

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA BHOPAL

Grading System

Mechanical Engg, VII-Semester

PTME-701 Heat and Mass Transfer

Unit-1 Basic Concepts: Modes of heat transfer, Fourier's law, Newton's law, Stefan Boltzman law; thermal resistance and conductance, analogy between flow of heat and electricity, combined heat transfer process; Conduction: Fourier heat conduction equation, its form in rectangular, cylindrical and spherical coordinates, thermal diffusivity, linear one dimensional steady state conduction through a slab, tubes, spherical shells and composite structures, electrical analogies, critical-insulation-thickness for pipes, effect of variable thermal conductivity.

Unit 2 Extended surfaces (fins): Heat transfer from a straight and annular fin (plate) for a uniform cross section; error in measurement of temperature in a thermometer well, fin efficiency, fin effectiveness, applications; Unsteady heat conduction: Transient and periodic conduction, heating and cooling of bodies with known temperatures distribution, systems with infinite thermal conductivity, response of thermocouples

Unit 3 Convection: Introduction, free and forced convection; principle of dimensional analysis, Buckingham 'pie' theorem, application of dimensional analysis of free and forced convection, empirical correlations for laminar and turbulent flow over flat plate and tubular geometry; calculation of convective heat transfer coefficient using data book.

Unit 4 Heat exchangers: Types- parallel flow, counter flow; evaporator and condensers, overall heat transfers coefficient, fouling factors, log-mean temperature difference (LMTD), method of heat exchanger analysis, effectiveness of heat exchanger, NTU method; Mass transfer: Fick's law, equi-molar diffusion, diffusion coefficient, analogy with heat transfer, diffusion of vapour in a stationary medium.

Unit 5 Thermal radiation: Nature of radiation, emissive power, absorption, transmission, reflection and emission of radiation, Planck's distribution law, radiation from real surfaces; radiation heat exchange between black and gray surfaces, shape factor, analogical electrical network, radiation shields.

Boiling and condensation: Film wise and drop wise condensation; Nusselt theory for film wise condensation on a vertical plate and its modification for horizontal tubes; boiling heat transfer phenomenon, regimes of boiling, boiling correlations.

References:

1. Sukhatme SP; Heat and mass transfer; University Press Hyderabad
2. Holman JP; Heat transfer; TMH
3. Nag PK; heat and Mass Transfer; TMH
4. Dutta BK; Heat Transfer Principles And App; PHI Learning
5. Mills AF and Ganesan V; Heat transfer; Pearson
6. Cengel Yunus A; Heat and Mass transfer;TMH
7. Yadav R; Heat and Mass Transfer; Central India pub-Allahaba

List of Experiments (Pl. expand it):

- 1 Conduction through a rod to determine thermal conductivity of material
- 2 Forced and free convection over circular cylinder
- 3 Free convection from extended surfaces
- 4 Parallel flow and counter flow heat exchanger effectiveness and heat transfer rate
- 5 Calibration of thermocouple
- 6 Experimental determination of Stefan-Boltzman constant

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Grading System

Mechanical Engg, VII-Semester

Elective I PTME-702(A) Machine Tool Design

Unit 1. Classification, General Requirements and Design Recommendations of Machine Tools. Cutting forces in various machining processes and power requirements of various Machine Tools such as Lathe Machine, Drilling Machine, Shaping Machine, Milling Machine, Grinding Machine and Broaching Machine.

Unit 2. Kinematics of Machine Tool Drives, Classification, selection of maximum and minimum cutting speeds and feeds, series of spindle speed, standard series and value of common ratio, determining common ratio and transmission ratio for drives powered by multispeed electric motor, Semigraphical method for transmission ratio, structures deviating from normal uniform structures, gear box layout and teeth calculations, step less regulationsElectrical and Mechanical.

Unit 3. Design aspects of Machine Tool Elements, Framework, Guides, Spindle Bearing and Power Screws

Unit 4. Lubrication and Rigidity in Machine Tools, Introduction, Steps in selecting proper lubrication oil, Frictional conditions of working, Specifications of lubrication oil, Rigidity of Machine Tool Units, Rigidity of recirculating ball Screw Assembly, overall static rigidity of machine tools, dynamic rigidity of machine tools

Unit 5. Stick slip vibration in machine tools, Vibration isolated tool holders, Forced vibrations in machine tools, Shock Absorber self excited vibrations or chatter.

References:

1. Ghosh and Bhattacharya, Machine Tool Design
2. Acherken, Design of Machine Tools, Mir Publications.

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Mechanical Engg, VII-Semester

Elective I PTME-702(B) Energy Conservation & Audit.

UNIT-I Energy Management: Concept of energy management, energy demand and supply, economic analysis; Duties and responsibilities of energy managers. Energy Conservation: Basic concept, energy conservation in Household, Transportation, Agricultural, service and Industrial sectors, Lighting, HAVC.

UNIT-II Energy Audit: Definition, need and types of energy audit; Energy management (Audit) approach: Understanding energy cost, bench marking, energy performance, matching energy use to requirement, maximizing system efficiencies, optimizing the input energy requirement; Fuel & energy substitution; Energy audit instruments; Energy conservation Act; Duties and responsibilities of energy manager and auditors.

UNIT-III Material energy balance: Facility as an energy system; Method for preparing process flow; material and energy balance diagrams. Energy Action Planning: Key elements, force field analysis; Energy policy purpose, perspective, content, formulation, rectification

UNIT-IV Monitoring and Targeting: Definition monitoring & targeting; Data and information analysis. Electrical Energy Management: energy conservation in motors, pumps and fan systems; energy efficient motors.

UNIT-V Thermal energy management: Energy conservation in boilers, steam turbine and industrial heating system; Application of FBC; Cogeneration and waste heat recovery; Thermal insulation; Heat exchangers and heat pump; Building Energy Management.

References:

1. Murphy & McKay, Energy Management, BSP Books Pvt. Ltd
2. Smith CB; Energy Management Principle, Pergamon Press, New York.
3. Rajan GG, Optimising Energy Efficiency in Industry, TMH.
4. Callaghan P O, Energy Management, McGraw-Hill Book Company.
5. Amit Kumar Tyagi, Handbook on Energy Audit and Management, Tata Energy Research Institute.
6. Bureau of Energy Efficiency, Study material for energy Managers and Auditors: Paper I to V
7. Hamies; Energy Auditing and Conservation: Method, Measurement, Hemisphere, Washington.
8. Witty, Larry C, Industrial Energy Management Utilisation, Hemisphere Publishers, Washington
9. Kreith & Goswami, Energy Management and Conservation Handbook, CRC Press

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Grading System

Mechanical Engg, VII-Semester

Elective II PTME-703(A) Reliability Engineering

Unit 1. Reliability : Definition, Importance, History, Failure pattern of complex product, Factor of safety and reliability, Reliability analysis procedure, Reliability management
Some examples of system failures.

Unit 2. Basic probability theory, Set theory, Laws of probability, Probability theorem Random variables and probability distributions, Central limit theorem,

Unit 3. Functions of random variables, Single , two and several random variables, Probability distribution functions, density functions for different types of discrete and continuous variables, mean, mode and median, Numerical solutions, Extremal distributions,

Unit 4. Modeling of geometry, strength and loads, Fatigue strength, Time dependent reliability of components, Failure rate versus time, reliability and hazard functions and different distributions, Estimation of failure rate, Expected residual life, Series, parallel and mixed systems, complex systems, Reliability enhancement,

Unit 5. Reliability based design, Optimization problems, Failure modes and effect analysis, Event tree and fault tree analysis, Reliability testing, Reliability data and analysis, measurement of reliability, Monte Carlo Simulation, Computation of reliability

References:

1. Singiresu S. Rao, Reliability Engineering, Pearson
2. Grant E. L. & Leave Worth, Statistical Q. C., T.M.H.
3. Balagurusamy, Reliability Engg., T.M.H.
4. Mahajan , Statistical Q.C.
5. Juran and Grayan, Quality Planning Analysis, T.M.H. RAJIV GANDHI PROUDYOGIKI VISHWAV

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Mechanical Engg, VII-Semester

Elective II PTME-703(B) Ergonomics

Unit 1. Productivity and work study, Techniques for productivity improvement, The influence of working conditions on work study.

Unit 2. Work measurement, Purpose and procedure, Work sampling study, sample size, Random observations, Errors, Standard data, Man power planning, Production planning based on work study, Design of individual work, design of group work, Design of product oriented organisation. Process charts of man and material, Multiple activity chart, String chart.

Unit 3. Human factors in engineering, Introduction: Definition, History of Development, Characteristics of Man Machine Systems, Relative capabilities of Human beings and Machines, Information Input and Processing : Human Motor Activities : a. Bio mechanisms of motion, Measurement of Physiological Functions, Energy Expenditure in Physical Activities. b. Human Control of Systems: Human input and output channels. Compatibility, Tracking Operations, Design of Control. c. Anthropometry: Anthropometrics Data and their uses, Work Space Dimensions. Design of seats and seating Arrangement, Location of components, Design of work place. d. Introduction to information theory, Factors affecting information reception and processing. Coding and Selection of sensory inputs. e. Human Sensory Process: Vision, Hearing, Cutaneous, Kinesthetics, and orientation senses.

Unit 4. Display: a. Visual Display: Quantitative and qualitative types of visual display, Visual indicators and warning signals, pictorial and Graphic displays, Alphanumeric Characteristics, Symbolic Codes. b. Auditory and Textual Display: General Principles, Characteristics and Selection of Auditory and Textual display.

Unit 5. Environment and Safety: Introduction to Environmental stresses and their impacts on human work. Industrial Safety: Analysis of cost of accidents, Hazards in various fields like Fire, Electrical shocks. Chemicals, Material Handling, Radiation Machine and Machine Tools and Methods of eliminating them, Personnel Protective equipments, Government legislation about occupational safety, organization for safety, plant safety.

References:

1. McCormick, Human Factors in Engineering and design.
2. Singalton, Introduction to Ergonomics.
- 3 Grandjean, fitting task to the men, TMH
- 4 ILO, Work study
- 5 R.M. Currie, Work Study, BIM Publication

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Mechanical Engg, VII-Semester

PTME-704 Machine Design - II

Note: PSG Design data book and/ or Mahadevan and Reddy's Mechanical design data book are to be provided/ permitted in exam hall (duly verified by authority)

Unit I Design of Belt, Rope and Chain Drives: Methods of power transmission, selection and design of flat belt and pulley; Selection of V-belts and sheave design; Design of chain drives, roller chain and its selection; Rope drives, design of rope drives, hoist ropes.

Unit II Spur and Helical Gears: Force analysis of gear tooth, modes of failure, beam strength, Lewis equation, form factor, formative gear and virtual number of teeth; Gear materials; Surface strength and wear of teeth; strength against wear; Design of straight tooth spur and Helical Gears. Bevel Gears: Application of bevel, formative gear and virtual number of teeth; Force analysis; Lewis equation for bevel gears; Strength against wear; Design of bevel gear.

Unit III Design of I.C. Engine Components: General design considerations in I C engines; design of cylinder; design of piston and piston-rings; design of connecting rod; design of crankshaft.

Unit IV Design of Miscellaneous Components: design of Flanged coupling; Rigid coupling, Design of Pressure vessels subjects to internal pressure, external pressure, design of penetration, design of flanges, cone cylinder junctions ,Materials, Fabrication.

Unit V Optimization: Basic concept of optimization, classification of optimization, optimization techniques, engineering applications of optimization. Classical optimization techniques: unconstrained optimization single-variable optimization, multivariable optimization, solution by direct search method, solution by Lagrange-multipliers method.

- References:**
1. Shigley J.E.; Machine Design; TMH
 2. BhandariVB; Design of Machine Elements; TMH
 3. Sharma CS and Purohit K; Design of Machine Elements; PHI Learning.
 4. Hall and Somani; Machine Design; Schaum Series; TMH
 5. Wentzell TH; Machine Design; Cengage Learning
 6. Sharma & Agrawal; Machine Design; Katson
 7. Kulkarni SG; Machine Design; TMH
 8. Abdul Mubeen; Machine Design; Khanna Publishers
 9. Juvinall RC, Marshek KM; Fundamentals of Machine Component Design; Wiley
 10. Norton R; Design Of Machinery; TMH

List of Experiment (Pl. expand it): Designing and sketching of components contained in the syllabus

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PTME-705 Minor Project-II

Minor Project Provision of Minor project is made as preparation phase-I for major project or to take it as an independent small project.