Students Career Development

Mechanical

Chemical — Water treatment — Consultant — Refractory — Metal Working — Agriculture

Cement — Oil - Gas — Wood Working — Textile — Testing — Spatial — Rubber — Printing — Plastic — Paper-working

Automation — Entertainment — Garment — Cottage — Construction — Power Plant — Automobile — Machine Building

II Year

III Year

IV Year

Final Year

Graduate

- Dynamics of Machinery
- Design of Transmission System
- Design of Machine Elements
- Finite Element Analysis
- Strength of Materiel
- Electives I
- Electives II
- Kinematics of Machinery

APM WinMachine

VariCAD

KOMPAS-3D

Artas Engineering Software

Project — Career — Thermal — Mechanism — Manufacturing

Industrial Training — Design — Production — Inspection — Maintenance — CAD/CAE/CAM/CAPP

Professional

R&D

Production

Quality

sales

Service

Packaging — Mineral Processing — Material Handling — Marine - Ship Building — Interior

CAI/CAE/CAD/CAM/CAPP

Institution

Syllabus Program

Equating

Integrated

Solution

Project - Career Program

Paviath Integrated solution

Email: info@paviathintegreatedsolution.com
Web: www.paviathintegratedsolution.com

Certificate

Jointly with institution

Basic Lab

30 User Network

APM WINMACHINE | KOMPAS 3D | VARICAD | SAM

Undergraduate

- Reference books
- Video demo - webinar
- Industrial trainer
- Tutorial - user guide

Projects & Career Oriented Program

- Zero gap - industries
- Areas and projects
- Reverse engineering
- Product development

Syllabus Program

- Conceptual method
- Academic procedure
- Analytical analysis
- Embedding syllabus

Advance Lab

Post Gradauate

Dexma PLM

SprutCAM

Research Lab

KOMPAS 3D

START — The Pipe Flexibility and Stress Analysis

PASSAT — STRENGTH AND STABILITY ANALYSIS

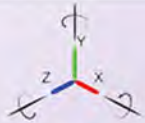
NOZZLE-FEM — Stresses / Flexibility / Loads Nozzle - Shells

Thermodynamics — Termophysical / Phase Equilibria / Graph

HYDROSYSTEM — Isothermal / Non-Isothermal Pipeline System

DEGREE OF FREEDOM
- DISPLACEMENT ALONG THREE AXIS
- ROTATION ABOUT THREE AXIS

SI UNITS



Translational Degree of Freedom
Rotational Degree of Freedom

Basic Data

SIZES
LENGTH
WIDTH
HEIGHT
DIAMETER
SPECIFICATION

MATERIAL DATABASE
STANDARD PARAMETRIC PARTS

TRAINING 25 HOURS
EXERCISE & TEST FULL SEMESTER

STANDARD
DRAWING SHEET
TITLE BLOCK

STANDARD
ISO – INTERNATIONAL
BIS – INDIAN
EN – EURO
DIN - GERMAN
GOST – RUSSIAN
ASME – AMERICAN

PLANE
XY PLANE
YZ PLANE
ZXPLANE

COORDINATES (0, 0, 0)
LEVELLING (10, 20, 80)

PREFERRED NUMBERS
R5 SERIES
R10 SERIES
R20 SERIES
R40 SERIES

Projects & Career Oriented Program

APPLICATION - AREA - PRODUCT DEVELOPMENT - REVERSE ENGINEERING

MECHANISM - MACHINES - EQUIPMENTS
- AGRICULTURE INDUSTRIES
- AUTOMATION INDUSTRIES
- CONSTRUCTION INDUSTRIES
- TEXTILE - GARMENT INDUSTRIES
- MACHINE BUILDING INDUSTRIES
- BULK HANDLING - MINERAL PROCESSING
- AUTOMOBILE - OEM INDUSTRIES
- PRINTING - PACKAGING INDUSTRIES
- PLASTIC - RUBBER INDUSTRIES
- TESTING - SPACE INDUSTRIES
- MARINE - SHIP BUILDING INDUSTRIES

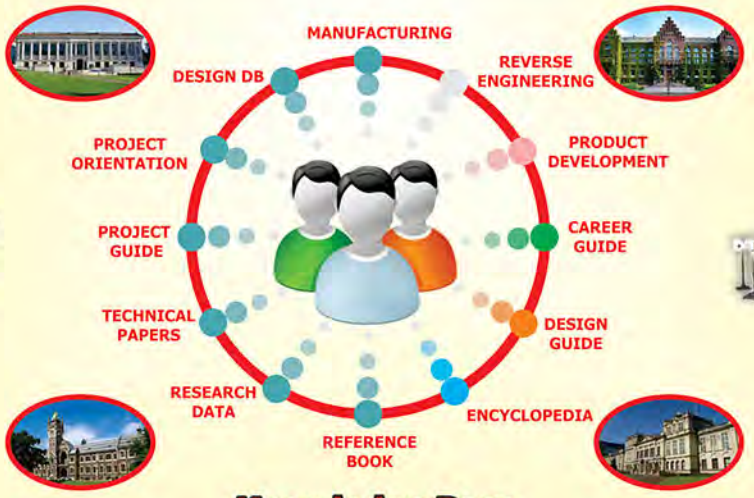
THERMAL - CHEMICAL - PROCESS
- CHEMICAL PLANT
- THERMAL PLANT
- FOOD PROCESSING INDUSTRIES
- OIL - GAS INDUSTRIES
- EFFLUENT TREATMENT INDUSTRIES
- WATER TREATMENT INDUSTRIES
- NUCLEAR EQUIPMENT INDUSTRIES
- ALLIED EQUIPMENT INDUSTRIES

MANUFACTURING - PLM
- AGRICULTURE INDUSTRIES
- AUTOMATION INDUSTRIES
- CONSTRUCTION INDUSTRIES
- TEXTILE - GARMENT INDUSTRIES
- MACHINE BUILDING INDUSTRIES
- BULK HANDLING - MINERAL PROCESSING
- AUTOMOBILE - OEM INDUSTRIES
- PRINTING - PACKAGING INDUSTRIES
- PLASTIC - RUBBER INDUSTRIES
- TESTING - SPACE INDUSTRIES
- MARINE - SHIP BUILDING INDUSTRIES

PROGRAM
- SAM - SYNTHESIS ANALYSIS MECHANISM
- APM WINMACHINE - MACHINE ELEMENTS
- KOMPAS 3D - 2D GRAPHIC - 3D - BOM
- VARICAD - 2D - 3D - PDM - BOM

PROGRAM
- PASSAT - PRESSURE VESSELS - HEAT EXCH.
- START - PIPING ANALYSIS
- HYDRO SYSTEM - FLOW ANALYSIS
- NOZZLE FEM - NOZZLE ANALYSIS
- KOMPAS 3D - 3D PLANT - PIPING
- APM WINMACHINE STRUCTUREAL ANALYSIS

PROGRAM
- DEXMA PLM - DEGIN - MFG MANAGEMENT
- SPRUT CAM - CNC TURING - MILLING -
- MULTI AXIS - INDEX MILLING - EDM -
- JET CUTTING - ROBOT PROGRAM
- KOMPAS 3D - DIMENSION ANALYSIS



Knowledge Base

FINAL YEAR PROJECT TOPICS ARE BASED ON RESEARCH ARTICLE OF APPLICATION OF ABOVE AREAS WITH INDUSTRIES APPLICATION.

CHOICE OF TOPICS ARE EITHER FROM US OR FROM INSTITUTION - FOLLOWED BY SEQUENCE WITH INDUSTRIES APPROACH

ME6401- 3 0 0 3 - Kinematics of Machinery - SEMESTER

OBJECTIVES

- To understand the basic components and layout of linkages in the assembly of a system /machine.
- To understand the principles in analyzing the assembly with respect to the displacement, velocity, and acceleration at any point in a link of a mechanism.
- To understand the motion resulting from a specified set of linkages, design few linkage mechanisms and cam mechanisms for specified output motions.
- To understand the basic concepts of toothed gearing and kinematics of gear trains and the effects of friction in motion transmission and in machine components.

And apply exercise in SAM (Synthesis Analysis of Mechanism) - APM WINMACHINE (CAE) – KOMPAS 3D (CAD) Programs.

APM WINMACHINE
APM BASE
APM GRAPH
APM TRANS
APM DRIVE
APM CAM
APM DYNAMICS
APM BOOK
APM USER GUIDE
APM DEMO
SAM (Mechanism)
KOMPAS 3D
APPLICATION

UNIT I
BASICS OF MECHANISMS 9

Classification of mechanisms – Basic kinematic concepts and definitions – Degree of freedom, Mobility – Kutzbach criterion, Gruebler's criterion – Grashof's Law – Kinematic inversions of four-bar chain and slider crank chains – Limit positions – Mechanical advantage – Transmission Angle – Description of some common mechanisms – Quick return mechanisms, Straight line generators, Universal Joint – rocker mechanisms.

UNIT II
KINEMATICS OF LINKAGE MECHANISMS 9

Displacement, velocity and acceleration analysis of simple mechanisms – Graphical method– Velocity and acceleration polygons – Velocity analysis using instantaneous centres – kinematic analysis of simple mechanisms – Coincident points – Coriolis component of Acceleration – Introduction to linkage synthesis problem.

UNIT III
KINEMATICS OF CAM MECHANISMS 9

Classification of cams and followers – Terminology and definitions – Displacement diagrams –Uniform velocity, parabolic, simple harmonic and cycloidal motions – Derivatives of follower motions – Layout of plate cam profiles – Specified contour cams – Circular arc and tangent cams – Pressure angle and undercutting – sizing of cams.

UNIT IV
GEARS AND GEAR TRAINS 9

Law of toothed gearing – Involutes and cycloidal tooth profiles –Spur Gear terminology and definitions–Gear tooth action – contact ratio – Interference and undercutting. Helical, Bevel, Worm, Rack and Pinion gears [Basics only]. Gear trains – Speed ratio, train value – Parallel axis gear trains – Epi-cyclic Gear Trains.

UNIT V
FRICTION IN MACHINE ELEMENTS 9

Surface contacts – Sliding and Rolling friction – Friction drives – Friction in screw threads –Bearings and lubrication – Friction clutches – Belt and rope drives – Friction in brakes- Band and Block brakes.

TEXT BOOKS:

1. Uicker, J.J., Pennock G.R and Shigley, J.E., "Theory of Machines and Mechanisms", 3rd Edition, Oxford University Press, 2009.
2. Rattan, S.S, "Theory of Machines", 3rd Edition, Tata McGraw-Hill, 2009.

REFERENCES:

1. Thomas Bevan, "Theory of Machines", 3rd Edition, CBS Publishers and Distributors, 2005.
2. Cleghorn. W. L, "Mechanisms of Machines", Oxford University Press, 2005
3. Robert L. Norton, "Kinematics and Dynamics of Machinery", Tata McGraw-Hill, 2009.
4. Allen S. Hall Jr., "Kinematics and Linkage Design", Prentice Hall, 1961
5. Ghosh. A and Mallick, A.K., "Theory of Mechanisms and Machines", Affiliated East-West Pvt.Ltd., New Delhi, 1988.
6. Rao.J.S. and Dukkipati.R.V. "Mechanisms and Machine Theory", Wiley-Eastern Ltd., New Delhi, 1992.
7. John Hannah and Stephens R.C., "Mechanics of Machines", Viva Low-Prices Student Edition, 1999.
8. Ramamurthi. V, "Mechanics of Machines", Narosa Publishing House, 2002.
9. Khurmi, R.S., "Theory of Machines",14th Edition, S Chand Publications, 2005
10. Sadhu Sigh : Theory of Machines, "Kinematics of Machine", Third Edition, Pearson Education, 2012 Pvt. Ltd., New Delhi, 1988.

CE6306 - Strength of Materials - SEMESTER III

OBJECTIVES

To understand the stresses developed in bars, compounds bars, beams, shafts, cylinders and spheres in Theory. And apply exercise in APM WINMACHINE (CAE) – KOMPAS 3D (CAD) Programs.

APM WINMACHINE
APM BASE
APM GRAPH
APM STRUCTURE 3D
APM BOOK
APM USER GUIDE
APM DEMO
KOMPAS 3D
INDUSRIAL APPLICATION

UNIT I
STRESS, STRAIN AND DEFORMATION OF SOLIDS 9

Rigid bodies and deformable solids – Tension, Compression and Shear Stresses – Deformation of simple and compound bars – Thermal stresses – Elastic constants – Volumetric strains –Stresses on inclined planes – principal stresses and principal planes – Mohr's circle of stress.

UNIT II
TRANSVERSE LOADING ON BEAMS AND STRESSES IN BEAM 9

Beams – types transverse loading on beams – Shear force and bending moment in beams – Cantilevers – Simply supported beams and over – hanging beams. Theory of simple bending– bending stress distribution – Load carrying capacity – Proportioning of sections – Flitched beams – Shear- stress distribution.

UNIT III
TORSION 9

Torsion formulation stresses and deformation in circular and hollows shafts – Stepped shafts–Deflection in shafts fixed at the both ends – Stresses in helical springs – Deflection of helical springs, carriage springs.

UNIT IV
DEFLECTION OF BEAMS 9

Double Integration method – Macaulay's method – Area moment method for computation of slopes and deflections in beams - Conjugate beam and strain energy – Maxwell's reciprocal theorems.

UNIT V
THIN CYLINDERS, SPHERES AND THICK CYLINDERS 9

Stresses in thin cylindrical shell due to internal pressure circumferential and longitudinal stresses and deformation in thin and thick cylinders – spherical shells subjected to internal pressure –Deformation in spherical shells – Lame's theorem.

TEXT BOOKS:

1. Bansal, R.K., "Strength of Materials", Laxmi Publications (P) Ltd., 2007
2. Jindal U.C., "Strength of Materials", Asian Books Pvt. Ltd., New Delhi, 2007

REFERENCES:

1. Egor. P.Popov "Engineering Mechanics of Solids" Prentice Hall of India, New Delhi, 2001
2. Subramanian R., "Strength of Materials", Oxford University Press, Oxford Higher Education Series, 2007.
3. Hibbeler, R.C., "Mechanics of Materials", Pearson Education, Low Price Edition, 2007
4. Ferdinand P. Been, Russell Johnson, J.r. and John J. Dewole "Mechanics of Materials", Tata McGraw Hill Publishing 'co. Ltd., New Delhi, 2005.

OBJECTIVES

ME 2040 -3003 - Pressure Vessels & Piping Design - ELECTIVE

AIM: To give exposure to various types of process equipments and their design.
OBJECTIVES: To understand the different types of stresses and their effects in pressure vessel - To understand the piping layout and the stresses acting on it..
And apply exercise in PASSAT – START – APM WINMACHINE (CAE) – KOMPAS 3D (CAD) Programs.

UNIT I
CYLINDRICAL SHELL AND VARIOUS CLOSURES 9
Membrane theory for thin shells, stresses in cylindrical, spherical and conical shells, dilation of above shells, general theory of membrane stresses in vessel under internal pressure and its application to ellipsoidal and torispherical end closures. Bending of circular plates and determination of stresses in simply supported and clamped circular plate. Introduction to ASME code and formulae

UNIT III
SUPPORT DESIGN 9
Supports for vertical & horizontal vessels. Design of base plate and support lugs. Types of anchor bolt, its material and allowable stresses. Design of saddle supports.

[UNIT V
PIPING STRESS ANALYSIS 9
Flow diagram, Piping layout and piping stress analysis. Flexibility factor and stress intensification factor. Design of piping system as per B31.1 piping code. Piping components – bends, tees, bellows and valves. Types of piping supports and their behaviour.

APM WINMACHINE
APM BASE
APM GRAPHIC TOOLS
APM ENGINEERING ANALYSIS
APM FINITE ELEMENT ANALYSIS
APM BOOK
APM USER GUIDE
APM DEMO

KOMPAS 3D

PASSAT
CODES
STANDARDS
START
APPLICATION

UNIT II
JUNCTION STRESSES, OPENING AND REINFORCEMENTS 9
Discontinuity stresses. Stress concentration in plate having circular hole due to bi-axial loading. Theory of reinforced opening and reinforcement limits.

UNIT IV
BUCKLING IN VESSELSB 9
Buckling of vessels under external pressure. Elastic buckling of long cylinders, buckling modes, Collapse under external pressure. Design for stiffening rings. Buckling under combined external pressure and axial loading.

TEXT BOOKS:

1. Harvey J F , 'Pressure vessel design' CBS publication
2. Brownell. L. E & Young. E. D , 'Process equipment design', Wiley Eastern Ltd., India

REFERENCES:

1. ASME Pressure Vessel and Boiler code, Section VIII Div 1 & 2, 2003 American standard code for pressure piping , B 31.1
2. Henry H Bednar, Pressure vessel Design Hand book,CBS publishers and distributors
3. Stanley M Wales, Chemical Process equipment, selection and design, Butterworths, series in Chemical Engineering,1988
4. William.j.,Bees,"Approximate methods in the Design and Analysis of pressure vessels and piping", ASME Pressure vessels and piping conference,1997

OBJECTIVES

ME 2353-3104 -Finite Element Analysis - SEMESTER VI

INTRODUCTION
Solution to engineering problems – mathematical modeling – discrete and continuum - modeling – need for numerical methods of solution – relevance and scope of finite element methods – engineering applications of FEA.
And apply exercise in SAM (Synthesis Analysis of Mechanism) - APM WINMACHINE (CAE) – KOMPAS 3D (CAD) Programs

UNIT I
FINITE ELEMENT FORMULATION OF BOUNDARY VALUE
Weighted residual methods –general weighted residual statement – weak formulation of the weighted residual statement –comparisons – piecewise continuous trial functions example of a bar finite element –functional and differential forms – principle of stationary total potential – Rayleigh Ritz method – piecewise continuous trial functions – finite element method – application to bar element

UNIT III
TWO DIMENSIONAL FINITE ELEMENT ANALYSIS 10+4
Introduction – approximation of geometry and field variable – 3 noded triangular elements – four noded rectangular elements – higher order elements – generalized coordinates approach to nodal approximations – difficulties – natural coordinates and coordinate transformations – triangular and quadrilateral elements – iso-parametric elements – structural mechanics applications in 2-dimensions – elasticity equations – stress strain relations – plane problems of elasticity – element equations – assembly – need for quadrature formule – transformations to natural coordinates – Gaussian quadrature – example problems in plane stress, plane strain and axisymmetric applications.

APM WINMACHINE
APM BASE
APM GRAPHIC TOOLS
APM ENGINEERING ANALYSIS
APM FINITE ELEMENT ANALYSIS
APM DYNAMICS
APM BOOK
APM USER GUIDE
APM DEMO
SAM (Mechanism)
KOMPAS 3D
APPLICATION

UNIT II
ONE DIMENSIONAL FINITE ELEMENT ANALYSIS
General form of total potential for 1-D applications – generic form of finite element equations – linear bar element – quadratic element –nodal approximation – development of shape functions – element matrices and vectors – example problems – extension to plane truss– development of element equations – assembly – element connectivity – global equations – solution methods –beam element – nodal approximation – shape functions – element matrices and vectors – assembly – solution – example problems

UNIT IV
DYNAMIC ANALYSIS USING FINITE ELEMENT METHOD
Introduction – vibrational problems – equations of motion based on weak form – longitudinal vibration of bars – transverse vibration of beams – consistent mass matrices – element equations –solution of eigenvalue problems – vector iteration methods – normal modes – transient vibrations – modeling of damping – mode superposition technique – direct integration methods

UNIT V
APPLICATIONS IN HEAT TRANSFER & FLUID MECHANICS
One dimensional heat transfer element – application to one-dimensional heat transfer problems- scalar variable problems in 2-Dimensions – Applications to heat transfer in 2-Dimension – Application to problems in fluid mechanics in 2-D

TEXT BOOKS

1. P.Seshu, "Text Book of Finite Element Analysis", Prentice-Hall of India Pvt. Ltd. New Delhi. 2007.

REFERENCE BOOKS

1. J.N.Reddy, "An Introduction to the Finite Element Method", McGraw-Hill International Editions(Engineering Mechanics Series), 1993. ISBN-0-07-051355-4
2. Chandrupatla & Belagundu, "Introduction to Finite Elements in Engineering", 3rd Edition, Prentice-Hall of India, Eastern Economy Editions. ISBN-978-81-203-2106-9
3. David V.Hutton,"Fundamentals of Finite Element Analysis", Tata McGraw-Hill Edition 2005. ISBN-0-07-239536-2
4. Cook,Robert.D., Plesha,Michael.E & Witt,Robert.J. "Concepts and Applications of Finite Element Analysis",Wiley Student Edition, 2004. ISBN-10 81-265-1336-5

OBJECTIVES

ME 2352 -3104 - Design of Transmission Systems - SEMESTER VI

To gain knowledge on the principles and procedure for the design of power Transmission components
To understand the standard procedure available for Design of Transmission sip terms - To learn to use standard data and catalogues
And apply exercise in SAM (Synthesis Analysis of Mechanism) - APM WINMACHINE (CAE) – KOMPAS 3D (CAD) Programs.

APM WINMACHINE
APM BASE
APM GRAPHIC TOOLS
APM ENGINEERING ANALYSIS
APM FINITE ELEMENT ANALYSIS
APM DYNAMICS
APM BOOK
APM USER GUIDE
APM DEMO
SAM (Mechanism)
KOMPAS 3D
APPLICATION

UNIT I
DESIGN OF TRANSMISSION SYSTEMS FOR FLEXIBLE ELEMENTS 12
Selection of V belts and pulleys – selection of Flat belts and pulleys - Wire ropes and pulleys – Selection of Transmission chains and Sprockets. Design of pulleys and sprockets.

UNIT II
SPUR GEARS AND PARALLEL AXIS HELICAL GEARS 12
Gear Terminology-Speed ratios and number of teeth-Force analysis -Tooth stresses -Dynamic effects - Fatigue strength - Factor of safety - Gear materials – Module and 56
Face width-power rating calculations based on strength and wear considerations - Parallel axis Helical Gears – Pressure angle in the normal and transverse plane- Equivalent number of teeth-forces and stresses. Estimating the size of the helical gears

UNIT III
BEVEL, WORM AND CROSS HELICAL GEARS 12
Straight bevel gear: Tooth terminology, tooth forces and stresses, equivalent number of teeth. Estimating the dimensions of pair of straight bevel gears. Worm Gear: Merits and demerits- terminology. Thermal capacity, materials-forces and stresses, efficiency, estimating the size of the worm gear pair.Cross helical: Terminology-helix angles-Estimating the size of the pair of cross helical gears.

UNIT IV
DESIGN OF GEAR BOXES 12
Geometric progression - Standard step ratio - Ray diagram, kinematics layout -Design of sliding mesh gear box -Constant mesh gear box. – Design of multi speed gear box.

UNIT V
DESIGN OF CAM CLUTCHES AND BRAKES 12
Cam Design: Types-pressure angle and under cutting base circle determination-forces and surface stresses.Design of plate clutches –axial clutches-cone clutches-internal expanding rim clutches internal and external shoe brakes.

REFERENCES:

1. Maitra G.M., Prasad L.V., "Hand book of Mechanical Design", II Edition, Tata McGraw-Hill, 1985.
2. Bhandari, V.B., "Design of Machine Elements", Tata McGraw-Hill Publishing Company Ltd., 1994.
3. Prabhu. T.J., "Design of Transmission Elements", Mani Offset, Chennai, 2000,
4. Hamrock B.J., Jacobson B., Schmid S.R., "Fundamentals of Machine Elements",McGraw-Hill Book Co., 1999.
5. Ugural A,C, "Mechanical Design, An Integrated Approach", McGraw-Hill , 2003.

TEXT BOOKS:

1. Shigley J.E and Mischke C. R., "Mechanical Engineering Design", Sixth Edition, Tata McGraw-Hill , 2003.
2. Sundararajamoorthy T. V, Shanmugam .N, "Machine Design", Anuradha Publications, Chennai, 2003.

STANDARDS:
1. IS 4460 : Parts 1 to 3 ; 1995, Gears – Spur and Helical Gears – Calculation of Load Capacity.
2. IS 7443 : 2002, Methods of Load Rating of Worm Gears
3. IS 15151: 2002, Belt Drives – Pulleys and V-Ribbed belts for Industrial applications – PH, PJ, PK, PI and PM Profiles : Dimensions
4. IS 2122 : Part 1: 1973, Code of practice for selection, storage, installation and maintenance of belting for power transmission : Part 1 Flat Belt Drives.
5. IS 2122: Part 2: 1991, Code of practice for selection, storage, installation and maintenance of belting for power transmission : Part 2 V-Belt Drives.

OBJECTIVES

ME 2042 Design of Heat Exchangers -3003 - ELECTIVE

AIM: To Build up necessary background for the design of various type of heat exchangers
OBJECTIVES: To learn the sizing of heat exchangers, thermal and mechanical stress analysis for various heat exchange applications
.And apply exercise in PASSAT – START -- APM WINMACHINE (CAE) – KOMPAS 3D (CAD) Programs.

APM WINMACHINE
APM BASE
APM GRAPHIC TOOLS
APM ENGINEERING ANALYSIS
APM FINITE ELEMENT ANALYSIS
APM BOOK
APM USER GUIDE
APM DEMO

KOMPAS 3D

PASSAT
CODES
STANDARDS
START
APPLICATION

UNIT I
DIFFERENT CLASIFICATION OF HEAT EXCHANGERS 9
Parallel flow, Counter flow and cross flow; shell and tube and plate type; single pass and multipass; once through stream generators etc;

UNIT II
PROCESS DESIGN OF HEAT EXCHANGERS
Heat transfer correlations, Overall heat transfer coefficient, LMTD, sizing of finned tube heat exchangers, U tube heat exchangers, fouling factors, pressure drop calculations.

UNIT III
MECHANICAL DESIGN OF SHELL AND TUBE TYPE
Thickness calculations, Tubesheet design using TEMA formula, Concept of equivalent plate for analyzing perforated analysis, flow induced vibration risks including acoustic issue and remedies, tube to tube sheet joint design, buckling of tubes, thermal stresses

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
CONDENSORS AND COOLING TOWERS
Design of surface and evaporative condensers – cooling tower – performance - characteristics

TEXT BOOKS / REFERENCES:

1. T.Taborek, G.F. Hewitt and N.Afgan, Heat Exchangers, Theory and practice, McGraw-Hill Book Co.1980
2. Walkers, Industrial Heat Exchangers – A Basic Guide, Mc Graw Hill Book Co. 1980
3. Nicholas Cheremistoff, Cooling Tower Ann Arbor Science Pub1981
4. Arthur, P. Frass, Heat Exchanger Design, John Wiley and Sons, 1988
5. J. P .Gupta, Fundamentals of Heat exchanger and pressure vessels technology, Hemisphere publishing corporation, springer –Verlag (outside NA), 1986
6. Donald Q. Kern and Alban D. Karus, " Extended surface heat transfer" Mc Graw Hill Book Co., 1972.
7. E.A.D. Sanders, Heat Exchangers, Selection Design and Construction

ME 2302 -3104 - Dynamics of Machinery - SEMESTER V

OBJECTIVES

To understand the method of static force analysis and dynamic force analysis of mechanisms
To study the undesirable effects of unbalances in rotors and engines.
To understand the concept of vibratory systems and their analysis
To understand the principles of governors and gyroscopes.

And apply exercise in SAM (Synthesis Analysis of Mechanism) - APM WINMACHINE (CAE) – KOMPAS 3D (CAD) Programs.

UNIT I
FORCE ANALYSIS AND FLYWHEELS 12

Static force analysis of mechanisms – D ' Alemberts principle - Inertia force and Inertia torque – Dynamic force analysis - Dynamic Analysis in Reciprocating Engines – Gas Forces - Equivalent masses - Bearing loads - Crank shaft Torque–Engine shaking Forces - Turning moment diagrams - Flywheels of engines and punch press

UNIT II
BALANCING 12

Static and dynamic balancing - Balancing of rotating masses - Balancing a single cylinder Engine – Primary and secondary unbalanced forces - Balancing Multi-cylinder Engines – Firing order – Pivoted cradle balancing machines

APM WINMACHINE
APM BASE
APM GRAPH
APM STRUCTURE 3D
APM SHAFT
APM DYNAMICS
APM BOOK
APM USER GUIDE
APM DEMO
SAM (Mechanism)
KOMPAS 3D
APPLICATION

STANDARDS:

1. IS 11717 : 2000, Vocabulary on Vibration and Shock
2. IS 13301 : 1992, Guidelines for vibration isolation for machine foundations
3. IS 10000 : Part 7 : 1980, Methods of tests for internal combustion engines: Part 7 Governing tests for constant speed engines and selection of engines for use with electrical generators
4. IS 13274 : 1992, Mechanical vibration - Balancing – Vocabulary
5. IS 13277 : 1992, Balancing machine - Description and evaluation

UNIT IV
FORCED VIBRATION 12

Response to periodic forcing - Harmonic Forcing – Forced vibration caused by unbalance - Support motion – Force transmissibility and amplitude transmissibility - Vibration isolation

UNIT III
FREE VIBRATION 12

Basic features of vibratory systems - Basic elements and lumping of parameters - Degrees of freedom - Single degree of freedom - Free vibration - Equations of motion - natural frequency - Types of Damping - Damped free vibration – Whirling of shafts and critical speed - Torsional systems; Natural frequency of two and three rotor systems.

UNIT V
MECHANISMS FOR CONTROL 12

Governors - Types - Centrifugal governors - Gravity controlled and spring controlled centrifugal governors –Characteristics - Effect of friction - Controlling Force – Quality of governors – effect of friction.Gyroscopes - Gyroscopic couple - Gyroscopic stabilization - Gyroscopic effects in Automobiles and ships

TEXT BOOKS:

1. Ambekar A. G., Mechanism and Machine Theory, Prentice Hall of India, New Delhi, 2007.

REFERENCES:

1. Thomas Bevan, "Theory of Machines", CBS Publishers and Distributors, 1984.
2. Ghosh A. and Mallick A.K., "Theory of Mechanisms and Machines", Affiliated East-West Press Pvt. Ltd., New Delhi, 1988.
3. Shigley J.E. and Uicker J.J., "Theory of Machines and Mechanisms", McGraw-Hill,Inc., 1995.
4. Rao J.S. and Dukkipati R.V., "Mechanism and Machine Theory ", Wiley-Eastern Limited, New Delhi. 1992.
5. John Hannah and Stephens R.C., "Mechanics of Machines", Viva low-Priced Student Edition, 1999.
6. Sadhu Singh "Theory of Machines" Pearson Education, 2002.

ME 2303 -3104 - Design of Machine Elements - SEMESTER V

OBJECTIVES

To familiarise the various steps involved in the Design Process
To understand the principles involved in evaluating the shape and dimensions of a component to satisfy functional and strength requirements.
To learn to use standard practices and standard data
To learn to use catalogues and standard machine components

And apply exercise in SAM (Synthesis Analysis of Mechanism) - APM WINMACHINE (CAE) – KOMPAS 3D (CAD) Programs.

UNIT I
STEADY STRESSES AND VARIABLE STRESSES IN MACHINE MEMBERS 12

Introduction to the design process - factor influencing machine design, selection of materials based on mechanical properties – Preferred numbers, fits and tolerances – 46 Direct, Bending and torsional stress equations – Impact and shock loading – calculation of principle stresses for various load combinations, eccentric loading – Design of curved beams – crane hook and 'C' frame - Factor of safety - theories of failure – stress concentration – design for variable loading – Soderberg, Goodman and Gerber relations

UNIT II
DESIGN OF SHAFTS AND COUPLINGS 12

Design of solid and hollow shafts based on strength, rigidity and critical speed – Design of keys, key ways and splines - Design of crankshafts – Design of rigid and flexible couplings.

APM WINMACHINE
APM BASE
APM GRAPHIC TOOLS
APM ENGINEERING ANALYSIS
APM FINITE ELEMENT ANALYSIS
APM DYNAMICS
APM BOOK
APM USER GUIDE
APM DEMO
SAM (Mechanism)
KOMPAS 3D
APPLICATION

UNIT III
DESIGN OF TEMPORARY AND PERMANENT JOINTS 12

Threaded fastners - Design of bolted joints including eccentric loading, Knuckle joints, Cotter joints – Design of welded joints, riveted joints for structures - theory of bonded joints.

UNIT IV
DESIGN OF ENERGY STORING ELEMENTS 12

Design of various types of springs, optimization of helical springs – rubber springs – Design of flywheels considering stresses in rims and arms, for engines and punching machines.

UNIT V
DESIGN OF BEARINGS AND MISCELLANEOUS ELEMENTS 12

Sliding contact and rolling contact bearings – Design of hydrodynamic journal bearings,
McKee's Eqn., Sommerfield Number, Raimondi & Boyd graphs, – Selection of Rolling
Contact bearings – Design of Seals and Gaskets – Design of Connecting Rod.

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1. Sundararajamoorthy T. V, Shanmugam .N, "Machine Design", Anuradha Publications, Chennai, 2003.
2. Orthwein W, "Machine Component Design", Jaico Publishing Co, 2003.
3. Ugural A.C, "Mechanical Design – An Integral Approach, McGraw-Hill Book Co, 2004.
4. Spotts M.F., Shoup T.E "Design and Machine Elements" Pearson Education, 2004.

STANDARDS:

1. IS 10260 : Part 1 : 1982 Terms, definitions and classification of Plain bearings Part 1 : Construction.
2. IS 10260 : Part 1 : 1982 Terms, definitions and classification of Plain bearings Part 2 : Friction and Wear.
3. IS 10260 : Part 1 : 1982 Terms, definitions and classification of Plain bearings Part 3 : Lubrication.

TEXT BOOKS:

1. Shigley J.E and Mischke C. R., "Mechanical Engineering Design", Sixth Edition, Tata McGraw-Hill , 2003.
2. Bhandari V.B. "Design of Machine Elements". Second Edition. Tata McGraw-Hill Book Co. 2007.