RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA BHOPAL

Credit Based Grading System

Mechanical Engg, VIII-Semester

ME- 8001 Advance Machine Design

[1] Fundamentals of technical systems, systems approach fundamentals, assemblies and components, phases and interactions of design process, design tools and resources, standards and codes, uncertainty and reliability, design based on reliability,

[2] Design based on theory of elasticity, deign based on theory of plasticity, design based on failure analysis, failure modes of mechanical components, statistical approach to failure and design modifications, design based on propagation of defects in production and life cycle of components.

[3] Design based on tribology, effect of variable coefficient of friction, effect of variability of modulus of elasticity, effect of different lubrication parameters, Effect of surface characteristics. Effect of different kinds of wear and design changes as per wear mechanisms.

[4] Limit design analysis, simple case of deformation beyond elastic limit, design of parts of unsymmetrical sections, shear centre of different engineering sections, parts subjected to unsymmetrical bending,

[5] Strain gauges, electrical wire resistance gages, bonding gage factor, measuring circuits, strain gage rosette, potentiometric circuits, circuit sensitivity, application of straingages in practical problems, photoelasticity, photoelastic bench, stress analysis,

Various design soft ware and applications

Books:

1. The strain gage primere, CC Perry and HR Lissener, McGraw - Hill
2. G.E.Dieter, Engineering Design.
3. Failure analysis, vol,1,2,
4. Fracture Mechanics, Fundamentals and applications, TL Anderson, CRC Press
5. CMTI Handbook

Tutorial topics.

[1] force analysis of CNC machine tool design, five axis machines, six axis machines,
[2] Design aspects of linkages of industrial robots, classifications and applications.
[3] Function structure diagram
[4] Design analysis of production sequences and processes of automation

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA BHOPAL

Credit Based Grading System

Mechanical Engg, VIII-Semester

ME- 8002 Refrigeration & Air conditioning

Unit-I Introduction: Principles and methods of refrigeration, freezing; mixture cooling by gas reversible expansion, throttling, evaporation, Joule Thomson effect and reverse Carnot cycle; unit of refrigeration, coefficient of performance, vortex tube & thermoelectric refrigeration, adiabatic demagnetization; air refrigeration cycles- Joule's cycle Boot-strap cycle, reduced ambient cycle and regenerative cooling
cycles.

Unit-II Vapor compression system: Vapor compression cycle, p-h and t-s diagrams, deviations from theoretical cycle, sub-cooling and super heating, effects of condenser and evaporator pressure on cop; multi-pressure system: removal of flash gas, multiple expansion & compression with flash inter cooling; low temperature refrigeration: production of low temperatures, cascade system, dry ice, production of dry ice, air liquefaction system,.

Unit-III (a) **Vapor absorption system**: Theoretical and practical systems such as aquaammonia, electrolux & other systems; (b) **Steam jet refrigeration**: Principles and working, simple cycle of operation, description and working of simple system, (c) **refrigerants:** nomenclature & classification, desirable properties, common refrigeration, comparative study, leak detection methods, environment friendly refrigerants and refrigerant mixtures, brine and its properties

Unit-IV Psychometric: Calculation of psychometric properties of air by table and charts; psychometric processes: sensible heating and cooling, evaporative cooling, cooling and dehumidification, heating and humidification, mixing of air stream, sensible heat factor; principle of air conditioning, requirements of comfort air conditioning, ventilation standards, infiltrated air load, fresh air load human comfort, effective temperature & chart, heat production & regulation of human body,
Unit-V Air conditioning loads: calculation of summer & winter air conditioning load, bypass factor of coil, calculation of supply air rate & its condition, room sensible heat factor, grand sensible heat factor, effective sensible heat factor, dehumidified air quantity. Problems on cooling load calculation. Air distribution and ventilation systems

References:
1. Arora CP; Refrigeration and Air Conditioning; TMH
2. Sapali SN; Refrigeration and Air Conditioning; PHI
3. Ananthanarayan; Basic Refrigeration and Air conditioning; TMH
4. Manohar Prasad; Refrigeration and Air Conditioning; New Age Pub
5. Ameen; Refrigeration and Air Conditioning; PHI
6. Pita ; Air conditioning Principles and systems: an energy approach; PHI
7. Stoecker W.F, Jones J; Refrigeration and Air conditioning; McGH, Singapore
8. Jordan RC and Priester GB Refrigeration and Air Conditioning, PHI USA
9. Arora RC; Refrigeration and Air conditioning; PHI Learning

List of Experiments :-

Refrigeration and Air Conditioning AU/ ME 8002

1. General Study of vapor compression refrigeration system.
2. General Study of Ice Plant
3. General Study and working of cold storage
4. General Study Trane Air Condition (Package Type).
5. General Study of Electrolux Refrigeration
6. General Study One tone thermax refrigeration unit.
7. General Study of Water cooler
8. General Study of Psychrometers (Absorption type)
9. General Study of Leak Detectors (Halide Torch).
10. General Study and working of Gas charging Rig.
11. General Study of window Air Conditioner.
12. General Study and working of Vapor compression Air conditioning Test rig.
13. Experimentation on Cold Storage of Calculate COP & Heat Loss.
14. Experimentation on Vapor compression Air Conditioning test rig.
15. Changing of Refrigerant by using Gas Charging Kit.

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA BHOPAL

Credit Based Grading System

Mechanical Engg, VIII-Semester

Elective –V ME- 8003 (1) Tribology

[1] Introduction, history of tribology, early scientific studies of - friction, Wear Lubrication. Tribo-Surface preparations and characteristics. Surface contacts, Hertz contact stresses, residual stress, surface fatigue, creep, stress relaxation, fracture mechanics, elastic, visco elastic and plastic behavior of materials. Choice of materials.

[2] Friction, laws of friction, rolling/sliding friction, theory of adhesion and abrasion, different mechanisms of friction , stick slip characteristics, interface temperature, thermal analysis, Molecular mechanical theory of friction, operating conditions and system parameters, calculations of coefficient of friction, design of friction devices.

[3] Wear, different types of wear mechanisms, adhesive, abrasive impact,percussion erosion, fretting wear calculations of wear rate, two body/ three body wear, wear prevention, wear of metal cutting and metal forming tools, wear mapping of materials, cavitation, surface fatigue, corrosion, performance levels classifications and specifications of lubricants,

[4] Lubrication, lubricants and additives, composition and properties of lubricants, maintenance of oil and emulsions, industrial hygiene aspects, technical regulations for lubricants. boundary/ mixed and fluid film lubrication, industrial methods of lubrications, SAE,BIS, ASTM, IP, DIN Standards.oil testings.wear and chemistry of lubricants.

[5] Nano tribology, Instrumental tests,. Bearings, clutches and brakes, slide units, dynamic seals, Automobile applications, machine tools/ press machines applications. Other applications and case studies

Books:

1 . Principles and applications of tribology, Bharat Bhushan, John Wiley& sons, ISBN 0 471 59407 5

2. Tribology,, - lubrication ,friction and wear, I V Kragelsky and V V Alisin, Mir publication, ISBN 1 86058 288 5

3 . Applied Tribology,M M Khonsari and E. R. Booser, John Wiley, ISBN 0 471 28302 9

Tutorial topics.

[1] Testing equipments of tribology.
[2] Various industrial applications of tribology.
[3] NEMS and MEMS applications

[4] Solid, liquid and mist/ gas lubricants.
[5] Surface coatings.
[6] Chemical analysis of materials
[7] Various simulations
[8]AFM/ FFM , SFA, STM, studies.

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA BHOPAL

Credit Based Grading System

Mechanical Engg, VIII-Semester

Elective –V ME- 8003 (2) Failure analysis & Trouble Shooting

[1]Failure data and statistical distributions analysis.Reliability. The component's life cycle. The equipment's life cycle. Mechanical mechanisms associated with the components. Forces and vibration analysis. Safety factors. Different applications and case studies.

[2] Failure analysis from the tribological considerations. Friction , wear and lubrication analysis , wear maps, lubricants and alternatives. Surface compatibility and elastic matching. Methods of friction reduction. Geometrical accuraciesassembly requirements

[3] Failure analysis from material selection and subsequent treatments. Alloying elements, heat/ mechanical treatments. Mechanical elastic and plastic behavior of materials. Alternative newer materials. Microscopic/ macroscopic analysis.

[4] Failure analysis from the production methods and maintenance procedures considerations. Faulty methods, fittings, assembly and disassembly problems, faulty maintenance methods, reconditioning, reverse engineering, Hand tools and preparation of inspection procedure.

[5] Failure analysis and trouble shooting with specific processes and subsequent testing of individual components. Make or buy decisions, value analysis. NDT method of testing. BIS and other specifications.

Books:

1 Machinery failure analysis and trouble shooting , H.P. Block and F.K.Geitner, Gulf publishing co.,ISBN 0-87201-872-5

Tutorial topics.

[1] Understanding the drawings and use of different drawing software.
[2] Limits ,fits and dimensional/ geometrical/ assembly tolerances, Surface finish
[3] Mechanical destructive and non destructive tests.
[4] Solid, liquid and mist/ gas lubricants.
[5] Trial, commissioning and test charts.
[6] Chemical analysis of materials
[7] Calibration of inspection instruments.

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA BHOPAL

Credit Based Grading System

Mechanical Engg, VIII-Semester

Elective –V ME- 8003 (3) Advance Machining Process

[1] Mechanical processes, process selection, mechanics of cutting, metal removal rate, cutting tool system design, ultrasonic machining, abrasive jet machining, water jet machining, , effect of parameters and variables, applications and limitations, recent developments in mechanical processes.

[2] Electrochemical and chemical metal removal processes, electrochemical machining[ECM], elements of ECM, power source and control system, electrolytes, tool work system, chemistry of the process, tool design and metal removal rate, process faults, material removal and surface finish, electrochemical grinding, electrochemical deburring, electrochemical honing, chemical machining,

[3] Thermal metal removal processes, electric discharge machining[EDM], spark erosion, mechanism of metal removal, spark erosion generator, electrod feed control, vibrating electrode system, dielectric fluid, flushing, accuracy, plasma arc machining[PAM], non thermal generation of plasma, mechanisms and parameters, equipments, electron beam machining[EBM],generation and control of electron beam, theory and process capabilities, neutral particle etching, laser beam machining, hot machining, methods of local heating,tool lie and production rate.

[4] Rapid prototyping fabrication methods, fundamentals, technologies, applications, principles and working of 3D printing, subtractive v/s additive manufacturing process, VAT photo polymerization, material and binder jetting, continuous liquid inter phase production, direct metal laser sintering.

[5] Technologies of micro fabrication, types of micro system devices, indusrial applications, micro fabrication processes, LIGA process .Technologies of nano fabrication, importance of size, scanning probe microscope, carbon Buckyballs and nano tubes, nano fabrication processes,

Books:

1. Mikell P. Groover, Fundamentals of Modern Manufacturing, Wiley India, ISBN 978 81 265 2301 6
2. Pandey P.C, Shan H.S., Modern Machining Processes, Tata McGraw Hill,ISBN 0 07 096518 8
3. Lal G.K,Gupta V, Reddy N.V., Narosa Publishing House,ISBN 81 7319 709 1
4. CMTI Handbook

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA BHOPAL

Credit Based Grading System

Mechanical Engg, VIII-Semester

Elective –VI ME- 8004 (1) Optimization Technique

[1] Introduction to optimization, engineering applications in brief, design constrains and objectives, classifications, classical optimization techniques, single and multi variable optimization with no constraints/ equality / inequality constraints.

[2] Linear programming, definitions and theorems, standard forms of linear programming , algorithms, two phases of the simplex methods, duality in programming, decomposition of principle, sensitivity analysis, transportation problems, quadratic programming.

[3] Non linear programming, unconstrained techniques one dimension minimization methods, elimination and interpolation methods, practical considerations, implementation in multivariable problems, comparisons, constrained optimization techniques, direct / indirect methods, test problems, trusses, welded beams, gear train design, heat exchanger design.

[4] dynamic programming, introduction, posynomial, geometrical programming, unconstraint/ constraint minimization, applications of geometric programming, multistage decision processes, suboptimization and principles of optimality, computational procedures, linear programming as a case of dynamic programming, continuous dynamic programming, design of continuous beam, trusses,

[5] Integer linear and non linear programming, graphical representation, stochastic programming, Introduction to genetic algorithm, neural network based optimization, practical aspect of optimization,

Books:

1. S.S. Rao, Engineering optimization, New Age International Publishers,ISBN: 81 224 1149 5
2. A. Ravindran,K. Ragsdell and G. Reklaitis, Engineering Opimization, John wiley &Sons
3. K. Deb, Optimization for Engineering Design, Prentice Hall of India

Tutorial topics.

[1] Lagrange Multipliers and use in optimization problems
[2] Simplex method, Duel simplex method
[3] Constraint qualifications
[4] Convex programming problems
[5] Comparison of elimination methods
[6] Newton method, quasi Newton method
[7] Penalty function method
[8] Simulated Annealing

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA BHOPAL

Credit Based Grading System

Mechanical Engg, VIII-Semester

Elective –VI ME- 8004 (2) Product Design

[1] Basic concepts of engineering products' drawings. Softwares' applications for preparation of drawings, designs and animations. (5L)

[2] Creativity , Concept generation – Intuitive / Rational and as per customers choice amongst alternatives. Needs and wants. Products' specifications and product architecture.

[3] A brief review of engineering materials and their properties. Concepts of tribology – Friction, Wear and Lubrication . (5L)

[4] Basic concepts of limits, fits and tolerances in individual components and assemblies. A brief review of process planning, Jigs, Fixtures, manufacturing methods and shop floor practices. Review of drawings and design from industrial and manufacturing aspects. A brief review of quality assessment and control (5L)

[5] Basic concepts of ergonomics and related proportions. Value analysis , cost analysis, market impact and feed back data from market to designer. The product life cycle. Intellectual property rights/ Patent procedures and governments' support for export/import substitutions..

Books:

1. K.T.Ulrich and S.D.Eppinger," Product design and development".
2. G.E.Dieter, Engineering Design.
3. Product design – Otto, Wood,

Tutorial topics.

[1] Why-whom-how-how much – when – where – end result :safety, social effects
[2] Fish bone diagram
[3]Function structure diagram
[4] Sequence diagram
[5]Liaison diagram
[6] Datum Flow Chain diagram
[7] Specifications and ergonomics
[8] Drawings
[9]Process sheets : Required m/cs, equipment,time and motion studies,costings
[10] Basic mechanical component design
[11] Manufacturing methods
[12]Design traits and Biasness
[13] Maintenance schedule , services , analysis ,
[14] Software available

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA BHOPAL

Credit Based Grading System

Mechanical Engg, VIII-Semester

Elective –VI ME- 8004 (3) MAINTENANCE MANAGEMENT

[1] Maintenance, definition, preventive, corrective, on- line off- line maintenance, window maintenance, emergency, reconditioning, design out maintenance . " product- item- machine – plant structure characteristics. Design , cost and safety aspects.

[2] Production- maintenance system, Maintenability, Maintenance procedures, guidelines for matching procedures to items, universal maintenance procedures. shutdown programs

[3] Maintenance organization, work load, resource characteristics, administrative structure, work planning, scheduling and control strategy, feed back, combinations of manpower, tools and spares. Documentations. Network planning, computer based management information systems,.

[4] restoration of components, assembly, disassembly bush bearing, housings, Ball and roller bearings, key-splines, couplings shafts- lead screw fittings, clutches- brakes, belt pulley, chain sprocket, guideways, machine hydraulics, pneumatics, electrical works and motors, seals, and packings. Fasteners , welding, machining, repair cycles, repair complexities, maintenance stages. Lubrication, accuracies and technological test charts.

[5] Failure statistics, Failure data, failure patterns/ statistical models, Failure analysis, applications of different models, Depreciation and average machine life. case studies.

Books:

1 .Maintenance management – Hand book, Higgins

2.Maintenance planning and control, Anthony Kelly

Tutorial topics.

[1] Drawings, manuals and specifications.
[2] Limits, fits and tolerances, Surface finish
[3] Measurement tools
[4] Engineering materials
[5] Wear mechanisms
[6] Maintenance softwares
[7] Industrial safety norms and regulations
[8] Motivation