 2010.
2. Modern Control System Theory, M. Gopal, New Age International Publishers, Revised 2nd edition, 2005

Reference Books:

1. Control Systems Engineering, I.J. Nagarath and M.Gopal, New Age International Publishers, 5th Edition, 2007, Reprint 2012.
2. Modern Control Engineering, D. Roy Choudhury, PHI Learning Private Limited, 9th Printing, January 2015.

ADVANCED POWER SYSTEM PROTECTION
(Professional Elective-V)

Course Code	L:T:P	Credits	Exam marks	Exam Duration	Course Type
22A0240T	3:0:0	3	CIE:30& SEE:70	3 Hours	PEC

Course Objectives:

The objectives of the course are to make the students learn about:

- The different types of electromagnetic relays and microprocessor based relays
- The protection of Generators
- The protection of Transformers
- The protection of feeders and lines
- The technical aspects involved in the operation of circuit breakers
- Generation of over voltages and protection from them

Syllabus — **Total Hours: 48Hrs**

UNIT-I	FUSES AND CIRCUIT BREAKERS	9Hrs

Circuit Breakers: Elementary Principles of Arc Interruption, Restriking Voltage and Recovery Voltage - Restriking Phenomenon, Average and Max. RRRV, Current Chopping and Resistance Switching – AutoReclosures. Minimum Oil Circuit Breakers, Air Blast Circuit Breakers, Vacuum and SF6 Circuit Breakers

Unit-II	RELAYS	10Hrs

Electromagnetic Relays - Basic Requirements of Relays – Primary and Backup Protection - Construction Details of – Attracted Armature, Balanced Beam, Inductor Type and Differential Relays – Universal Torque Equation – Characteristics of Over Current, Direction and Distance Relays. Static Relays – Advantages and Disadvantages – Definite Time, Inverse and IDMT. Static Relays – Comparators – Amplitude and Phase Comparators. Microprocessor Based Relays – Advantages and Disadvantages – Block Diagram for Over Current (Definite, Inverse and IDMT) and Distance Relays and Their Flow Charts.

Unit -III	PROTECTION OF GENERATORS & TRANSFORMERS	10Hrs

Protection of Generators against Stator Faults, Rotor Faults and Abnormal Conditions. Restricted Earth Fault and Inter-Turn Fault Protection – calculation of percentage winding unprotected. **Protection of Transformers:** Percentage Differential Protection, Numerical Problems on Design of CT Ratio, Buchholtz Relay Protection, Numerical Problem.

Unit -IV	PROTECTION OF FEEDERS & LINES	10Hrs

Protection of Feeder (Radial & Ring Main) Using Over Current Relays. Protection of Transmission Line – 3 Zone Protection Using Distance Relays. Carrier Current Protection. Protection of Bus Bars.s.

Unit -V	STATIC RELAYS	9Hrs

Instantaneous over current relay – Time over current relays - Basic principles - Definite time and Inverse definite time over current relays, directional over current relays - Static Differential Relays-Analysis of static differential relays–Static relay schemes-Dual bias transformer differential protection – Harmonic restraint relay.

Course Outcomes(CO):

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

- Distinguish between the principles of operation of electromagnetic relays, static relays and microprocessor based relays
- Determine the unprotected percentage of generator winding under fault occurrence
- Design the protection system for transformers
- Identify various types of the relays in protecting feeders, lines and bus bars
- Solve numerical problems for arc interruption and recovery in circuit breakers
- Demonstrate the protection of a power system from over voltages .

Textbooks:

Badri Ram, D.N Viswakarma, "Power System Protection and Switchgear", TMH Publications, 2011.
Sunil S Rao, "Switchgear and Protection", Khanna Publishers, 1992

ReferenceBooks:

C.L.Wadhwa, "Electrical Power Systems", New Age international (P) Limited, Publishers, 2012.
Y.G. Paithankar , "Transmission network Protection", Taylor and Francis,2009.

Bhuvanesh Oza, “Power system protection and switch gear”, TMH, 2010..

Web References:

1. https://www.researchgate.net
2 https://www.facstaff.bucknell.edu/
3. https://www.electrical4u.com
4. https://www.gist.edu.in

E-Text Books:

1 .https://www.jntubook.com/
2. https://www.freeengineeringbooks.com

SMART GRID

(Professional Elective-V)

Course Code	L:T:P	Credits	Exam marks	Exam Duration	Course Type
22A0241T	3:0:0	3	CIE:30& SEE:70	3 Hours	PEC

Course Objectives:

The objectives of the course are to make the students learn about:

- Overview of the technologies required for the smart grid
- Switching techniques and different means for data communication
- Standards for information exchange and smart metering
- Methods used for information security on smart grid
- Smart metering and protocols for smart metering
- Power quality management with upgraded technologies

Syllabus		Total Hours:48
Unit-I	**INTRODUCTION TO SMART GRID**	**10Hrs**

Evolution of Electric Grid, Concept, Definitions and Need for Smart Grid, Smart grid drivers, functions, opportunities, challenges and benefits, Difference between conventional & Smart Grid, Concept of Resilient &Self-Healing Grid, Present development & International policies in Smart Grid, Diverse perspectives from experts and global Smart Grid initiatives

Unit-II	**SMART GRID TECHNOLOGIES**	**8Hrs**

Technology Drivers, Smart energy resources, Smart substations, Substation Automation, Feeder Automation ,Transmission systems: EMS, FACTS and HVDC, Wide area monitoring, Protection and control, Distribution systems: DMS, Volt/VAR control, Fault Detection, Isolation and service restoration, Outage management, HighEfficiency Distribution Transformers, Phase Shifting Transformers, Plug in Hybrid Electric Vehicles (PHEV).

Unit -III	**SMART METERS**	**10Hrs**

Introduction to Smart Meters, Advanced Metering infrastructure (AMI) drivers and benefits, AMI protocols, standards and initiatives, AMI needs in the smart grid, Phasor Measurement Unit(PMU), Intelligent Electronic Devices(IED) & their application for monitoring & protection.

Unit -IV	**POWER QUALITY MANAGEMENT IN SMART GRID**	**10Hrs**

Power Quality & EMC in Smart Grid, Power Quality issues of Grid connected Renewable Energy Sources, Power Quality Conditioners for Smart Grid, Web based Power Quality monitoring, Power Quality Audit.

Unit -V	**HIGH PERFORMANCE COMPUTING)**	**10Hrs**

Local Area Network (LAN), House Area Network (HAN), Wide Area Network (WAN),Broadband over Power line (BPL), IP based Protocols, Basics of Web Service and CLOUD Computing to make Smart Grids smarter, Cyber Security for Smart Grid.

Course Outcomes(CO):

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

- Understand the concepts and design of Smart grid.
- Understand the various communication technologies in smart grid.
- Understand the various measurement technologies in smart grid.
- Understand the analysis and stability of smart grid.
- Learn the renewable energy resources and storages integrated with smart grid.
- familiarize the high performance computing for Smart Grid applications

Textbooks:

1. Smart Grid, Janaka Ekanayake, Liyanage, Wu, Akihiko Yokoyama, Jenkins, Wiley Publications, 2012, Reprint 2015.

2. Smart Grid: Fundamentals of Design and Analysis, James Momoh, Wiley, IEEE Press., 2012, Reprint 2016.

Reference Books:

1. The Smart Grid – Enabling Energy efficiency and demand response, Clark W. Gellings, P.E., CRC Press, Taylor & Francis group, First Indian Reprint. 2015.
2. Smart Grid – Applications, Communications, and Security Edited by Lars Torsten Berger, Krzysztof Iniewski, WILEY, 2012, Reprint 2015.
3. Practical Electrical Network Automation and Communication Systems, Cobus Strauss, ELSVIER, 2003

SWITCHED MODE POWER CONVERTERS(EEE)

(Professional Elective-V)

Course Code	L:T:P	Credits	Exam marks	Exam Duration	Course Type
22A0242T	3:0:0	3	CIE:30& SEE:70	3 Hours	PEC

Course Objectives:

The objectives of the course are to make the students learn about:

- To understand the concepts of modern power electronic converters and their applications
- Analyzing and control of various power converter circuits
- To understand the concepts of resonant converters
- To Analyze the dynamic analysis of DC-DC converter

Syllabus		Total Hours:48Hrs
Unit-I	**NON-ISOLATED DC-DC CONVERTERS**	**10Hrs**

Basic Types of Switching Power Supplies – Volt-Sec balance – Non-Isolated Switched Mode DC-to-DC Converters – Buck Converter – Boost Converter – Buck-Boost Converter – Cuk Converter – SEPIC and Zeta Converters – Comparison of Non Isolated Switched mode DC-to-DC Converters..

Unit-II	ISOLATED DC-DC CONVERTERS	10Hrs

Need of Transformer Isolations in high frequency Power conversion - Isolated Switched Mode DC-to-DC Converters – Single Switch Isolated DC-to-DC Converters – Forward, Flyback, Push-Pull, Flux Weakening Phenomena, Half and Full Bridge Converters – Multi Switch Isolated DC-to-DC Converters – Comparison of Isolated and Non-Isolated Switched Mode DC-to-DC Converters.

Unit -III	RESONANT CONVERTERS	8Hrs

Classification of Resonant converters-Basic resonant circuits- Series resonant circuitparallel resonant circuits- Resonant switches, Concept of Zero voltage switching, principle of operation, analysis of M-type and L-type Resonant Buck and boost Converters.

Unit -IV	DYNAMIC ANALYSIS OF DC-DC CONVERTERS	10Hrs

Formulation of dynamic equations of buck and boost converters, State-Space Models, Averaged Models, linearization technique, small-signal model and converter transfer functions, Significance of Small Signal Models, Dynamical Characterization.

Unit -V	CONTROLLER DESIGN	10Hrs

Review of frequency-domain analysis of linear time-invariant systems, controller specifications, Proportional (P), Proportional plus Integral (PI), Proportional, Integral plus Derivative controller (PID), selection of controller parameters for Isolated and NonIsolated DC -DC Converters.

Course Outcomes(CO):

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

- The student learns the fundamental concepts of DC - DC Converters
- Student can explain the operation of different topologies of DC to DC converters
- Student will be able to model various converters as per state space, time average
- Student can analyse in frequency domain with different P, PI and PID converters

Textbooks:

1. Issa Batarseh, Fundamentals of Power Electronics, John Wiley Publications, 2009.
2. Robert Erickson and Dragon Maksimovic, Fundamentals of Power Electronics, Springer Publications., 2nd Edition, 2001.

Reference Books:

1. Switched Mode Power Supplies design and construction 2nd Edition, H W Whittington, B W Flynn and D E Macpherson, Universities Press, 2009.

2. Philip T.Krein Elements of Power Electronics - Oxford University Press, 1997. 3. L. Umanand Power Electronics, Tata Mc-Graw Hill, 2004.

DISASTER MANGEMENT
(Common to ME, CSE,AI&ML, CS, DS, ECE,EEE)
(Open Elective Course -III)

Course Code	L:T:P	Credits	Exam marks	Exam Duration	Course Type
22A0151T	3:0:0	3	CIE:30 SEE:70	3 Hours	OEC

Course Objectives:

- Develop an understanding of why and how the modern disaster manager is involved with pre-disaster and post-disaster activities.
- Develop an awareness of the chronological phases of natural disaster response and refugee reliefoperations.
- Describe the three planning strategies useful in mitigation.
- Describe public awareness and economic incentive possibilities.
- Understand the tools of post-disaster management

Syllabus		Total Hours:48
Unit-I	**Natural Hazards and Disaster Management**	**9 Hrs**
Introduction of DM – Inter disciplinary -nature of the subject– Disaster Management cycle – Fivepriorities for action. Case study methods of the following: floods, draughts – Earthquakes – global warming, cyclones & Tsunamis – Post Tsunami hazards along the Indian coast – landslides		
Unit-II	**Man Made Disaster**	**9 Hrs**
Fire hazards – transport hazard dynamics – solid waste management – post disaster – bio terrotirism -threat in mega cities, rail and air craft's accidents, and Emerging infectious diseases & Aids and their management.		
Unit -III	**Risk and Vulnerability**	**10 Hrs**
Building codes and land use planning – social vulnerability – environmental vulnerability – Macroeconomic management and sustainable development, climate change risk rendition – financial management of disaster – related losses.		
Unit -IV	**Role of Technology in Disaster Managements**	**10 Hrs**
Disaster management for infra structures, taxonomy of infra structure – treatment plants and process facilities-electrical substations roads and bridges- mitigation programme for earth quakes – flowchart, geospatial information in agriculture drought assessment-multimedia technology in disaster risk management and training-transformable indigenous knowledge in disaster reduction.		
Unit -V	**Education and Community Preparedness**	**10 Hrs**
Education in disaster risk reduction-Essentials of school disaster education-Community capacity and disaster resilience-Community based disaster recovery -Community based disaster management andsocial capital-Designing resilience- building community capacity for action.		

Textbooks:

1. Rajib shah & R R Krishnamurthy "Disaster Management" – Global Challenges andLocal Solutions' Universities press. (2009),
2. Tushar Bhattacharya, "Disaster Science & Management" Tata McGraw Hill Education Pvt. Ltd., New Delhi

Reference Books:

1. Harsh. K . Gupta "Disaster Management edited", Universities press, 2003.

E-resources:

1. https://www.youtube.com/watch?v=DExlZTfKZAM&list=PLC4PaTsQiLcbejXqJR7S59Ohk2OK1rgEG

Course Outcomes(CO):

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

CO1: Know about the natural hazards and its management

CO2: Know about the fire hazards and solid waste management

CO3: Understand about the emerging infectious diseases and aids their management

CO4: Know about the regulations of building codes and land use planning related to risk and vulnerability.

CO5: Impart the education related to risk reduction in schools and communities.

CO6: Describe public awareness and economic incentive possibilities.

BASIC VLSI DESIGN Common to (EEE,CSE, AI&ML, CS, DS)
(Open Elective Course-III)

Course Code	L:T:P	Credits	Exam marks	Exam Duration	Course Type
22A0432T	3:0:0	3	CIE:30& SEE:70	3 Hours	OEC

Course Objectives:

The objectives of the course are to make the students learn about:

- To give exposure to different steps involved in fabrication Process of PMOS & NMOS transistors, CMOS & BICOM Inverters.
- To provide knowledge on electrical properties of MOS & BICMOS devices to analyze the behaviour of inverters designed with various loads.
- To provide knowledge on Basic Circuit Concepts of VLSI Design
- To apply the design Rules and draw layout of a given logic circuit and basic circuit concepts to MOS circuits.
- To Apply the design for testability methods for combinational & sequential CMOS circuits

Syllabus		Total Hours:48Hrs
Unit-I	**Introduction to Fabrication Process**	**10Hrs**

Introduction: Brief Introduction to IC technology, Moore's Law, Different modes MOSFET operation, Fabrication Process of PMOS, NMOS, CMOS & Bi-CMOS devices, Comparison between CMOS and Bi-polar Technologies.

Fabrication Steps: Wafer Preparation, Oxidation, Photolithography, Etching, Ion Implantations,Metallization, Testing

Unit-II	Basic Electrical Properties of MOS/BiCMOS devices	10Hrs

Basic Electrical Properties: Ids Vs Vds relationships, MOS transistor Threshold Voltage-VT, figure of merit-ω0, Transconductance - gm, Output conductance-gds, Pass transistor logic, NMOS Inverter, Pull-up to Pull-down Ratio for NMOS inverter driven by another NMOS inverter, and through one or more pass transistors Various pull ups, CMOS Inverter analysis and design, Bi-CMOS Inverters.

Unit -III	Basic Circuit Concepts	8Hrs

Basic Circuit Concepts: Sheet Resistance Rs and its concepts to MOS, Area Capacitances calculations, Inverter Delays, Driving large Capacitive Loads, Wiring Capacitances, Fan-in and fan-out

Unit -IV	VLSI Circuit Design Processes	10Hrs

VLSI Design Flow, MOS Layers, Stick Diagrams, Design Rules and Layout, Lambda(λ)-based design rules for wires, contacts and Transistors, Layout Diagrams for NMOS and CMOS Inverters Logic Gates and Various MOS Circuits. Scaling of MOS circuits, Limitations of Scaling.

Unit -V	CMOS Testing	10Hrs

CAD Tools for Design and Simulation, Aspects of Design Tools, Design for Testability, Testing Combinational Logic, Testing Sequential Logic, Practical Design for Test (OFT) Guidelines, Scan Design Techniques, Built-In-Self-Test (BIST), Future Trends.

Course Outcomes(CO):

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

- Acquire qualitative knowledge about the fabrication process of integrated circuit using MOS transistors.
- Understand the concept of Basic Electrical Properties of MOS/Bi-CMOS Devices
- Apply the basic circuit concepts to MOS circuits.
- Understand the concept of Scaling of MOS circuits and Limitations of Scaling
- Apply the design Rules to draw the Stick diagram &layout of a given logic circuit.
- Interpret the need for testability and testing methods in VLSI

Textbooks:

1. Kamran Eshraghian, "Essentials of VLSI Circuits and Systems", Douglas and A. Pucknell and SholehEshraghian, Prentice-Hall of India Private Limited, 2005 Edition.
2. Behzad Razavi , "Design of Analog CMOS Integrated Circuits", McGraw Hill, 2003
3. Modern VLSI Design – Wayne Wolf, 3 Ed., 1997, Pearson Education.

References:

1. Jan M. Rabaey, “Digital Integrated Circuits”, AnanthaChandrakasan and Borivoje Nikolic, Prentice-Hall of India Pvt.Ltd, 2nd edition, 2009.
2. John P. Uyemura, “Introduction to VLSI Circuits and Systems”, John Wiley & Sons, reprint 2009
3. CMOS VLSI Design-A Circuits and Systems Perspective, Neil H.E Weste, David Harris, Ayan Banerjee, 3rd Edn, Pearson, 2009.

CLOUD COMPUTING
(Common to CE,EEE,ME and ECE)
(Open Elective Course-III)

Course Code	L:T:P	Credits	Exam Marks	Exam Duration	Course Type
22A0529T	3:0:0	3	CIE: 30 SEE:70	3 Hours	OEC

Course Objectives:

This course will enable students to:

- To introduce the broad perceptive of cloud architecture and model
- To understand the concept of Virtualization and familiar with the lead players in cloud.
- To understand the features of cloud simulator and apply different cloud programming model
- To design of cloud Services and explore the trusted cloud Computing system

Syllabus		Total Hours:48
Unit -I	**Basics of Cloud Computing**	**10Hrs**

Introduction to Cloud: Introduction to Cloud, Cloud Computing Reference Model, Characteristics and Benefits, Challenges Ahead, Elasticity in Cloud, On-demand Provisioning.

Virtualization: Introduction, Characteristics of Virtualized Environment, Taxonomy of Virtualization Techniques, Virtualization, and Cloud computing.

Unit -II	Cloud Architecture, Models and Security	9Hrs

Cloud Computing Architecture: Introduction, Cloud Reference Model, Architecture, Infrastructure / Hardware as a Service, Platform as a Service, Software as a Service, Types of Clouds.

Cloud Deployment Model: Public Clouds, Private Clouds, Hybrid Clouds, Community Clouds, Economics of the Cloud.

Unit -III	Cloud Technologies and Advancements	10Hrs

Apache Hadoop, Map Reduce, Hadoop Cluster setup, Virtual Box, Google App Engine, Programming Environment for Google App Engine – Open Stack

Unit -IV	VM ware Simulator	9Hrs

VM Ware: Basics of VM Ware, Advantages of VMware virtualization, create a new virtualmachine on local host, cloning virtual machines, virtualize a physical machine, starting and stopping a virtual machine.

Unit -V	Cloud Applications	10Hrs

Cloud Applications: Scientific Applications – Health Care, Geoscience.

Business And Consumer Applications - CRM and ERP, Social Networking, Media Applications,and Multiplayer Online Gaming.

Text Books:

1. Mastering Cloud Computing by RajkumarBuyya, Christian Vecchiola, S.Thamarai Selvi fromTMH 2013.
2. George Reese, "Cloud Application Architectures: Building Applications and Infrastructure inthe Cloud" O'Reilly
3. Cloud computing a practical approach - Anthony T.Velte , Toby J. Velte Robert Elsenpeter, TATA McGraw- Hill , New Delhi – 2010.

Reference Books:

1. Cloud computing for dummies- Judith Hurwitz , Robin Bloor , Marcia Kaufman ,Fern Halper,Wiley Publishing, Inc, 2010
2. Cloud Computing (Principles and Paradigms), Edited by Rajkumar Buyya, James Broberg,Andrzej Goscinski, John Wiley & Sons, Inc. 2011
3. Enterprise Cloud Computing, Gautam Shroff, Cambridge University Press, 2010.
4. Cloud Application Architectures: Building Applications and Infrastructure in the Cloud,George Reese, O 'Reilly, SPD, rp2011.
5. Essentials of Cloud Computing by K. Chandrasekaran. CRC Press. Cloud computing A Hands-On Approach by ArshdeepBahga and Vijay Madisetti.

Web Resources:

1. https://nptel.ac.in/courses
2. https://freevideolectures.com/university/iitm

Course Outcomes(CO):

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

CO1: Understand the basic concepts about cloud computing vision and its developments and gainthe Knowledge of virtualization technology.

CO2: Analyze the concepts of cloud services and the deployment models.

CO3: Choose among various cloud technologies for implementing applications (GAE, Open stack,etc)

CO4: Construct the virtual machines by using VMware simulator.

CO5: Build scientific applications by using Cloud environment.

CO6: Develop Business and Consumer Applications.

MEASUREMENTS AND MECHATRONICS (Open Elective Course-III)					
Course Code	**L:T:P**	**Credits**	**Exam marks**	**Exam Duration**	**Course Type**
22A0329Tc	**3:0:0**	**3**	**CIE:30 SEE:70**	**3 Hours**	**OEC**

Course Objectives:

- To instruct the principles of interchangeable manufacture.
- To introduce basic principles of mechanical measurements.
- To impart knowledge on mechatronics systems.

Syllabus		**Total Hours: 48**
UNIT-I	**Limits & Fits**	**10 Hrs**

Introduction, terminology pertaining to limits and fits – unilateral and bilateral tolerance system, holeand shaft basis systems – Interchangeability, deterministic & statistical tolerance, selective assembly. International Standard system of limits and fits

Limit Gauges: Taylor's principle – Classification and design of limit gauges.

UNIT-II	**Linear and Angular Measurements**	**10 Hrs**

Line and end standards, slip gauges and length bars. bevel protractor – angle slip gauges – spiritlevels and auto collimator.

Interferometry Applied to Measurement: NPL flatness interferometer and NPL gaugeinterferometer.

Surface Roughness Measurement: Differences between surface roughness and surface waviness-Numerical assessment of surface finish – CLA, R.M.S, Rz values, Methods of measurement of surface finish – Profilograph, Talysurf

UNIT-III	**Mechanical Measurements**	**9 Hrs**

Introduction to measurement: Elements of generalized measurement system **Displacement Measurement**- Linear Variable Differential Transformer (LVDT), encoders,potentiometers.

Temperature Measurement - Pyrometers, Resistance Temperature Detector (RTD)

Strain Measurement-Electrical strain gauge – gauge factor – method of usage of resistance straingauge

UNIT-IV	**Mechatronics Systems**	**9 Hrs**

Mechatronics systems- Elements of mechatronics system, mechatronics design process, system - measurement systems, control systems, programmable logic controllers, case studies of mechatronic systems

UNIT-V	**Actuating Systems:**	**10Hrs**

Hydraulic and pneumatic actuating systems - fluid systems, hydraulic systems, and pneumatic systems, components, control valves. mechanical actuating systems and electrical actuating systems – basic principles and elements.

Textbooks:

1. R.K. Jain, "Engineering Metrology", Khanna Publishers.
2. BeckWith, Marangoni, Linehard, " Mechanical Measurements", 6th edition,PHI / PE.
3. W. Bolton , "Mechatronics – Electronic Control Systems in Mechanical and
4. Electrical Engg.", 4th Edition, Pearson, 2012.

Reference Books:

1. 1. IC Guptha,"Engineering Metrology ",Danpath Rai Publications.
2. Doeblin Earnest. O. Adaptation by Manik and Dhanesh,"Measurement Systems: Application andDesign", Tata Mc Graw Hill Publications.

Course Outcomes(CO):

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

CO1: Design the limit gauges for interchangeable manufacture.

CO2: Apply the basic principles of mechanical measurements for engineering practice.

CO3: Illustrate the role of mechatronics systems in manufacturing.

CO4: Explain principles of mechanical, hydraulic, pneumatic and electrical actuating systems.

CO5: Understand the components of a typical mechatronic system.

CO6: Understand the Design Aspects of a Mechatronic system.

Unconventional Machining Processes
(Open Elective Course-III)

Course Code	L:T:P:S	Credits	Exam marks	Exam Duration	Course Type
22A0330Tc	3: 0:0 :0	3	CIE:30 SEE:70	3 Hours	OEC

Course Objectives:

1. Define various Modern Machining Processes.
2. Acquire knowledge in the elementary mechanism and machinability of materials with different Modern Machining Processes.
3. Determine basic principles of operation for each process and their applications.
4. State various parameters influencing MRR in Non – Traditional Machining Process.
5. Classify and understand the working of Additive Manufacturing Processes.

Syllabus **Total Hours:56**

UNIT - I	Non – Traditional Machining Processes	12 Hrs

Introduction, Need, Classification and Brief Overview, Considerations in Process selection, Materials, Applications.

Mechanical Energy Based Processes: Abrasive Jet Machining, Water Jet Machining, Abrasive Water Jet Machining, Ultra Sonic Machining – Working Principle, Description of Equipment, Process Parameters, Metal Removal Rate, Applications, Advantages and Limitations.

UNIT - II	Electrical Energy Based Processes:	10 Hrs

Electric Discharge Machining – Working Principles, Description of Equipment, Process Parameters, Surface Finish and MRR, Electrode / Tool, Power and Control Circuits, Tool Wear, Dielectric Fluid, Flushing, Advantages, Limitations and Applications. Wire cut EDM – Working Principle and Applications.

UNIT - III	Chemical and Electro Chemical Energy Based Processes:	10 Hrs

Chemical Machining and Electro Chemical Machining – Working Principle, Description of Equipment, Etchants, Maskants, Techniques of Applying Maskants, Process Parameters, Surface Finish and MRR, Electro Chemical Grinding, Electro Chemical Honing, Applications, Advantages and Limitations

UNIT - IV	Thermal Energy Based Processes:	12 Hrs

Laser Beam Machining and Drilling, Plasma Arc Machining, Electron Beam Machining – Working Principle, Description of Equipment, Process Parameters, Applications, Advantages and Limitations.

UNIT - V	Additive Manufacturing	12 Hrs

Introduction to Additive Manufacturing, Classification of Additive Manufacturing Processes, Working Principle, Advantages, Limitations and Applications of Sterolithography (SLA), Fused Deposition Modeling, Selective Laser Sintering, Laminated Object Manufacturing

CourseOutcomes(CO):

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

1. Illustrate advanced machining processes, cutting tools and cutting fluids for a specific material and part features.
2. Classify the mechanism of Mechanical Energy based machining processes, its applications and limitations.
3. Differentiate Electrical Energy Based machining processes, mechanism of metal removal, machine tool selection.
4. Interpret Electro Chemical machining process, economic aspects of ECM and problems on estimation of metal removal rate.

Textbooks:

1. Jain V.K., Advanced Machining Processes, 1st Edition, Allied Publishers Pvt. Ltd., New Delhi, 2007.
2. Pandey P.C and Shan H.S., Modern Machining Processes, 1/e, McGraw Hill, New Delhi, 2007.
3. Ian Gibson, David W. Rosen, Brent Stucker, Additive Manufacturing Technologies: Rapid Prototyping to Direct Digital Manufacturing, 1/e, Springer, 2010.

Reference Books:

1. Chua C.K., Leong K.F. and Lim C.S., Rapid Prototyping: Principles and Applications, 2/e, World Scientific Publishers, 2003.
2. Benedict G.F., Nontraditional Manufacturing Processes, 1/e, CRC Press, 1987.
3. Mishra P.K., Nonconventional Manufacturing, 1/e, Narosa Publishing House, New Delhi, 2014.
4. McGeough J.A., Advanced Methods of Machining, 1/e, Springer, 1988.

CONSTRUCTION MANAGEMENT
(Common to ME, CSE,AI&ML, CS, DS, ECE,EEE)
(Open Elective Course-IV)

Course Code	L:T:P	Credits	Exam marks	Exam Duration	Course Type
22A0152T	3:0:0	3	CIE:30 SEE:70	3 Hours	OEC

Course Objectives:

- To make the student familiar with various construction activities, preparing constructionschedule and maintaining documents and records of those activities
- To teach the students about various terms and technologies involved in earthwork of constructionactivities
- To make the students familiar with concepts involved in project management like bar charts andmilestone charts
- To teach the students the concepts of time estimates involved in CPM and PERT , float andslack, critical path calculations

Syllabus		Total Hours:48
Unit-I	**Fundamentals of Construction Technology**	**9 Hrs**

Definitions and Discussion – Construction Activities –Construction Processes -Construction Works – Construction Estimating – Construction Schedule – Productivity and Mechanized Construction – Construction Documents – Construction Records – Quality – Safety – Codes and Regulations.

Unit-II	**Earth Work**	**9 Hrs**

Classification of Soils – Project Site – Development – Setting Out - Mechanized Excavation – Groundwater Control – Trenchless (No-dig) Technology – Grading – Dredging.Rock Excavation – Basic Mechanics of Breakage – Blasting Theory – Drillability of Rocks – Kinds of Drilling – Selection of the Drilling Method and Equipment – Explosives – Blasting Patterns and Firing Sequence – Smooth Blasting – Environmental Effect of Blasting

Unit -III	**Project Management , Bar Charts and Milestone Charts**	**10 Hrs**

Project planning – Scheduling – Controlling – Role of decision in project management – Techniques for analyzing alternatives Operation research – Methods of planning and programming problems – Development of bar chart – Illustrative examples – Shortcomings of bar charts and remedial measures – Milestone charts

Unit -IV	**Elements of Network and Development of Network**	**10 Hrs**

Introduction – Event – Activity – Dummy – Network rules – Graphical guidelines for network –Common partial situations in network – Numbering the events – Cycles Problems.

Unit -V	**PERT and CPM**	**10 Hrs**

Time estimates – Frequency distribution – Mean, variance and standard deviation-Expected time Problems - Earliest expected time – Formulation for TE - Latest allowable occurrence time – Formulation for TL - Combined tabular computations for TE and TL problems. Introduction - Slack – Critical path-Illustrative examples Problems.

Textbooks:

1. Construction project management by Jha ,Pearsonpublications, New Delhi 2nd Edition 2015
2. Construction Technology by SubirK.Sarkar and SubhajitSaraswati – Oxford Higher EducationUniv.Press, Delhi 2008 edition
3. 3. Project Planning and Control with PERT and CPM by Dr.B.C.Punmia, K.K.Khandelwal, Lakshmi Publications New Delhi 2022 editionDelhi

Reference Books:

1. Optimal design of water distribution networks P.R.Bhave, Narosa Publishing house 2003.
2. Total Project management, the Indian context- by: P.K.JOY- Mac Millan Publishers IndiaLimited.

E-resources:

1. https://nptel.ac.in/courses/105104161

Course Outcomes(CO):

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

CO1: Identify the various construction activities like preparing construction schedule an maintainingdocuments and records of those activities

CO2: Understand the concepts and techniques involved in earthwork activities

CO3: Understand about the emerging infectious diseases and aids their management

CO4: Understand the steps involved in developing a project scheduling and management and theapplication of bar charts and milestone charts.

CO5: Understand the various elements of a network diagram like event, activity and dummy.

CO6: Understand the concepts of calculation of time estimates of CPM and PERT

INDUSTRIAL ELECTRONICS Common to (EEE,CSE, AI&ML, CS, DS)
(Open Elective Course-IV)

Course Code	L:T:P	Credits	Exam marks	Exam Duration	Course Type
22A0433T	3:0:0	3	CIE:30& SEE:70	3 Hours	OEC

Course Objectives:

The objectives of the course are to make the students learn about:

- Describe semi-conductor devices (such as PN junction diode & Transistor) and their switching characteristics.
- Understand the characteristics of AC to DC converters.
- Understand about the practical applications Electronics in industries.
- Describe the ultrasonic and its application.

Syllabus — **Total Hours:48Hrs**

Unit-I — **10Hrs**

Scope of industrial Electronics, Semiconductors, Merits of semiconductors, crystalline structure, Intrinsic semiconductors, Extrinsic semiconductors, current flow in semi conductor, Open circuited p-n junction, Diode resistance, Zener diode, Photo conductors and junction photo diodes, Photo voltaic effect, Light emitting diodes(LED).

Unit-II — **10Hrs**

Introduction, The junction transistor, Conventions for polarities of voltages and currents, Open circuited transistor, Transistor biased in the active region, Current components in transistors, Currents in a transistor, Emitter efficiency, Transport factor and transistor-α, Dynamic emitter resistance, Transistor as an amplifier, Transistor construction, Letter symbols for semiconductor Devices, Characteristic curves of junction transistor in common configuration, static characteristic curves of PNP junction transistor in common emitter configuration, The transistor in common collector Configuration.

Unit -III — **8Hrs**

AC to DC converters- Introduction, Classification of Rectifiers, Half wave Rectifiers, Full wave Rectifiers, Comparison of Half wave and full wave rectifiers, Bridge Rectifiers, Bridge Rectifier meter, Voltage multiplying Rectifier circuits, Capacitor filter, LC Filter, Metal Rectifiers, Regulated Power Supplies, Classification of Voltage Regulators, Short period Accuracy of Regulators, Long period .Accuracy of Voltage Regulator, Principle of automatic voltage Regulator, Simple D.C. Voltage stabilizer using Zener diode, D.C. Voltage Regulators, Series Voltage Regulators, Complete series voltage regulator circuit, Simple series voltage regulator.

Unit -IV — **10Hrs**

Resistance welding controls: Introduction, Resistance welding process, Basic Circuit for A.C.resistance welding, Types of Resistance welding, Electronic welding control used in Resistance welding, Energy storage welding. Induction heating: Principle of induction heating, Theory of Induction heating merits of induction heating, Application of induction heating, High frequency power source of induction heating. Dielectric heating: Principle of dielectric heating, theory of dielectric heating, dielectric properties of typical materials, electrodes used in dielectric heating, method of coupling of electrodes to the R.F. generator, Thermal losses in Dielectric heating, Applications

Unit -V — **10Hrs**

Ultrasonics: Introduction, Generation of Ultrasonic waves, Application of Ultrasonic waves, Ultrasonic stroboscope, ultrasonic as means of communication, ultrasonic flaw detection, Optical image on nonhomogeneities, ultrasonic study of structure of matter, Dispersive study of structure of matter, Dispersive and colloidal effect of Ultrasonic, Coagulating action of Ultrasonic, separation of mixtures by ultrasonic waves, cutting and machining of hard materials by ultrasonic vibrations, Degassing of liquids by ultrasonic waves, Physio-chemical effects of ultrasonics, chemical effects of ultrasonics, Thermal effects of ultrasonics, soldering and welding by ultrasonics, Ultrasonic Drying

Course Outcomes(CO):

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

- Understand the semi-conductor devices and their switching characteristics.
- Apply the Ultrasonic waves with different applications.
- Understand the working of Transistor and its different configurations.
- Analyze the thermal effects of ultrasonic, soldering and welding by ultrasonic, ultrasonic Drying in the industry; interpret the characteristics of AC to DC converters.
- Develop the practical applications Electronics in industries.
- Apply the process of Resistance welding, Induction heating and Dielectric heating in the industry

Textbooks:

1. Fundamentals of Industrial Electronics, Bogdan M Wilamowski, J David irwin, 2nd Edition, 2011.
2. Industrial and Power Electronics – G. K. Mithal and Maneesha Gupta, Khanna Publishers, 19th Ed., 2003.
3. Integrated Electronics – J. Millman and C.C Halkias, McGraw Hill, 1972

References:

1. Electronic Devices and circuits – Theodore. H. Bogart, Pearson Education, 6th Edn., 2003.
2. Integrated Circuits and Semiconductor Devices – Deboo and Burroughs, ISE

CYBER SECURITY
(Common to CE,EEE,ME and ECE)
(Open Elective Course-IV)

Course Code	L:T:P	Credits	Exam Marks	Exam Duration	Course Type
22A0534Ta	3:0:0	3	CIE: 30 SEE:70	3 Hours	OEC

Course Objectives:

This course will enable students to:

- The Cyber security Course will provide the students with foundational Cyber Security principles,Security architecture, risk management, attacks, incidents, and emerging IT and IS technologies.
- Students will gain insight into the importance of Cyber Security and the integral role of Cyber Security professionals.
- Evaluate the trends and patterns that will determine the future state of cyber security.

Syllabus		Total Hours:48
Unit -I	**Introduction to Cybercrime**	**9 Hrs**

Introduction to Cybercrime: Definition and Origins of the Word, Cybercrime and Information Security, Who are Cybercriminals, Classifications of Cybercrimes, Cybercrime: The Legal Perspectives, Cybercrimes: An Indian Perspective, Cybercrime and the Indian ITA 2000, AGlobal Perspective on Cybercrimes, Cybercrime Era: Survival Mantra for the Netizens

Unit -II	**Cyber Offenses**	**10 Hrs**

How Criminals Plan Them –Introduction, How Criminals Plan the Attacks, Social Engineering, Cyber stalking, Cyber Cafe and Cybercrimes, Botnets: The Fuel for Cybercrime, Attack Vector Backdoors-Steganography-SQL Injection.

Unit -III	**Cybercrime Mobile and Wireless Devices**	**9 Hrs**

Introduction, Proliferation of Mobile and Wireless Devices, Trends in Mobility, Credit Card Frauds in Mobile and Wireless Computing Era, Security Challenges Posed by Mobile Devices, Registry Settings for Mobile Devices, Authentication Service Security, Attacks on Mobile/Cell Phones, Mobile Devices: Security Implications for Organizations, Organizational Measures for
Handling Mobile.

Unit -IV	**Tools and Methods Used in Cybercrime**	**10Hrs**

Introduction, Proxy Servers and Anonymizers, Phishing, Password Cracking, Key loggers and Spywares, Virus and Worms, Trojan Horses and Backdoors, DoS and DDoS Attacks, Buffer Overflow, Attacks on Wireless Networks, Phishing and Identity Theft: Introduction, Phishing, Identity Theft (ID Theft).

Unit -V	**Cyber Crimes and Security**	**10Hrs**

Cyber Security –Organizational implications-cost of cybercrimes and IPR issues Web threats for organizations: the evils and Perils-Social media marketing Security and privacy Implications- Protecting people privacy in the organizations Forensic best practices for organizations. Cases.

Text Books:

1. Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives, NinaGodbole, SunitBelapure, Wiley.
2. Principles of Information Security, MichealE.Whitman and Herbert J.Mattord, Cengage Learning

Reference Books:

1. Information Security, Mark Rhodes, Ousley, MGH.

E-resources:

1. https://www.tutorialspoint.com/fundamentals_of_science_and_technology/cyber_crime_and_cyber_security.htm
2. https://www.javatpoint.com/cyber-security-tutorial
3. https://www.youtube.com/watch?v=lpa8uy4DyMo&list=PL9ooVrP1hQOGPQVeapGsJCktzIO 4DtI4_

Course Outcomes(CO):

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

CO1: Understand Cyber Security architecture principles

CO2: Identifying System and application security threats and vulnerabilities

CO3: Identifying different classes of attacks

CO4: Cyber Security incidents to apply appropriate response

CO5: Describing risk management processes and practices

CO6: Demonstrate the role security management in cyber security defense

Non-Destructive Evaluation
(Open Elective Course-IV)

Course Code	L:T:P	Credits	Exam Marks	Exam Duration	Course Type
22A0332Tb	3:0:0	3	CIE: 30 SEE:70	3 Hours	OEC

Course Objectives:

Course Objectives
• To familiarize with the concepts of various NDT techniques to identify the defect in a mechanical component.

Syllabus		Total Hours:56
UNIT - I	Introduction to NDT and Radiography Test	12 Hrs

Introduction: Overview of non-destructive testing, types of materials testing, Preliminary NDT methods, NDT methods
Radiography test: Sources of X rays and Gamma Rays, their properties and interaction with matter, radiographic test, film characteristics, radiographic equipment, Radiographic techniques, safety aspects, advantages, limitations, industrial applications of radiography test.

UNIT - II	Ultrasonic Test	10 Hrs

Principle of wave propagation, piezo-electric effect, ultrasonic transducers - characteristics, ultrasonic equipment, testing procedure, interpretation, evaluation, advantages, limitations, industrial applications of ultrasonic testing.

UNIT - III	Liquid Penetrant Test	10 Hrs

Basic concepts, liquid penetrant system, surface preparation, test procedure, examination, interpretation, evaluation, advantages, limitations, industrial applications of liquid penetrant testing.

UNIT - IV	Magnetic Particle Test	12 Hrs

Magnetic materials, principle of magnetic particle test, magnetic particle test equipment, test procedure, interpretation and evaluation, advantages, limitations, Industrial applications of the magnetic particle test.

UNIT - V	Eddy Current Test	12 Hrs

Principle of eddy current, factors affecting eddy currents, impedance diagram, eddy current test system, test coils, advantages, limitations and industrial applications of eddy current test.

Course Outcomes

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

1. describe choose a suitable non-destructive method to find the defect in the given mechanical components using radiography test, ultrasonic test, liquid penetrant test, magnetic particle test and eddy current test

Textbooks:

1. J Prasad and GCK Nair, "Non-Destructive Test and Evaluation of Materials", Tata McGraw-Hill Education, 2nd edition, 2011.
2. B Raj, T Jayakumar and M Thavasimuthu, "Practical Non Destructive Testing", Alpha Science International Limited, 3rd edition, 2017.

Reference Books:

1. V Jayakumar and K Elangovan, "Non-Destructive Testing of Materials", Lakshmi Publications, 2nd edition, 2018.
2. George V. Crowe, "An Introduction to Nondestructive Testing", American Society for Nondestructive Testing, 3rd edition, 2009.
3. Ravi Prakash, "Non-Destructive Testing Techniques", New age international publishers, 1st edition, 2021.

RENEWABLE ENERGY SOURCES (Open Elective Course-IV)					
Course Code	**L:T:P**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
22A0327Ta	**3:0:0**	**3**	**CIE: 30 SEE:70**	**3 Hours**	**OEC**

Course Objectives:

This course will enable students to:

- To impart knowledge on non-conventional sources of energy and techniques used in exploitingsolar, wind, tidal and geothermal sources of energy and Biomass.
- To introduce direct energy conversion systems such as thermo electric, MHD and Fuel Cells.

Syllabus		Total Hours:47
UNIT-I	**Energy Sources and Their Availability**	**10Hrs**

Energy Sources and Their Availability: Conventional and non-conventional energy sources. Needof Renewable Energy Sources (RES), classification of RES, role and potential of RES in India.

Solar Radiation: Structure of the sun, solar constant, environmental impact of solar radiation, radiation at the earth surfaces, solar radiation measuring instruments, solar radiation Geometry, extraterrestrial and terrestrial solar radiation, spectral distribution of extraterrestrial radiation, solar radiation on tilted surfaces and empirical equations for estimating solar radiation.

UNIT-II	**Solar Collectors**	**9Hrs**

Solar Collectors: Principles of the conversion of solar radiation into heat, classifications of solar collectors-flat plate collectors and concentrating collectors, collector materials, performance analysis of a flat plate collector.

Solar Energy Storage and applications: Different storage methods-sensible and latent heat, solar ponds, solar water heating, space heating /cooling, solar electric conversion, solar distillation, solar pumping, solar furnace, solar cooking and solar green house.

UNIT-III	**Wind Energy**	**10Hrs**

Wind Energy: Principles of wind energy conversion, site selection consideration, basic components,types of wind machines – horizontal axis and vertical axis, applications, Betz coefficient.

Biomass Energy Conversion Systems: Biomass conversion technologies, photosynthesis, biogasgeneration, factors affecting bio-digestion, classification of biogas plants, advantages and disadvantages, bio mass gasification

Geothermal Thermal Energy: Resources, types of wells, methods of harnessing the energy.

UNIT-IV	**Ocean Thermal Energy**	**9Hrs**

Ocean Thermal Energy: Methods of Ocean thermal electric power generation open cycle systems,closed cycle systems

Tidal Power System: Working principle, components of tidal power plant, single basin and doublebasin tidal energy system advantages and limitations.

Wave Energy: Wave energy conversion Devices-wave energy conversion by floats, high level reservoir wave machine and dolphin type wave power machine. Advantages and disadvantages.

UNIT-V	**Direct Energy Conversion**	**9Hrs**

Direct Energy Conversion: Need for DEC, limitations, principles of DEC. thermoelectric Power –See-beck, Peltier, Joule -Thomson effects, Thermo-electric Power generators

MHD Power Generation: Principles, dissociation and ionization, Hall effect, magnetic flux, MHDaccelerator, MHD engine, power generation systems, electron gas dynamic conversion.

Fuel Cell: Working principle, classification – efficiency – VI characteristics

Text Books:

1. SP Sukhatme, "Solar Energy: Principles of thermal collection and storage" Tata McGraw Hill
2. Tiwari and Ghosal, "Renewable Energy Resources: Basic Principles and Applications", narosa
3. G.D. Rai, "Non-Conventional Energy Sources", Dhanpat Rai and Sons

Reference Books:

1. B.H.Khan, "Non – conventional Energy Resources", Tata McGraw Hill education Pvt. Ltd.
2. 2. Twidell& Weir, "Renewable Energy Sources ". Routledge (Taylor &Francis Group)

Course Outcomes(CO):

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

CO1: Classify various types of renewable sources of energy and illustrate the principles of solarradiation.

CO2: Evaluate solar flat plate collector efficiency and illustrate various solar energy storagemethods and applications.

CO3: Describe the techniques of exploiting wind, biomass and geothermal energies in powergeneration.

CO4: Illustrate the methods of tapping ocean thermal, tidal and wave energies in power generation.

CO5: Describe the working of various direct energy conversion systems and their applications.

Cyber Security incidents to apply appropriate response

CO6: Describing risk management processes and practices

MANAGEMENT SCIENCE					
Course Code	**L:T:P**	**Credits**	**Exam marks**	**Exam Duration**	**Course Type**
22A0023T	**3:0:0**	**3**	**CIE:30& SEE:70**	**3 Hours**	**HSSE**

Course Objectives:

Student will be able to

- To provide fundamental knowledge on Management, Administration, Organization & its concepts.
- To make the students understand the role of management in Production
- To impart the concept of HR Min order to have an idea on Recruitment, Selection, Training & Development, job evaluation and Meritrating concepts.
- To create awareness on identify Strategic Management areas & the PERT/CPM for better Project Management.
- To make the students aware of the contemporary issues in management..

Syllabus		**Total Hours: 48**
Unit-I	**INTRODUCTION TO MANAGEMENT**	**10Hrs**

Management - Concept and meaning - Nature-Functions - Management as a Science and Art and both. Schools of Management Thought - Taylor's Scientific Theory-Henry Fayal's principles -Elton Mayo's Human relations - Systems Theory - Organizational Designs - Line organization -Line&StaffOrganization-FunctionalOrganization-MatrixOrganization-ProjectOrganization-CommitteeformofOrganization-SocialresponsibilitiesofManagement.

Unit-II	**OPERATIONS MANAGEMENT**	**10Hrs**

Principles and Types of Plant Layout - Methods of Production (Job, batch and Mass Production),WorkStudy-StatisticalQualityControl-Deming'scontributiontoQuality.MaterialManagement - Objectives - Inventory-Functions - Types, Inventory Techniques - EOQ-ABC Analysis - Purchase Procedure and Stores Management - Marketing Management - Concept -Meaning-Nature-Functions of Marketing-Marketing Mix-Channels of Distribution-Advertisement and Sales Promotion-Marketing Strategies based on Product Life Cycle.

Unit–III	**HUMAN RESOURCES MANAGEMENT**	**10Hrs**

HRM - Definition and Meaning – Nature - Managerial and Operative functions - Evolution of HRM - Job Analysis - Human Resource Planning(HRP)- Employee Recruitment-Sources of Recruitment- Employee Selection -Process and Tests in Employee Selection –Employee Training and Development- On- the- job & Off-the-job training methods-Performance Appraisal Concept- Methods of Performance Appraisal – Placement- Employee Induction –Wage and Salary Administration.

Unit -IV	**STRATEGIC & PROJECT MANAGEMENT**	**10Hrs**

Definition & Meaning-Setting of Vision -Mission -Goals – Corporate Planning Process-Environmental Scanning - Steps in Strategy Formulation and Implementation - SWOT Analysis –Project Management-Network Analysis- Programme Evaluation and Review Technique (PERT) - Critical Path Method (CPM) Identifying Critical Path - Probability of Completing the project within given time-Project Cost-Analysis-Project Crashing (Simple problems).

Unit–V	**CONTEMPORARY ISSUES IN MANAGEMENT**	**8Hrs**

The concept of Management Information System (MIS) – Materials Requirement Planning (MRP)- Customer Relations Management (CRM) – Total Quality Management (TQM) – Six Sigma Concept – Supply Chain Management (SCM)- Enterprise Resource Planning (ERP)- Performance Management-Business Process Outsourcing (BPO)- Business Process Re-engineering and Bench Marking-Balanced Score Card- Knowledge Management.

Course Outcomes(CO):

On completion of this course, student will be able to

- Understand the concepts & principles of management and designs of organization in a practical world(L2)
- Apply the knowledge of Work-study principles & Quality Control techniques in industry(L3)
- Analyze the concepts of HR Min Recruitment, Selection and Training & Development.(L4)
- Evaluate PERT/CPM Techniques for projects of an enterprise and estimate time & cost of project & to analyze the business through SWOT.(L3)

- Create Modern technology in management science.(L3)

Textbooks:

1. A.RAryasri, “Management Science”, TMH, 2013 Stoner, Freeman, Gilbert, Management, Pearson Education,NewDelhi,2012

Reference Books:

1. Koontz & Weihrich, “Essentials of Management”, 6th edition, TMH,2005.
2. Thomas N.Duening & John M.Ivancevich, “Management Principles and Guidelines”,Biztantra.
3. KanishkaBedi, “Production and Operations Management”, Oxford University Press,2004.
4. Samuel C.Certo, “Modern Management”, 9th edition, PHI,2005

ENTERPRENEURSHIP & INNOVATION					
Course Code	**L:T:P**	**Credits**	**Exam marks**	**Exam Duration**	**Course Type**
22A0024T	**3:0:0**	**3**	**CIE:30 &SEE:70**	**3 Hours**	**HSSE**

Course Objectives:

Student will be able to

- To make the student understand about Entrepreneurship
- To enable the student in knowing various sources of generating new ideas in setting up of New enterprise.
- To facilitate the student in knowing various sources off in an cein starting up of a business
- To impart knowledge about various government sources which provide financial assistance to entrepreneurs / women entrepreneurs
- To encourage the student in creating and designing business plans

Syllabus		**Total Hours: 48**
Unit-I	**INTRODUCTION TO ENTREPRENEURSHIP**	**10Hrs**

Entrepreneurship- Concept, knowledge and skills requirement- Characteristics of successful entrepreneurs- Entrepreneurship process- Factors impacting emergence of entrepreneurship-Differences between Entrepreneur and Intrapreneur- Understanding individual entrepreneurial mind set and personality-Recent trends in Entrepreneurship.

Unit-II	**STARTING UP NEW VENTURE**	**10Hrs**

Starting the New Venture - Generating business idea – Sources of new ideas & methods of generating ideas-Opportunity recognition-Feasibility study-Market feasibility, technical /operational feasibility - Financial feasibility - Drawing business plan - Preparing project report – Presenting business planto investors

Unit–III	**SOURCES OF FINANACE**	**9Hrs**

Sources of finance - Various sources of Finance available - Long term sources - Short term sources -Institutional Finance – Commercial Banks, SFC's in India- NBFC's in India – their way of financing in India for small and medium business - Entrepreneurship development programs in India – The entrepreneurial journey- Institutions in aid of entrepreneurship development.

Unit -IV	**WOMEN ENTREPRENEURSHIP**	**9Hrs**

Women Entrepreneurship- Entrepreneurship Development and Government- Role of Central Government and State Government in promoting women Entrepreneurship - Introduction to various incentives, subsidies and grants – Export-oriented Units - Fiscal and Tax concessions available –Women entrepreneurship - Role and importance - Growth of women entrepreneurship in India- Issues & Challenges-Entrepreneurial motivations.

Unit–V	**INTRODUCTION TO INCUBATION & INNOVATION**	**10Hrs**

Fundamentals of Business Incubation - Principles and good practices of business incubation- Process of business incubation – Types, Advantages and Disadvantages of incubation.

Innovation Meaning & Definition - Forms of innovation - Innovation, features and characteristics - Factors initiating innovations - Innovation process and its stages.

Course Outcomes(CO):

On completion of this course, student will be able to

- Understand the concept of Entrepreneurship and challenges in the world of competition.(L2)
- Apply the Knowledge in generating ideas for New Ventures.(L3)
- Analyzevarioussourcesoffinanceandsubsidiestoentrepreneur/womenEntrepreneurs.(L4)
- Evaluate the role of central government and state government in promoting entrepreneurship.(L3)
- Create and design business plan structure through incubations.(L3)

Textbooks:

1. DFKuratkoandTVRao,"Entrepreneurship**"**-ASouth-AsianPerspective– CengageLearning,2012.(ForPPT,CaseSolutions Facultymayvisit:login.cengage.com)
2. NandanH,"FundamentalsofEntrepreneurship",PHI,2013

Reference Books:

1. VasantDesai, "Small Scale Industries and Entrepreneurship", HimalayaPublishing2012.
2. RajeevRoy"Entrepreneurship",2nd Edition, Oxford, 2012.
3. B.JanakiramandM.Rizwana"EntrepreneurshipDevelopment:Text&Cases",ExcelBooks,2011.
4. StuartRead, Effectual"Entrepreneurship",Routledge, 2013.

BUSINESS ENVIRONMENT

Course Code	L:T:P	Credits	Exam marks	Exam Duration	Course Type
22A0025T	3:0:0	3	CIE:30 &SEE:70	3 Hours	HSSE

Course Objectives:

Student will be able to

- To make the student understand about the business environment.
- To enable the min knowing the importance of fiscal and monitory policy.
- To facilitate the min understanding the export policy of the country.
- Impart knowledge about the functioning and role of WTO.
- Encourage the student in knowing the structure of stock market

Syllabus — **Total Hours: 48**

Unit-I	AN OVERVIEW OF BUSINESS ENVIRONMENT	10Hrs

Overview of Business Environment – Types of Environments - Internal & External –Micro and Macro environment-Competitive structure of industries - Environmental analysis - Scope of business- Characteristics of business-Process & limitations of environmental analysis.

Unit-II	FISCAL POLICY & MONETARY POLICY	10Hrs

FISCALPOLICY-PublicRevenues-PublicExpenditure-PublicdebtDevelopmentactivities financed by public expenditure - Evaluation of recent fiscal policy of Government of India - Highlights of Budget - MONETARY POLICY - Demand and Supply of Money – RBI -Objectivesofmonetaryandcreditpolicy-Recenttrends-RoleofFinanceCommission.

Unit –III	INDIA'S TRADE POLICY & BALANCE OFPAYMENTS	10Hrs

INDIA'S TRADE POLICY - Magnitude and direction of Indian International Trade – Bilateral and Multilateral Trade Agreements - EXIM policy and role of EXIM bank - BALANCE OFPAYMENTS–Structure &Major components-Causes for Disequilibrium in Balance of Payments-Correction measures–WTO - Nature and Scope - Organization and Structure – Role and functions of WTO in promoting world trad.

Unit -IV	MONEY MARKETS AND CAPITAL MARKETS	10Hrs

Features and components of Indian financial systems - Objectives, features and structure of money markets and capital markets -Reforms and recent development– SEBI - Stock Exchanges - Investor protection and role of SEBI.

Unit –V	INTRODUCTION TO INFLATION	8Hrs

Inflation – Meaning & Definition – Causes – Effects – Types – Advantages &Disadvantages Deflation – Meaning & Definition - Causes & Effects.

Course Outcomes(CO):

On completion of this course, student will be able to

- Understand various types of business environment. (L2)
- Evaluate fiscal and monitory policy (L3)
- Analyze India's Trade Policy(L4)
- Understand the role of WTO(L2)
- Apply the knowledge of Money markets in future investment (L3)

Textbooks:

1. Francis Cherunilam (2009), "International Business":Textand Cases, Prentic e Hall of India.
2. K.Aswathappa,"Essentials of Business Environment": Texts and Cases & Exercises 13th Revised Edition. HPH 2016.13

Reference Books:

1. K.V.Sivayya,V.B.MDas(2009),IndianIndustrialEconomy,Sultan Chand Publishers,NewDelhi,India.
2. Sundaram,Black(2009),InternationalBusinessEnvironmentTextandCases,PrenticeHallofIndia,New Delhi,India.
3. Chari.S.N (2009),International Business,WileyIndia.
4. E.Bhattacharya(2009),International Business,Excel Publications,NewDelhi.

HUMAN RESOURCE MANAGEMENT					
Course Code	**L:T:P**	**Credits**	**Exam marks**	**Exam Duration**	**Course Type**
22A0026T	**3:0:0**	**3**	**CIE:30 &SEE:70**	**3 Hours**	**HSSE**

Course Objectives:

Student will be able to

- To make the student understand about human resource management.
- To enable the students about job analysis, job specification and job enrichment.
- To enable the students knowing about HR planning and retention.
- To impact knowledge about recruitment, selection and performance appraisal.
- To create knowledge on training and development, compensation management.

Syllabus		**Total Hours: 48**
Unit-I	**HUMAN RESOURCE MANAGEMENT-INTRODUCTION**	**9Hrs**

Introduction- Objectives – Scope & Features of HRM – Importance & - Functions of HRM- Challenges of HRM. Personnel Management Vs HRM – Role of HR manager - Strategic Human Resource Management.

Unit-II	**JOB ANALYSIS AND JOB DESIGN**	**9Hrs**

Job Analysis Process –Techniques of Data Collection - Contents of Job Description & Job Specification - Job design - Factors affecting Job design - Job enrichment Vs Job enlargement.

Unit –III	**HUMAN RESOURCE PLANNING AND EMPLOYEE RETENTION**	**10Hrs**

Objectives and Need of HR planning, Process of HR Planning and factors affect the HR Planning -HR Information System - Employee retention - Importance of retention - strategies of retention.

Unit -IV	**HR ACQUISITION AND MANAGING EMPLOYEE PERFORMANCE**	**11Hrs**

Recruitment - Objectives and Sources of recruitment - Selection - Objectives - Selection Procedure - Placement - Performance Appraisal –Objectives & Importance, performance Appraisal Methods – Constraints.

Unit –V	**HR DEVELOPMENT AND COMPENSATION MANAGEMENT**	**9Hrs**

Training and Development– Objectives, Need and Methods of Training –career planning and career development - Compensation Management - Job evaluation – welfare provisions and fringe benefits - Quality Circles and Total Quality Management.

Course Outcomes(CO):

On completion of this course, student will be able to

- Understand the basic concept of Human Resource Management.(L2)
- Explain the job analysis and job design methods.(L2)
- Understand the demand and supply of HR & concept of employee retention.(L2)
- Understand the sources of Recruitment, Selection process and Performance appraisal methods.(L2)
- Examine the Training and Development methods and compensation management process.(L2)

Textbooks:

1. Gary Dessler, Biju Varkkey, Human Resource Management, 4e, Pearson 2017.
2. Robert L. Mathis, John H. Jackson, Manas Ranjan Tripathy, Human Resource Management, Cengage Learning 2016.

Reference Books:

1. Aswathappa, Human Resource Management, 4th Edition, TMH 2006.
2. Subbarao, Personnel and Human Resource Management –Text and cases, Himalaya, 2009
3. R.Wayne Mondy, Robert M.Noe, Human Resource Management, Pearson
4. Noea.Raymond, John Hollenbeck, Barry Gerhart and Patrick Wright, Human Resource Management, Tata McGraw Hill.
5. Muller, Human Resource Management a case study approach, Jaico Publishers, 2008
6. VSP Rao, Human Resource Management, Text and Cases, Excel Books 2006.

OBJECT ORIENTED PROGRAMMING THROUGH JAVA (SKILL)
(Common to EEE,ME and ECE)

Course Code	L:T:P	Credits	Exam marks	Exam Duration	Course Type
22A0509P	1:0:2	2	CIE:30 &SEE:70	3 Hours	SC

Course Objectives:

This course will enable students to:

- To introduce the fundamental concepts of object-oriented programming to design & implement object oriented programming concepts in Java.
- To obtain knowledge about the principles of inheritance and polymorphism
- Learn the usage of Control structures in java
- To implement the concept of Array, interfaces, exception handling
- To understand the usage of Threads in java.

List of Experiments:

1. Fundamentals of Object Oriented Programming: Introduction, Object Oriented Paradigm, Basic concepts of OOP : Class, Object, Inheritance, Polymorphism, Abstraction, Encapsulation.
Task: introduction to Object Oriented Programming and its basic concepts.

2. Overview of Java Language: Introduction, Java features, Java program structure, parts of Java, Java Virtual Machine-Java versus C++, How to Compile & Executing a basic java program.
Task: Differences between Java and C++, Execute "Hello welcome to java" program

3. Variables-Identifiers-Literals- Data types: Integer literals-character literals-Floating point literals- String Literals, Variables, Keywords, Data types.
Task: implementing data types with variables, find valid/invalid variables, Identifiers

4. Operators: Arithmetic operators, Relational operators, Assignment operators, Conditional operators, Type casting/Type Conversion in java.
Task: Perform all arithmetic operators using a single program, program using typecast/type conversion

Module : 5
Java Statements: Input and Output Statements, Accepting Input from the Keyboard, Displaying output with System.out.printf( ) , Displaying Formatted output with String. Format( )
Task: Write a program using I/O statements in java.

6. Control Structures: Conditional control statements :- if ..statement, if… else statement- if-else-if ladder, Switch statement
Task: Write a program to find a person is eligible for vote >18?, Largest number among 3 numbers?

7. Looping/Repetitive/Iterative statements: While statement- Do ..While statement-For Statement,Continue statement-Break statement.
Task: print N natural numbers, sum of N natural numbers, Armstrong number, Strong number using for statement.

8. Arrays: Arrays, One-dimensional arrays, Creating an array, Find The Length Of An Array, Types of Arrays:- Two-dimensional arrays, Creating a two-dimensional array.
Task: Find the N^{th} Largest value in an array, Insert and Addition of values using array

9. Strings: Introduction to strings, Built in strings, Creating Strings, String reverse, String Concatenation, String comparison, Immutability of Strings
Task: write a program to Perform all string operations as single output

10. Classes , Objects& Methods: Introduction, Defining a class, Adding Variables, Object Creation, Initializing the Instance variables, Access Specifiers, Methods, Constructors, Method Overloading
Task: To implement Class and Object concept, Method Overloading program

11. Interfaces: Interface, Multiple Inheritance using Interfaces.
Exception Handling: Errors in Java Program, Exceptions, throws clause, throw clause, Types of Exceptions,
Task: Implement a program using exception handling; write a program Multiple Inheritance using Interfaces.

12. Threads: Introduction, Creating Threads, Extending the Threads, Stopping and Blocking a Thread, Life Cycle of a Thread. single Tasking Using a Thread, Multi tasking Using Threads
Task: Implement a program using Threads.

Course Outcomes:
At the end of the course, students should be able to

- Understand the basic concepts of OOP
- Compare & Contrast basic constructs of C++ & Java
- Develop a program on operators in Java
- Apply Control statements to solve real time problems
- Analyze the concepts of constructers, overloading, Inheritance and Interfaces in java
- Implementing different types of Threads to solve real time problems

Reference Book(s):

1. Programming with Java by E.Balagurusamy.
2. Programming in Java by Sachin Malhotra, OXFORD University Press.
3. Java Complete Reference by Herbert Schildt.
4. John R.Hubbard, Programming with Java, Second Edition, Schaum's outline series, TATA McGraw-Hill Company.

Web Reference:

1. https://www.javatpoint.com/java-tutorial
2. https://www.learnjavaonline.org/
3. https://www.tutorialspoint.com/java/index.htm
4. https://www.w3schools.com/java/
5. https://www.geeksforgeeks.org/java/