CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (A)
(AICTE Model Curriculum with Effect from the AY 2020 – 2021)
ME (Thermal Engineering)

SEMESTER – I to SEMESTER - IV

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (A)

(AICTE Model Curriculum with Effect from the AY 2020 – 2021)

ME (Thermal Engineering)

SEMESTER – I

S. No.	Course Code	Title of the Course	Scheme of Instruction			Scheme of Examination			Credits
			Hours per week			Duration of SEE in Hours	Maximum Marks		
			L	T	P		CIE	SEE	
THEORY									
1	20ME C201	Thermodynamics and Combustion	3	--	--	3	40	60	3
2	20ME C202	Advanced Fluid Dynamics	3	--	--	3	40	60	3
3		Programme Elective - I	3	--	--	3	40	60	3
4		Programme Elective - II	3	--	--	3	40	60	3
5	20ME M103	Research Methodology and IPR	2	--	--	3	40	60	2
6		Audit course - 1	2	--	--	2	--	50	Non-Credit
PRACTICALS									
5	20ME C203	Thermal Systems Lab	--	--	4	--	50	--	2
6	20ME C204	Design of Solar and Wind Systems Lab	--	--	4	--	50	--	2
TOTAL			**16**	--	**8**	--	**300**	**350**	**18**

L: Lecture D: Drawing CIE - Continuous Internal Evaluation

T: Tutorial P: Practical/Mini Project with Seminar/Dissertation Phase

SEE – Semester End Examination

Programme Elective – I (3/3)			Programme Elective – II (3/3)		
S No	Subject Code	Name of the Subject	S No	Subject Code	Name of the Subject
1	20ME E201	Thermal and Nuclear Power Plants	4	19ME E203	Air Conditioning System Design
2	20ME E202	Environmental Engineering and Pollution Control	5	19ME E204	Energy Conservation and Management
3	20ME E103	Optimization Techniques	6	19ME E205	Design of Solar and Wind Systems

Audit Course – 1					
S NO	Subject Code	Name of the Subject	S NO	Subject Code	Name of the Subject
1	20CE A101	Disaster Mitigation and Management	5	20EG A101	English for Research Paper Writing
2	20EE A101	Sanskrit for Technical Knowledge	6	20EG A102	Indian Constitution and Fundamental Rights
3	20EC A101	Value Education	7	20EG A103	Stress Management by Yoga
4	20IT A101	Pedagogy Studies	8	20EG A104	Personality Development through Life's Enlightenment Skills

20ME C201

THERMO DYNAMICS AND COMBUSTION

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

Objectives: To make the students to

1. Review the basic laws of thermodynamics and create awareness of the importance of thermodynamic principles in engineering applications
2. Understand the behavior of real gases vis-à-vis ideal gas
3. Create awareness about the importance of combustion reactions in real time applications
4. Understand the basic principles of power cycles and its relation with combustion processes
5. Understand various methods of direct energy conversion

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

1. Apply various laws of thermodynamics to suit the engineering applications.
2. Apply the knowledge of thermodynamics for the behavior of real gases.
3. Understand the phenomenon of combustion
4. Understand the application of power cycles to engineering practice.
5. Understand various non-conventional energy conversion methods like fuel cells etc

UNIT – I

Thermodynamic Laws: Review of Thermo dynamic Laws and Corollaries – Transient Flow Analysis – Second law of thermodynamics – Entropy - Availability and unavailability – Irreversibility – Thermo dynamic Potentials – Maxwell Relations – Specific Heat Relations – Mayer's relation - Evaluation of Thermodynamic properties of working substance. Third law of thermodynamics, Nerst heat theorem, Introduction to - Statistical thermodynamics, statistical interpretations of first and second law and Entropy

UNIT – II

Real Gas Behaviour: P.V.T. surface – Equations of state – Real Gas Behaviour – Vander Waal's equation - Generalized compressibility Factor – Energy properties of Real Gases – Vapour pressure – Clausius – Clapeyron Equation – Throttling – Joule – Thompson coefficient, Non-reactive Mixture of perfect Gases – Governing Laws, Real Gas Mixture

UNIT – III

Combustion: Combustion – Combustion Reactions – Enthalpy of Formation – Entropy of Formation – Reference Levels for Tables – Heat of Reaction – Adiabatic flame Temperature, General product – Enthalpies – Equilibrium. Chemical Equilibrium of Ideal Gases – Effects of Non-reacting Gases Equilibrium in Multiple Reactions. The Van Hoff's Equation - The chemical potential and phase Equilibrium – The Gibbs phase Rule

UNIT – IV

Power Cycles: Power cycles, Review Binary vapour cycle, co-generation and combined cycles – Second law analysis of cycles – Refrigeration cycles. Thermo Dynamics of irreversible processes – Thermo electric circuits

UNIT – V

Direct Energy Conversion: Introduction – Fuel Cells - Thermo electric energy – Thermo-ionic power generation -Thermodynamic devices - Magneto Hydrodynamic Generations – Photo voltaic cells

Text Books:

1. Younus. A. Cengel & Michael. A. Boles, "Thermodynamics: An Engineering Approach", 7/e, TMH.
2. Y.V.C. Rao. "Postulates and Statistical Thermodynamics", Allied Publishers Inc., 1994.

Suggested Reading:

1. P.K. Nag, "Basic and Applied Thermodynamics", TMH, 2008.
2. J.P. Holman, "Thermo Dynamics", Mc Graw Hill, 2008
3. Howell and Dedcius, "Fundamentals of Engineering Thermodynamics", McGraw Hill Inc., U.S.A.

20ME C202

ADVANCED FLUID DYNAMICS

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

Objectives: Student will understand

1. Understand different types of fluid flows and various functions related to fluids
2. Learn important equations related to fluids
3. Understand the concept of boundary layer
4. Understand the isentropic behavior of gas in nozzles
5. Learn about shocks of fluids

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

1. Understand the concept of stream and velocity potential function
2. Apply of the knowledge of equations for analysis in cfd
3. Calculate thickness of boundary layer and shear stress
4. Design nozzles and diffusers
5. Estimate various parameters in fluids subjected to shocks

UNIT - I

Fluid Flows: Classification of fluids. Lagrangian and Eularian Methods of Study of fluid flow. Velocity and acceleration vectors. Circulation and Vorticity. Stream lines. Stream tube. Path lines. Streak lines and Time lines. Stream function and Potential function

UNIT - II

Laws of Fluid Flow: Continuity. Euler's and Bernoulli's equations. Incompressible and Compressible flows. Potential and viscous flows. Navier – Stoke's equation and applications

UNIT- III

Concept of Boundary Layer: Flow over an aerofoil – Lift and Drag coefficients. Boundary layer theory – laminar and turbulent boundary layers. Hydrodynamic and thermal boundary layer equations. Flow separation in boundary layers

UNIT - IV

Gas Dynamics: Energy equation for flow and non flow processes. Application of Steady flow energy equation for turbines, turbo-compressors, nozzles and diffusers. Adiabatic energy equation. Acoustic velocity, Mach Number. Stagnation properties. Relationships between static and stagnation properties. Various regimes of flow – Steady flow ellipse

UNIT - V

Principles of Gas Dynamics Applicable to Shocks: Isentropic flow through variable area passages. Design of supersonic and subsonic nozzles and diffusers. Supersonic flows. Expansion and Shock waves. Normal and Oblique Shock waves. Prandtl-Meyer and Rankine-Hugoniot Relations. Simple problems on normal and oblique shock waves.

Text Books:

1. C. P. Kothandaraman, R. Rudramoorthy, "Basic Fluid Mechanics", New Age Intl. Publishers, 2014.
2. S. M. Yahya,"Fundamentals of Compressible flow", Wiley Eastern Ltd, 2014.
3. S. Radhakrishnan, "Fundamentals of Compressible flow", TMH, 2014.

Suggested Reading:

1. Shapiro, "Compressible fluid flow", Ronold Press, New York, 1956.
2. Liepmen & Rosko, "Elements of Gas Dynamics", Wiley, New York, 1956.
3. Zoeb Hussain, "Gas Dynamics Though Problems", Wiley, New York, 1980.

20ME E201

THERMAL AND NUCLEAR POWER PLANTS

(Programme Elective – I)

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

Objectives: Student will understand

1. Performance of steam power plant and to observe the importance of combustion of coal
2. Combined cycle effect in gas turbine power plants
3. Different nuclear reactors and estimate the economical benefits
4. Calculation of different energy tariffs under various load conditions
5. Pressure, temperature and flow parameters of a power plant

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

1. Analyze on combustion of coal and find performance of different power plant cycles
2. Analyze the combined cycle power plants and waste heat recovery systems
3. Design various types of nuclear reactors taking safety precautions and making economically beneficial
4. Calculate the energy rates of power distribution considering the factors affecting the economy
5. Determine the pressure, temperature and flow measurements of steam and water to operate the power plant most efficiently and suggest various remedies to control pollutants

UNIT - I

Layout of Power Plants: Sources of Energy, types of Power Plants, Direct Energy Conversion System, Energy Sources in India, and Recent developments in Power Generation. Combustion of Coal, Volumetric Analysis, Gravimetric Analysis, and Flue gas analysis. Steam Power Plants: Introduction – General Layout of Steam Power Plant, Modern Coal-fired Steam Power Plants, Power Plant cycles, Fuel handling, Combustion Equipment, Ash handling, Dust Collectors

UNIT - II

Combined Cycle Power Plant: Cogeneration, Combined cycle Power Plants, Analysis, Waste-Heat Recovery, IGCC Power Plants, Fluidized Bed Combustion – Advantages & Disadvantages

UNIT- III

Nuclear Power Plant: Nuclear Physics, Nuclear Reactors, Classification – Types of Reactors, Site Selection, Methods of enriching Uranium, Applications of Nuclear Power Plants. Nuclear Power Plants Safety: By-Products of Nuclear Power Generation, Economics of Nuclear Power Plants, Nuclear Power Plants in India, Future of Nuclear Power

UNIT - IV

Economics of Power Plant: Economics of Power Generation: Factors affecting the economics, Load Factor, Utilization factor, Performance and Operating Characteristics of Power Plants. Economic Load Sharing, Depreciation, Energy Rates, Criteria for Optimum Loading, Specific Economic energy problems

UNIT - V

Power Plant Instrumentation: Classification, Pressure measuring instruments, Temperature measurement and Flow measurement. Analysis of Combustion gases, Pollution – Types, Methods to Control

Text Books:

1. E.L Wakil, "Power Plant Technology", Mc Graw Hill, New York, 1985.
2. J. Weis Man and R Eckert, "Modern Power Plant Engineering", PHI, NewDelhi, 1983.

Suggested Reading:

1. S.C. Arora and S. Domkundwar, "A course in Power Plant Engineering", Dhanpat Rai & Sons 2002.
2. P.K. Nag, "Power Plant Engineering", TMH, 2003.
3. P.C. Sharma, "Power Plant Engineering", Kataria Publications. 2007.

20ME E202

ENVIRONMENTALENGINEERINGAND POLLUTION CONTROL

(Programme Elective – I)

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

Objectives: Student will understand

1. Harmful effects of pollutants and their control
2. Different techniques adopted in solid waste management
3. Causes and remedies for water pollution
4. Other types of pollution like oils, pesticides, noise etc
5. Controlling methods adopted to reduce pollution from their power plants

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

1. Estimate air pollutants and suggest suitable remedial methods to control them
2. Suggest a suitable solid waste disposal system
3. Suggest suitable remedy to control water pollution
4. Suggest suitable remedy to control other pollutants like oils, pesticides, noise etc.
5. Suggest a suitable instrumentation for pollution control

UNIT - I

Air Pollution: Sources and Effect - Acid Rain - Air Sampling and Measurement - Analysis of Air Pollutants - Air Pollution Control Methods and Equipments - Issues in Air Pollution control.

UNIT - II

Solid Waste Management: Sources and Classification - Characteristics of solid waste-Potential methods of solid waste Disposal – Process and Equipments for Energy Recovery from Municipal Solid Waste and Industrial Solid Waste

UNIT- III

Water Pollution: Sources and Classification of Water Pollutants - Characteristics - Waste Water Sampling Analysis - Waste Water Treatment - Monitoring compliance with Standards - Treatment, Utilization and Disposal of Sludge

UNIT - IV

Other Types of Pollution: Noise Pollution and its impact - Oil Pollution - Pesticides - Radioactivity Pollution Prevention and Control

UNIT - V

Pollution from Thermal Power Plants and Control Methods: Instrumentation for pollution control - Water Pollution from Tanneries and other Industries and their control

Text Books:

1. G. Masters, "Introduction to Environmental Engineering and Science", Prentice –Hall, International Editions,1988..
2. S. Peavy, D. R. Rowe and G. Tchobanoglous, "Environmental Engineering", McGraw- Hill Book Company, NY, 1985.

Suggested Reading:

1. H. Ludwig and W. Evans, "Manual of Environmental Technology in Developing Countries", 1991.
2. "Environmental Considerations in Energy Development", Asian Development Bank (ADB), Manilla, 1991.

20ME E103

OPTIMIZATION TECHNIQUES

(Programme Elective – I)

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

Objectives: The students will

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

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

1. Formulate a managerial decision problem into a mathematical model.
2. Apply Operations Research models to real time industry problems
3. Build and solve Transportation Models and Assignment Models.
4. Apply project management techniques like CPM and PERT to plan and execute project successfully
5. Apply sequencing and concepts in industry applications

UNIT - I

Basic Concepts: Operations Research definition, scope, Models, Linear programming problems, Formulation, Graphical Method, Simplex Method, and 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

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 - IV

Queuing Theory: Kendols Notation, single server models, Inventory control - deterministic inventory models - Probabilistic inventory control models.

UNIT - V

Sequencing Models: Introduction, General assumptions, processing 'n' jobs through two Machines, processing 'n' jobs through three machines. Game Theory – definition saddle point Principle of Dominance.

Text Books:

1. H.A. Taha, "Operations Research, An Introduction", PHI, 2008
2. H.M. Wagner, "Principles of Operations Research", PHI, Delhi, 1982
3. J.C. Pant, "Introduction to Optimisation: Operations Research", Jain Brothers, Delhi,2008

Suggested Reading:

1. Hitler Libermann, "Operations Research", McGraw Hill Pub. 2009
2. Pannerselvam, "Operations Research", Prentice Hall of India 2010
3. Harvey M Wagner, "Principles of Operations Research", Prentice Hall of India 2010

20ME E203

AIR CONDITIONING SYSTEM DESIGN

(Programme Elective – II)

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

Objectives: Student will understand

1. The difference between refrigeration and air conditioning
2. Working principles of simple vapour compression refrigeration cycle and absorption refrigeration
3. Necessity of psychrometry chart in air conditioning system design
4. Classification of air conditioning systems
5. How to calculate loads on air conditioning sysem

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

1. Effect of refrigerants on environment and ozone depletion,
2. List out merits and demerits of absorption refrigeration system over simple vapour compression refrigeration system
3. List out factors effecting design of air conditioning system
4. Importance of air conditioning in engineering applications
5. Design components used in air conditioning circuits

UNIT - I

Refrigeration and Air Conditioning: Differentiation of refrigeration and air conditioning, COP, tone of refrigeration, classification of refrigerant, properties of refrigerants, eco-friendly refrigerants, green-house effect, ozone depletion, air refrigeration, Bell Coleman cycle, air craft refrigeration, classification of ari craft refrigeration

UNIT - II

Refrigeration Systems: Simple vapor compression refrigeration system, COP, pressure-enthalpy, temperature-entropy diagrams, theoretical and practical cycles, absorption refrigeration cycle, COP of absorption refrigeration cycle, simple and practical NH3 refrigeration cycle, Electrolux refrigeration cycle, lithium bromide refrigeration cycle

UNIT- III

Psychrometry : Introduction to psychrometry, psychrometric processes, comfort air conditioning, factors effecting comfort air conditioning, thermodynamics of

human being, effective temperature, comfort chart, by-pass factor, indoor air quality, infiltration, problems on summer air conditioning and winter air conditioning

UNIT - IV

Air Conditioning Systems : Classification of air conditioning systems, window air conditioning system, split air conditioning system, year round air conditioning system, ERSH, GSHF, industrial air conditioning, transport air conditioning, food processing industries, photographic industries, food preserving industries, chillers

UNIT - V

Design of Air Conditioning System: Loads on air conditioning system, factors effecting design of air conditioning system, design of condensers, evaporators, fillers, humidifiers, de-humidifiers, fans, blowers and ducts, expansion devices, case studies of calculation of heat loads like auditorium, operation theatre, chilling centers, software used in design of air conditioning system.

Text Books:

1. C. P. Arora, "Refrigeration &Air Conditioning", Tata Mc Graw Hill, 1985.
2. Stoecker, "Refrigeration &Air Conditioning", Mc Graw Hill, 1992.
3. W. P. Jones, "Air Conditioning Engineering", Edward Arnold Publishers Ltd., London, 1984.

Suggested Reading:

1. Norman C. Harris, "Modern Air Conditioning", New York, McGraw-Hill, 1974.
2. Manohar Prasad, "Refrigeration &Air Conditioning", New Age Publishers, 2014.
3. ASHRAE Hand book.

20ME E204

ENERGY CONSERVATION AND MANAGEMENT

(Programme Elective – II)

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

Objectives: Student will understand

1. Know the importance of energy sector in countries' development
2. Identify various auditing services
3. Prepare the organizational structure energy policy
4. Get the concept of management in process industries
5. Explain how to take tax considerations

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

1. Know energy scenario both India and world
2. Review and asses the various audit tools
3. Understand energy policy planning and take energy management as a profession
4. Analyze energy security, codes, standards
5. Arrange the financial arrangements for industries

UNIT - I

Global & Indian Energy Scenario: Classification of Energy sources-Energy needs of growing economy-Energy sector reform, Energy and Environment: Global Environmental Concerns, Basics of Energy and its various forms.

UNIT - II

Energy Audit: Types of energy audit, Energy Auditing Services Basic Components of an Energy Audit Specialized Audit Tools Industrial Audits Commercial Audits Residential Audits Indoor Air Quality

UNIT- III

Energy Management: Program

Organizational Structure, Energy Policy Planning Audit Planning Educational Planning Strategic Planning, The Value of Energy Management The Energy Management Profession Some Suggested Principles of Energy Management, Energy Management Systems Justification of EMCSs Systems Integration

UNIT - IV

Waste Heat Recovery: Energy Management in Process Industries, Energy Security, Codes, Standards, Electricity Act, Energy Conservation Act. Economics of Waste-Heat Recovery, Energy management in water and waste water treatment – solid waste treatment- air pollution control systems . Energy Management in Boilers and Fired systems – Steam and condensate systems – cogeneration –

UNIT - V

Capital Investments: Introduction General Characteristics of Capital Investments, Sources of Funds Tax Considerations Time Value of Money Concepts Project Measures of Worth Economic Analysis-Financing Energy Management Projects Introduction Financial Arrangements: A Simple Example Financial Arrangements: Details and Terminology Applying Financial Arrangements: A Case Study "Pros" & "Cons"

Text Books:

1. W. C. Turner, "Energy Management Handbook", 5/e, Marcel Dekker, Inc, New York, 2005.
2. W. R. Murphy and G. McKay, "Energy Management", Butterworth Heinemann, 2007.

Suggested Reading:

1. "General Aspects of Energy Management and Audit", National Productivity Council of India, Chennai (Course Material- National Certification Examination for Energy Management).
2. B. L. Capehart, W. C. Turner, W. J. Kennedy, "Guide to Energy Management", CRC Press, New York, 2005.

20ME E205

DESIGN OF SOLAR AND WIND SYSTEMS

(Programme Elective – II)

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

Objectives: Student will understand

1. Need and importance of NCES and extent of Solar Energy as source.
2. Concepts of Solar collectors, applications and Storage.
3. Concepts of Solar Energy storage
4. Wind Energy Conversion Fuel cell and MHD principles
5. Biomass conversion principles and also about Geothermal energy

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

1. Understand the implementation status of NCES in India along with basic concepts of Solar Energy
2. Analyze the performance of Solar Collectors
3. Understand PV Cell technology and storage methods
4. Conceptually design the wind turbine and understand fuel cells functioning.
5. Understand various Waste to Energy conversion technologies.

UNIT - I

Basics And Solar Energy: Definition-Concepts of Non Conventional Energy Sources (NCES), potential and limitations of NCES, their Classification and comparison, Solar Radiation, Basic definitions, Sun to Earth angles, Sun rise, Sunset and Day length

UNIT - II

Solar Energy Collectors: Flat plate and concentrating collectors along with their applications. Performance of flat plate and concentrating collectors. P-V Cell.

UNIT- III

Solar Energy Storage and Applications: Solar Satellite, Different Methods of storage, Sensible, Latent and Stratified, Solar engine Stirling and Brayton engines Solar Ponds, solar chimney, solar satellite, Stand alone grid connection

UNIT - IV

Wind Energy: Wind energy conversion, General formula -Lift and Drag- Basics of wind energy conversion -Effect of density, frequency variances, angle of attack, and wind speed. Windmill rotors- Horizontal axis and vertical axis rotors. Determination of torque coefficient, Induction type generators- working principle, Fuel Cells and MHD Working principles

UNIT - V

Bio-mass and Geothermal Energy: Availability of Biomass and various conversion process; Direct Combustion, Thermo chemical and Bio chemical conversion process, Factors effecting generation of Biogas and various types of biogas plants, Introduction to Geothermal Energy

Text Books:

1. J. A. Duffie and W. A. Beckman, "Solar Engineering of Thermal Processes", John Wiley.
2. Hasan Sayed, and D K Sharma, "Non Conventional Energy Sources", Katson Publishing.
3. G. D. Rai, "Non Conventional Energy Sources".

Suggested Reading:

1. S.P. Sukhatme. "Solar Energy", Tata Mcgraw Hill Publishing, 2014..
2. N.K. Bansal, "Non Conventional Energy Sources", Vikas Publishers, 2012.

20ME M103

RESEARCH METHODOLOGY AND IPR

Instruction	2 Hours per week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	2

Objectives: To make the students to

1. Motivate to choose research as career
2. Formulate the research problem, prepare the research design
3. Identify various sources for literature review and data collection report writing
4. Equip with good methods to analyze the collected data
5. Know about IPR copyrights

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

1. Define research problem, review and asses the quality of literature from various sources
2. Improve the style and format of writing a report for technical paper/ Journal report, understand and develop various research designs
3. Collect the data by various methods: observation, interview, questionnaires
4. Analyze problem by statistical techniques: ANOVA, F-test, Chi-square
5. Understand apply for patent and copyrights

UNIT - I

Research Methodology: Research Methodology: Objectives and Motivation of Research, Types of Research, research approaches, Significance of Research, Research Methods verses Methodology, Research Process, Criteria of Good Research, Problems Encountered by Researchers in India, Benefits to the society in general. Defining the Research Problem: Selection of Research Problem, Necessity of Defining the Problem

UNIT - II

Literature Survey Report Writing: Literature Survey: Importance and purpose of Literature Survey, Sources of Information, Assessment of Quality of Journals and Articles, Information through Internet. Report writing: Meaning of interpretation, layout of research report, Types of reports, Mechanics of writing

a report. Research Proposal Preparation: Writing a Research Proposal and Research Report, Writing Research Grant Proposal

UNIT- III

Research Design: 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, Developing a Research Plan, Steps in sample design, types of sample designs.

UNIT - IV

Data Collection and Analysis: Data Collection: Methods of data collection, importance of Parametric, non parametric test, testing of variance of two normal population, use of Chi-square, ANOVA, Ftest, z-test

UNIT - V

Patents and Copy Right: Patent: Macro economic impact of the patent system, Patent document, How to protect your inventions. Granting of patent, Rights of a patent, how extensive is patent protection. Copyright: What is copyright. What is covered by copyright. How long does copyright last? Why protect copyright? Related Rights: what are related rights? Enforcement of Intellectual Property Rights: Infringement of intellectual property rights, Case studies of patents and IP Protection

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. Y. P. Agarwal, "Statistical Methods: Concepts, Application and Computation", Sterling Publs., Pvt., Ltd., New Delhi, 2004.

Suggested Reading:

1. Ajit Parulekar 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.

20CE A101

DISASTER MITIGATION AND MANAGEMENT

Instruction	2 Hours per week
Duration of SEE	2 Hours
SEE	50 Marks
CIE	———
Credits	0

Objectives:

1. To equip the students with the basic knowledge of hazards, disasters, risks and vulnerabilities including natural, climatic and human induced factors and associated impacts
2. To impart knowledge in students about the nature, causes, consequences and mitigation measures of the various natural disasters
3. To enable the students to understand risks, vulnerabilities and human errors associated with human induced disasters
4. To enable the students to understand and assimilate the impacts of any disaster on the affected area depending on its position/ location, environmental conditions, demographic, etc.
5. To equip the students with the knowledge of the chronological phases ina disaster management cycle and to create awareness about the disaster management framework and legislations in the context of national and global conventions

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

1. Analyze and critically examine existing programs in disaster management regarding vulnerability, risk and capacity at different levels
2. Understand and choose the appropriate activities and tools and set up priorities to build a coherent and adapted disaster management plan
3. Understand various mechanisms and consequences of human induced disasters for the participatory role of engineers in disaster management
4. Understand the impact on various elements affected by the disaster and to suggest and apply appropriate measures for the same
5. Develop an awareness of the chronological phases of disaster preparedness, response and relief operations for formulating effective disaster management plans and ability to understand various participatory approaches/strategies and their application in disaster management.

UNIT- I:

Introduction: Basic definitions- Hazard, Disaster, Vulnerability, Risk, Resilience, Mitigation, Management; classification of types of disaster- Natural and man-made; 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; Geographical based disasters: Tsunami generation, 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 hydro meteorological and geographical based disasters.

UNIT-III:

Human induced hazards: 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 tragedy; Management of chemical terrorism disasters and biological disasters; Radiological Emergencies and case studies; Case studies related to major power break downs, fire accidents, traffic accidents, oil spills and stampedes, disasters due to double cellar construction in multi-storeyed buildings.

UNIT- IV:

Disaster Impacts: 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.

UNIT- V:

Concept of Disaster Management: Disaster management cycle – its phases; prevention, mitigation, preparedness, relief and recovery; 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. "Hazards, Disasters and your community: A booklet for students and the community", Ministry of home affairs.

Online Resources:

1. http://www.indiaenvironmentportal.org.in/files/file disaster_management_india1.pdf
2. http://www.ndmindia.nic.in/ (National Disaster management in India, Ministry of Home Affairs)

20EE A101

SANSKRIT FOR TECHNICAL KNOWLEDGE

Instruction	2 Hours per week
Duration of SEE	2 Hours
SEE	50 Marks
CIE	————
Credits	0

Objectives:

1. To get a working knowledge in illustrious Sanskrit, the scientific language in the world
2. To make the novice Learn the Sanskrit to develop the logic in mathematics, science & other subjects
3. To explore the huge knowledge from ancient Indian literature

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

1. Develop passion towards Sanskrit language
2. Decipher the latent engineering principles from Sanskrit literature
3. Correlates the technological concepts with the ancient Sanskrit history.
4. Develop knowledge for the technological progress
5. Explore the avenue for research in engineering with aid of Sanskrit

UNIT-I

Introduction to Sanskrit Language: Sanskrit Alphabets-vowels-consonants-significance of Amarakosa-parts of speech-Morphology-creation of new words-significance of synonyms-sandhi-samasa-sutras-active and passive voice-Past/Present/Future Tense-syntax-Simple Sentences (elementary treatment only)

UNIT-II

Role of Sanskrit in Basic Sciences: Brahmagupthas lemmas (second degree indeterminate equations), sum of squares of n-terms of AP- sulba_sutram or baudhayana theorem (origination of pythogorous theorem)-value of pie-Madhava's sine and cosine theory (origination of Taylor's series).
The measurement system-time-mass-length-temp, Matter elasticity-optics-speed of light (origination of michealson and morley theory).

UNIT-III

Role of Sanskrit in Engineering-I (Civil, Mechanical, Electrical and Electronics Engineering):

Building construction-soil testing-mortar-town planning-Machine definition-crucible-furnace-air blower- Generation of electricity in a cell-magnetism-Solar

system-Sun: The source of energy, the earth-Pingala chandasutram (origination of digital logic system)

UNIT-IV

Role of Sanskrit in Engineering-II (Computer Science Engineering & Information Technology): Computer languages and the Sanskrit languages-computer command words and the vedic command words-analogy of pramana in memamsa with operators in computer language-sanskrit analogy of physical sequence and logical sequence, programming.

UNIT-V

Role of Sanskrit in Engineering-III (Bio-technology and Chemical Engineering): Classification of plants-plants, the living-plants have senses-classification of living creatures, Chemical laboratory location and layout-equipment-distillation vessel-kosthi yanthram

Text Books:

1. M Krishnamachariar, "History of Classical Sanskrit Literature", TTD Press, 1937.
2. M.R. Kale, "A Higher Sanskrit Grammar: For the Use of School and College Students", Motilal Banarsidass Publishers, ISBN-13: 978-8120801783, 2015

Suggested Reading:

1. Kapail Kapoor, "Language, Linguistics and Literature: The Indian Perspective", ISBN- 10: 8171880649, 1994.
2. "Pride of India", Samskrita Bharati Publisher, ISBN: 81-87276-27-4, 2007
3. Shri RamaVerma, "Vedas the source of ultimate science", Nag publishers, ISBN:81-7081-618-1,2005

20EC A101

VALUE EDUCATION

Instruction	2 Hours per week
Duration of SEE	2 Hours
SEE	50 Marks
CIE	———
Credits	0

Objectives: This course aims to:

1. Understand the need and importance of Values for self-development and for National development.
2. Imbibe good human values and Morals
3. Cultivate individual and National character.

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

1. Gain necessary Knowledge for self-development
2. Learn the importance of Human values and their application in day to day professional life.
3. Appreciate the need and importance of interpersonal skills for successful career and social life
4. Emphasize the role of personal and social responsibility of an individual for all-round growth.
5. Develop a perspective based on spiritual outlook and respect women, other religious practices, equality, non-violence and universal brotherhood.

UNIT-I

Human Values, Ethics and Morals: Concept of Values, Indian concept of humanism, human values; Values for self-development, Social values, individual attitudes; Work ethics, moral and non- moral behaviour, standards and principles based on religion, culture and tradition.

UNIT-II

Value Cultivation, and Self-management: Need and Importance of cultivation of values such as Sense-of Duty, Devotion to work, Self-reliance, Confidence, Concentration, Integrity & discipline, and Truthfulness.

UNIT-III

Spiritual outlook and social values: Personality and Behavior, Scientific attitude and Spiritual (soul) outlook; Cultivation of Social Values Such as Positive

Thinking, Punctuality, Love & Kindness, Avoiding fault finding in others, Reduction of anger, forgiveness, Dignity of labour, True friendship, Universal brotherhood and religious tolerance.

UNIT-IV

Values in Holy Books : Self-management and Good health; internal & external cleanliness**,** Holy books versus Blind faith, Character and Competence, Equality, Nonviolence, Humility, Role of Women.

UNIT-V

Dharma, Karma and Guna: Concept of soul; Science of Reincarnation, Character and Conduct, Concept of Dharma; Cause and Effect based Karma Theory; The qualities of Devine and Devilish; Satwic, Rajasic and Tamasic gunas.

Text Books:

1. Chakroborty, S.K. "Values & Ethics for organizations Theory and practice", Oxford University Press, New Delhi, 1998.

Suggested Reading:

1. Jaya Dayal Goyandaka, "Srimad Bhagavad Gita with Sanskrit Text, Word Meaning and Prose Meaning", Gita Press, Gorakhpur, 2017.

20IT A101

PEDAGOGY STUDIES

Instruction	2 Hours per week
Duration of SEE	2 Hours
SEE	50 Marks
CIE	———
Credits	0

Course Objectives:

1. To present the basic concepts of design and policies of pedagogy studies.
2. To provide understanding of the abilities and dispositions with regard to teaching techniques, curriculum design and assessment practices.
3. To familiarize various theories of learning and their connection to teaching practice.
4. To create awareness about the practices followed by DFID, other agencies and other researchers.
5. To provide understanding of critical evidence gaps that guides the professional development.

Course Outcomes: Upon completing this course, students will be able to:

1. Illustrate the pedagogical practices followed by teachers in developing countries both in formal and informal classrooms.
2. Examine the effectiveness of pedagogical practices.
3. Understand the concept, characteristics and types of educational research and perspectives of research.
4. Describe the role of classroom practices, curriculum and barriers to learning.
5. Understand Research gaps and learn the future directions.

UNIT-I

Introduction and Methodology: Aims and rationale, Policy background, Conceptual framework and terminology - Theories of learning, Curriculum, Teacher education - Conceptual framework, Research questions - Overview of methodology and Searching.

UNIT-II

Thematic Overview: Pedagogical practices followed by teachers in formal and informal classrooms in developing countries - Curriculum, Teacher education.

UNIT-III

Evidence on the Effectiveness of Pedagogical Practices: Methodology for the in depth stage: quality assessment of included studies - How can teacher education (curriculum and Practicum) and the school curriculum and guidance material best support effective pedagogy? - Theory of change - Strength and nature of the body of evidence for effective pedagogical practices - Pedagogic theory and pedagogical approaches - Teachers' attitudes and beliefs and pedagogic strategies.

UNIT-IV

Professional Development: alignment with classroom practices and follow up support - Support from the head teacher and the community – Curriculum and assessment - Barriers to learning: Limited resources and large class sizes.

UNIT-V

Research Gaps and Future Directions: Research design – Contexts – Pedagogy - Teacher education - Curriculum and assessment – Dissemination and research impact.

Text Books:

1. Ackers J, Hardman F, "Classroom Interaction in Kenyan Primary Schools, Compare", 31 (2): 245 – 261, 2001.
2. Agarwal M, "Curricular Reform in Schools: The importance of evaluation", Journal of Curriculum Studies, 36 (3): 361 – 379, 2004.

Suggested Reading:

1. Akyeampong K, "Teacher Training in Ghana – does it count? Multisite teacher education research project (MUSTER)", Country Report 1.London: DFID, 2003.
2. Akyeampong K, Lussier K, Pryor J, Westbrook J, "Improving teaching and learning of Basic Maths and Reading in Africa: Does teacher Preparation count?, International Journal Educational Development, 33 (3): 272- 282, 2013.
3. Alexander R J, "Culture and Pedagogy: International Comparisons in Primary Education", Oxford and Boston: Blackwell, 2001.
4. Chavan M, "Read India: A mass scale, rapid, 'learning to read' campaign", 2003.

Web Resources:

1. https://onlinecourses.nptel.ac.in/noc17_ge03/preview
2. www.pratham.org/images/resources%20working%20paper%202.pdf.

20EG A101

ENGLISH FOR RESEARCH PAPER WRITING

Instruction	2 Hours per week
Duration of SEE	2 Hours
SEE	50 Marks
CIE	————
Credits	0

Objectives: The Course will introduce the students to

1. Understand the nuances of language and vocabulary in writing a Research Paper.
2. Develop the content, structure and format of writing a research paper.
3. Produce original research papers without plagiarism.

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

1. Interpret the nuances of research paper writing.
2. Differentiate the research paper format and citation of sources.
3. To review the research papers and articles in a scientific manner.
4. Avoid plagiarism and be able to develop their writing skills in presenting the research work.
5. Create a research paper and acquire the knowledge of how and where to publish their original research papers.

UNIT - I

Academic Writing : Meaning & Definition of a research paper– Purpose of a research paper – Scope – Benefits – Limitations – outcomes.

UNIT - II

Research Paper Format: Title – Abstract – Introduction – Discussion – Findings – Conclusion – Style of Indentation – Font size/Font types – Indexing – Citation of sources.

UNIT- III

Research Methodology: Methods (Qualitative – Quantitative) Review of Literature. Criticizing, Paraphrasing & Plagiarism.

UNIT - IV

Process of Writing a research paper: Choosing a topic - Thesis Statement – Outline – Organizing notes - Language of Research – Word order, Paragraphs – Writing first draft –Revising/Editing - The final draft and proof reading.

UNIT - V

Research Paper Publication: Reputed Journals – National/International – ISSN No, No. of volumes, Scopus Index/UGC Journals – Free publications - Paid Journal publications – /Advantages/Benefits

Text Books:

1. C. R Kothari, Gaurav, Garg, "Research Methodology Methods and Techniques", 4/e, New Age International Publishers.

Suggested Reading:

1. Day R, "How to Write and Publish a Scientific Paper**",** Cambridge University Press, 2006
2. "MLA Hand book for writers of Research Papers", 7/e, East West Press Pvt. Ltd, New Delhi
3. Lauri Rozakis, Schaum's, "Quick Guide to Writing Great Research Papers", Tata McGraw Hills Pvt. Ltd, New Delhi.

Online Resources:

1. NPTEL: https://onlinecourses.nptel.ac.in/noc18_mg13/preview

20EG A102

INDIAN CONSTITUTION AND FUNDAMENTAL RIGHTS

Instruction	2 Hours per week
Duration of SEE	2 Hours
SEE	50 Marks
CIE	———
Credits	0

Objectives: The Course will introduce the students to

1. The history of Indian Constitution and its role in the Indian democracy.
2. Address the growth of Indian opinion regarding modern Indian intellectuals' constitutional role and entitlement. to civil and economic rights as well as the emergence of nationhood in the early years of Indian nationalism.
3. Have knowledge of the various Organs of Governance and Local Administration.

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

1. Understand the making of the Indian Constitution and its features.
2. Understand the Rights of equality, the Right of freedom and the Right to constitutional remedies.
3. Have an insight into various Organs of Governance - composition and functions.
4. Understand powers and functions of Municipalities, Panchayats and Co-operative Societies.
5. Understand Electoral Process, special provisions.

UNIT - I

History of making of the Indian constitutions: History, Drafting Committee (Composition &Working).

Philosophy of the Indian Constitution: Preamble, Salient Features.

UNIT - II

Contours of Constitutional Rights and Duties - Fundamental Rights, Right to Equality, Right to Freedom, Right against Exploitation, Right to Freedom of Religion, Cultural and Educational Rights, Right to Constitutional Remedies, Directive Principles of State Policy, Fundamental Duties.

UNIT- III

Organs of Governance - Parliament: Composition, Qualifications, Powers and Functions

Union Executives : President, Governor, Council of Ministers, Judiciary, appointment and transfer of judges, qualifications, powers and functions

UNIT - IV

Local Administration - District's Administration head: Role and importance. Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal Corporation. Panchayati Raj: Introduction, PRI: Zilla Panchayat, Elected Officials and their roles, CEO Zilla Panchayat: positions and role.
Block level: Organizational Hierarchy(Different departments) Village level: role of elected and appointed officials. Importance of grass root democracy.

UNIT - V

Election commission: Election Commission: Role and functioning, Chief Election Commissioner and Election Commissioners, State Election Commission :Role and functioning. Institute and Bodies for the welfare of SC/ST/OBC and women**.**

Text Books:

1. Dr. S. N. Busi, Dr. B. R. Ambedkar, "Framing of Indian Constitution", 1/e, 2015.
2. M. P. Jain, "Indian Constitution Law", 7/e, Lexis Nexis, 2014

Suggested Reading:

1. "The Constitution of India", 1950 (Bare Act), Government Publication
2. D.D. Basu, "Introduction to the Constitution of India", Lexis Nexis, 2015.

Online Resources:

1. http://www.nptel.ac.in/courses/103107084/Script.pdf

20EG A103

STRESS MANAGEMENT BY YOGA

Instruction	2 Hours per week
Duration of SEE	2 Hours
SEE	50 Marks
CIE	———
Credits	0

Objectives: The Course will introduce the students to

1. Creating awareness about different types of stress and the role of yoga in the management of stress.
2. Promotion of positive health and overall wellbeing (Physical, mental, emotional, social and spiritual).
3. Prevention of stress related health problems by yoga practice.

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

1. Understand yoga and its benefits.
2. Enhance Physical strength and flexibility.
3. Learn to relax and focus.
4. Relieve physical and mental tension through asanas
5. Improve work performance and efficiency.

UNIT - I

Meaning and Definition of Yoga - Historical perspective of Yoga - Principles of Astanga Yoga by Patanjali.

UNIT - II

Meaning and Definition of Stress - Types of stress - Eustress and Distress. Anticipatory Anxiety and Intense Anxiety and depression. Meaning of Management- Stress Management.

UNIT- III

Concept of Stress According to Yoga - Stress assessment methods - Role of Asana, Pranayama and Meditation in the management of stress

UNIT - IV

Asanas- (5 Asanas in each posture) - Warm up - Standing Asanas - Sitting Asanas - Prone Asanas - Supine asanas - Surya Namaskar

UNIT - V

Pranayama- Anulom and Vilom Pranayama - Nadishudhi Pranayama - Kapalabhati Pranayama - Bhramari Pranayama - Nadanusandhana Pranayama.

Meditation Techniques: Om Meditation - Cyclic meditation : Instant Relaxation technique (QRT), Quick Relaxation Technique (QRT), Deep Relaxation Technique (DRT)

Text Books:

1. "Yogic Asanas for Group Training - Part-I": Janardhan Swami Yogabhyasi Mandal, Nagpur.
2. Swami Vivekananda, "Rajayoga or Conquering the Internal Nature", Advaita Ashrama (Publication Department), Kolkata.

Suggested Reading:

1. Nagendra H.R nad Nagaratna R, "Yoga Perspective in Stress Management", Swami Vivekananda Yoga Prakashan, Bangalore,

Online Resources:

1. https://onlinecourses.nptel.ac.in/noc16_ge04/preview
2. https://freevideolectures.com/course/3539/indian-philosophy/11

20EG A104

PERSONALITY DEVELOPMENT THROUGH LIFE'S ENLIGHTENMENT SKILLS

Instruction	2 Hours per week
Duration of SEE	2 Hours
SEE	50 Marks
CIE	——————-
Credits	0

Objectives: The Course will introduce the students to

1. Learn to achieve the highest goal happily.
2. Become a person with stable mind, pleasing personality and determination.
3. Awaken wisdom among them.

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

1. Develop their personality and achieve their highest goal of life.
2. Lead the nation and mankind to peace and prosperity.
3. Practice emotional self regulation.
4. Develop a positive approach to work and duties.
5. Develop a versatile personality.

UNIT - I

Neetisatakam – Holistic Development of Personality - Verses 19, 20, 21, 22 (Wisdom) - Verses 29, 31, 32 (Pride and Heroism) - Verses 26,28,63,65 (Virtue)

UNIT - II

Neetisatakam – Holistic Development of Personality (cont'd) - Verses 52, 53, 59 (dont's) - Verses 71,73,75 & 78 (do's) - Approach to day to day works and duties.

UNIT- III

Introduction to Bhagavadgeetha for Personality Development - Shrimad Bhagavadgeetha: Chapter 2 – Verses 41, 47, 48 - Chapter 3 – Verses 13,21,27,35 - Chapter 6 – Verses 5,13,17,23,35 - Chapter 18 – Verses 45, 46, 48 Chapter – 6: Verses 5, 13, 17, 23, 35; Chapter – 18: Verses 45, 46, 48

UNIT - IV

Statements of Basic Knowledge - Shrimad Bhagavadgeetha: Chapter 2- Verses 56, 62,68 - Chapter 12 – Verses 13, 14, 15, 16, 17, 18 - Personality of Role model from Shrimad Bhagawat Geeta.

UNIT - V

Role of Bhagavadgeetha in the Present Scenario - Chapter 2 – Verses 17 - Chapter 3 – Verses 36, 37, 42 - Chapter 4 – Verses 18, 38, 39 - Chapter 18 – Verses 37, 38, 63.

Text Books:

1. "Srimad Bhagavad Gita" , Swami SwarupanandaAdvaita Ashram (Publication Department), Kolkata

Suggested Reading:

1. "Bhartrihari's Three Satakam (Niti-sringar-vairagya)", P.Gopinath, Rashtriya Sanskrit Sansthanam, New Delhi

Online Resources:

1. NTPEL: http://nptel.ac.in/downloads/109104115/

20ME C203

THERMAL SYSTEMS LAB

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

Objectives: Student will understand to

1. Evaluate the performance of I.C Engine
2. Determine heat transfer coefficient in two phase heat transfer
3. Determine effectiveness of cross flow heat exchanger
4. Evaluate the thermal properties of fluids
5. Evaluate the COP of Refrigeration & Air conditioning Tutors

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

1. Estimate the thermal efficiency of IC engine
2. Prove that value of convection heat transfer coefficient is very high with two phase heat transfer
3. Estimate the effectiveness of cross flow heat exchanger and prove that it is very high compared with other configurations
4. Find out properties of fluids such as coefficient of thermal expansion, enthalpy of fusion
5. Determine COP of Refrigeration and air conditioned tutors

List of Experiments:

1. Performance Evaluation on single/multi cylinder 4-stroke SI Engine.
2. Performance Evaluation on single/multi cylinder 4 stroke CI Engine.
3. Determination of heat transfer coefficient in Film wise and Drop wise condensation
4. To determine the effectiveness of Cross flow Heat Exchanger.
5. Heat Pipe Demonstration
6. Performance text on Axial flow compressor
7. Determination of coefficient of thermal expansion of Solids, Liquids and Gases
8. Determination of thermal capacity of Solids
9. Determination of isentropic coefficient of air by Clement-Desormes method
10. Measure of enthalpy of fusion and solidification
11. Determination of COP of Refrigeration tutor
12. Determination of COP of Air-conditioning tutor

Note : Out of the above 12 experiments, any ten experiments have to be carried out.

Text Books:

1. Younus. A. Cengel & Michael A. Boles, "Thermodynamics An Engineering Approach", 7/e, TMH.
2. Y.V.C. Rao. "Postulates and Statistical Thermodynamics", Allied Publishers Inc., 1994.

Suggested Reading:

1. P.K. Nag, "Basic and Applied Thermodynamics", TMH, 2008.
2. J.P.Holman, "Thermo Dynamics", Mc Graw Hill, 2008.
3. Howell and Dedcius, "Fundamentals of Engineering Thermodynamics", McGraw Hill Inc., U.S.A.

20ME C204

DESIGN OF SOLAR AND WIND SYSTEMS LAB

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

Objectives: To make the students to understand

1. Concepts of solar energy collection and measurements
2. Wind and solar thermal applications
3. Direct conversion using solar PV cell
4. Wind turbine working and factors effecting its performance
5. Bio energy conversion principles

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

1. Measure radiation using various instruments
2. Find the performance of solar water pump, water heater
3. Determine the effect of tilting angle on pv cell
4. Evaluate efficiency of wind turbine
5. Differentiate KVIC and JANATA bio energy conversion systems

List of Experiments:

1. Study of direct and diffused beam solar radiation (Solar Radiation Measurement)
2. Performance evaluation of solar flat plate collector (water heating, water pumping)
3. Performance evaluation of concentrating solar collector
4. Performance of PV panel in series and parallel combination: (Charging characteristics of a battery using PV panel, Effect of tilt angle on solar PV panel, Effect of shadow on solar PV panel , Effect of surrounding temperature on PV panel)
5. Study of direct and indirect solar dryer (how to dry various types of Agricultural products)
6. Analysis of KVIC Bio gas plant
7. Performance studies of Gasifier
8. Study of Janata Bio gas plant, Deenabandhu Biogas plant for demonstration
9. Small wind turbine of 500kw for the purpose of demonstration

Text Books:

1. J. A. Duffie and W. A. Beckman, "Solar Engineering of Thermal Processes", John Wiley.
2. Hasan Sayed and D. K. Sharma, "Non Conventional Energy Sources", Katson Publishing.
3. G. D. Rai, "Non Conventional Energy Sources".

Suggested Reading:

1. P. Sukhatme "Solar Energy", Tata Mcgraw Hill Publishing, 2004
2. N.k. Bansal, "Non Conventional Energy Sources". Vikas Publishing, 2009.

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (A)
(AICTE Model Curriculum with Effect from the AY 2020 – 2021)
ME (Thermal Engineering)

SEMESTER – II

S. No.	Course Code	Title of the Course	Scheme of Instruction			Scheme of Examination			Credits
			Hours per week			Duration of SEE in Hours	Maximum Marks		
			L	T	P		CIE	SEE	
THEORY									
1	20ME C106	Finite Element Techniques	3	--	--	3	40	60	3
2	20ME C205	Advanced Heat and Mass Transfer	3	--	--	3	40	60	3
3		Programme Elective - III	3	--	--	3	40	60	3
4		Programme Elective - IV	3	--	--	3	40	60	3
5		Audit Course – 2	2	--	--	2	--	50	Non-Credit
PRACTICALS									
6	20ME C108	Computer Aided Engineering Lab	--	--	4	--	50	--	2
7	20ME C206	Computational Fluid Dynamics Lab	--	--	4	--	50	--	2
8	20ME C207	Mini Project with Seminar	--	--	4	--	50	--	2
TOTAL			**14**	--	**12**		**310**	**290**	**18**

L: Lecture D: Drawing CIE - Continuous Internal Evaluation
T: Tutorial P: Practical/Mini Project with Seminar/Dissertation Phase
SEE – Semester End Examination

Programme Elective – III (3/3)			Programme Elective – IV (3/3)		
SNo	Subject Code	Name of the Subject	SNo	Subject Code	Name of the Subject
1	20ME E206	Computational Fluid Dynamics	1	20ME E209	Turbo Machines
2	20ME E207	Refrigeration and Cryogenics	2	20ME E210	Gas Turbines
3	20ME E208	Design of Heat Exchangers	3	20ME E211	Power Plant Control and Instrumentation

Audit Course – 2					
SNO	Subject Code	Name of the Subject	SNO	Subject Code	Name of the Subject
1	20CE A101	Disaster Mitigation and Management	5	20EG A101	English for Research Paper Writing
2	20EE A101	Sanskrit for Technical Knowledge	6	20EG A102	Indian Constitution and Fundamental Rights
3	20EC A101	Value Education	7	20EG A103	Stress Management by Yoga
4	20IT A101	Pedagogy Studies	8	20EG A104	Personality Development through Life's Enlightenment Skills

20ME C106

FINITE ELEMENT TECHNIQUES

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

Objectives: To make the students to

1. Understand finite element analysis fundamentals and formulations
2. Formulate the axial, truss, beam and 2D problems
3. Formulate the heat conduction and dynamics problems, understand the use of numerical integration and Gauss quadrature
4. Understand the convergence requirements and 3D problems
5. Perform engineering simulations using finite element analysis software (ANSYS)

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

1. Apply FE method for solving field problems using virtual work and potential energy formulations
2. Analyze linear problems like axial, truss and beam, torsional analysis of circular shaft
3. Analyze 2D structural problems using CST element and analyze the axi-symmetric problems with triangular elements. Write shape functions for 4 node quadrilateral, isoparametric elements and apply numerical integration and Gaussian quadrature to solve the problems.
4. Evaluate the eigen values and eigen vectors for stepped bar, formulate 3 D elements, check for convergence requirements
5. Solve linear 1 D and 2 D heat conduction and convection heat transfer problems, Use of FEA software ANSYS for engineering solutions

UNIT - I

Introduction to Finite Element Method of Solving Field Problems: Stress and Equilibrium. Boundary conditions. Strain-Displacement relations. Stress-strain relations.

One Dimensional Problem: Finite element modeling. Local, natural and global coordinates and shape functions. **Potential Energy Approach**: Assembly of Global stiffness matrix and load vector. Finite element equations, treatment of boundary conditions. Quadratic shape functions.

UNIT - II

Analysis of Trusses: Analysis of plane truss with number of unknowns not exceeding two at each node.

Analysis of Beams: Element stiffness matrix for two noded, two degrees of freedom per node for beam element

Analysis of Frames: Analysis of frames with two translations and a rotational degree of freedom at each node.

UNIT- III

Two Dimensional Stress Analysis: Finite element modeling of two dimensional stress analysis problems with constant strain triangles and treatment of boundary conditions. Two dimensional four noded isoparametric elements and numerical integration. Finite element modeling of Axisymmentric solids subjected of axisymmetric loading with triangular elements.

Convergence requirements and geometric isotropy

UNIT - IV

Steady State Heat Transfer Analysis: One dimensional analysis of a fin and two dimensional conduction analysis of thin plate.

Time Dependent Field Problems: Application to one dimensional heat flow in a rod.

Dynamic Analysis: Formulation of finite element modeling of Eigen value problem for a stepped bar and beam. Evaluation of Eigen values and Eigen vectors.

Analysis of a uniform shaft subjected to torsion using Finite Element Analysis.

UNIT - V

Three Dimensional Problems in Stress Analysis: 3D elements: Introduction to tetrahedron and brick elements.

Introduction to thin and thick plates

Introduction to non-linear formulation through FE.

Text Books:

1. R. Tirupathi. Chandrupatla and D.B. Ashok, "Introduction of Finite Element in Engineering", Prentice Hall of India, 2004.
2. S.S. Rao. "The Finite Element Methods in Engineering", 2/e, Pergamon Press, 2001.
3. David. V. Hutton, "Fundamentals of Finite Element Analysis", Tata McGraw Hill, 2003.

Suggested Reading:

1. Robert Cook , "Concepts and applications of finite element analysis", 4/e, John Wiley and sons, 2009.
2. K.J. Bathe, "Finite element procedures", 2/e, Prentice Hall of India, 2007.
3. D.L. Logan, "First course in finite element method", 5/e, Mason, OH: South Western, Cengage Learning, 2011.

20ME C205

ADVANCED HEAT AND MASS TRANSFER

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

Objectives: To make the students to

1. Understand the basic principles of fins and unsteady state heat transfer applied to industries.
2. Learn various equations and their application in engineering heat transfer
3. Understand boundary layer concept and their applications
4. Learn about principles of phase heat transfer and radiation heat transfer
5. Learn about mass transfer and its applications in process industries

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

1. Apply the equations pertaining to unsteady state heat transfer and knowledge in extended surfaces
2. Evaluate mass, momentum and energy equations with approximate and exact methods
3. Apply heat transfer knowledge in calculation of boundary layer thickness and various dimensionless numbers
4. Evaluate heat transfer coefficients under phase change phenomena and radiation heat transfer
5. Apply the knowledge of mass transfer in process industries

UNIT - I

Brief Introduction to Different Modes of Heat Transfer: Conduction: General heat conduction equation-Initial and Boundary conditions Steady State Heat Transfer: Simplified heat transfer in 1D and 2D – Fins. Transient heat conduction; Lumped system analysis- Heisler charts-semi infinite solid-use of shape factors in conduction - 2D transient heat conduction – product solutions

UNIT - II

Finite Difference Methods for Conduction: 1D & 2D steady state and simple transient heat conduction problems – implicit and explicit methods. Forced Convection: Equations of Fluid Flow – Concepts of Continuity, momentum

equations – Derivation of Energy equation - Methods to determine heat transfer coefficient: Analytical Methods - Dimensional Analysis and concept of exact solution. Approximate Method – Integral analysis

UNIT- III

External Flows: Flow over a flat plate: Integral method for laminar heat transfer coefficient for different velocity and temperature profiles. Application of empirical relations to variation geometrics for Laminar and Turbulent flows. Internal flows: Fully developed flow: Integral analysis for laminar heat transfer coefficient – Types of flow – Constant Wall Temperature and Constant Heat Flux Boundary Conditions - Hydrodynamic & thermal entry lengths; use of empirical correlations

UNIT - IV

Free Convection & Radiation: Approximate analysis on laminar free convective heat transfer – Boussinesque Approximation - Different geometries – combined free and forced convection, Boiling and condensation: Boiling curve – Correlations- Nusselt's theory of film condensation on a vertical plate – Assumptions & correlations of film condensation for different geometrics

UNIT - V

Mass Transfer: Radiation Heat Transfer, Radiant heat exchange in grey, non-grey bodies, with transmitting, reflecting and absorbing media, specular surfaces, gas radiation – radiation from flames. Mass Transfer: Concepts of mass transfer – Diffusion & convective mass transfer Analogies – Significance of non-dimensional numbers.

Text Books:

1. Necati Ozisik, "Heat Transfer", TMH, 1998.
2. Incropera Dewitt, "Fundamentals of Heat & Mass Transfer", John Wiley, 2007.
3. Yunus A. Cengel, "Heat Transfer: A basic approach", TMH, 2008.

Suggested Reading:

1. R. C. Sachdeva, "Fundamentals of Engineering Heat & Mass Transfer", New Age International Publications, 2010.
2. J.P. Holman, "Heat Transfer", Mc Graw Hill, 2008.

20ME E206

COMPUTATIONAL FLUID DYNAMICS

(Programme Elective – III)

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

Objectives: To make the students to learn the

1. Basic equations and concept of CFD
2. Concept of pdes and finite difference methods
3. Various types of grid generation and errors in numerical solution
4. Crank-Nihcolson, Implicit and Explicit methods & Jacobi, Gauss Seidel and ADI methods
5. Importance of FVM

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

1. Derive CFD governing equations and turbulence models
2. Apply elliptical, parabolic and hyperbolic pdes and forward, backward and center difference methods
3. Understand errors, stability, consistency and develop O,H and C grid generated models
4. Evaluate the use of Crank-Nihcolson, Implicit and Explicit methods and analyze problem by Jacobi, Gauss Seidel and ADI methods
5. Solve conduction and convection problems using FVM.

UNIT - I

Governing Equations: Continuity, Momentum and Energy equations, Navier Stokes equations, Reynolds and Favre averaged N – S equations. Introduction to turbulence, Turbulence models-mixing length model, K-å turbulence Model.

UNIT - II

Grid Generation: Grid Generation- Types of grid O,H,C. Coordinate transformation, Unstructured grid generation, Errors, Consistency, Stability analysis by von Neumann. Convergence criteria

UNIT- III

Classification of PDEs: Elliptic, parabolic and hyperbolic equations, Initial and boundary conditions. Concepts of Finite difference methods – forward, backward and central difference

UNIT - IV

Finite Difference Solutions: Finite difference solutions - Crank Nicholson, Implicit and explicit, ADI - Jacobi, Gauss Seidel, solution for Viscous incompressible flow using Stream function – Vorticity method

UNIT - V

Finite Volume Method: Introduction to Finite volume method, Finite volume formulations for diffusion equation, convection diffusion equation, Solution algorithm for pressure velocity coupling in steady flows. Use of Staggered grids SIMPLE Algorithm

Text Books:

1. John D. Anderson, "Computational Fluid Dynamics", Mc Graw Hill Inc., 2015.
2. H. K. Versteeg and Malala Shekara, "Introduction to Finite Volume Method", Pearson, 2015.

Suggested Reading:

1. K. Muralidhar and T. Sundararajan T., "Computational Fluid flow and Heat transfer", Narosa Publishing House, 2003.
2. S.V. Patankar, "Numerical Heat transfer and Fluid flow", Hemisphere Publishing Company, New York, 1980.

20ME E207

REFRIGERATION AND CRYOGENICS

(Programme Elective – III)

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

Objectives: To make the students to learn the

1. Importance of selection of refrigerant,
2. Utility of simple vapour compression refrigeration cycle
3. Working principle of absorption refrigeration cycle,
4. The design principles of components of refrigeration system
5. Working principle of gas liquefaction

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

1. Learn the applications of refrigeration and ODP, GWP and related environment issues
2. To design the refrigeration systems for domestic applications
3. Understand absorption refrigeration system and its advantages over vapor compression refrigeration
4. Design equipment needed for refrigeration system like evaporators, condensers.
5. To understand the applications in cryogenics and gas-liquefaction system

UNIT - I

Fundamentals of Refrigeration: Definition of refrigeration, applications of refrigeration, COP, tone of refrigeration, refrigerants and their classification, properties of refrigerants, designation of refrigerants, ozone depletion, eco-friendly refrigerants, Air Refrigeration, Bell Coleman cycle, air craft refrigeration, classification

UNIT - II

Vapor Compression Refrigeration System: Actual cycle, theoretical cycle, flash chamber, accumulator, sub-cooling, superheating, cascade refrigeration, wet compression, dry compression, improvements in the performance of cycle, multi-stage compression with Intercooling, multi-evaporator system

UNIT- III

Vapor Absorption Refrigeration System: Absorption Refrigeration, Simple and Practical NH3 refrigeration, Electrolux refrigeration, LiBr refrigeration system, Efficiency of absorption refrigeration system, steam jet refrigeration, merits and demerits of steam jet refrigeration over simple vapour compression cycle

UNIT - IV

Refrigeration Applications and Psychrometry: Design, selection of evaporators, condensers, control systems, motor selection, Refrigeration applications, food preservation, transport, Introduction to psychrometry, psychrometric processes, humidifiers, de-humidifiers, filters, ducts

UNIT - V

Cryogenics: Application of cryogenics, Gas liquefaction systems - Linde-Hampson, Linde dual pressure, Claudecycle, merits of one system over other system, Production of liquid air, Production of liquid nitrogen and production of liquid oxygen.

Text Books

1. C. P. Arora, "Refrigeration and Air-conditioning", Tata McGraw-Hill, 2000.
2. Stoecker & Jones, "Refrigeration and Air-conditioning", McGraw Hill Book Company, 1992.
3. Bailey, "Advanced Cryogenics", Plenum Press, London, 1971.

Suggested Books.

1. Jordan & Priester, "Refrigeration and Air-conditioning", Prentice-Hall, 2/e, 1957.
2. G. G. Hasseldon, "Cryogenic Fundamentals", Academic Press, 1992.

20ME E208

DESIGN OF HEAT EXCHANGERS

(Programme Elective – III)

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

Objectives: To make the students to learn the

1. Importance of heat exchanger in engineering application
2. Various co-relations for forced convection heat transfer coefficients for different geometries
3. Importance of pressure drop and its effect on heat transfer rate
4. Working principle of hair pin heat exchanger
5. Design concepts of condensers and heat pipe

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

1. Explain different types of heat exchangers, LMTD method and NTU methods
2. List out co-relations for forced convection heat transfer coefficient for various geometries
3. Estimate the pressure drop in laminar and turbulent flow in heat exchangers
4. Determine pressure drop in hair pin and finned tube heat exchangers
5. Explain design and operational considerations in condensers and heat pipes

UNIT - I

Heat Exchanger Types and Design Methods: Tubular heat exchangers, plate heat exchangers, extended surface heat exchangers, flow arrangements, applications, overall heat transfer coefficient, multi-pass and cross flow heat exchangers, LMTD method, NTU method for heat exchanger analysis

UNIT – II

Forced Convection Heat Transfer Coefficient: Laminar forced convection in ducts and concentric annuli, turbulent forced convection in ducts and circular pipes, heat transfer in helical coils, and spirals and heat transfer in bends

UNIT – III

Pressure Drop and Fouling: Tube side pressure drop in laminar and turbulent flows, pressure drop in bends and fittings, Fouling of heat exchangers, basic considerations, effect of fouling on heat transfer and pressure drop.

UNIT - IV

Hair Pin and Finned Heat Exchangers: Pressure drop-hydraulic diameter, hair pin heat exchanger, parallel and series arrangements of hairpins, total pressure drop, compact heat exchangers, plate-fin heat exchangers, tube fin heat exchangers, pressure drop for fin tube heat exchanger

UNIT - V

Condensers: Horizontal shell and tube condensers, plate condensers, air cooled condensers, design and operational considerations, Heat pipe, working principle, heat pipe components and materials

Text Books:

1. Donald Q. Kern, "Process Heat Transfer", TMH Publications, 1963.
2. Sadik Kakac and Hongtan Liu, "Heat Exchangers-Selection, Rating and Thermal Design", 3/e, CRC Press, 2012.
3. David Reay and Peter Kew, "Heat Pipes, Theory, design and Applications", Butterworth-Heinemann (Elsevier), 5/e, 2006.

Suggested Reading:

1. S. Kakac, A. E. Bergles and F. Mayinger, "Heat Exchangers, Thermal, Hydraulic Fundamentals and Design", Hemisphere Publications, 1981.
2. "Standards of Tubular Exchangers Manual Association (TEMA)", 7/e, 1988.

20ME E209

TURBO MACHINES

(Programme Elective – IV)

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

Objectives: Student will understand

1. Principles and equations of turbo machinery
2. Velocity triangle and power developed by steam turbines
3. Working principles of Pelton, Francis and Kaplan turbines
4. Working principles of axial flow compressor and centrifugal compressor and their performance
5. Power required for rotary compressors and power developed by gas turbines

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

1. Apply gas dynamics equations depending upon applications
2. Estimate the power developed by steam turbines
3. Calculate hydraulic efficiency of impulse and reaction turbines
4. Find the efficiency, pressure rise, degree of reaction, slip factor and performance of axial flow and centrifugal compressors
5. Understand cycles and improve the cycle efficiency in gas turbines

UNIT - I

Fundamentals of Turbo Machines: Classifications, Applications, Isentropic flow, Energy transfer, Efficiencies, Static and Stagnation conditions, Fluid equations - continuity, Euler's, Bernoulli's equation and its applications. Euler's flow through variable cross sectional areas.

UNIT - II

Steam Turbines: Convergent and Convergent-Divergent nozzles, Energy Balance, Effect of back pressure, Design of nozzles. Steam Turbines: Impulse turbines, Work done and Velocity triangle, Efficiencies, Compounding

UNIT- III

Hydraulic Turbines: Introduction, Classification of turbines, Impulse and reaction turbines, construction, working and performance of Pelton, Francis and Kaplan Turbines, Selection of turbines: specific speed, unit quantities.

UNIT - IV

Axial Flow Compressors and Centrifugal Compressors: Work and velocity triangles, Efficiencies, Stage pressure rise, Degree of reaction, Performance of compressors, Velocity triangles and efficiencies; slip factor, performance of compressors.

UNIT - V

Gas Turbines: Principle of working – Classification – Joule's cycle – work done and efficiency – Brayton Cycle – Optimum Pressure ratio for maximum power and maximum efficiency – P_{max} and η_{max} – Improvement in cycle performance – Intercooling, Reheating and Regeneration (Heat exchanging) – Problems using these principles.

Text Books:

1. S. M. Yahya, "Turbines, Compreessors and Fans", 4/e, Tata McGraw-Hill Education Pvt. Ltd., 2010.
2. G. Gopalakishnan and D. Prithvi Raj, "A treatise on Turbomachines", Scitec Publications, Chennai, 2002.
3. Seppo. A. Korpela, "Principles of Turbomachinery", John Wiley & sons Inc. Publications, 2011.

Suggested Reading:

1. R. K. Turton, "Principles of Turbomachinery", E & F N Spon Publishers, London & New York,2004.
2. Dennis G. Shepherd, "Principles of Turbomachines", Macmillan, 2007.

20ME E210

GAS TURBINES

(Programme Elective – IV)

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

Objectives: Student will understand

1. Adiabatic energy equation of nozzle.
2. Thermodynamic cycle of gas turbine
3. Working principle of rotary compressors.
4. Working principle of gas turbine power plant.
5. Working principle of jets and propulsions.

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

1. Design nozzle with known inlet conditions
2. Evaluate thermal efficiency of gas turbines and its improvement
3. Determine overall efficiency of Axial flow compressor and Centrifugal compressors
4. Design combustion system for gas turbine plant
5. Determine thrust and propulsive force developed by jets and rockets.

UNIT - I

Gas Dynamics Fundamentals: Conservation Laws and governing equations for Mass, Momentum and Energy for Compressible flows; Basic definitions for Static and Stagnation Pressure, Mach Wave, Mach Angle and Over expanding Nozzle, Adiabatic Flow through Converging-Diverging Nozzle, Adiabatic Flow through a constant area duct, Phenomenon of Shock, Rayleigh Lines, Fanno Lines in duct flows

UNIT - II

Gas Turbines: Relative merits over conventional IC Engines, Introduction to Brayton and Atkinson cycle for Gas turbines, Pressure Ratio, Thermal Efficiency, Specific Output, optimum pressure ratio, Enhancement of Thermal Efficiency and/or specific power output using inter cooling, heat exchangers, reheat burners

UNIT- III

Compressors: Centrifugal Compressor-Major components – Inducer, Impeller, Vaneless Diffuser, Vaned Diffuser, Volute Casing, Velocity & Pressure variation

in a stage, Degree of Reaction, Prewhirl and Surging. Axial Flow Compressor : Stage consisting of a Rotor and a Stator, Pressure Rise in a Stage, Polytropic Efficiency, Losses in a Compressor stage, Phenomenon of Blade Stall & Surging and Phenomenon of Chocking, Performance Curves

UNIT - IV

Gas Turbine Power Plants: Fuel and fuel feed systems; combustion systems-design considerations and flame stabilization; regenerator types and design; gas turbine power; plant performance. Application of airfoil theory to the study of flow through turbine blades; aerodynamic and thermodynamic design considerations; blade materials; blade attachments and blade cooling.

UNIT - V

Jets and Propulsion: Concept of Propulsion and Thrust, Variety of Propulsion systems for flying vehicles – Turboprop, Turbojet, Ram Jet, Pulse Jet, Analysis of propulsion cycle. Thrust Augmentation: Water Injection, Liquid Injection, Afterburning, Bleed Air system

Rocket Propulsion: Distinction between Turbojets and Rockets, Rocket Thrust, Specific Impulse, Total Impulse, Thermal Efficiency, Rocket Equation and applications.

Text Books:

1. H. I. H. Saravanamuttoo, G. F. C. Rogers, H. Cohen , Paul Straznicky, "Gas Turbine Theory", Pearson education. Ltd, 6/e, 2009.
2. V. Ganesan, "Gas Turbines", Tata McGraw-Hill Education, 3/e, 2010.

Suggested Reading:

1. S. M. Yahya, "Turbines, Compressors and Fans", Tata McGraw-Hill Education, 1992.
2. Vincent, "The Theory and design of Gas Turbines and Jet Engines", McGraw-Hill Education, 1950.

20ME E211

POWER PLANT CONTROL AND INSTRUMENTATION

(Programme Elective – IV)

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

Objectives: Student will understand

1. Principles of static and dynamic characteristics of instruments
2. Working principles of feedback control concepts of electrical parameters
3. Create awareness of the importance of working principles of various measuring instruments, their applications in engineering industry and understand characteristics of instruments
4. Familiarize the principles of data acquisition along influence of electrical parameters on instrumentation
5. Understand the principles of modeling of power systems

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

1. Estimate static and dynamic characteristics of instruments
2. Estimate the influence of electrical parameters on measurements
3. Understand theory on stability of instruments used for thermal systems and model power systems using various numerical methods
4. Estimate the role of computers for data acquisition
5. Represent various types of process control system

UNIT - I

Static & Dynamic Characteristics of Instruments: Static & dynamic characteristics of instruments, sensors, signal processing & data transmission elements, indicating & recording elements

UNIT - II

Data Acquisition: Use of computers for data acquisition & instrumentation for measuring temperature, pressure flow, speed, vibration & noise

UNIT- III

Electrical Parameters: On-line process instruments. Automatic process control systems Representation. Feedback control concepts. Transient & Frequency response. Types of controllers

UNIT - IV

Stability Of Instruments: Stability, Digital Control System Modern Control theory. Boiler Control, Governing & Control of turbo-machines

UNIT – V

Computer Aided Power Systems Analysis: Modelling of power system, components, Formation of bus admittance and impedance matrices, Power flow solution Gauss-Seidel, Newton Raphson, and fast de-coupled load flow, Short Circuit studies, Static equivalents of power system, Basic concepts of security analysis and state estimation.

Text Books:

1. T.G.Beckwith and N. Lewis Buck, "Mechanical Measurements". Wesley Publishing, 1961.
2. K. Tayal, "Instruments and Mechanical Measurements", Galgotia Publications.
3. Mc Cloy and H.R. Martin, "The Control of Fluid Power", Longman Publication, 1973.
4. D.A. Williams and G. James, "Liquid Fuels", London Pergamon, 1963.

Suggested Reading:

1. David Lindsley, "Power-Plant Control and Instrumentation", IEE Control Engineering Series 585.
2. W. Bolton, "Instrumentation and Control Systems", 1/e, Elsevier, 2004.

20CE A101

DISASTER MITIGATION AND MANAGEMENT

Instruction	2 Hours per week
Duration of SEE	2 Hours
SEE	50 Marks
CIE	————
Credits	0

Objectives:

1. To equip the students with the basic knowledge of hazards, disasters, risks and vulnerabilities including natural, climatic and human induced factors and associated impacts
2. To impart knowledge in students about the nature, causes, consequences and mitigation measures of the various natural disasters
3. To enable the students to understand risks, vulnerabilities and human errors associated with human induced disasters
4. To enable the students to understand and assimilate the impacts of any disaster on the affected area depending on its position/ location, environmental conditions, demographic, etc.
5. To equip the students with the knowledge of the chronological phases ina disaster management cycle and to create awareness about the disaster management framework and legislations in the context of national and global conventions

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

1. Analyze and critically examine existing programs in disaster management regarding vulnerability, risk and capacity at different levels
2. Understand and choose the appropriate activities and tools and set up priorities to build a coherent and adapted disaster management plan
3. Understand various mechanisms and consequences of human induced disasters for the participatory role of engineers in disaster management
4. Understand the impact on various elements affected by the disaster and to suggest and apply appropriate measures for the same
5. Develop an awareness of the chronological phases of disaster preparedness, response and relief operations for formulating effective disaster management plans and ability to understand various participatory approaches/strategies and their application in disaster management.

UNIT- I:

Introduction: Basic definitions- Hazard, Disaster, Vulnerability, Risk, Resilience, Mitigation, Management; classification of types of disaster- Natural and man-made; 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; Geographical based disasters: Tsunami generation, 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 hydro meteorological and geographical based disasters.

UNIT-III:

Human induced hazards: 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 tragedy; Management of chemical terrorism disasters and biological disasters; Radiological Emergencies and case studies; Case studies related to major power break downs, fire accidents, traffic accidents, oil spills and stampedes, disasters due to double cellar construction in multi-storeyed buildings.

UNIT- IV:

Disaster Impacts: 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.

UNIT- V:

Concept of Disaster Management: Disaster management cycle – its phases; prevention, mitigation, preparedness, relief and recovery; 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. "Hazards, Disasters and your community: A booklet for students and the community", Ministry of home affairs.

Online Resources:

1. http://www.indiaenvironmentportal.org.in/files/file/disaster_management_india1.pdf
2. http://www.ndmindia.nic.in/ (National Disaster management in India, Ministry of Home Affairs)

20EE A101

SANSKRIT FOR TECHNICAL KNOWLEDGE

Instruction	2 Hours per week
Duration of SEE	2 Hours
SEE	50 Marks
CIE	———
Credits	0

Objectives:

1. To get a working knowledge in illustrious Sanskrit, the scientific language in the world
2. To make the novice Learn the Sanskrit to develop the logic in mathematics, science & other subjects
3. To explore the huge knowledge from ancient Indian literature

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

1. Develop passion towards Sanskrit language
2. Decipher the latent engineering principles from Sanskrit literature
3. Correlates the technological concepts with the ancient Sanskrit history.
4. Develop knowledge for the technological progress
5. Explore the avenue for research in engineering with aid of Sanskrit

UNIT-I

Introduction to Sanskrit Language: Sanskrit Alphabets-vowels-consonants-significance of Amarakosa-parts of speech-Morphology-creation of new words-significance of synonyms-sandhi-samasa-sutras-active and passive voice-Past/Present/Future Tense-syntax-Simple Sentences (elementary treatment only)

UNIT-II

Role of Sanskrit in Basic Sciences: Brahmagupthas lemmas (second degree indeterminate equations), sum of squares of n-terms of AP- sulba_sutram or baudhayana theorem (origination of pythogorous theorem)-value of pie-Madhava's sine and cosine theory (origination of Taylor's series).
The measurement system-time-mass-length-temp, Matter elasticity-optics-speed of light (origination of michealson and morley theory).

UNIT-III

Role of Sanskrit in Engineering-I (Civil, Mechanical, Electrical and Electronics Engineering):

Building construction-soil testing-mortar-town planning-Machine definition-crucible-furnace-air blower- Generation of electricity in a cell-magnetism-Solar system-Sun: The source of energy, the earth-Pingala chandasutram (origination of digital logic system)

UNIT-IV

Role of Sanskrit in Engineering-II (Computer Science Engineering & Information Technology): Computer languages and the Sanskrit languages-computer command words and the vedic command words-analogy of pramana in memamsa with operators in computer language-sanskrit analogy of physical sequence and logical sequence, programming.

UNIT-V

Role of Sanskrit in Engineering-III (Bio-technology and Chemical Engineering): Classification of plants-plants, the living-plants have senses-classification of living creatures, Chemical laboratory location and layout-equipment-distillation vessel-kosthi yanthram

Text Books:

1. M Krishnamachariar, "History of Classical Sanskrit Literature", TTD Press, 1937.
2. M.R. Kale, "A Higher Sanskrit Grammar: For the Use of School and College Students", Motilal Banarsidass Publishers, ISBN-13: 978-8120801783, 2015

Suggested Reading:

1. Kapail Kapoor, "Language, Linguistics and Literature: The Indian Perspective", ISBN- 10: 8171880649, 1994.
2. "Pride of India", Samskrita Bharati Publisher, ISBN: 81-87276-27-4, 2007
3. Shri RamaVerma, "Vedas the source of ultimate science", Nag publishers, ISBN:81-7081-618-1,2005

20EC A101

VALUE EDUCATION

Instruction	2 Hours per week
Duration of SEE	2 Hours
SEE	50 Marks
CIE	———
Credits	0

Objectives: This course aims to:

1. Understand the need and importance of Values for self-development and for National development.
2. Imbibe good human values and Morals
3. Cultivate individual and National character.

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

1. Gain necessary Knowledge for self-development
2. Learn the importance of Human values and their application in day to day professional life.
3. Appreciate the need and importance of interpersonal skills for successful career and social life
4. Emphasize the role of personal and social responsibility of an individual for all-round growth.
5. Develop a perspective based on spiritual outlook and respect women, other religious practices, equality, non-violence and universal brotherhood.

UNIT-I

Human Values, Ethics and Morals: Concept of Values, Indian concept of humanism, human values; Values for self-development, Social values, individual attitudes; Work ethics, moral and non- moral behaviour, standards and principles based on religion, culture and tradition.

UNIT-II

Value Cultivation, and Self-management: Need and Importance of cultivation of values such as Sense-of Duty, Devotion to work, Self-reliance, Confidence, Concentration, Integrity & discipline, and Truthfulness.

UNIT-III

Spiritual outlook and social values: Personality and Behavior, Scientific attitude and Spiritual (soul) outlook; Cultivation of Social Values Such as Positive

Thinking, Punctuality, Love & Kindness, Avoiding fault finding in others, Reduction of anger, forgiveness, Dignity of labour, True friendship, Universal brotherhood and religious tolerance.

UNIT-IV

Values in Holy Books : Self-management and Good health; internal & external cleanliness**,** Holy books versus Blind faith, Character and Competence, Equality, Nonviolence, Humility, Role of Women.

UNIT-V

Dharma, Karma and Guna: Concept of soul; Science of Reincarnation, Character and Conduct, Concept of Dharma; Cause and Effect based Karma Theory; The qualities of Devine and Devilish; Satwic, Rajasic and Tamasic gunas.

Text Books:

1. Chakroborty, S.K. "Values & Ethics for organizations Theory and practice", Oxford University Press, New Delhi, 1998.

Suggested Reading:

1. Jaya Dayal Goyandaka, "Srimad Bhagavad Gita with Sanskrit Text, Word Meaning and Prose Meaning", Gita Press, Gorakhpur, 2017.

20IT A101

PEDAGOGY STUDIES

Instruction	2 Hours per week
Duration of SEE	2 Hours
SEE	50 Marks
CIE	———
Credits	0

Course Objectives:

1. To present the basic concepts of design and policies of pedagogy studies.
2. To provide understanding of the abilities and dispositions with regard to teaching techniques, curriculum design and assessment practices.
3. To familiarize various theories of learning and their connection to teaching practice.
4. To create awareness about the practices followed by DFID, other agencies and other researchers.
5. To provide understanding of critical evidence gaps that guides the professional development.

Course Outcomes: Upon completing this course, students will be able to:

1. Illustrate the pedagogical practices followed by teachers in developing countries both in formal and informal classrooms.
2. Examine the effectiveness of pedagogical practices.
3. Understand the concept, characteristics and types of educational research and perspectives of research.
4. Describe the role of classroom practices, curriculum and barriers to learning.
5. Understand Research gaps and learn the future directions.

UNIT-I

Introduction and Methodology: Aims and rationale, Policy background, Conceptual framework and terminology - Theories of learning, Curriculum, Teacher education - Conceptual framework, Research questions - Overview of methodology and Searching.

UNIT-II

Thematic Overview: Pedagogical practices followed by teachers in formal and informal classrooms in developing countries - Curriculum, Teacher education.

UNIT-III

Evidence on the Effectiveness of Pedagogical Practices: Methodology for the in depth stage: quality assessment of included studies - How can teacher education (curriculum and Practicum) and the school curriculum and guidance material best support effective pedagogy? - Theory of change - Strength and nature of the body of evidence for effective pedagogical practices - Pedagogic theory and pedagogical approaches - Teachers' attitudes and beliefs and pedagogic strategies.

UNIT-IV

Professional Development: alignment with classroom practices and follow up support - Support from the head teacher and the community – Curriculum and assessment - Barriers to learning: Limited resources and large class sizes.

UNIT-V

Research Gaps and Future Directions: Research design – Contexts – Pedagogy - Teacher education - Curriculum and assessment – Dissemination and research impact.

Text Books:

1. Ackers J, Hardman F, "Classroom Interaction in Kenyan Primary Schools, Compare", 31 (2): 245 – 261, 2001.
2. Agarwal M, "Curricular Reform in Schools: The importance of evaluation", Journal of Curriculum Studies, 36 (3): 361 – 379, 2004.

Suggested Reading:

1. Akyeampong K, "Teacher Training in Ghana – does it count? Multisite teacher education research project (MUSTER)", Country Report 1.London: DFID, 2003.
2. Akyeampong K, Lussier K, Pryor J, Westbrook J, "Improving teaching and learning of Basic Maths and Reading in Africa: Does teacher Preparation count?, International Journal Educational Development, 33 (3): 272-282, 2013.
3. Alexander R J, "Culture and Pedagogy: International Comparisons in Primary Education", Oxford and Boston: Blackwell, 2001.
4. Chavan M, "Read India: A mass scale, rapid, 'learning to read' campaign", 2003.

Web Resources:

1. https://onlinecourses.nptel.ac.in/noc17_ge03/preview
2. www.pratham.org/images/resources%20working%20paper%202.pdf.

20EG A101

ENGLISH FOR RESEARCH PAPER WRITING

Instruction	2 Hours per week
Duration of SEE	2 Hours
SEE	50 Marks
CIE	———
Credits	0

Objectives: The Course will introduce the students to

1. Understand the nuances of language and vocabulary in writing a Research Paper.
2. Develop the content, structure and format of writing a research paper.
3. Produce original research papers without plagiarism.

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

1. Interpret the nuances of research paper writing.
2. Differentiate the research paper format and citation of sources.
3. To review the research papers and articles in a scientific manner.
4. Avoid plagiarism and be able to develop their writing skills in presenting the research work.
5. Create a research paper and acquire the knowledge of how and where to publish their original research papers.

UNIT - I

Academic Writing : Meaning & Definition of a research paper– Purpose of a research paper – Scope – Benefits – Limitations – outcomes.

UNIT - II

Research Paper Format: Title – Abstract – Introduction – Discussion – Findings – Conclusion – Style of Indentation – Font size/Font types – Indexing – Citation of sources.

UNIT- III

Research Methodology: Methods (Qualitative – Quantitative) Review of Literature. Criticizing, Paraphrasing & Plagiarism.

UNIT - IV

Process of Writing a research paper: Choosing a topic - Thesis Statement – Outline – Organizing notes - Language of Research – Word order, Paragraphs – Writing first draft –Revising/Editing - The final draft and proof reading.

UNIT - V

Research Paper Publication: Reputed Journals – National/International – ISSN No, No. of volumes, Scopus Index/UGC Journals – Free publications - Paid Journal publications – /Advantages/Benefits

Text Books:

1. C. R Kothari, Gaurav, Garg, "Research Methodology Methods and Techniques", 4/e, New Age International Publishers.

Suggested Reading:

1. Day R, "How to Write and Publish a Scientific Paper**",** Cambridge University Press, 2006
2. "MLA Hand book for writers of Research Papers", 7/e, East West Press Pvt. Ltd, New Delhi
3. Lauri Rozakis, Schaum's, "Quick Guide to Writing Great Research Papers", Tata McGraw Hills Pvt. Ltd, New Delhi.

Online Resources:

1. NPTEL: https://onlinecourses.nptel.ac.in/noc18_mg13/preview

20EG A102

INDIAN CONSTITUTION AND FUNDAMENTAL RIGHTS

Instruction	2 Hours per week
Duration of SEE	2 Hours
SEE	50 Marks
CIE	————
Credits	0

Objectives: The Course will introduce the students to

1. The history of Indian Constitution and its role in the Indian democracy.
2. Address the growth of Indian opinion regarding modern Indian intellectuals' constitutional role and entitlement. to civil and economic rights as well as the emergence of nationhood in the early years of Indian nationalism.
3. Have knowledge of the various Organs of Governance and Local Administration.

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

1. Understand the making of the Indian Constitution and its features.
2. Understand the Rights of equality, the Right of freedom and the Right to constitutional remedies.
3. Have an insight into various Organs of Governance - composition and functions.
4. Understand powers and functions of Municipalities, Panchayats and Co-operative Societies.
5. Understand Electoral Process, special provisions.

UNIT - I

History of making of the Indian constitutions: History, Drafting Committee (Composition &Working).

Philosophy of the Indian Constitution: Preamble, Salient Features.

UNIT - II

Contours of Constitutional Rights and Duties - Fundamental Rights, Right to Equality, Right to Freedom, Right against Exploitation, Right to Freedom of Religion, Cultural and Educational Rights, Right to Constitutional Remedies, Directive Principles of State Policy, Fundamental Duties.

UNIT- III

Organs of Governance - Parliament: Composition, Qualifications, Powers and Functions

Union Executives : President, Governor, Council of Ministers, Judiciary, appointment and transfer of judges, qualifications, powers and functions

UNIT - IV

Local Administration - District's Administration head: Role and importance. Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal Corporation. Panchayati Raj: Introduction, PRI: Zilla Panchayat, Elected Officials and their roles, CEO Zilla Panchayat: positions and role.
Block level: Organizational Hierarchy(Different departments) Village level: role of elected and appointed officials. Importance of grass root democracy.

UNIT - V

Election commission: Election Commission: Role and functioning, Chief Election Commissioner and Election Commissioners, State Election Commission :Role and functioning. Institute and Bodies for the welfare of SC/ST/OBC and women**.**

Text Books:

1. Dr. S. N. Busi, Dr. B. R. Ambedkar, "Framing of Indian Constitution", 1/e, 2015.
2. M. P. Jain, "Indian Constitution Law", 7/e, Lexis Nexis, 2014

Suggested Reading:

1. "The Constitution of India", 1950 (Bare Act), Government Publication
2. D.D. Basu, "Introduction to the Constitution of India", Lexis Nexis, 2015.

Online Resources:

1. http://www.nptel.ac.in/courses/103107084/Script.pdf

20EG A103

STRESS MANAGEMENT BY YOGA

Instruction	2 Hours per week
Duration of SEE	2 Hours
SEE	50 Marks
CIE	————
Credits	0

Objectives: The Course will introduce the students to

1. Creating awareness about different types of stress and the role of yoga in the management of stress.
2. Promotion of positive health and overall wellbeing (Physical, mental, emotional, social and spiritual).
3. Prevention of stress related health problems by yoga practice.

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

1. Understand yoga and its benefits.
2. Enhance Physical strength and flexibility.
3. Learn to relax and focus.
4. Relieve physical and mental tension through asanas
5. Improve work performance and efficiency.

UNIT - I

Meaning and Definition of Yoga - Historical perspective of Yoga - Principles of Astanga Yoga by Patanjali.

UNIT - II

Meaning and Definition of Stress - Types of stress - Eustress and Distress. Anticipatory Anxiety and Intense Anxiety and depression. Meaning of Management- Stress Management.

UNIT- III

Concept of Stress According to Yoga - Stress assessment methods - Role of Asana, Pranayama and Meditation in the management of stress

UNIT - IV

Asanas- (5 Asanas in each posture) - Warm up - Standing Asanas - Sitting Asanas - Prone Asanas - Supine asanas - Surya Namaskar

UNIT - V

Pranayama- Anulom and Vilom Pranayama - Nadishudhi Pranayama - Kapalabhati Pranayama - Bhramari Pranayama - Nadanusandhana Pranayama.

Meditation Techniques: Om Meditation - Cyclic meditation : Instant Relaxation technique (QRT), Quick Relaxation Technique (QRT), Deep Relaxation Technique (DRT)

Text Books:

1. "Yogic Asanas for Group Training - Part-I": Janardhan Swami Yogabhyasi Mandal, Nagpur.
2. Swami Vivekananda, "Rajayoga or Conquering the Internal Nature", Advaita Ashrama (Publication Department), Kolkata.

Suggested Reading:

1. Nagendra H.R nad Nagaratna R, "Yoga Perspective in Stress Management", Swami Vivekananda Yoga Prakashan, Bangalore,

Online Resources:

1. https://onlinecourses.nptel.ac.in/noc16_ge04/preview
2. https://freevideolectures.com/course/3539/indian-philosophy/11

20EG A104

PERSONALITY DEVELOPMENT THROUGH LIFE'S ENLIGHTENMENT SKILLS

Instruction	2 Hours per week
Duration of SEE	2 Hours
SEE	50 Marks
CIE	————
Credits	0

Objectives: The Course will introduce the students to

1. Learn to achieve the highest goal happily.
2. Become a person with stable mind, pleasing personality and determination.
3. Awaken wisdom among them.

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

1. Develop their personality and achieve their highest goal of life.
2. Lead the nation and mankind to peace and prosperity.
3. Practice emotional self regulation.
4. Develop a positive approach to work and duties.
5. Develop a versatile personality.

UNIT - I

Neetisatakam – Holistic Development of Personality - Verses 19, 20, 21, 22 (Wisdom) - Verses 29, 31, 32 (Pride and Heroism) - Verses 26,28,63,65 (Virtue)

UNIT - II

Neetisatakam – Holistic Development of Personality (cont'd) - Verses 52, 53, 59 (dont's) - Verses 71,73,75 & 78 (do's) - Approach to day to day works and duties.

UNIT- III

Introduction to Bhagavadgeetha for Personality Development - Shrimad Bhagavadgeetha: Chapter 2 – Verses 41, 47, 48 - Chapter 3 – Verses 13,21,27,35 - Chapter 6 – Verses 5,13,17,23,35 - Chapter 18 – Verses 45, 46, 48 Chapter – 6: Verses 5, 13, 17, 23, 35; Chapter – 18: Verses 45, 46, 48

UNIT - IV

Statements of Basic Knowledge - Shrimad Bhagavadgeetha: Chapter 2- Verses 56, 62,68 - Chapter 12 – Verses 13, 14, 15, 16, 17, 18 - Personality of Role model from Shrimad Bhagawat Geeta.

UNIT - V

Role of Bhagavadgeetha in the Present Scenario - Chapter 2 – Verses 17 - Chapter 3 – Verses 36, 37, 42 - Chapter 4 – Verses 18, 38, 39 - Chapter 18 – Verses 37, 38, 63.

Text Books:

1. "Srimad Bhagavad Gita" , Swami SwarupanandaAdvaita Ashram (Publication Department), Kolkata

Suggested Reading:

1. "Bhartrihari's Three Satakam (Niti-sringar-vairagya)", P.Gopinath, Rashtriya Sanskrit Sansthanam, New Delhi

Online Resources:

1. NTPEL: http://nptel.ac.in/downloads/109104115/

20ME C108

COMPUTER AIDED ENGINEERING LAB

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

Objectives: To make the students

1. Model one and two-dimensional elements in ANSYS
2. Understand vibration, harmonic and transient analysis
3. Carry out buckling analysis
4. Analyze forming and sheet metal operations by FEA
5. Model crack element

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

1. Understand the applications of one and two-dimensional elements
2. Solve engineering problems
3. Find buckling factors
4. Understand industrial applications of forming and sheet metal operations
5. Find fracture toughness

List of Exercises:

1. Introduction to Finite Element Analysis Software
2. Statically indeterminate reaction force analysis and determination of Beam stresses and Deflection
3. Static analysis of a corner bracket
4. Analysis of cylindrical shell under pressure
5. Bending of a circular plate using axisymmetric shell element.
6. Vibration analysis of a simply supported beam
7. Harmonic analysis of plates and shells
8. Transient analysis of vehicle crash
9. Buckling analysis of shells
10. Analysis of forming
11. Analysis of sheet metal operation
12. Stress intensity factor in cracked plates

Note: Out of the above 12 experiments, any **ten (10)** experiments have to be carried out.

Text Books:

1. R. Tirupathi, Chandrupatla and B.D. Ashok, "Introduction of Finite Element in Engineering", Prentice Hall of India, 2004
2. David.V.Hutton, "Fundamentals of Finite Element Analysis", Tata McGraw Hill,2003

Suggested Reading:

1. Robert Cook , "Concepts and applications of finite element analysis", 4/e, John Wiley and sons,2009
2. S.S. Rao, ,"The Finite Element Methods in Engineering", 2 /e, Pergamon Press, 2001.

20ME C206

COMPUTATIONAL FLUID DYNAMICS LAB

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

Objectives: To acquaint the student with

1. Basic steps in a CFD simulation: ANSYS Workbench design modular and meshing
2. Simulation of laminar, turbulent, internal flow, steady and unsteady problems
3. Simulation of steady and unsteady problems
4. Physics setup involves boundary conditions
5. Solution of thermal related problems

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

1. Analyze laminar flow problems in plates and pipes
2. Solve steady and unsteady flow past a cylinder
3. Perform analysis for free and forced convection
4. Evaluate the effect of angle of attack and velocity on NACA aerofiol
5. Simulate compressible flow in a nozzle, premixed combustion

List of Experiments:

1. Laminar Flow over Flat plate
2. Laminar Pipe Flow
3. Steady Flow past a Cylinder
4. Unsteady Flow past a Cylinder
5. Two Dimensional Steady Free Convection
6. Forced Convection for pipe cross section
7. Study of Hot & Cold Fluid Mix
8. Flow analysis of Aerofoil.
9. Study of compressible flow through a nozzle
10. Partially premixed combustion analysis
11. Supersonic flow over a wedge
12. Study of flow over wind turbine blade/flow through bifurcation artery

Note: Out of the above 12 experiments, any **ten (10)** experiments have to be carried out.

Text Books:

1. John D Anderson, "Computational Fluid Dynamics", Mc Graw Hill, Inc., 2015.
2. H.K.Versteeg and Malala Shekara, "Introduction to Finite Volume Method", Pearson, 2015

Suggested Reading:

1. J.H. Ferziger and M. Peric, "Computational Methods for Fluid Dynamics", Springer.
2. K. Muralidhar and T. Sundararajan T, "Computational Fluid flow and Heat transfer", Narosa Publishing House, 2003

20ME C207

MINI PROJECT WITH SEMINAR

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

Outcomes: Students are able to

1. Formulate a specific problem and give solution
2. Develop model/models either theoretical/practical/numerical form
3. Solve, interpret/correlate the results and discussions
4. Conclude the results obtained
5. Write the documentation in standard format

Guidelines:

1. As part of the curriculum in the II- semester of the progarmme each students shall do a mini project, generally comprising about three to four weeks of prior reading, twelve weeks of active research, and finally a presentation of their work for assessment.
2. Each student will be allotted to a faculty supervisor for mentoring.
3. Mini projects should present students with an accessible challenge on which to demonstrate competence in research techniques, plus the opportunity to contribute something more original.
4. Mini projects shall have inter disciplinary/ industry relevance.
5. The students can select a mathematical modeling based/Experimental investigations or Numerical modeling.
6. All the investigations are clearly stated and documented with the reasons/explanations.
7. The mini-project shall contain a clear statement of the research objectives, background of work, literature review, techniques used, prospective deliverables, and detailed discussion on results, conclusions and references.

Department committee: Supervisor and two faculty coordinators

Guidelines for awarding marks in CIE (Continuous Internal Evaluation): Max. Marks: 50		
Evaluation by	**Max .Marks**	**Evaluation Criteria / Parameter**
Supervisor	20	Progress and Review
	05	Report
Department Committee	05	Relevance of the Topic
	05	PPT Preparation
	05	Presentation
	05	Question and Answers
	05	Report Preparation

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (A)

(AICTE Model Curriculum with Effect from the AY 2020 – 2021)

ME (Thermal Engineering)

SEMESTER – III

S. No.	Course Code	Title of the Course	Scheme of Instruction			Scheme of Examination			Credits
			Hours per week			Duration of SEE in Hours	Maximum Marks		
			L	T	P		CIE	SEE	
THEORY									
1		Programme Elective - V	3	--	--	3	40	60	3
2		Open Elective	3	--	--	3	40	60	3
3	20ME C208	Industrial Project / Dissertation Phase - I	--	--	20	--	100	--	10
TOTAL			**6**	--	20		**180**	**120**	**16**

L: Lecture D: Drawing CIE - Continuous Internal Evaluation

T: Tutorial P: Practical/Mini Project with Seminar/Dissertation Phase

SEE – Semester End Examination

Programme Elective – V (3/3)			Open Elective (3/3)		
S. No.	Subject Code	Name of the Subject	SNo	Subject Code	Name of the Subject
1	20ME E212	Advances in IC Engines	1	20CE O101	Cost Management of Engineering Projects
2	20ME E213	Convective Heat Transfer	2	20EE O101	Waste to Energy
3	20ME E214	Heat Pipe			

20ME E212

ADVANCES IN IC ENGINES

(Programme Elective – V)

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

Objectives: Student will understand

1. Importance of combustion phenomena and various injection systems in SI engines
2. Combustion phenomena and increasing methods of power output in CI engine
3. Concept of formation of pollutants from IC engines along with pollutant control and measurement techniques
4. Concept of alternative fuel technologies to improve the performance of the engine
5. Concepts of recent trends with changes in engine configuration

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

1. Describe the phenomena of combustion and knock in SI engines
2. Combustion phenomena of CI engines and various power boosting techniques
3. Understand how undesirable pollutants can be measured and controlled
4. Demonstrate an understanding of technological, environmental and social impact of alternative fuels
5. Explain modern concepts like lean burn, stratification, HCCI and GDI techniques

UNIT - I

Spark Ignition Engines: Spark ignition engine mixture requirements – Fuel – Injection systems – Monopoint, Multipoint injection, Direct injection –Stages of combustion – Normal and abnormal combustion – Factors affecting knock – Combustion chambers

UNIT - II

Compression Ignition Engines: Stages of combustion in C.I. Engine – Direct and indirect injection systems – Combustion chambers – Normal and Abnormal

Combustion – Knock in C.I Engines-Basic Concepts and Study of Fuel Spray – Supercharging and Turbocharging methods

UNIT- III

Pollutant Formation and Control: Pollutant – Sources – Formation of carbon monoxide, Unburnt hydrocarbon, Aldehydes, NOx, Smoke and Particulate matter – Methods of controlling Emissions – Catalytic converters and Particulate Traps-Methods of measurements and Introduction to emission norms

UNIT - IV

Alternative Fuels: Alcohol, Hydrogen, Natural Gas, Biogas and Liquefied Petroleum Gas- Properties, Suitability, Merits and Demerits as fuels, Engine Modifications

UNIT - V

Recent Trends: Lean Burn and Adiabatic concepts, Rotary engines, – Stratified charge Engines – homogeneous charge compression ignition (HCCI) engines and GDI concepts

Text Books:

1. V. Ganeshan, "Internal Combustion engines", Tata McGraw Hills Publishing Co. Ltd, New Delhi
2. J.B. Heywood, "Internal Combustion engine fundamentals", McGrave Hills, Book Co., New York.

Suggested Reading:

1. M.L. Mathur, and R.P. Sharma, "Internal Combustion Engine", Dhanpat Rai & Sons, Delhi
2. E.F. Obert, "Internal Computation Engines", Harper & Row Publishers N.Y
3. P.W. Gill, and J.H. Smith(Jr), "Fundamentals of Internal combustion Engines", Oxford & IBH publishing Co. New Delhi,

20ME E213

CONVECTIVE HEAT TRANSFER

(Programme Elective – V)

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

Objectives: Student will understand

1. Different types of convection heat transfer and their equations to apply for various engineering applications
2. To familiarize the concept of forced convection and its behavior in pipes
3. To familiarize the concept of natural convection and its behavior in pipes
4. To familiarize the concept of combination of natural convection and forced convention in pipes
5. To understand the principles of conjugate heat transfer and its applications in engineering heat transformation

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

1. Select the mode of convection heat transfer rate and calculate heat transfer rate depending on the application
2. Determine rate of heat transfer under forced convention phenomena in pipes
3. Determine rate of heat transfer under natural convention phenomena in pipes
4. Calculate the rate of heat transfer with the combination of conduction and convection in applications like heat exchangers
5. Determine heat transfer rate through the porous media

UNIT - I

Introduction To Convective Heat Transfer: Forced, free & combined convection – convective heat transfer coefficient – Application of dimensional analysis to convection – Physical interpretation of dimensionless numbers. Equations of Convective Heat Transfer: Continuity, Navier-Strokes equation & energy equation for steady state flows – similarity – Equations for turbulent convective heat transfer – Boundary layer equations for laminar, turbulent flows – Boundary layer integral equations

UNIT - II

Forced Convection: External Laminar Forced Convection: Similarity solution for flow over an isothermal plate – integral equation solutions – Numerical solutions – Viscous dissipation effects on flow over a flat plate. External Turbulent Flows: Analogy solutions for boundary layer flows – Integral equation solutions – Effects of dissipation on flow over a flat plate. Internal Laminar Flows: Fully developed laminar flow in pipe, plane duct & ducts with other cross-sectional shapes – Pipe flow & plane duct flow with developing temperature field – Pipe flows & plane duct flow with developing velocity & temperature fields. Internal Turbulent Flows: Analogy solutions for fully developed pipe flow –Thermally developing pipe & plane duct flow.

UNIT- III

Natural Convection: Boussineq approximation – Governing equations – Similarity – Boundary layer equations for free convective laminar flows – Numerical solution of boundary layer equations. Free Convective flows through a vertical channel across a rectangular enclosure – Horizontal enclosure – Turbulent natural convection

UNIT - IV

Combined Convection: Governing parameters & equations – laminar boundary layer flow over an isothermal vertical plate – combined convection over a horizontal plate – correlations for mixed convection – effect of boundary forces on turbulent flows – internal flows - internal mixed convective flows – Fully developed mixed convective flow in a vertical plane channel & in a horizontal duct

UNIT - V

Heat Transfer Through Porous Media: Area weighted velocity – Darcy flow model – energy equation – boundary layer solutions for 2-D forced convection – Fully developed duct flow – Natural convection in porous media – filled enclosures – stability of horizontal porous layers

Text Books:

1. Patrick H. Oosthuigen & David Naylor, "Introduction to Convective Heat Transfer Analysis", TMH.
2. Kays & Crawford, "Convective Heat & Mass Transfer", TMH, 2000.

Suggested Reading:

1. Oosthigen, "Convective Heat and Mass Transfer", McGraw Hill, 1998.
2. Adrian Bejan, "Convection Heat Transfer", 2/e, John Wiley, 1984.

20ME E214

HEAT PIPE

(Programme Elective – V)

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

Objectives: To make the students to understand the

1. Importance of heat pipe and its working principle
2. Classification of heat pipe
3. Design concept of heat pipe
4. Testing method of heat pipe
5. Different types of Modeling of heat pipe

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

1. Understand the physics of heat pipe
2. Calculate the heat load on heat pipe
3. Design of heat pipe
4. Test the heat pile
5. Model different types of heat pipes under different conditions

UNIT - I

Background and Historical Development of Heat Pipe: Operating Principle-Limits of Heat Transport Capacity-Advantages of Heat Pipes-Physics of Heat Pipe- Vaporization & Condensation-Wettabilty-Capillarity-Surface Tension

UNIT - II

Limiting Heat Loads: Capillary, Viscous and Boiling Limits- Dry out and Rewetting, Classification of Heat Pipes- Thermo-siphon Heat Pipes- Wick Heat Pipes- Rotating Heat Pipes- Micro Heat Pipes- Cryogenic Heat Pipes-Variable Condensation Heat Pipes-Thermal Switches and Diodes

UNIT-III

Design and Manufacturing of Heat Pipes: Working Fluids-Components-Wick Structures-Design Criteria- Fabrication and Fluid Charging-Reliability Tests

UNIT-IV

Heat Pipe Testing: Testing Methods- Start up Methods

Heat Pipe Applications: Electronic, Power Plant, Space and Industry Applications

UNIT - V

Modeling of Heat Pipes- Steady State Modeling-Transient Modeling-Start up Characteristics

Text Books:

1. Dunn & Reay, "Heat Pipes", Pergamon Press, 1994.
2. Rice Graham, "Heat Pipes", Academic Publishers, 1995.
3. Faghri, "Heat Pipe Science and Technology", Taylor & Francis, 1995.

Suggested Reading:

1. Bahman Zohuri, "Heat Pipe Design and Technology: A Practical Approach", CRC Publishing Company, 2011.
2. G. P. Peterson, "Introduction to Heat Pipes: Modeling, Testing, and Applications", John Wiley & Sons, 1/e, 1994.
3. David Reay, Peter Kew, and Ryan McGlen, "Heat Pipes: Theory, Design and Applications", 6/e, Elsevier Ltd, 2013.

20CE O101

COST MANAGEMENT OF ENGINEERING PROJECTS

(Open Elective)

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

Objectives:

1. To enable the students to understand the concepts of Project management.
2. To provide knowledge on concepts of Project Planning and scheduling.
3. To create an awareness on Project Monitoring and Cost Analysis
4. To provide adequate knowledge to the students on Recourse Management Costing-Variance Analysis
5. To train the students with the concepts of Budgetary Control for cost management and to provide basic platform on Quantitative techniques for cost management.

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

1. Acquire in-depth knowledge about the concepts of project management and understand the principles of project management.
2. Determine the critical path of a typical project using CPM and PERT techniques.
3. Prepare a work break down plan and perform linear scheduling using various methods.
4. Solve problems of resource scheduling and leveling using network diagrams.
5. Learn the concepts of budgetary control and apply quantitative techniques for optimizing project cost.

UNIT- I:

Project Management: Introduction to project managements, stakeholders, roles, responsibilities and functional relationships, Principles of project management, objectives and project management system, Project team, organization, roles, and responsibilities, Concepts of project planning, monitoring, staffing, scheduling and controlling.

UNIT-II:

Project Planning and Scheduling: Introduction for project planning, defining activities and their interdependency, time and resource estimation. Work break

down structure. Linear scheduling methods-bar charts, Line of Balance (LOB), their limitations. Principles, definitions of network-based scheduling methods: CPM, PERT. Network representation, network analysis-forward and backward passes.

UNIT-III:

Project Monitoring and Cost Analysis: introduction-Cost concepts in decision-making; Relevant cost, Differential cost, Incremental cost and Opportunity cost. Objectives of a Costing System; Inventory valuation; Creation of a Database for operational control; Provision of data for Decision-Making, Time cost tradeoff-Crashing project schedules, its impact on time on time, cost, Project direct and indirect costs.

UNIT- IV:

Resources Management and Costing-Variance Analysis: Planning, Enterprise Resource Planning, Resource scheduling and leveling, Total Quality Management and Theory of constraints. Activity-Based Cost Management, Bench Marking; Balanced Score Card and Value-Chain Analysis

Standard Costing and Variance Analysis: Pricing strategies: Pareto Analysis, Target costing, Life Cycle Costing, Costing of service sector. Just-in-time approach, Material Requirement

UNIT- V:

Budgetary Control: Flexible Budgets; Performance budgets; Zero-based budgets, Measurement of Divisional profitability pricing decisions including transfer pricing.

Quantitative techniques for cost management: Linear Programming, PERT/CPM, Transportation Assignment problems, Simulation, Learning Curve Theory.

Text Books:

1. Charles T Horngren "Cost Accounting A Managerial Emphasis", Pearson Education; 14 edition (2012),
2. Charles T. Horngren and George Foster, "Advanced Management Accounting" Prentice-Hall; 6th Revised edition (1 February 1987)
3. Robert S Kaplan Anthony A. Atkinson, "Management & Cost Accounting" , Pearson; 2 edition (18 October 1996)

Suggested Reading:

1. K. K Chitkara, "Construction Project Management: Planning, scheduling and controlling", Tata McGraw-Hill Education. (2004).
2. Kumar Neeraj Jha "Construction Project Management Theory and Practice",Pearson Education India; 2 edition (2015)

20EE O101

WASTE TO ENERGY

(Open Elective)

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

Objectives:

1. To know the various forms of waste
2. To understand the processes of Biomass Pyrolysis.
3. To learn the technique of Biomass Combustion.

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

1. Understand the concept of conservation of waste
2. Identify the different forms of wastage
3. Chose the best way for conservation to produce energy from waste
4. Explore the ways and means of combustion of biomass
5. Develop a healthy environment for the mankind

UNIT - I

Introduction to Energy from Waste: Classification of waste as fuel – Agro based, 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

Biomass Gasification: Gasifiers – Fixed bed system – Downdraft and updraft gasifiers – Fluidized bed gasifiers – Design, construction and operation – Gasifier burner arrangement for thermal heating – Gasifier engine arrangement and electrical power – Equilibrium and kinetic consideration in gasifier operation.

UNIT–IV

Biomass Combustion: Biomass stoves – Improved chullahs, types, some exotic designs, Fixed bed combustors, Types, inclined grate combustors, Fluidized

bed combustors, Design, construction and operation - Operation of all the above biomass combustors.

UNIT – V

Biogas: Properties of biogas (Calorific value and composition) - Biogas plant technology and status - Bio energy system - Design and constructional features - Biomass resources and their classification - Biomass conversion processes - Thermo chemical conversion - Direct combustion - biomass gasification - pyrolysis and liquefaction - biochemical conversion - anaerobic digestion - Types of biogas Plants – Applications - Alcohol production from biomass - Bio diesel production - Urban waste to energy conversion - Biomass energy programme in India.

Text Books:

1. V. Ashok V., "Non Conventional Energy", Desai, Wiley Eastern Ltd., 1990.
2. K.C. Khandelwal and Mahdi, S. S., "Biogas Technology - A Practical Hand Book" - Vol. I & II, Tata McGraw Hill Publishing Co. Ltd., 1983.

.

Suggested Readings:

1. D.S. Challal,"Food, Feed and Fuel from Biomass", IBH Publishing Co. Pvt. Ltd., 1991.
2. C. Y. WereKo-Brobby and E. B. Hagan, "Biomass Conversion and Technology", John Wiley & Sons, 1996.

20ME C208

INDUSTRIAL PROJECT / DISSERTATION PHASE - I

Instruction	20 Hours per week
Duration of SEE	———
SEE	———
CIE	100 Marks
Credits	10

Outcomes: At the end of the course:

1. Students will be exposed to self-learning various topics.
2. Students will learn to survey the literature such as books, national/ international refereed journals and contact resource persons for the selected topic of research.
3. Students will learn to write technical reports.
4. Students will develop oral and written communication skills to present.
5. Student will defend their work in front of technically qualified audience.

Guidelines:

1. The Project work will preferably be a problem with research potential and should involve scientific research, design, generation/collection and analysis of data, determining solution and must preferably bring out the individual contribution.

2. Seminar should be based on the area in which the candidate has undertaken the dissertation work.

3. The CIE shall include reviews and the preparation of report consisting of a detailed problem statement and a literature review.

4. The preliminary results (if available) of the problem may also be discussed in the report.

5. The work has to be presented in front of the committee consists of Head, Chairperson-BoS, Supervisor and Project coordinator.

6. The candidate has to be in regular contact with his supervisor and the topic of dissertation must be mutually decided by the guide and student.

Guidelines for awarding marks in CIE (Continuous Internal Evaluation): Max. Marks: 100		
Evaluation by	**Max .Marks**	**Evaluation Criteria / Parameter**
Supervisor	30	Project Status / Review(s)
	20	Report
Department Committee	10	Relevance of the Topic
	10	PPT Preparation(s)
	10	Presentation(s)
	10	Question and Answers
	10	Report Preparation

Note: Department committee has to assess the progress of the student for every two weeks.

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (A)
(AICTE Model Curriculum with Effect from the AY 2020 – 2021)
ME (Thermal Engineering)

SEMESTER – IV

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		CIE	SEE	
THEORY									
1	20ME C209	Industrial Project / Dissertation Phase - II	--	--	32	Viva	100	100	16
TOTAL			**--**	**--**	**32**	**--**	**100**	**100**	**16**

L: Lecture D: Drawing CIE - Continuous Internal Evaluation
T: Tutorial P: Practical/Mini Project with Seminar/Dissertation Phase
SEE – Semester End Examination

19MEC 209

INDUSTRIAL PROJECT / DISSERTATION PHASE - II

Instruction	32 Hours per week
Duration of SEE	Viva - Voce
SEE	100 Marks
CIE	100 Marks
Credits	16

Outcomes: At the end of the course:

1. Students will be able to use different experimental techniques and will be able to use different software/ computational/analytical tools.
2. Students will be able to design and develop an experimental set up/ equipment/test rig.
3. Students will be able to conduct tests on existing set ups/equipments and draw logical conclusions from the results after analyzing them.
4. Students will be able to either work in a research environment or in an industrial environment.
5. Students will be conversant with technical report writing and will be able to present and convince their topic of study to the engineering community.

Guidelines:

1. It is a continuation of Project work started in semester III.
2. The student has to submit the report in prescribed format and also present a seminar.
3. The dissertation should be presented in standard format as provided by the department.
4. The candidate has to prepare a detailed project report consisting of introduction of the problem, problem statement, literature review, objectives of the work, methodology (experimental set up or numerical details as the case may be) of solution and results and discussion.
5. The report must bring out the conclusions of the work and future scope for the study. The work has to be presented in front of the examiners panel consisting of an approved external examiner, an internal examiner (HoD and BoS Chair Person) guide/co-guide.
6. The candidate has to be in regular contact with his/her guide/co-guide.

Guidelines for awarding marks in CIE (Continuous Internal Evaluation): Max. Marks: 100		
Evaluation by	**Max . Marks**	**Evaluation Criteria / Parameter**
Department Review Committee	05	Review 1
	10	Review 2
	10	Review 3
	15	Final presentation with the draft copy of the report standard format
	10	Submission of the report in a standard format
Supervisor	10	Regularity and Punctuality
	10	Work Progress
	10	Quality of the work which may lead to publications
	10	Analytical / Programming / Experimental Skills Preparation
	10	Report preparation in a standard format

Guidelines for awarding marks in SEE (Semester End Examination): Max. Marks: 100		
Evaluation by	**Max. Marks**	**Evaluation Criteria / Parameter**
External and Internal Examiner(s) together	20	Power Point Presentation
	40	Quality of thesis and evaluation
	20	Quality of the project 1. Innovations 2. Applications 3. Live Research Projects 4. Scope for future study 5. Application to society
	20	Viva-Voce

Service Courses Offered by Mechanical Engineering Department

Open Elective (3/3)		
SNO	Subj. Code	Name of the Subject
1	20ME O101	Industrial Safety
2	20ME O102	Introduction to Optimization Techniques
3	20ME O103	Composite Materials

20ME O101

INDUSTRIAL SAFETY

(Open Elective)

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

Objectives: The students will be able to understand

1. Causes for industrial accidents and preventive steps to be taken.
2. Fundamental concepts of Maintenance Engineering.
3. About wear and corrosion along with preventive steps to be taken
4. The basic concepts and importance of fault tracing.
5. The steps involved in carrying out periodic and preventive maintenance of various equipments used in industry

Outcomes: At the end of the course the students will be able to

1. Identify the causes for industrial accidents and suggest preventive measures.
2. Identify the basic tools and requirements of different maintenance procedures.
3. Apply different techniques to reduce and prevent Wear and corrosion in Industry.
4. Identify different types of faults present in various equipments like machine tools, IC Engines, boilers etc.
5. Apply periodic and preventive maintenance techniques as required for industrial equipments like motors, pumps and air compressors and machine tools etc

UNIT - I

Industrial safety: Accident, causes, types, results and control, mechanical and electrical hazards, types, causes and preventive steps/procedure, describe salient points of factories act 1948 for health and safety, wash rooms, drinking water layouts, light, cleanliness, fire, guarding, pressure vessels, etc, Safety color codes, Fire prevention and firefighting, equipment and methods.

UNIT – II

Fundamentals of Maintenance Engineering: Definition and aim of maintenance engineering, Primary and secondary functions and responsibility of maintenance department, Types of maintenance, Types and applications of tools used for

maintenance, Maintenance cost & its relation with replacement economy, Service life of equipment.

UNIT – III

Wear and Corrosion and their Prevention: Wear- types, causes, effects, wear reduction methods, lubricants-types and applications, Lubrication methods, general sketch, working and applications of Screw down grease cup, Pressure grease gun, Splash lubrication, Gravity lubrication, Wick feed lubrication, Side feed lubrication, Ring lubrication, Definition of corrosion, principle and factors affecting the corrosion, Types of corrosion, corrosion prevention methods.

UNIT–IV

Fault Tracing: Fault tracing-concept and importance, decision tree concept, need and applications, sequence of fault finding activities, show as decision tree, draw decision tree for problems in machine tools, hydraulic, pneumatic, automotive, thermal and electrical equipment's like, any one machine tool, Pump, Air compressor, Internal combustion engine, Boiler, Electrical motors, Types of faults in machine tools and their general causes.

UNIT – V

Periodic and Preventive Maintenance: Periodic inspection-concept and need, degreasing, cleaning and repairing schemes, overhauling of mechanical components, overhauling of electrical motor, common troubles and remedies of electric motor, repair complexities and its use, definition, need, steps and advantages of preventive maintenance. Steps/procedure for periodic and preventive maintenance of Machine tools, Pumps, Air compressors, Diesel generating (DG) sets, Program and schedule of preventive maintenance of mechanical and electrical equipment, advantages of preventive maintenance. Repair cycle concept and importance

Text Books:

1. H. P. Garg, "Maintenance Engineering", S. Chand and Company
2. Audels, "Pump-hydraulic Compressors", Mcgraw Hill Publication

Suggested Readings:

1. Higgins & Morrow, "Maintenance Engineering Handbook", Da Information Services.
2. Winterkorn, Hans, "Foundation Engineering Handbook", Chapman & Hall London

20ME O102

INTRODUCTION TO OPTIMIZATION TECHNIQUES

(Open Elective)

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

Objectives: The students will

1. Come to know the formulation of LPP models
2. Understand the Transportation and Assignment techniques
3. Come to know the procedure of Project Management along with CPM and PERT techniques
4. Understand the concepts of queuing theory and inventory models
5. Understand sequencing techniques

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

1. Formulate a linear programming problems (LPP)
2. Build and solve Transportation Models and Assignment Models.
3. Apply project management techniques like CPM and PERT to plan and execute project successfully
4. Apply queing and inventory concepts in industrial applications
5. Apply sequencing models in industries

UNIT - I

Operations Research: Definition, scope, Models, Linear programming problems (LPP), Formulation, Graphical Method, and Simplex Method

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

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

UNIT - IV

Queuing Theory and Inventory:: Kendols Notation, single server models, Inventory control - deterministic inventory models - Probabilistic inventory control models.

UNIT - V

Sequencing Models: Introduction, Objectives, General assumptions, processing 'n' jobs through two Machines, processing 'n' jobs through three machines

Text Books:

1. H.A. Taha, "Operations Research, An Introduction", PHI, 2008
2. H.M. Wagner, "Principles of Operations Research", PHI, Delhi, 1982
3. J.C. Pant, "Introduction to Optimisation: Operations Research", Jain Brothers, Delhi, 2008

Suggested Reading:

1. Hitler Libermann, "Operations Research", McGraw Hill Pub. 2009
2. Pannerselvam, "Operations Research", Prentice Hall of India 2010
3. Harvey M Wagner, "Principles of Operations Research", Prentice Hall of India 2010

20ME O103

COMPOSITE MATERIALS

(Open Elective)

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

Objectives: Student will understand

1. Composite materials and their constituents.
2. Classification of the reinforcements and evaluate the behavior of composites.
3. Fabrication methods of metal matrix composites.
4. Manufacturing of Polymer matrix composites.
5. Failure mechanisms in composite materials.

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

1. Classify and characterize the composite materials.
2. Describe types of reinforcements and their properties.
3. Understand different fabrication methods of metal matrix composites.
4. Understand different fabrication methods of polymer matrix composites.
5. Decide the failure of composite materials.

UNIT - I

Introduction: Definition – Classification and characteristics of Composite materials. Advantages and application of composites. Functional requirements of reinforcement and matrix. Effect of reinforcement (size, shape, distribution, volume fraction) on overall composite performance.

UNIT – II

Reinforcements: Preparation-layup, curing, properties and applications of glass fibers, carbon fibers, Kevlar fibers and Boron fibers. Properties and applications of whiskers, particle reinforcements. Mechanical Behavior of composites: Rule of mixtures, Inverse rule of mixtures. Isostrain and Isostress conditions.

UNIT – III

Manufacturing of Metal Matrix Composites: Casting – Solid State diffusion technique, Cladding – Hot isostatic pressing. Properties and applications. Manufacturing of Ceramic Matrix Composites: Liquid Metal Infiltration – Liquid

phase sintering. Manufacturing of Carbon – Carbon composites: Knitting, Braiding, Weaving. Properties and applications.

UNIT–IV

Manufacturing of Polymer Matrix Composites: Preparation of Moulding compounds and prepegs – hand layup method – Autoclave method – Filament winding method – Compression moulding – Reaction injection moulding. Properties and applications.

UNIT – V

Strength: Lamina Failure Criteria-strength ratio, maximum stress criteria, maximum strain criteria, interacting failure criteria, hygrothermal failure. Laminate first play failure-insight strength

Text Books:

1. R.W.Cahn – VCH , "Material Science and Technology", Vol 13, Composites, West Germany.
2. WD Callister, Jr., Adapted by R. Balasubramaniam , "Materials Science and Engineering, An introduction"., John Wiley & Sons, NY, Indian edition, 2007.

Suggested Readings:

1. Ed-Lubin, "Hand Book of Composite Materials"
2. K.K.Chawla, "Composite Materials".
3. Deborah D.L. Chung, "Composite Materials Science and Applications"
4. Daniel Gay, Suong V. Hoa, and Stephen W. Tsai, "Composite Materials Design and Applications".