MALLA REDDY COLLEGE OF ENGINEERING & TECHNOLOGY

(Autonomous Institution – UGC, Govt. of India)

Sponsored by CMR Educational Society

(Affiliated to JNTU, Hyderabad, Approved by AICTE - Accredited by NBA & NAAC – 'A' Grade - ISO 9001:2008 Certified)

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MASTER OF TECHNOLOGY
THERMAL ENGINEERING

DEPARTMENT OF
MECHANICAL ENGINEERING

ACADEMIC REGULATIONS
COURSE STRUCTURE AND SYLLABUS
(Batches admitted from the academic year 2017 - 2018)

Note: The regulations hereunder are subjected to amendments as may be made by the Academic Council of the College from time to time. Any or all such amendments will be effective from such date and to such batches of candidates (including those already pursuing the program) as may be decided by the Academic Council.

MALLA REDDY COLLEGE OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF MECHANICAL ENGINEERING

M.TECH. (THERMAL ENGINEERING)

I Year I Semester (3 Subjects + 2 Electives + 1 Open Elective + 1 Lab)

S.NO.	SUBJECT CODE	SUBJECT	L	T/P/D	C	MAX MARKS	
						INT	EXT
1	R17D2101	Advanced Thermodynamics	3	-	3	25	75
2	R17D2102	Advanced Heat and Mass Transfer	3	-	3	25	75
3	R17D2103	Advanced Fluid Mechanics	3	-	3	25	75
4	**	**Elective I**	3	-	3	25	75
	R17D2104	Cryogenics Engineering					
	R17D2105	Solar Energy Technology					
	R17D2106	Turbomachines					
5	**	**Elective II**	3	-	3	25	75
	R17D2107	Advanced I.C. Engines					
	R17D2108	Design of Heat Exchangers					
	R17D2109	Energy and Environmental Engineering					
6	****	**Open Elective I**	3	-	3	25	75
7	R17D2181	Thermal Engineering Lab	-	3	2	25	75
8	R17D2182	Technical Seminar-I		3	2	100	-
Total			18	6	22	275	525

I Year M. Tech (TE) – I Semester - Open Elective -I

1 R17DEC51 EMBEDDED SYSTEMS PROGRAMMING
2 R17DCS51 SCRIPTING LANGUAGES
3 R17DME51 NON CONVENTIONAL ENERGY SOURCES
4 R17DAE51 MATHEMATICAL MODELING TECHNIQUES

I Year II Semester (3 Subjects+ 2 Electives+1 Open Elective+ 1 Lab)

S.NO.	SUBJECT CODE	SUBJECT	L	T/P/D	C	MAX MARKS	
						INT	EXT
1	R17D2110	Fuels, Combustion and Environment	3	-	3	25	75
2	R17D2111	Computational Fluid Dynamics	3	-	3	25	75
3	R17D2112	Advanced Finite Element Analysis	3	-	3	25	75
4	**	**Elective III**	3	-	3	25	75
	R17D2113	Energy Management					
	R17D2114	Industrial Refrigeration Systems					
	R17D2115	Jet Propulsion and Rocket Engines					
5	**	**Elective IV**	3	-	3	25	75
	R17D2116	Thermal and Nuclear Power Plants					
	R17D2117	Thermal Measurements and Process Controls					
	R17D2118	Refrigeration and Air-Conditioning					
6	****	**Open Elective II**	3		3	25	75
7	R17D2183	Computational Methods Laboratory	-	3	2	25	75
8	R17D2184	Technical Seminar-II	-	3	2	100	-
Total			18	6	22	275	525

I Year M. Tech (TE) – II Semester - Open Elective -II

1 **R17DEC52 INTERNET OF THINGS**
2 **R17DCS52 INFORMATION SECURITY**
3 **R17DME52 INDUSTRIAL MANAGEMENT**
4 **R17DCS53 RESEARCH METHODOLOGY**

II Year I Semester

S.NO.	SUBJECT CODE	SUBJECT	L	T/P/D	C	MAX.MARKS	
						INT	EXT
1	R17D2185	**Technical Seminar – III**	-	-	2	50	-
2	R17D2191	**Project Review - I**	-	-	10	100	-
3	R17D2192	**Project Review - II**	-	-	10	100	-
Total			-	-	22	-	-

II Year II Semester

S.NO.	SUBJECT CODE	SUBJECT	L	T/P/D	C	MAX.MARKS	
						INT	EXT
1	R17D2186	**Technical Seminar – IV**	-	-	2	50	-
2	R17D2193	**Project Review - III**	-	-	10	100	-
3	R17D2194	**Project Viva Voce**	-	-	10	-	100
Total			-	-	22	-	-

MALLAREDDY COLLEGE OF ENGINEERING AND TECHNOLOGY

M.Tech I Year – I Sem (Thermal Engineering)

L	T/P/D	C
3	0	3

(R17D1201) ADVANCED THERMODYNAMICS

Objectives:

- To understand the nature and operating principles of systems involving energy flows, relate idealized thermodynamic system models to corresponding real systems.
- To describe and apply basic thermodynamic principles to analyze and predict. Performance of idealized forms of thermodynamic systems.
- To describe and assess benefits of improvements to thermodynamic systems.

UNIT-I

Review of Thermodynamic Laws and Corollaries: Transient flow analysis, Second law thermodynamics, Entropy, Availability and unavailability, Thermodynamic potential. Maxwell relations, Specific heat relations, Mayer's relation. Evaluation of thermodynamic properties of working substance.

UNIT-II

P.V.T Surface: Equation of state. Real gas behavior, Vander Waal's equation, Generalization compressibility factor. Energy properties of real gases. Vapour pressure, Clausius, Clapeyro equation. Throttling, Joule. Thompson coefficient. Non reactive mixtures of perfect gases. Governing laws, Evaluation of properties, Psychometric mixture properties and psychometric chart, Air conditioning processes, cooling towers. Real gas mixture.

UNIT-III

Combustion: Combustion Reactions, Enthalpy of formation. Entropy of formation, Reference levels of tables. Energy of formation, Heat reaction, Adiabatic flame temperature generated product, Enthalpies, Equilibrium. Chemical equilibrium of ideal gased, Effect of non reacting gases equilibrium in multiple reactions, the vent hoff's equation. The chemical potential and phase equilibrium. The Gibbs phase rule.

UNIT-IV

Power Cycles: Review binary vapour cycle, co generation and combined cycles, Second law analysts of cycles. Refrigeration cycles. Thermodynamics off irreversible processes. Introduction, Phenomenological laws, Onsaga Reciprocity relation, Applicability of the Phenomenological relations, Heat flux and entropy production, Thermodynamic phenomena, Thermo electric circuits.

UNIT-V

Direct Energy Conversion Introduction: Fuel cells, Thermo electric energy, Thermo ionic power eneration, Thermodynamic devices magneto hydronamic generations, Photovoltaic cells.

TEXT BOOKS:

1. P.K. Nag, "Engineering Thermodynamics", 4 th Edition, Tata McGraw-Hill Education Private Limited, 2010.
2. S.S. Thipse, "Advanced Thermodynamics", Narosa Publishing House, New Delhi, 2013
3. Thermal Engineering by R.K.Rajput, Lakshmi Publications.

REFERENCE BOOKS:

1. Y.A. Cengel and M.A. Boles, "Thermodynamics – An Engineering Approach", 5 th Edition in SI Units, Tata McGraw Hill Publishing Company Limited, New Delhi, 2006.
2. C. Borganakke and R.E. Sonntag, "Fundamentals of Thermodynamics", 7 th Edition, Wiley India, Delhi, 2012.
3. Van P. Carey, "Statistical thermodynamics and micro scale thermo physics", Cambridge University Press, 1999

OUT COMES:

- Provide in-depth knowledge on fundamental and applied thermodynamics
- Firm grasp, clear understanding of basic principles of work and energy conversion
- Students get the exposure of applications in advanced thermodynamic cycles.

MALLAREDDY COLLEGE OF ENGINEERING AND TECHNOLOGY

M.Tech I Year – I Sem (Thermal Engineering)

L	T/P/D	C
3	0	3

(R17D2102) ADVANCED HEAT AND MASS TRANSFER

Objectives:

- To develop the ability to use the heat transfer concepts for various applications like finned systems, turbulence flows, high speed flows.
- To analyze the thermal analysis and sizing of heat exchangers and to learn the heat transfer coefficient for compact heat exchanges**.**
- To achieve an understanding of the basic concepts of phase change processes and mass transfer

UNIT-I

Brief introduction to different modes of heat transfer: Conduction: General heat Conduction equation-initial and boundary conditions.

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 geometries 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: Approximate analysis on laminar free convective heat transfer-bousisinesq 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 geometries.

UNIT-V

Radiation heat transfer: Radiant heat exchange in grey, non-grey bodies, with transmitting. Reflecting and absorbing media, spherical surfaces, and gas radiation-radiation from flames.

Mass Transfer: Concepts of mass transfer-diffusion & convective mass transfer analogies-significance of non-dimensional numbers.

TEXTBOOKS:

1. Principles of Heat Transfer/Frank Kreith/Cengage Learning
2. Elements of Heat Transfer/E. Radha Krishna/CRC Press/2012
3. Heat Transfer/RK Rajput/S.Chand

REFERENCE BOOKS:

1. Introduction to Heat Transfer/SK Som/PHI
2. Engineering Heat & Mass Transfer/Mahesh Rathore/Lakshmi Publications
3. Heat Transfer / Necati Ozisik / TMH

OUTCOMES:

- On successful completion of this course the student will be able to apply Various Correlations for heat transfer calculations.
- Students get the exposure of Finite difference methods for conduction mode**.**
- Students get the exposure of concepts of phase change processes and mass transfer.

MALLAREDDY COLLEGE OF ENGINEERING AND TECHNOLOGY

M.Tech I Year – I Sem (Thermal Engineering)

L	T/P/D	C
3	0	3

(R17D2103) ADVANCED FLUID MECHANICS

Objectives:

- To understand the laws of fluid flow for ideal and viscous fluids.
- To represent the real solid shapes by suitable flow patterns and to analyze the same for aerodynamics performances.
- To understand the changes in properties in compressible flow and shock expansion.

UNIT-I

In Viscid Flow of Incompressible Fluids: Lagrangian and Eulerain Descriptions of fluid motion- Path lines, Stream lines, Streak lines, stream tubes velocity of a fluid particle, types of flows, Equations of three dimensional continuity equation- Stream and Velocity potential functions.

Basic Laws of Fluid Flow: Condition for irrotationality, circulation & vorticity Accelerations in Cartesystems normal and tangential accelerations, Euler's, Bernouli equations in 3D– Continuity and Momentum Equations

UNIT-II

Viscous Flow: Derivation of Navier-Stoke's Equations for viscous compressible flow – Exact solutions to certain simple cases: Plain Poisoulle flow - Coutte flow with and without pressure gradient - Hagen Poisoulle flow - Blasius solution.

UNIT-III

Boundary Layer Concepts: Prandtl's contribution to real fluid flows – Prandtl's boundary layer theory - Boundary layer thickness for flow over a flat plate – Approximate solutions – Creeping motion (Stokes) – Oseen's approximation - Von-Karman momentum integral equation for laminar boundary layer –– Expressions for local and mean drag coefficients for different velocity profiles.

UNIT-IV

Introduction to Turbulent Flow: Fundamental concept of turbulence – Time Averaged Equations – Boundary Layer Equations - Prandtl Mixing Length Model - Universal Velocity

Distribution Law: Van Driest Model –Approximate solutions for drag coefficients – More Refined Turbulence Models – k-epsilon model - boundary layer separation and form drag – Karman Vortex Trail, Boundary layer control, lift on circular cylinders

Internal Flow: Smooth and rough boundaries – Equations for Velocity Distribution and frictional Resistance in smooth rough Pipes – Roughness of Commercial Pipes – Moody's diagram.

UNIT –V

Compressible Fluid Flow – I: Thermodynamic basics–Equations of continuity, Momentum and Energy - Acoustic Velocity Derivation of Equation for Mach Number–Flow Regimes– Mach Angle–Mach Cone–Stagnation State

Compressible Fluid Flow – II: Area Variation, Property Relationships in terms of Mach number, Nozzles, Diffusers – Fanno and Releigh Lines, Property Relations – Isothermal Flow in Long Ducts – Normal Compressible Shock, Oblique Shock: Expansion and Compressible Shocks – Supersonic Wave Drag.

TEXT BOOKS

1. Fluid Mechanics and Machines/Modi and Seth/Standard Book House
2. Fluid Mechanics/Cohen and Kundu/Elsevier/5th edition
3. Fluid Mechanics/Potter/Cengage Learning

REFERENCE BOOK:

1. Fluid Mechanics and Machines/CP Kodandaraman/New Age Publications
2. A Text book of Fluid Mechanics/RK Rajput/S. Chand
3. Boundary Layer Theory/ Schlichting H /Springer Publications

OUTCOMES:

- Apply knowledge of mathematics, science and engineering.
- Derive the governing equations of fluid flow and applying them to simple flow problems.
- Emphasizing the mathematical formulation of various flow problems

MALLAREDDY COLLEGE OF ENGINEERING AND TECHNOLOGY

M.Tech I Year – I Sem (Thermal Engineering)

L	T/P/D	C
3	0	3

(R17D2104) CRYOGENIC ENGINEERING
(ELECTIVE-I)

Objectives:

- To provide an introductory knowledge of Cryogenic Engineering.
- To understand the behavior of materials at low temperatures.
- To develop skills for designing cryogenic systems including refrigeration, storage & . transfer of cryogens, and instrumentation.

UNIT-I

Introduction to Cryogenic Systems: Mechanical Properties at low temperatures. Properties of Cryogenic Fluids.

Gas Liquefaction: Minimum work for liquefaction. Methods to protect low temperature, Liquefaction systems for gases other than, Neon, Hydrogen and Helium.

UNIT-II

Liquefaction Systems for Neon, Hydrogen and Helium: Components of Liquefaction systems. Heat exchangers. Compressors and Expanders, Expansion valve, Losses in real machines.

UNIT-III

Gas Separation and Purification Systems: Properties of mixtures, Principles of mixtures, Principles of gas separation, Air separation systems.

UNIT-IV

Cryogenic Refrigeration Systems: Working Medium, Solids, Liquids, Gases, Cryogenic fluid storage & transfer, Cryogenic storage systems, Insulation, Fluid transfer mechanisms, Cryostat, CryoCoolers

UNIT-V

Applications: Space technology, In-Flight air separation and collection of LOX, Gas industry, Biology, Medicine, Electronics.

TEXTBOOKS:

1. Cryogenic Systems/ R.F.Barren/ Oxford University Press
2. Cryogenic Research and Applications: Marshal Sitting/ Von Nostrand/ Inc. New Jersey
3. Cryogenic Heat Transfer/ R.F.Baron

REFERENCE BOOKS:

1. Experimental Techniques in Low Temperature Physics- O.K. White, Oxford Press, 1968
2. Cryogenic Process Engineering/ K.D. Timmerhaus & TM Flynn/ Plenum Press, 1998
3. Hand Book of Cryogenic Engineering – J.G.Weisend –II, Taylor and Francis,

OUTCOMES:

- Understand the structures of different cryogenic systems and the analytical method.
- Understand cryogenic thermodynamic cycle, and cryogenic gases and liquids and their mixtures.
- Understand the measurement equipment and basic experimental skills, in particular of cryogenic heat transfer, superconducting magnetic levitation, as well as low. power crayo coolers.

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M.Tech I Year –I Sem(Thermal Engineering)

L	T/P/D	C
3	0	3

(R17D2105) SOLAR ENERGY TECHNOLOGY (ELECTIVE-I)

Objectives:

- To introduce the basic concepts and novel technologies in solar thermal systems.
- To provide a balance between both frontier technology updates and existing solar thermal energy strategies, in both quantitative and qualitative way.
- Student able to know the Direct Energy Conversion and Economics**.**

UNIT-I

Introduction – Solar energy option, specialty and potential – Sun – Earth – Solar radiation, beam and diffuse – measurement – estimation of average solar radiation on horizontal and tilted surfaces – problems – applications.

Capturing solar radiation – physical principles of collection – types – liquid flat plate collectors – construction details – performance analysis – concentrating collection – flat plate collectors with plane reflectors – cylindrical parabolic collectors – Orientation and tracking – Performance Analysis.

UNIT-II

Design of Solar Water Heating System and Layout: Power generation – solar central receiver system – Heliostats and Receiver – Heat transport system – solar distributed receiver system – Power cycles, working fluids and prime movers, concentration ratio.

UNIT-III

Thermal Energy Storage: Introduction – Need for – Methods of sensible heat storage using solids and liquids – Packed bed storage – Latent heat storage – working principle – construction – application and limitations. Other solar devices – stills, air heaters, dryers, Solar Ponds & Solar Refrigeration, active and passive heating systems.

UNIT-IV

Direct Energy Conversion: solid-state principles – semiconductors – solar cells – performance – modular construction – applications - conversion efficiencies calculations.

UNIT-V

Economics: Principles of Economic Analysis – Discounted cash flow – Solar system – life cycle costs – cost benefit analysis and optimization – cost based analysis of water heating and photo voltaic applications.

TEXTBOOKS:

1. Principles of solar engineering/ Kreith and Kerider/Taylor and Franscis/2nd edition.
2. Solar energy thermal processes/ Duffie and Beckman/John Wiley & Sons.
3. Solar energy: Principles of Thermal Collection and Storage/ Sukhatme/TMH/2nd . Edition.

REFERENCE BOOKS:

1. Solar energy/ Garg/TMH.
2. Solar energy/ Magal/Mc Graw Hill.
3. Solar Thermal Engineering Systems / Tiwari and Suneja/Narosa.

OUTCOMES:

- Outline the technologies that are used to harness the power of solar energy.
- Discuss the aspects of solar energy in relation to natural and human aspects of the environment.
- Student get the exposure on Solar devices.

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M.Tech I Year – I Sem (Thermal Engineering)

L	T/P/D	C
3	0	3

(R17D2106) TURBOMACHINES
(ELECTIVE-I)

Objectives:

- Understand the fundamental concepts of turbo machines and apply concepts of fluid mechanics in turbo machines.
- Understand the thermodynamic analysis of steam nozzles and turbines.
- Understand the different types of compressors and evaluating their performances in the form of velocity triangles.

UNIT-I

Fundamentals of Turbo Machines: Classifications, Applications, Thermodynamic analysis, isentropic flow. Energy transfer. Efficiencies, Static and Stagnation conditions, Continuity equations, Euler's flow through variable cross sectional areas, unsteady flow in turbo machines.

UNIT –II

Steam Nozzles: Convergent and Convergent-Divergent nozzles, Energy Balance, Effect of back pressure of analysis. Designs of nozzles.

Steam Turbines: Impulse turbines, Compounding, Work done and Velocity triangle, Efficiencies, Constant reactions, Blading, Design of blade passages, Angle and height, Secondary flow. Leakage losses, Thermodynamic analysis of steam turbines.

UNIT-III

Gas Dynamics: Fundamental thermodynamic concepts, isentropic conditions, mach numbers and area, Velocity relations, Dynamic Pressure, Normal shock relation for perfect gas. Supersonic flow, oblique shock waves. Normal shock recoveries, detached shocks, Aerofoil theory.

Centrifugal Compressor: Types, Velocity triangles and efficiencies, Blade passage design, Diffuserand pressure recovery. Slip factor, Stanitz and Stodolas formula's, Effect of inlet mach numbers, Pre whirl, Performance.

UNIT-IV

Axial Flow Compressors: Flow Analysis, Work and velocity triangles, Efficiencies, Thermodynamic analysis. Stage pressure rise, Degree of reaction, Stage Loading, General design, Effect of velocity, Incidence, Performance.

Cascade Analysis: Geometrical and terminology. Blade force, Efficiencies, Losses, Free end force, Vortex Blades.

UNIT-V

Axial Flow Gas Turbines: Work done. Velocity triangle and efficiencies, Thermodynamic flow analysis, Degree of reaction, Zweifels relation, Design cascade analysis, Soderberg, Hawthrone, Ainley, Correlations, Secondary flow, Free vortex blade, Blade angles for variable degree of reaction. Actuator disc, Theory, Stress in blades, Blade assembling, Material and cooling of blades, Performances, Matching of compressors and turbines, off design performance.

TEXTBOOKS:

1. Principles of Turbo Machines/DG Shepherd / Macmillan.
2. Fundamentals of Turbo machinery/William W Perg/John Wiley & Sons.
3. Basic Concepts in Turbo machinery by Grant Ingram.

REFERENCE BOOKS:

1. Element of Gas Dynamics/Yahya/TMH.
2. Principles of Jet Propulsion and Gas Turbine/NJ Zucrow/John Wiley.
3. Textbook Of Turbomachines Si Units by MS Govinde Gowda, AM Nagaraja.

OUTCOMES:

- Able to derive the basic equations used for turbo machines.
- Will be able to understand the concept of velocity triangles used for performance .. evaluation of turbines.
- Able to understand the concept of degree of reaction for axial flow compressors.

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M.Tech I Year – I Sem (Thermal Engineering)

L	T/P/D	C
3	0	3

(R17D2107) ADVANCED I.C. ENGINES
(ELECTIVE-II)

Objectives:

- Analyze engine cycles and the factors responsible for making the cycle different from the Ideal cycle.
- Apply principles of thermodynamics, fluid mechanics, and heat transfer to influence the engine's Performance.
- Understand the delay period and fuel injection system.

UNIT-

Introduction – Historical Review – Engine Types – Design and operating Parameters.

Cycle Analysis: Thermo-chemistry of Fuel – Air mixtures, properties – Ideal Models of Engine cycles– Real Engine cycles - differences and Factors responsible for – Computer Modeling.

UNIT -II

Gas Exchange Processes: Volumetric Efficiency – Flow through ports – Supercharging and Turbo charging.

Charge Motion: Mean velocity and Turbulent characteristics – Swirl, Squish – Pre-chamber Engine flows.

UNIT -III

Engine Combustion in SI Engines: Combustion and Speed – Cyclic Variations – Ignition – Abnormal combustion Fuel factors, MPFI, SI engine testing.

Combustion in CI Engines: Essential Features – Types off Cycle. Pr. Data – Fuel Spray Behavior – Ignition Delay – Mixing Formation and control, Common rail fuel injection system.

UNIT -IV

Pollutant Formation and Control: Nature and extent of problems – Nitrogen Oxides, Carbon monoxide, unburnt Hydrocarbon and particulate – Emissions – Measurement – Exhaust Gas Treatment, Catalytic converter, SCR, Particulate Traps, Lean, NO_X, Catalysts.

UNIT -V

Engine Heat Transfer: Importance of heat transfer, heat transfer and engine energy balance, Convective heat transfer, radiation heat transfer, Engine operating characteristics. Fuel supply systems for S.I. and C.I engines to use gaseous fuels like LPG, CNG and Hydrogen.

Modern Trends in IC Engines: Lean Burning and Adiabatic concepts, Rotary Engines, Modification in I.C engines to suit Bio – fuels, HCCI and GDI concepts

TEXTBOOKS:

1. I.C. Engines / V.Ganesan/TMH
2. I.C. Engines Fundamentals/Heywood/TMH
3. I.C. Engines/G.K. Pathak & DK Chevan/ Standerd Publications.

REFERENCE BOOKS:

1. I.C. Engines /RK Rajput/Laxmi Publications
2. Computer Simulation of C.I. Engine Process/ V.Ganesan/University Pre
3. Advanced I.C Engines by Senthil

OUTCOMES:

- Analyze engine cycles and the factors responsible for making the cycle different from the Ideal cycle.
- Apply principles of thermodynamics, fluid mechanics, and heat transfer to influence the engine's performance.
- To demonstrate the delay period and fuel injection system.

MALLAREDDY COLLEGE OF ENGINEERING AND TECHNOLOGY

M.Tech I Year – I Sem (Thermal Engineering)

L	T/P/D	C
3	0	3

(R17D2108) DESIGN OF HEAT EXCHANGERS
(ELECTIVE-II)

Objectives:

- To learn the thermal and stress analysis on various parts of the heat exchangers.
- To analyze the sizing and rating of the heat exchangers for various applications.
- Student able to know the design conditions and procedures of heat exchanges.

UNIT-I

Fundamentals of Heat Exchanger Temperature distribution and its implications types – shell and tube heat exchangers – regenerators and recuperators – analysis of heat exchangers – LMTD and effectiveness method.

UNIT-II

Flow and Stress Analysis: Effect of turbulence – friction factor – pressure loss – stress in tubes – header sheets and pressure vessels – thermal stresses, shear stresses - types of failures.

UNIT-III

Design Aspects: Heat transfer and pressure loss – flow configuration – effect of baffles – effect of deviations from ideality – design of double pipe - finned tube - shell and tube heat exchangers - simulation of heat exchangers.

UNIT–IV

Compact and Plate Heat Exchangers: Types – merits and demerits – design of compact heat exchangers, plate heat exchangers –performance influencing parameters – limitations

UNIT-V

Condensers and Cooling Towers: Design of surface and evaporative condensers – cooling tower – performance characteristics.

TEXT BOOKS:

1. Sadik Kakac and Hongtan Liu, Heat Exchangers Selection, Rating and Thermal Design, CRC Press, 2002.
2. Fundamentals of Heat Exchanger Design by Ramesh K. Shah, Dusan P. Sekulic.
3. Plate Heat Exchangers: Design, Applications and Performance by Bengt Sundén, R. M.Manglik.

REFERENCE BOOKS:

1. Arthur. P Frass, Heat Exchanger Design, John Wiley & Sons, 1988
2. Taborek.T, Hewitt.G.F and Afgan.N, Heat Exchangers, Theory and Practice. McGraw-Hill Book.
3. Hewitt.G.F, Shires.G.L and Bott.T.R, Process Heat Transfer, CRC Press, 1994.

OUTCOMES:

- Able to design the heat exchanger based on the information provided for a particular application
- Able to know the cost and economic analysis of heat exchangers.
- Student gets the exposure of various stress failures in heat exchangers designs.

MALLAREDDY COLLEGE OF ENGINEERING AND TECHNOLOGY

M.Tech I Year–I Sem (Thermal Engineering)

L	T/P/D	C
3	0	3

(R17D2109) ENERGY AND ENVIRONMENTAL ENGINEERING (ELECTIVE-II)

Objectives:

- Learn the principles of air and water pollution, effect of these pollutants on the environment and the methods available to control them.
- Familiar with technical and scientific methods for treating, controlling or safely disposing of air and water emissions, which could pose a threat to the environment.
- Student able to the learn Pollution Sampling and Measurement.

UNIT-I

Introduction to Pollution: Pollution of air, water, and soil; Effect of pollution on living systems

Air Pollution: Sources and classification of air pollutants, Effect of air pollution, Pollution from industries, Chemical reactions in a contaminated atmosphere, urban air pollution, Green house effect, Ozone layer depletion, Acid rain, Photo chemical smog, Meteorological aspects of air pollution.

Air Pollution Sampling and Measurement: Collection of gaseous and particulate pollutants, Analysis of air pollutants – Sulphur dioxide, Nitrogen oxides, Carbon monoxide, Oxidants and Ozone, Hydro carbons and Particulate matter

UNIT–II

Air Pollution Control Methods and Equipment: Cleaning of gaseous effluents, Particulate emission control, Control of specific gaseous pollutants SO2, NOx, Hydrocarbons, CO.

Water Pollution and Control: Types of water pollutants and their effects, Thermal pollution and effects, Water pollution laws and standards, Waste water sampling and analysis, Treatment of waste water (primary, secondary and tertiary treatment processes).

UNIT–III

Waste to Energy Conversion: Sources and classification of wastes, Energy generation from wastes -

Biochemical vs. Thermo-chemical Conversion and their environment benefits, Introduction to Biochemical conversion (anaerobic digestion), Thermo-chemical conversion processes direct combustion, incineration, pyrolysis, gasification and liquefaction, Economics of thermo-chemical conversion, Industrial applications of incinerators and gasifiers, Briquetting; Utilization and advantages of briquetting.

UNIT–IV

Energy Conservation in Industry: Energy Conservation and its Importance, Energy Strategy for the Future, The Energy Conservation Act, 2001 and its Features, Energy conservation in Boilers, Steam Turbines and Cooling Towers.

Waste Heat Recovery: Introduction, Classification and Application, Benefits of Waste Heat

Recovery, Development of a Waste Heat Recovery System.

TEXT BOOKS:

1. "Environmental pollution control engineering" C. S. Rao/New age International. Pvt.Ltd
2. "Air pollution" M.N.Rao and M.V.N.Rao /Tata Mc Graw Hill
3. G.Masters: Introduction to Environmental Engineering and Science Prentice Hall of India Pvt Ltd, New Delhi -2003.

REFERENCE BOOKS:

1. "Pollution control in process industries" S.P. Mahajan/ Tata Mc Graw Hill
2. "Energy Technology" S.Rao and B.B.Parulekar /Khanna publishers
3. H.S.Peavy, D.R..Rowe, G.Tchobanoglous (1985): Environmental Engineering McGraw- Hill BookCompany, NewYork

OUTCOMES:

- Design of mechanical systems and interdisciplinary engineering applications.
- Student gets the exposure of Business solutions using suitable optimization technique.
- Apply numerical or iterative techniques in power systems for optimal power flow solutions.

MALLAREDDY COLLEGE OF ENGINEERING AND TECHNOLOGY

M.Tech I Year – I Sem (Thermal Engineering)

L	T/P/D	C
0	3	2

(R17D2181) THERMAL ENGINEERING LABORATORY

Objectives:

The lab is mainly intended to

- Analyze the performance and exhaust emissions of an IC engine by conducting the performance test on IC Engines.
- Evaluate the performance of the Vapor compression and Air conditioning units.
- Analyze the flame propagation velocity of the gaseous fuels and evaluate the performance of the solar flat plate collector and evacuated tube concentrator.

LIST OF EXPERIMENTS:

1. Load test on four stroke single cylinder diesel engine using biodiesels
2. Measurement of Burning Velocity of premixed flame.
3. To study V-I characteristics of solar panel
4. Performance test and analysis of exhaust gases of an I.C engine.
5. Heat balance sheet, volumetric efficiency and air fuel ratio estimation of an I.C. . engine.
6. COP estimation of vapor compression refrigeration system.
7. To estimate power generation from solar photovoltaic system.
8. Performance analysis of heat pipe.
9. To study the performance of solar flat plate collector.
10. A study on Evacuative tube concentrator.

OUTCOMES:

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

- Analyze the performance and exhaust emissions of an IC engines, and flame propagation velocity of the gaseous fuels
- Evaluate the performance of the Vapor compression and Air conditioning units.
- Evaluate the performance of the solar flat plate collector and evacuated tube concentrator.

MALLAREDDY COLLEGE OF ENGINEERING AND TECHNOLOGY

M.Tech I Year – I Sem (Thermal Engineering)

L	T/P/D	C
0	3	2

(R17D2182) TECHNICAL SEMINAR-I

OPEN ELECTIVE - I

MALLAREDDY COLLEGE OF ENGINEERING AND TECHNOLOGY

M.Tech I Year – I Sem

L	T/P/D	C
3	0	3

(R17DEC51) EMBEDDED SYSTEMS PROGRAMMING (OPEN ELECTIVE –I)

Unit 1 - Embedded OS (Linux) Internals

Linux internals: Process Management, File Management, Memory Management, I/O Management. Overview of POSIX APIs, Threads – Creation, Cancellation, POSIX Threads Inter Process Communication - Semaphore, Pipes, FIFO, Shared Memory

Kernel: Structure, Kernel Module Programming Schedulers and types of scheduling.

Interfacing: Serial, Parallel Interrupt Handling Linux Device Drivers: Character, USB, Block & Network

Unit 2 – Open source RTOS

Basics of RTOS: Real-time concepts, Hard Real time and Soft Real-time, Differences between General Purpose OS & RTOS, Basic architecture of an RTOS, Scheduling Systems, Inter-process communication, Performance Matric in scheduling models, Interrupt management in RTOS environment, Memory management, File systems, I/O Systems, Advantage and disadvantage of RTOS.

Unit 3 – Open Source RTOS Issues

POSIX standards, RTOS Issues - Selecting a Real Time Operating System, RTOS comparative study. Converting a normal Linux kernel to real time kernel, Xenomai basics.

Overview of Open source RTOS for Embedded systems (Free RTOS/ Chibios-RT) and application development.

Unit 4 – VxWorks / Free RTOS

VxWorks/ Free RTOS Scheduling and Task Management - Realtime scheduling, Task Creation, Intertask Communication, Pipes, Semaphore, Message Queue, Signals, Sockets, Interrupts I/O Systems - General Architecture, Device Driver Studies, Driver Module explanation, Implementation of Device Driver for a peripheral

Unit 5 – Case study

Cross compilers, debugging Techniques, Creation of binaries & porting stages for Embedded Development board (Beagle Bone Black, Rpi or similar), Porting an Embedded OS/ RTOS to a target board ().Testing a real time application on the board

TEXT BOOKS:

1. Essential Linux Device Drivers, Venkateswaran Sreekrishnan
2. Writing Linux Device Drivers: A Guide with Exercises, J. Cooperstein
3. Real Time Concepts for Embedded Systems – Qing Li, Elsevier

REFERENCES:

1. Embedded Systems Architecture Programming and Design: Raj Kamal, Tata McGraw Hill
2. Embedded/Real Time Systems Concepts, Design and Programming Black Book, Prasad, KVK
3. Software Design for Real-Time Systems: Cooling, J E Proceedings of 17the IEEE Real-Time Systems Symposium December 4-6, 1996 Washington, DC: IEEE Computer Society
4. Real-time Systems – Jane Liu, PH 2000
5. Real-Time Systems Design and Analysis : An Engineer's Handbook: Laplante, Phillip A
6. Structured Development for Real - Time Systems V1 : Introduction and Tools: Ward, Paul T & Mellor, Stephen J

7. Structured Development for Real - Time Systems V2 : Essential Modeling Techniques: Ward, Paul T & Mellor, Stephen J
8. Structured Development for Real - Time Systems V3 : Implementation Modeling Techniques: Ward, Paul T & Mellor, Stephen J
9. Monitoring and Debugging of Distributed Real-Time Systems: TSAI, Jeffrey J P & Yang, J H
10. Embedded Software Primer: Simon, David E.
11. Embedded Systems Architecture Programming and Design: Raj Kamal, Tata McGraw Hill

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M.Tech I Year – I Sem

L	T/P/D	C
3	0	3

(R17DCS51) SCRIPTING LANGUAGES
(OPEN ELECTIVE – I)

UNIT I

Introduction to PERL and Scripting Scripts and Programs, Origin of Scripting , Scripting Today, Characteristics of Scripting Languages, Web Scripting, and the universe of Scripting Languages. PERL-Names and Values, Variables, Scalar Expressions, Control Structures, arrays, list, hashes, strings, pattern and regular expressions, subroutines, advance perl - finer points of looping, pack and unpack, filesystem, eval, data structures, packages, modules, objects, interfacing to the operating system, Creating Internet ware applications, Dirty Hands Internet Programming, security Issues.

UNIT II

PHP Basics- Features, Embedding PHP Code in your Web pages, Outputting the data to the browser, Datatypes, Variables, Constants, expressions, string interpolation, control structures, Function, Creating a Function, Function Libraries, Arrays, strings and Regular Expressions.

UNIT III

Advanced PHP Programming Php and Web Forms, Files, PHP Authentication and Methodologies - Hard Coded, File Based, Database Based, IP Based, Login Administration, Uploading Files with PHP, Sending Email using PHP, PHP Encryption Functions, the Mcrypt package, Building Web sites for the World – Translating Websites- Updating Web sites Scripts, Creating the Localization Repository, Translating Files, text, Generate Binary Files, Set the desired language within your scripts, Localizing Dates, Numbers and Times.

UNIT IV

TCL Structure, syntax, Variables and Data in TCL, Control Flow, Data Structures, input/output, procedures, strings, patterns, files, Advance TCL- eval, source, exec and up level commands, Name spaces, trapping errors, event driven programs, making applications internet aware, Nuts and Bolts Internet Programming, Security Issues, C Interface. Tk- Visual Tool Kits, Fundamental Concepts of Tk, Tk by example, Events and Binding , Perl-Tk.

UNIT V

Python Introduction to Python language, python-syntax, statements, functions, Built-in-functions and Methods, Modules in python, Exception Handling, Integrated Web Applications in Python – Building Small, Efficient Python Web Systems, Web Application Framework.

TEXT BOOKS:

1. The World of Scripting Languages, David Barron, Wiley Publications.
2. Python Web Programming, Steve Holden and David Beazley, New Riders Publications.
3. Beginning PHP and MySQL, 3rd Edition, Jason Gilmore, Apress Publications (Dreamtech)

REFERENCE BOOKS:

1. Open Source Web Development with LAMP using Linux, Apache, MySQL, Perl and PHP, J.Lee and B.Ware (Addison Wesley) Pearson Education.
2. Programming Python, M.Lutz, SPD.
3. PHP 6 Fast and Easy Web Development, Julie Meloni and Matt Telles, Cengage Learning Publications.
4. PHP 5.1,I.Bayross and S.Shah, The X Team, SPD.
5. Core Python Programming, Chun, Pearson Education.
6. Guide to Programming with Python, M.Dawson, Cengage Learning.

7. Perl by Example, E.Quigley, Pearson Education.
8. Programming Perl, Larry Wall, T.Christiansen and J.Orwant, O'Reilly, SPD.
9. Tcl and the Tk Tool kit, Ousterhout, Pearson Education.
10. PHP and MySQL by Example, E.Quigley, Prentice Hall(Pearson).
11. Perl Power, J.P.Flynt, Cengage Learning.
12. PHP Programming solutions, V.Vaswani, TMH.

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M.Tech I Year – I Sem

L	T/P/D	C
3	0	3

(R17DME51) NON CONVENTIONAL ENERGY SOURCES (OPEN ELECTIVE-I)

UNIT-I

Introduction: Energy Scenario, Survey of energy resources. Classification and need for conventional energy resources.

Solar Energy: The Sun-sun-Earth relationship, Basic matter to waste heat energy circuit, Solar Radiation, Attention, Radiation measuring instruments.

Solar Energy Applications: Solar water heating. Space heating, Active and passive heating, Energy storage, Selective surface, Solar stills and ponds, solar refrigeration, Photovoltaic generation.

UNIT -II

Geothermal Energy: Structure of earth, Geothermal Regions, Hot springs. Hot Rocks, Hot Aquifers. Analytical methods to estimate thermal potential. Harnessing techniques, Electricity generating systems.

UNIT-III

Direct Energy Conversion: Nuclear Fusion, Fusion reaction, P-P cycle, Carbon cycle, Deuterium cycle, Condition for controlled fusion, Fuel cells and photovoltaic, Thermionic and Thermoelectric generation and MHD generator.

Hydrogen Gas as Fuel: Production methods, Properties, I.C. Engines applications, Utilization strategy, Performances.

UNIT-IV

Bioenergy: Biomass energy sources. Plant productivity, Biomass wastes, aerobic and anaerobic bioconversion processes, Raw material and properties of bio-gas, Bio-gas plant technology and status, the energetic and economics of biomass systems, Biomass gasification

UNIT-V

Wind Energy: Wind, Beaufort number, Characteristics, Wind energy conversion systems, Types, Betz model. Interference factor. Power coefficient, Torque coefficient and Thrust coefficient, Lift machines and Drag machines. Matching Electricity generation.

Energy from Oceans: Tidal energy, Tides, Diurnal and semi-diurnal nature, Power from tides, Wave Energy, Waves, Theoretical energy available. Calculation of period and phase velocity of waves, Wave power systems, submerged devices. Ocean thermal Energy, Principles, Heat exchangers, Pumping requirements, Practical considerations.

TEXTBOOKS:

1.Non-conventional Energy Sources / GD Rai/Khanna publications.

2.Non-Conventional Energy Sources and Utilisation (Energy Engineering)/ R KRajput/ S.Chand.

3.Renewable Energy Sources /Twidell & Weir/Taylor and Francis/ 2nd special Indian edition .

REFERENCE BOOKS:

1.Renewable Energy Resources- Basic Principles and Applications/ G.N.Tiwari and M.K.GhosalNarosa Publications.
2.Renewable Energy Resources/ John Twidell & Tony Weir/Taylor & Francis/2nd edition.
3.Non Conventional Energy / K.Mittal/ Wheeler.

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(R17DAE51) MATHEMATICAL MODELING TECHNIQUES (OPEN ELECTIVE-I)

UNIT-I: **INTRODUCTION TO MODELING AND SINGULAR PERTURBATION METHODS**

Definition of a model, Procedure of modeling: problem identification, model formulation, reduction, analysis, Computation, model validation, Choosing the model, Singular Perturbations: Elementary boundary layer theory, Matched asymptotic expansions, Inner layers, nonlinear oscillations

UNIT-II: **VARIATIONAL PRINCIPLES AND RANDOM SYSTEMS**

Variational calculus: Euler's equation, Integrals and missing variables, Constraints and Lagrange multipliers, Variational problems: Optics-Fermat's principle, Analytical mechanics: Hamilton's principle, Symmetry: Noether's theorem, Rigid body motion, Random systems: Random variables, Stochastic processes, Monte Carlo method

UNIT-III: **FINITE DIFFERENCES: ORDINARY AND PARTIAL DIFFERENTIAL EQUATIONS**

ODE: Numerical approximations, Runge-Kutta methods, Beyond Runge-Kutta, PDE: Hyperbolic equations-waves, Parabolic equations-diffusion, Elliptic equations-boundary values

CELLULAR AUTOMATA AND LATTICE GASES

Lattice gases and fluids, Cellular automata and computing

UNIT- IV: **FUNCTION FITTING AND TRANSFORMS**

Function fitting: Model estimation, Least squares, Linear least squares: Singular value decomposition, Non-linear least squares: Levenberg-Marquardt method, Estimation, Fisher information, and Cramer-Rao inequality, Transforms:Orthogonal transforms, Fourier transforms, Wavelets, Principal components

FUNCTION FITTING ARCHITECTURES

Polynomials: Pade approximants, Splines, Orthogonal functions, Radial basis functions, Over-fitting, Neural networks: Back propagation, Regularization

UNIT-V: **OPTIMIZATION AND SEARCH**

Multidimensional search, Local minima, Simulated annealing, Genetic algorithms

FILTERING AND STATE ESTIMATION

Matched filters, Wiener filters, Kalman filters, Non-linearity and entrainment, Hidden Markov models

TEXT BOOK

1. *The Nature of Mathematical Modeling*, Neil Gershenfeld, Cambridge University Press, 2006, ISBN 0-521-57095-6

REFERENCE BOOKS

1. *Mathematical Models in the Applied Sciences*, A. C. Fowler, Cambridge University Press, 1997, ISBN 0-521-46140-5
2. *A First Course in Mathematical Modeling*, F. R. Giordano, M.D. Weir and W.P. Fox, 2003, Thomson, Brooks/Cole Publishers
3. *Applied Numerical Modeling for Engineers*, Donald De Cogan, Anne De Cogan, Oxford University Press, 1997

MALLAREDDY COLLEGE OF ENGINEERING AND TECHNOLOGY

M.Tech I Year – II Sem (Thermal Engineering)

L	T/P/D	C
3	-	3

(R17D2110)FUELS, COMBUSTION AND ENVIRONMENT

Objectives:

- Provide students with knowledge of fuel quantity and engine technology effects on emissions.
- Understand the combustion phenomena.
- Understand the concept of laminar and turbulent flame propagation.

UNIT–I

Fuels: Detailed classification – Conventional and Unconventional Solid, Liquid, gaseous fuels and nuclear fuels – Origin of Coal – Analysis of coal. Coal – Carborisation, Gasification and liquefaction – Lignite: petroleum based fuels – problems associated with very low calorific value gases: Coal Gas – Blast Furnace Gas Alcohols and Biogas.

UNIT–II

Principles of Combustion: Chemical composition – Flue gas analysis – dew point of products– Combustion stoichiometry. Chemical kinetics – Rate of reaction – Reaction order – Molecularity – Zeroth, first, second and third order reactions – complex reactions – chain reactions. Theories of reaction Kinetics – General oxidation behavior of HC's.

UNIT–III

Thermodynamics of Combustion: Enthalpy of formation – Heating value of fuel - Adiabatic flame Temperature – Equilibrium composition of gaseous mixtures.

UNIT–IV

Laminar and Turbulent Flames Propagation and Structure: Flame stability – Burning velocity of fuels – Measurement of burning velocity – factors affecting the burning velocity. Combustion of fuel, droplets and sprays – Combustion systems – Pulverized fuel furnaces – fixed Entrained and Fluidised Bed Systems.

UNIT–V

Environmental Considerations: Air pollution – Effects on Environment, Human Health etc. Principal pollutants – Legislative Measures – Methods of Emission control.

TEXTBOOKS:

1. Combustion Fundamentals / Roger A strehlow / Mc Graw Hill
2. Fuels and combustion / Sharma and Chander Mohan/ Tata Mc Graw Hill
3. Combustion Engineering and Fuel Technology / Shaha A.K./ Oxford and IBH.

REFERENCE BOOKS:

1. Combustion / Sarkar / Mc. Graw Hill.
2. An Introduction to Combustion / Stephen R. Turns/ Mc. Graw Hill International . Edition.
3. Combustion Engineering / Gary L. Berman & Kenneth W. Ragland/ Mc. Graw Hill International Edition

OUTCOMES:

- Have the knowledge of fuel thermo-chemistry and fuel quality effects on emissions, engine technologies, engine combustion-related emissions and control technologies;
- Extend their knowledge of fuels and engines to different situations of engineering context and professional practice.
- Understand about different methods to reduce air pollution.

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(R17D2111) COMPUTATIONAL FLUID DYNAMICS

Objectives:

- To develop finite difference and finite volume discredited forms of the CFD equations.
- To formulate explicit & implicit algorithms for solving the Euler Equations & Navier Stokes Equations.
- Student able to know Formulations of Incompressible Viscous Flows and compressible flows.

UNIT-I

Introduction: Finite difference method, finite volume method, finite element method, governing equations and boundary conditions, Derivation of finite difference equations.

Solution Methods: Solution methods of elliptical equations — finite difference formulations, interactive solution methods, direct method with Gaussian elimination.

Parabolic equations-explicit schemes and Von Neumann stability analysis, implicit schemes, alternating direction implicit schemes, approximate factorization, fractional step methods, direct method with tridiagonal matrix algorithm.

UNIT–II

Hyperbolic Equations: Explicit schemes and Von Neumann stability analysis, implicit schemes, multi step methods, nonlinear problems, second order one-dimensional wave equations.

Burgers equations: Explicit and implicit schemes, Runge-Kutta method.

UNIT–III

Formulations of Incompressible Viscous Flows: Formulations of incompressible viscous flows by finite difference methods, pressure correction methods, vortex methods.

Treatment of compressible flows: potential equation, Euler equations, Navier-stokes system of equations, flow field-dependent variation methods, boundary conditions, example problems.

UNIT-IV

Finite Volume Method: Finite volume method via finite difference method, formulations for two and three-dimensional problems.

UNIT–V

Standard Variational Methods: Linear fluid flow problems, steady state problems, Transient problems.

TEXTBOOKS:

1. Text book of fluid dynamics/ Frank Choriton/ CBS Publishers & distributors, 1985
2. Numerical heat transfer and fluid flow / Suhas V. Patankar/ Hema shava Publishers corporation & Mc Graw Hill.
3. Computational Fluid Flow and Heat Transfer/ Muralidaran/ Narosa Publications

REFERENCE BOOKS:

1. Computational Fluid Dynamics: Basics with applications/John D. Anderson/ Mc Graw Hill.
2. Fundamentals of Computational Fluid Dynamics/Tapan K. Sengupta / Universities . Press.
3. Introduction to Theoretical and Computational Fluid Dynamics/C. Pozrikidis /Oxford . University Press/2nd Edition

OUTCOMES:

- Derive the basic governing equations applied for fluid flow problems.
- Apply the differential equations to fluid flow problems and the concept of discretization.
- Solve simple algorithms for incompressible fluid flow.

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M.Tech I Year – II Sem (Thermal Engineering)

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(R17D2112) ADVANCED FINITE ELEMENT ANALYSIS

Objectives:

- Gain a fundamental understanding of the finite element method for solving boundary value problems.
- Learn important concepts of variation form, minimum potential energy principles, and method of weighted residuals.
- Study one dimensional problems such as truss, beam, and frame members, two-dimensional problems such as plain stress and plain strain elasticity problems, torsion problem.

UNIT-I

Introduction to FEM: Basic concepts, historical back ground, applications of FEM, general description, comparison of FEM with other methods, variation approach, Glerkin's Methods. Co-ordinates, basic element shapes, interpolation function, Virtual energy principle, Rayleigh – Ritz method, properties of stiffness matrix, treatment of boundary conditions, solution of system of equations, shape functions and characteristics, Basic equations of elasticity, strain- displacement relations.

UNIT-II

1-D Structural Problems: Axial bar element – stiffness matrix, load vector, temperature effects, Quadratic shape functions and problems.

Analysis of Trusses: Plane Trusses and Space Truss elements and problems.

Analysis of Beams: Hermite shape functions – stiffness matrix – Load vector – Problems.

UNIT-III

2-D Problems: CST, LST, force terms, Stiffness matrix and load vectors, boundary conditions, Isoparametric elements – quadrilateral element, shape functions – Numerical Integration. Finite element modeling of Axi-symmetric solids subjected to Axi-symmetric loading with triangular elements.

3-D Problems: Tetrahedran element – Jacobian matrix – Stiffness matrix.

UNIT-VI

Scalar Field Problems: 1-D Heat conduction-Slabs – fins - 2-D heat conduction problems – Introduction to Torsional problems.

UNIT-V

Dynamic Considerations And Dynamic Equations – consistent mass matrix – Eigen Values, Eigen vector, natural frequencies – mode shapes – modal analysis.

TEXTBOOKS:

1. The Finite Element Methods in Engineering / SS Rao / Pergamon.
2. Finite Element Methods: Basic Concepts and applications, Alavala, PHI
3. Introduction to Finite Elements in Engineering, Chandrupatla, Ashok and Belegundu, Prentice – Hall

REFERENCE BOOKS:

1. Introduction to Fininte element analysis- S.Md.Jalaludeen,Anuradha Publications, . print-. 2012
2. A First Course in the Finite Element Method/Daryl L Logan/Cengage Learning/5th Edition
3. Finite Element Method – Krishna Murthy / TMH

OUTCOMES:

- Apply the concepts of minimum potential energy principles to solve structural mechanics problems.
- Compute Eigen values and eigenvectors of simple dynamic systems
- Obtain weak form from strong form and total potential, and recognize similarities between such solutions, and those obtained by variational principles and principal of virtual work.

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M.Tech I Year – II Sem (Thermal Engineering)

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(R17D2113) ENERGY MANAGEMENT
(ELECTIVE-III)

Objectives:

- To understand the principles associated with effective energy management and to apply these principles in the day-to-day life.
- To minimise energy costs / waste without affecting production & quality.
- To minimize environmental effects.

UNIT-I

Introduction: Principles of energy management. Managerial organization, Functional areas for i) manufacturing industry, ii) Process industry, iii) Commerce, iv) Government, Role of Energy manager in each of these organizations. Initiating, Organizing and managing energy management programs

UNIT-II

Energy Audit: Definition and concepts. Types of energy audits, Basic energy concepts, Resources for plant energy studies. Data gathering, Analytical techniques. Energy Conservation: Technologies for energy conservation, Design for conservation of energy materials, Energy flow networks. Critical assessment of energy usage. Formulation of objectives and constrains, Synthesis of alternative options and technical analysis of options. Process integration.

UNIT-III

Economic Analysis: Scope, Characterization of an investment project. Types of depreciation, Time value of money. Budget considerations, Risk analysis.

UNIT-IV

Methods of Evaluation of Projects: Payback, Annualized costs, Investor's rate of return, Present worth, Internal rate of return, Pros and cons of the common method of analysis, Replacement analysis.

UNIT-V

Alternative Energy Sources: Solar energy- Types of devices for solar energy collections, Thermal storage system, Control systems. Wind Energy, Availability, Wind Devices, Wind Characteristics, performance of turbines and systems.

TEXTBOOKS:

1. Energy Management Hand Book / W.C. Turner (Ed)
2. Energy Management Principles / CB Smith/ Pergamum Press
3. Energy Audits: A Workbook for Energy Management in Buildings by E-book by Tarik Al-Shemmeri.

REFERENCE BOOKS:

1. Energy Management / W.R.Murthy and G.Mc.Kay / BS Publication
2. Management / H.Koontz and Cyrill Donnel / McGraw Hill
3. Energy Management Hand Book, BSR Publications.

OUTCOMES:

- Understanding of energy conservation and identification of energy conservation opportunities in various industrial processes.
- Knowledge of various tools and components of energy auditing.
- Student gain the exposure on energy auditing.

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M.Tech I Year – II Sem (Thermal Engineering)

L	T/P/D	C
3	-	3

(R17D2114) INDUSTRIAL REFRIGERATION SYSTEMS (ELECTIVE- III)

Objectives:

- To provide concepts of Refrigeration systems in residential, commercial and industrial buildings.
- To educate about various system components and accessories of refrigeration systems and learn about cycle analysis pertaining to Refrigeration systems.
- To learn about performance of system components and their balancing in cycles.

UNIT-I

Introduction: Introduction to industrial refrigeration - difference from conventional system - applications – industrial and comfort air - conditioning - conditions for high COP.

UNIT-II

Compressors: Reciprocating and screw compressor: Multistage industrial applications, cylinder arrangement, cooling methods - oil injection and refrigeration injection, capacity regulations - Economizers.

UNIT-III

Evaporators and Condensers: Types of Evaporators, Liquid circulation: Mechanical pumping and gas pumping - advantage and disadvantage of liquid re-circulation - circulation ratio - top feed and bottom feed refrigerant - Net Positive Suction Head (NPSH) - two pumping vessel system - suction risers – design - piping loses. Different Industrial Condensers arrangement, Evaporators-Types and arrangement, liquid circulation, type of feed, refrigerant piping design, functional aspects. Lubricating oil types - physical properties, types of circulation and oil separator.

UNIT-IV

Vessels in Industrial Refrigeration: High pressure receiver , flash tank , liquid and vapour separator ,separation enhancers , low pressure receivers , surge drum, surge line accumulator , thermo siphon receiver and oil pots.

UNIT-V

Energy Conservation and Design Considerations - Source of losses, energy efficient components, and heat reclaim thermal storage, ice builder and ice harvester.

Insulation: critical thickness, insulation cost and energy cost, vapour barriers, construction methods of refrigerated spaces.

TEXTBOOKS:

1. Wilbert F.Stoecker,Industrial Refrigeration Hand Book, McGraw-Hill, 1998.
2. ASHRAE Hand Book: Fundamentals, 1997.
3. ASHRAE Hand Book: Refrigeration, 1998.

REFERENCE BOOKS:

1. ASHRAE Hand Book: HVAC Systems and Equipment, 1996.
2. Transport properties of SUVA Refrigerants, Du-Pont Chemicals, 1993.
3. Refrigeration and Air Conditioning Technology by Bill Whitman, Bill Johnson, John Tomczyk &Eugene Silberstein.

OUTCOMES:

- To enable students to demonstrate and apply knowledge of design,
- To select components for, and prepare design documents for industrial Refrigeration systems.
- Student able to know the different load characteristics of Refrigeration systems.

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(R17D2115) JET PROPULSION AND ROCKET ENGINES (ELECTIVE-III)

Objectives:

- Develop an understanding of how air-breathing engines and chemical Rockets produce thrust.
- Analyze the overall engine performance and characteristics of the Nozzle.
- Carry out performance analysis Rockets.

UNIT-I

Turbo Jet Propulsion System: Gas turbine cycle analysis – layout of turbo jet engine. Turbo machinery- compressors and turbines, combustor, blade aerodynamics, engine off design performance analysis.

Flight Performance: Forces acting on vehicle – Basic relations of motion – multi stage vehicles.

UNIT-II

Principles of Jet Propulsion and Rocket Engines : Fundamentals of jet propulsion, Rockets and air breathing jet engines – Classification – turbo jet , turbo fan, turbo prop, rocket (Solid and Liquid propellant rockets) and Ramjet engines.

Nozzle Theory and Characteristics Parameters: Theory of one dimensional convergent – divergent nozzles – aerodynamic choking of nozzles and mass flow through a nozzle – nozzle exhaust velocity – thrust, thrust coefficient, A_c / A_t of a nozzle, Supersonic nozzle shape, non-adapted nozzles, summer field criteria, departure from simple analysis – characteristic parameters – 1) characteristic velocity, 2) specific impulse 3) total impulse 4) relationship between the characteristic parameters 5) nozzle efficiency, combustion efficiency and overall efficiency.

UNIT-III

Aero Thermo Chemistry of the Combustion Products: Review of properties of mixture of gases – Gibbs – Dalton laws – Equivalent ratio, enthalpy changes in reactions, heat of reaction and heat of formation – calculation of adiabatic flame temperature and specific impulse – frozen and equilibrium flows.

Solid Propulsion System: Solid propellants – classification, homogeneous and heterogeneous propellants, double base propellant compositions and manufacturing methods. Composite propellant oxidizers and binders. Effect of binder on propellant properties. Burning rate and burning rate laws, factors influencing the burning rate, methods of determining burning rates.

UNIT-IV

Solid Propellant Rocket Engine – internal ballistics, equilibrium motor operation and equilibrium pressure to various parameters. Transient and pseudo equilibrium operation, end burning and burning grains, grain design. Rocket motor hard ware design. Heat transfer considerations in solid rocket motor design. Ignition system, simple pyro devices.

Liquid Rocket Propulsion System: Liquid propellants – classification, Mono and Bi propellants, Cryogenic and storage propellants, ignition delay of hypergolic propellants, physical and chemical characteristics of liquid propellant. Liquid propellant rocket engine – system layout, pump and pressure feed systems, feed system components. Design of combustion chamber, characteristic length, constructional features, and chamber wall stresses. Heat transfer and cooling aspects. Uncooled engines, injectors – various types, injection patterns, injector characteristics, and atomization and drop size distribution, propellant tank design.

UNIT-V

Ramjet and Integral Rocket Ramjet Propulsion System: Fuel rich solid propellants, gross thrust, gross thrust coefficient, combustion efficiency of ramjet engine, air intakes and their classification – critical, super critical and sub-critical operation of air intakes, engine intake matching, classification and comparison of IIRR propulsion systems.

TEXTBOOKS:

1. Mechanics and Dynamics of Propulsion/ Hill and Peterson/John Wiley & Sons.
2. Rocket propulsion elements/Sutton/John Wiley & Sons/8th Edition.
3. Gas Turbines/Ganesan /TMH.

REFERENCE BOOKS:

1. Gas Turbines & Propulsive Systems/Khajuria & Dubey/Dhanpat Rai & Sons.
2. Rocket propulsion/Bevere.
3. Jet propulsion /Nicholas Cumpsty.

OUTCOMES:

- The generation of thrust in air-breathing engines and rockets.
- The performance analysis engines and the overall performance exhaust nozzles.
- An understanding of axial flow compressors, turbines, and an ability to carry out flow and performance calculations.

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M.Tech I Year – II Sem (Thermal Engineering)

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(R17D2116) THERMAL AND NUCLEAR POWER PLANTS (ELECTIVE-IV)

Objectives:

- Provide awareness about resources of energies available in India for Power Production by Thermal and Nuclear Processes.
- Understand and know the requirements for a Thermal Power Plant and Nuclear Power Plant, from sources to consumption and economics of power plants.
- Study and learn the processes and cycles followed in Thermal Power Plants and nuclear power plants and components used in the power plants.

UNIT–I

Introduction: Sources of energy, Type of Power plants. Direct energy conversion system, Energy sources in India, Recent developments in power generation, Combustion of coal, Volumetric analysis, Gravimetric analysis. Fuel gas analysis.

Steam Power Plant: Introduction. General layout of steam power plant, Modern coal. Fired Steam, Steam power plant. Power plant cycle, Fuel Handling, Combustion equipment, Ash handling, Dust collectors.

Steam Generators: Types, Accessories. Feed water heaters, Performance of boiling, Water treatment, Cooling towers, and Steam turbines. Compounding of turbines, Steam condensers, Jet and surface condensers.

UNIT-II

Gas Turbine Power Plant: Cogeneration. Combined cycle power plant, Analysis, Waste heat recovery, IGCC power plant, Fluidized bed, Combustion, Advantages, and Disadvantages.

UNIT-III

Nuclear Power Plant: Nuclear physics, Nuclear Reactor, Classification, Types of reactors, Site selection. Method of enriching uranium. Application of nuclear power plant. Nuclear Power Plant Safety: Bi-Product of nuclear power generation, Economics of nuclear power plant, Nuclear power plant in India, Future of nuclear power.

UNIT-IV

Economics of Power Generation: Factors affecting the economics, Loading factors, Utilization factor, Performance and operating characteristics of power plant, Point economic load sharing, Depreciation. Energy rate, Criteria for optimum loading. Specific economic energy problem.

UNIT-V

Power Plant Instrumentations: Classification, Pressure measuring instrument, Temperature measurement and Flow Measurement, Analysis of combustion gases, Pollution types, Methods of control.

TEXTBOOKS:

1. Power Plant Engineering / P.K.Nag/ TMH.
2. Power Plant Engineering / R.K.Rajput / Lakshmi Publications.
3. Power Plant Engineering, by Samsher Gautam, First Edition.

REFERENCE BOOKS:

1. Power Plant Engineering / P.C.Sharma / Kotearia Publications.
2. Power Plant Technology / Wakil.
3. Power Plant Engineering by A.K. Raja, Amit Prakash Srivastava,Manish Dwivedi.

OUTCOMES:

- Gain the knowledge about resources of energies available in India for Power Production by Thermal and Nuclear Processes.
- Analyze the processes and cycles followed in Thermal Power Plants and nuclear power plants and components used in the power plants and identify the losses to get better efficiency.
- Gain the knowledge on steam power plants, steam generators and gas turbine power plants, their analyses on fuel and fluidized bed combustion, ash handling systems.

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(R17D2117) THERMAL MEASUREMENTS AND PROCESS CONTROLS (ELECTIVE-IV)

Objectives:

- Understand and analyze the behavioral characteristics of instruments
- Make the student learn about calibration procedure of measuring instruments.
- Students understand the various methods of design of temperature measuring instruments.

UNIT-I

General Concepts: Fundamental elements of a measuring instrument. Static and dynamic characteristics – errors in instruments – Different methods of measurement and their analysis – Sensing elements and transducers.

Measurement of pressure – principles of pressure measurement, static and dynamic pressure, vacuum and high pressure measuring – Measurement of low pressure, Manometers, Calibration methods, Dynamic characteristics- design principles.

UNIT-II

Measurement of Flow: Obstruction meters, variable area meters. Pressure probes, compressible fluid flow measurement, Thermal anemometers, calibration of flow measuring instruments. Introduction to design of flow measuring instruments.

UNIT-III

Temperature Measurement: Different principles of Temperature Measurement, use of bimetallic thermometers – Mercury thermometers, Vapor Pressure thermometers, Thermo positive elements, thermocouples in series & parallel, pyrometry, measurement of heat flux, calibration of temperature measuring instruments and design of temperature measuring instruments.

UNIT-IV

Level Measurement: Direct & indirect methods, manometric methods, float level meters, electrical conductivity, Capacitive, Ultrasonic, and Nucleonic Methods.

Measurement of density – Hydrometer, continuous weight method, Gamma rays, Gas impulse wheel. Velocity Measurement – Coefficient of viscosity, Ostesld method, free fall of piston under gravity, torque method. Measurement of moisture content and humidity. Measurement of thermal conductivity of solids, liquids and gases.

UNIT-V

Process Control: Introduction and need for process control principles, transfer functions, block diagrams, signal flow graphs, open and closed loop control systems – Analysis of First & Second order systems with examples of mechanical and thermal systems. Control System Evaluation – Stability, steady state regulations, transient regulations.

TEXTBOOKS:

1. Measurement System, Application & Design – E.O. Doeblin.
2. Mechanical and Industrial Measurements – R.K. Jain – Khanna Publishers.
3. Applied Thermal Engineering, Design. Processes. Equipment. Economics by T.S. Zhao

REFERENCE BOOKS:

1. Mechanical Measurements – Buck & Beckwith – Pearson.
2. Control Systems, Principles & Design, 2nd Edition – M. Gopal – TMH.
3. Thermal processing quality and Principles by George Awuah, Hosahalli S Ramaswamy, A Economides

OUTCOMES:

- Making the student conversant with different working principles of various instruments.
- Be able to analyze and design an instrumentation system,
- Student able to know the concepts of Dynamic range, signal noise ratio.

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(R17D2118) REFRIGERATION AND AIR CONDITIONING (ELECTIVE-IV)

Objectives:

- Familiarize students with the terminologies associated with refrigeration & air conditioning load calculations and elementary duct design.
- Cover the basic principles of psychometric and applied psychometrics
  Familiarize students with system analysis.
- Familiarize students with refrigerants; vapor compression refrigeration and multi-stage vapor compression systems.

UNIT–I

Vapour Compression Refrigeration: Performance of Complete vapor compression system.

Components of Vapor Compression System: The condensing unit – Evaporators – Expansion valve – Refrigerants – Properties – ODP & GWP - Load balancing of vapor compression Unit.

Compound Compression: Flash inter-cooling – flash chamber – Multi-evaporator & Multistage systems.

UNIT–II

Production of Low Temperature: Liquefaction system, Cascade System – Applications.– Dry ice system.

Vapor absorption system – Simple and modified aqua – ammonia system – Representation on Enthalpy –Concentration diagram. Lithium – Bromide system Three fluid system – HCOP.

UNIT–III

Air Refrigeration: Applications – Air Craft Refrigeration - Simple, Bootstrap, Regenerative and Reduced ambient systems – Problems based on different systems.

Steam Jet refrigeration system: Representation on T-s and h-s diagrams – limitations and applications.

Unconventional Refrigeration System – Thermo-electric – Vortex tube & Pulse tube – working principles.

UNIT–IV

Air Conditioning: Psychometric properties and processes – Construction of Psychometric chart. Requirements of Comfort Air –conditioning – Thermodynamics of human body – Effective temperature and Comfort chart – Parameters influencing the Effective Temperature. Summer, winter and year round air – conditioning systems.

Cooling load Estimation: Occupants, equipments, infiltration, duet heat gain fan load, Fresh air load.

UNIT–V

Air Conditioning Systems: All Fresh air, Re-circulated air with and without bypass, with reheat systems – Calculation of Bypass Factor, ADP,RSHF, ESHF and GSHF for different systems.

Components: Humidification and dehumidification equipment – Systems of Air cleaning – Grills and diffusers – Fans and blowers – Measurement and control of Temperature and Humidity.

TEXTBOOKS:

1. Refrigeration & Air Conditioning /C.P. Arora/TMH.
2. Refrigeration & Air Conditioning /Arora & Domkundwar/ Dhanpat Rai.
3. Refrigeration and Air Conditioning /Manohar Prasad.

REFERENCE BOOKS:

1. Principles of Refrigeration/ Dossat /Pearson.
2. Refrigeration and Air Conditioning /Ananthanarayana /TMH.
3. Refrigeration and Air Conditioning /Jordan& Preister /Prentice Hall.

OUTCOMES:

- Introduce students to HVAC technology, engineering, research, system designs, energy impacts, and overall goals.
- Develop understanding of the principles and practice of thermal comfort.
- Develop understanding of the principles and practice and requirements of ventilation.

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(R17D2183) COMPUTATIONAL METHODS LABORATARY

Objectives:

- To develop an understanding for the major theories, approaches and methodologies used in CFD.
- To build up the skills in the actual implementation of CFD methods (e.g. boundary conditions, turbulence modeling etc.) in using commercial CFD codes.
- To gain experience in the application of CFD analysis to real engineering designs.

LIST OF EXPERIMENTS:

1. Solution for the one dimensional wave equations using explicit method of lax using finite difference method (code development)
2. Solution for the one dimensional heat conduction equation using explicit method using finite difference method (code development)
3. Numerical simulation of Flat plate boundary layer using FEM software
4. Numerical simulation of Laminar flow through pipe using FEM software
5. Numerical simulation of Flow past cylinder using FEM software
6. Numerical simulation of flow through nozzle using FEM software
7. Numerical simulation of combustion using FEM software
8. Simulation of Compressible flow in convergent divergent nozzle.
9. Simulation of compressible flow in a compressor.
10. Six degrees of freedom simulation F-16 model.

Note: Any Ten Experiments can be conducted.

Equipment Needed:

1. **Computers**: Core 2 duo processor with 1 GB RAM
2. **Softwares:** Matlab or scilab and Ansys

Reference Books:

1. MATLAB an Introduction with Applications Fifth Edition AMOS GILAT by WILEY Publications
2. Programming in SCI lab by VINU V DAS New Age International Publications
3. ANSYS FLUENT and CFX Tutorials

Outcomes:

- Students will develop a better intuition of Aerodynamics more quickly than is possible with traditional analytical approaches.
- Ability to undertake problem identification, formulation and solution and apply knowledge of basic science and engineering fundamentals.

Developing a geometrical model of the flow, applying appropriate boundary conditions, specifying solution parameters, and visualizing and analyzing the results.

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(R17D2184) TECHNICAL SEMINAR-II

OPEN ELECTIVE - II

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M.Tech I Year – II Sem

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(R17DEC52) INTERNET OF THINGS
(OPEN ELECTIVE –II)

Unit 1: The IoT Networking Core :

Technologies involved in IoT Development: Internet/Web and Networking Basics OSI Model, Data transfer referred with OSI Model, IP Addressing, Point to Point Data transfer, Point to Multi Point Data transfer & Network Topologies, Sub-netting, Network Topologies referred with Web, Introduction to Web Servers, Introduction to Cloud Computing IoT Platform overview Overview of IoT supported Hardware platforms such as: Raspberry pi, ARM Cortex Processors, Arduino and Intel Galileo boards.

Unit 2: Network Fundamentals:

Overview and working principle of Wired Networking equipment's – Router, Switches, Overview and working principle of Wireless Networking equipment's – Access Points, Hubs etc. Linux Network configuration Concepts: Networking configurations in Linux Accessing Hardware & Device Files interactions.

Unit 3: IoT Architecture:

History of IoT, M2M – Machine to Machine, Web of Things, IoT protocols Applications: Remote Monitoring & Sensing, Remote Controlling, Performance Analysis. The Architecture The Layering concepts , IoT Communication Pattern, IoT protocol Architecture, The 6LoWPAN Security aspects in IoT

Unit 4: IoT Application Development:

Application Protocols MQTT, REST/HTTP, CoAP, MySQL.

Back-end Application Designing

Apache for handling HTTP Requests, PHP & MySQL for data processing, MongoDB Object type Database, HTML, CSS & jQuery for UI Designing, JSON lib for data processing, Security & Privacy during development, Application Development for mobile Platforms: Overview of Android / IOS App Development tools

Unit 5: Case Study & advanced IoT Applications:

IoT applications in home, infrastructures, buildings, security, Industries, Home appliances, other IoT electronic equipments. Use of Big Data and Visualization in IoT, Industry 4.0 concepts. Sensors and sensor Node and interfacing using any Embedded target boards (Raspberry Pi / Intel Galileo/ARM Cortex/ Arduino)

TEXT BOOKS:

1. 6LoWPAN: The Wireless Embedded Internet, Zach Shelby, Carsten Bormann, Wiley
2. Internet of Things: Converging Technologies for Smart Environments and Integrated Ecosystems, Dr. Ovidiu Vermesan, Dr. Peter Friess, River Publishers
3. Interconnecting Smart Objects with IP: The Next Internet, Jean-Philippe Vasseur, Adam Dunkels, Morgan Kuffmann

REFERENCES:

1. The Internet of Things: From RFID to the Next-Generation Pervasive Networked Lu Yan, Yan Zhang, Laurence T. Yang, Huansheng Ning

2. Internet of Things (A Hands-on-Approach) , Vijay Madisetti , Arshdeep Bahga
3. Designing the Internet of Things , Adrian McEwen (Author), Hakim Cassimally
4. Asoke K Talukder and Roopa R Yavagal, “Mobile Computing,” Tata McGraw Hill, 2010.
5. Computer Networks; By: Tanenbaum, Andrew S; Pearson Education Pte. Ltd., Delhi, 4th Edition
6. Data and Computer Communications; By: Stallings, William; Pearson Education Pte. Ltd., Delhi, 6th Edition
7. F. Adelstein and S.K.S. Gupta, “Fundamentals of Mobile and Pervasive Computing,” McGraw Hill, 2009.
8. Cloud Computing Bible, Barrie Sosinsky, Wiley-India, 2010.
9. Cloud Security: A Comprehensive Guide to Secure Cloud Computing, Ronald L. Krutz, Russell Dean Vines, Wiley-India, 2010

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(R17DCS52) INFORMATION SECURITY
(OPEN ELECTIVE – II)

UNIT I

A model for Internetwork security, Conventional Encryption Principles & Algorithms (DES, AES, RC4, Blowfish), Block Cipher Modes of Operation, Location of Encryption Devices, Key Distribution.

Public key cryptography principles, public key cryptography algorithms (RSA, Diffie-Hellman, ECC), public Key Distribution.

UNIT II

Approaches of Message Authentication, Secure Hash Functions (SHA-512, MD5) and HMAC, Digital Signatures, Kerberos, X.509 Directory Authentication Service, Email Security: Pretty Good Privacy (PGP)

IP Security: Overview, IP Security Architecture, Authentication Header, Encapsulating Security Payload, Combining Security Associations and Key Management.

UNIT III

Web Security: Requirements, Secure Socket Layer (SSL) and Transport Layer Security (TLS), Secure Electronic Transaction (SET). Firewalls: Firewall Design principles, Trusted Systems, Intrusion Detection Systems

UNIT IV

Auditing For Security: Introduction, Basic Terms Related to Audits, Security audits, The Need for Security Audits in Organization, Organizational Roles and Responsibilities for Security Audit, Auditors Responsibility In Security Audits, Types Of Security Audits.

UNIT V

Auditing For Security: Approaches to Audits, Technology Based Audits Vulnerability Scanning And Penetration Testing, Resistance to Security Audits, Phase in security audit, Security audit Engagement Costs and other aspects, Budgeting for security audits, Selecting external Security Consultants, Key Success factors for security audits.

TEXT BOOKS:

1. Cryptography and Network Security by William Stallings, Fourth Edition, Pearson Education 2007.
2. Network Security Essentials (Applications and Standards) by William Stallings Pearson Education, 2008.
3. Cryptography & Network Security by Behrouz A. Forouzan, TMH 2007.
4. Information Systems Security by Nina Godbole, WILEY 2008.

REFERENCE BOOKS:

1. Information Security by Mark Stamp, Wiley – INDIA, 2006.
2. Fundamentals of Computer Security, Springer.
3. Network Security: The complete reference, Robert Bragg, Mark Rhodes, TMH
4. Computer Security Basics by Rick Lehtinen, Deborah Russell & G.T.Gangemi Sr., SPD O'REILLY 2006.
5. Modern Cryptography by Wenbo Mao, Pearson Education 2007.
6. Principles of Information Security, Whitman, Thomson.

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M.Tech I Year – II Sem

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(R17DME52) INDUSTRIAL MANAGEMENT
(OPEN ELECTIVE-II)

UNIT- I

Concepts of Management and Organisation - Functions of Management - Evolution of Management Thought : Taylor's Scientific Management, Fayol's Principles of Management, Douglas Mc-Gregor's Theory X and Theory Y, Mayo's Hawthorne Experiments, Hertzberg's Two Factor Theory of Motivation, Maslow's Hierarchy of Human Needs - Systems Approach to Management.

UNIT –II

Designing Organisational Structures : Basic concepts related to Organisation - Departmentation and Decentralisation, Types of mechanistic and organic structures of organisation (Line organization, Line and staff organization, functional organization, Committee organization, matrix organization, Virtual Organisation, Cellular Organisation, team structure, boundaryless organization, inverted pyramid structure, lean and flat organization structure) and their merits, demerits and suitability.

UNIT –III

Plant location, definition, factors affecting the plant location, comparison of rural and urban sites-methods for selection of plant- Matrix approach. Plant Layout - definition, objectives, types of production, types of plant layout - various data analyzing forms-travel chart. Work study - Definition, objectives, method study - definition, objectives, steps involved-various types of associated charts-difference between micromotion and memomotion studies. Work measurement- definition,time study, steps involved-equipment, different methods of performance rating- allowances, standard time calculation. Work Sampling - definition, steps involved, standard time calculations, differences with time study.

UNIT –IV

Materials Management-Objectives, Inventory - functions, types, associated costs, inventory classification techniques-ABC and VED analysis. Inventory Control Systems-Continuous review system-periodical review system. Stores Management and Stores Records. Purchase management, duties of purchase of manager,associated forms.Introduction to PERT / CPM : Project management, network modeling-probabilistic model, various types of activity times estimation-programme evaluation review techniques- Critical Path-probability of completing the project, deterministic model, critical path method (CPM)-critical path calculation-crashing of simple of networks.

UNIT –V

Inspection and quality control, types of inspections - Statistical Quality Control-techniques-variables and attributes-assignable and non assignable causes- variable control charts, and R charts, attributes control charts, p charts and c charts. Acceptance sampling plan- single sampling and double sampling plans-OC curves. Introduction to TQM-Quality Circles, ISO 9000 series procedures. Introduction to Human Resource Management, Functions of HRM,

Job Evaluation, different types of evaluation methods. Job description, Merit Rating.- difference with job evaluation, different methods of merit ratings, wage incentives, different types of wage incentive schemes. Marketing, marketing vs selling, marketing mix, product life-cycle.

TEXT BOOKS:

1. Amrine, Manufacturing Organization and Management, Pearson, 2nd Edition, 2004.
2. Industrial Engineering and Management O.P. Khanna Dhanpat Rai.
3. A.R.Aryasri, Management Science , Tata McGraw-Hill, 2002.

REFERENCE BOOKS:

1. Panner Selvam, Production and Operations Management, PHI, 2004.
2. Dr. C. Nadha Muni Reddy and Dr. K. Vijaya Kumar Reddy, Reliability Engineering & Quality Engineering, Galgotia Publications, Pvt., Limited.
3. Phillip Kotler, Marketing Management, Pearson, 2004.

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(R17DCS53) RESEARCH METHODOLOGY
(OPEN ELECTIVE – II)

UNIT - I

Introduction: Research objective and motivation, Types of research, Research approaches, Significance, Research method vs. methodology, Research process.

UNIT - II

Formulating a research problem: Literature review, Formulation of objectives, Establishing Operational definitions, Identifying variables, constructing hypotheses.

UNIT - III

Research design and Data Collection: Need and Characteristics, Types of research design, Principles of Experimental research design, Method of data collection, Ethical issues in collecting data.

UNIT - IV

Sampling and Analysis of data: Need of Sampling, Sampling distributions, Central limit theorem, Estimation: mean and variance, Selection of sample size Statistics in research, Measures of Central tendency, Dispersion, asymmetry and relationships, Correlation and Regression analysis, Displaying data

UNIT - V

Hypothesis Testing: Procedure, Hypothesis testing for difference in mean, variance limitations, Chi-square test, Analysis of variance (ANOVA), Basic principles and techniques of writing a Research Proposal

Text Books:

1. R. C. Kothari, Research Methodology: Methods and Techniques, 2nd edition, New Age International Publisher, 2009

2. Ranjit Kumar, Research Methodology: A Step-by-Step Guide for Beginners, 2nd Edition, SAGE, 2005

References:

1. Trochim, William M. The Research Methods Knowledge Base, 2nd Edition. Internet WWW page, at URL: <http://www.socialresearchmethods.net/kb/>

2. (Electronic Version): StatSoft, Inc. (2012). Electronic Statistics Textbook. Tulsa, OK: StatSoft. WEB: http://www.statsoft.com/textbook/.(Printed Version): Hill, T. & Lewicki, P. (2007). STATISTICS: Methods and Applications. StatSoft, Tulsa, OK.

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(R17D2185) TECHNICAL SEMINAR-III

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(R17D2191) PROJECT REVIEW-I

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(R17D2192) PROJECT REVIEW-II

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(R17D2186) TECHNICAL SEMINAR-IV

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(R17D2193) PROJECT REVIEW-III

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(R17D2194) PROJECT VIVA VOCE