KANNUR UNIVERSITY

FACULTY OF ENGINEERING

Curricula, Scheme of Examinations and Syllabi

for

B.Tech Degree Programme in

MECHANICAL ENGINEERING

V11 and V111 Semesters

With Effect From 2007 Admissions

SEVENTH SEMESTER

Code	Subject	Hours/Week			Sessional Marks	University Exam	
		L	T	P		Hours	Marks
2K6ME 701	Metrology and Instrumentation	3	1	-	50	3	100
2K6ME 702	Industrial Management	3	1	-	50	3	100
2K6ME 703	Machine Design I	3	1	-	50	3	100
2K6ME 704	Power plant Engineering	3	1	-	50	3	100
2K6ME 705	Elective II	3	1	-	50	3	100
2K6ME 706(P)	Instrumentation Lab	-	-	3	50	3	100
2K6ME 707(P)	Computational Lab	-	-	3	50	3	100
2K6ME 708(P)	Mini Project	-	-	4	50	-	-
2K6ME 709(P)	Physical Education, Health and Fitness	-	-	-	50	-	-
TOTAL		**15**	**5**	**10**	**450**	**-**	**700**

ELECTIVE-11

2K6ME 705 (A) MARKETING MANAGEMENT

2K6ME 705 (B) OPTIMIZATION TECHNIQUES

2K6ME 705 (C) FLEXIBLE MANUFACTURING SYSTEMS

2K6ME 705 (D) ADVANCED FLUID MECHANICS

2K6ME 705 (E) MULTIPHASE FLOW

2K6ME 701: METROLOGY AND INSTRUMENTATION

3 hours lecture & 1 hour tutorial per week

Module I (13 hours)

Applications of measuring instruments-functional elements of an instrument-instrument as transducer-generalised measuring instrument-generalised mathematical model of measuring systems-zero order, first order and second order instruments-classification of instruments - input/output configurations - methods of correction for spurious inputs-inherent insensitivity - high-gain feed-back - signal - filtering and opposing inputs - static calibration and determination of bias and random error of an instrument- assumption of Gaussian distribution for experimental data-chi-square goodness-of-fit test-method of least squares for curve fitting - static characteristics-accuracy loading effect-backlash-friction-hysteresis-threshold-dead space- resolution-static sensitivity and linearity-problems on friction-loading effect-sensitivity and calibration

Module II (13 hours)

Uncertainty in "computed quantities" from measured values - estimation of permissible uncertainties of instruments for specific purposes - potentiometer transducer as a zero order instrument - analysis of its loading error - mercury-in-glass thermometer as a first order instrument - step, ramp and frequency response of first order instruments - problems - seismic instrument as a second order instrument - step, terminated ramp, ramp and frequency response of second order instruments - slip gages - assembling the blocks - temperature problems - LVDT - comparators: principle of working of mechanical, electrical, pneumatic comparators - measurement of strain: strain gauge classification - unbonded and bonded strain gauges - gage factor - strain gauge rosettes - selection and installation of bonded gauges - ballast, DC bridges and constant current circuits - temperature compensation – calibration

Module III (13 hours)

Measurement of force: multiple lever system for weighing - strain gauge load cells - temperature sensitivity-ballistic weighing-hydraulic & pneumatic load cells-measurement of torque: water brake Heenan & Froude hydraulic dynamometer - general purpose electric dynamometer - measurement of temperature: pressure thermometers-RTDs-compensation for lead resistance-thermistors - thermocouples - series in parallel connected thermocouples -

materials used and there ranges - pyrometry-infrared pyrometry - air pollution measurement: gas chromatography - Orsat's apparatus - nuclear instrumentation: Gieger Muller counter - ionisation chamber - scintillation counters

Module IV (13 hours)

Acoustical measurements: characterisation of sound (noise) - basic acoustical parameters - sound pressure - sound pressure level, power, intensity and power level - combination of sound pressure levels - attenuation with distance - psychoacoustic relationships - micro-phones - sound level meter - principles of automatic control: open and closed loop systems - servo mechanism - process control and regulators - mathematical modelling of mechanical and electrical systems - transfer function of simple systems - time domain analysis of control system: steady state response - steady state error - error coefficients - stability of control systems: concept of stability - method of determining stability of linear control systems - Routh Hurwitz criterion

Text Books and References

1. Beckwith T.G., Marangoni R.D. & Lienhard J.H., "*Mechanical Measurements"*
2. Doebelin E.O., *"Measurement Systems"*, McGraw Hill Publishing Company
3. Holman J.P., *"Experimental Methods for Engineers"*, McGraw Hill Inc.
4. Kuo, *"Automatic Control Systems"*, Asian Student Edition, Prentice Hall of India

Sessional work assessment

Two assignments = 20

Two tests = 30

Total marks = 50

University examination pattern

Q I - 8 short type questions of 5 marks each, 2 from each module

Q II - 2 questions A and B of 15marks each from module I with choice to answer any one

Q III - 2 questions A and B of 15marks each from module II with choice to answer any one

Q IV - 2 questions A and B of 15marks each from module III with choice to answer any one

Q V - 2 questions A and B of 15marks each from module IV with choice to answer any one

2K6ME 702 : INDUSTRIAL MANAGEMENT

3 hours lecture & 1 hour tutorial per week

Module I (14 hours)

Management concepts - system concepts of management - management functions - planning - principles of planning - organizing - organization structures - principles of organizing - span of control - delegation - leadership - directing - controlling

Decision making - strategic and tactical decisions - models of decision making - single stage decisions under risk - multi stage decision making - decision trees - decision making under uncertainty - Baye's decision theory - equally likely - minimax - maximum likelihood - maximin criterion –

Module II (12 hours)

Network techniques - basic concepts - network construction - CPM and PERT networks - algorithm for critical path - slacks and their significance - crashing - network flow problems - the shortest route problem - minimal spanning tree problem - maximal flow in capacitated network

Module III (14 hours)

Production planning and control - scope and objectives - functions of PPC - product consumption cycle - production planning - process planning - material requirement planning - forecasting - methods of forecasting - moving average method - single exponential smoothing - linear regression - linear forecaster - scheduling - objectives - performance measures - priority rules - single machine scheduling - job shop scheduling - 2 jobs N machines - flow shop scheduling - N jobs 2 machines - N jobs 3 machines scheduling

Module IV (12 hours)

Human resources management - job design - job enrichment - job enlargement - job evaluation - merit rating - wages and incentives - work study - method study - time study - work sampling.

Costing - cost concepts - concept of cost accounting - elements of cost - overhead costs - methods of allocation of overhead costs - depreciation - methods of depreciation - financial management - time value of money - comparison of alternatives - payback period method -

net present value method - internal rate of return method - basics of financial accounting - profit and loss account - balance sheet preparation

Text books

1. Koontz H., O'Donnel & Weihrich H., *Essentials of Management*, McGraw Hill Book Company
2 Mazda F., *Engineering Management*, Low Price Edition, Addison Wesley
3. Pandey I.M., *Financial Management*, Eighth Edition, Vikas Publishing House Private Limited
4 Bhattacharya A.K., *Principles and Practice of Cost Accounting,* Wheeler Publishing
5 Venkata Ratnam C.S. & Srivastava B.K., *Personnel Management and Human Resources*, Tata McGraw Hill Publishing Company Limited
6 Barnes., *Motion and Time Study Design and Measurement of Work*, Wiley
7 Jerome D Weist, *A Management Guide to PERT/CPM,* Mc.Graw Hill Co.
8 Samuel Eilon., Elements of Production Planning and Control, Prentice Hall India.

Reference books

1 Chase R.B., Aquilano N.J. & Jacobs F.R., *Production and Operations Management: Manufacturing and Services,* Eighth Edition, Tata McGraw Hill Publishing Company Limited

2 Prasanna Chandra, *Financial Management: Theory and Practice*, Fourth Edition, Tata McGraw Hill Publishing Company Limited

Sessional work assessment

Two assignments = 20

Two tests = 30

Total marks = 50

University examination pattern

Q I - 8 short type questions of 5 marks each, 2 from each module

Q II - 2 questions A and B of 15marks each from module I with choice to answer any one

Q III - 2 questions A and B of 15marks each from module II with choice to answer any one

Q IV - 2 questions A and B of 15marks each from module III with choice to answer any one

Q V - 2 questions A and B of 15marks each from module IV with choice to answer any one

2K6ME 703: MACHINE DESIGN I

3 hours lecture & 1 hour tutorial per week

Module I (13 Hours)

Introduction to design- Steps in design process –Design factors –Tolerances & fits – principles of standardization – Codes & standards – Selection of materials

Introduction to Computer aided design – Introduction to modeling, drafting, simulation and analysis software packages.

Stress & Strength considerations of mechanical elements – Stress concentration Theories of failure –Impact load – Fatigue loading – consideration of creep and thermal stresses in design.

Module II (13 Hours)

Threaded fasteners –Thread standards – Stresses in screw threads – preloading of bolts – bolted joints – eccentric loading – gasketed joints – Fatigue loading - analysis of power screws.

Keys – types of keys and pins – stresses in keys and pins – design of keys – design of cotter and pin joints

Riveted Joints – stresses in riveted joints – strength analysis – boiler and tank joints – structural joints

Module III (13 Hours)

Welded joints – types of welded joints – stresses in butt and fillet welds – torsion and bending in welded joints- welds subject to fluctuating loads – design of welded machine parts and structural joints.

Springs – Stresses in helical springs- deflection of helical springs – extension, compression and torsion springs- design of helical springs for static and fatigue loading – critical frequency of helical springs – stress analysis and design of leaf springs

Module IV (13 Hours)

Power shafting – stresses in shafts – design for static loads – reversed bending and steady torsion – design for strength and deflection – design for fatigue loading – critical speed of shafts – stresses in couplings – design of couplings

Text books:

1. Joseph Edward Shigley, Mechanical Engineering Design, McGraw Hill Book Company.
2. V B Bhandari, Design of Machine elements, Tata McGraw Hill Publishing Co. Ltd.

Reference books:

1. Stegel, Maleev & Hartman, Mechanical Design of Machines, International Book Company
2. Phelan R. M, Fundamentals of Mechanical Design, Tata McGraw Hill Publishing Co. Ltd.
3. Doughtie V L & Vallance. A V., Design of Machine Elements, McGraw Hill Book Company.
4. Paul H Black & O Eugene Adams Jr., Machine Design, McGraw Hill Book Company.
5. M F Spotts, T E Shoup, Design of Machine elements, Prentice Hall
6. V B Bhandari, Introduction to Machine Design, Tata McGraw Hill Publishing Co. Ltd.
7. Georeg E Dieter, Engineering Design, McGraw Hill Book Company.
8. Jack A Collins, Failure of Materials in Mechanical Design: Analysis, Prediction, Prevention. John Wiley & Sons Inc.
9. Ibrahim Zeid, CAD/CAM theory and practice, McGraw Hill Book Company.

Data hand books (allowed for reference during examinations)

1. Prof. Narayana Iyengar B R & Dr. Lingaiah K, Machine Design Data Hand Book Vol. I & II.
2. P. S. G. Tech, Machine Design Data Handbook

Sessional work assessment

Two tests = 30

Two assignments = 20

Total marks = 50

University examination pattern

Q I - 8 short type questions of 5 marks each, 2 from each module

Q II - 2 questions A and B of 15marks each from module I with choice to answer any one

Q III - 2 questions A and B of 15marks each from module II with choice to answer any one

Q IV - 2 questions A and B of 15marks each from module III with choice to answer any one

Q V - 2 questions A and B of 15marks each from module IV with choice to answer any one

2K6ME 704 POWER PLANT ENGINEERING

3 hours lecture and 1 hour tutorial per week

MODULE I (12 hours)

Steam engineering-temperature entropy diagram-mollier diagram-rankine cycle-modified rankine cycle-reheat and regenerative-binary vapour cycle-steam generators-classifications-cochran boiler-lancashire boiler-cornish boiler-locomotive boiler-babcock and wilcox boiler-stirling boiler-high pressure boilers-boiler mountings and accessories

MODULE II (12 hours)

Steam nozzles-flow through steam nozzles-throat pressure for maximum discharge- effect of friction-super saturated flow-steam turbines-impulse and reaction turbines-velocity diagram-condition for maximum efficiency-compounding-reheat factor-blade height-governing of steam turbines-cogeneration and combined cycle power generation-steam engines-components-compounding-indicator diagram

MODULE III (16 hours)

Thermal power plants-general layout-site selection-fuel handling storage and burning systems-dust and ash handling system-chimney draught-nuclear power plants-classification-components-safety measures-effects of nuclear radiation-nuclear waste disposal-gas turbine power plants-classification-closed open and other systems-hydro electric power plants-combined operation of different power plants-non conventional power generation-solar thermal collection-thermal storage-ocean power-principle of OTEC systems-wind energy-wind turbine-geothermal energy-geothermal electrical power plants-biogas energy-biogas production-design and construction of biogas plants

MODULE IV (12 hours)

Economics of power generation-terms and definitions-estimation of load-load curve-load factor-diversity factor-capacity factor-use factor-economics in plant selection-economics of generation and distribution of power-useful life-tariff for electrical energy-environmental pollution and its control-steam power plant pollutants-control of pollutants-control of particulate matter-control of SO_2- control of NO_2-control of waste water from steam power plants-pollution from nuclear power plants-noise pollution and noise control

Text Book:

1. El Wakil, “Power Plant Technology” McGraw Hill

Reference Books:

1. Nag, “Power Plant Engineering” TMH
2. Ngpal, “Power Plant Engineering” Khanna
3. Vapat & Scrotski, “Power Station Engineering and Economy” TMH
4. John F Lee, “Power Station Engineering and Economy” TMH

Sessional work Assessment

Two Tests	=30
Two Assignments	=20
Total Marks	=50

University examination pattern

Q I - 8 short type questions of 5 marks each, 2 from each module

Q II - 2 questions A and B of 15marks each from module I with choice to answer any one

Q III - 2 questions A and B of 15marks each from module II with choice to answer any one

Q IV - 2 questions A and B of 15marks each from module III with choice to answer any one

Q V - 2 questions A and B of 15marks each from module IV with choice to answer any one

2K6ME 705 (A): MARKETING MANAGEMENT

3 hours lecture & 1 hour tutorial per week

Module I (14 hours)

Introduction to marketing - concept of market and marketing - marketing environment - controllable factors - factors directed by top management - factors directed by marketing - uncontrollable factors - demography, economic conditions, competition, social and cultural forces, political and legal forces, and technology

Module II (14 hours)

Marketing planning - marketing planning process - Boston consultancy group model - marketing mix - marketing mix variables - market segmentation and market targeting - introduction to segmentation - targeting and product positioning

Module III (12 hours)

Marketing research - need and scope - marketing research process - research objectives, developing research plan, collecting information, analysis, and findings - consumer behaviour - factors influencing consumer behaviour - perceived risks - product life cycle - marketing strategies for different stages of product life cycle

Module IV (12 hours)

Marketing communication - marketing mix variables - steps in developing effective communication - identification of target audience - determination of communication objectives - designing the message - selecting the communication channels - promotion mix evaluation - advertising and sales promotion - factors in advertising - sales promotion tools

Text books

1. Kotler P., *Marketing Management: Analysis, Planning, Implementation and Control*, Prentice Hall of India Private Limited
2. Ramaswamy V.S. & Namkumari S., *Marketing Management: Planning, Implementation and Control*, Macmillan India Limited

Reference books

1. Stanton W.J., Etzel M.J. & Walker B.J., *Fundamentals of Marketing,* McGraw Hill International Edition
2. Majumdar R., *Marketing Research*, *Text, Applications and Case Studies*, New Age International (P) Limited Publishers
3. Robert, *Marketing Research,* Prentice Hall of India

Sessional work assessment

Two Tests = 30

Two Assignments = 20

Total marks = 50

University examination pattern

Q I - 8 short type questions of 5 marks each, 2 from each module

Q II - 2 questions A and B of 15marks each from module I with choice to answer any one

Q III - 2 questions A and B of 15marks each from module II with choice to answer any one

Q IV - 2 questions A and B of 15marks each from module III with choice to answer any one

Q V - 2 questions A and B of 15marks each from module IV with choice to answer any one

2K6ME 705 (B): OPTIMIZATION TECHNIQUES

3 hours lecture and 1 hour tutorial per week

MODULE I: Linear Programming I (14 hours)

Systems of linear equations and inequalities-convex sets-convex functions-formulation of linear programming problems-theory of simplex method-simplex algorithm-Big M method and two phase method-degeneracy-duality in linear programming-dual simplex method-optimization software packages-LINDO, LINGO-using LINGO to solve LPPs.

MODULE II: Linear Programming II (14 hours)

Sensitivity analysis-parametric programming-bounded variable problems-Integer programming-transportation problem-development of the method-degeneracy-unbalanced problems-assignment problem-development of the Hungarian method-routing problems.

MODULE III: Non-linear Programming (13 hours)

Mathematical preliminaries of non-linear programming-gradient and Hessian-unimodal functions-local and global optima-convex and concave functions-role of convexity-unconstrained optimization-Fibonacci search-golden section search-optimal gradient method-classical optimization-Legrange multiplier method-Kuhn-Tucker conditions-quadratic programming-separable convex programming-Frank and Wolfe method.

MODULE IV : Dynamic Programming and Metaheauristics (13 hours)

Nature of dynamic programming problem-Bellman's optimality principle-Cargo loading problem-replacement problems-multistage production planning and allocation problems.

Introduction to Genetic Algorithm-steps-coding and selection-reproduction-cross over and mutation

Text books and Reference books

1. Bazarra M.S., Jarvis J.J. & Sherali H.D., '*Linear Programming and Network Problems*', John Wiley
2. Bazarra M.S., Sherali H.D. & Shetty C.M., '*Nonlinear Programming, Theory and Algorithms',* John Wiley
3. Hadley G., '*Linear Programming*', Addison Wesley
4. Hillier F.S. & Lieberman G.J. '*Introduction to Operations Research'*, McGraw Hill
5. Ravindran A., Phillips D.T. & Solberg J.J., *Operations Research Principles and Practice*, John Wiley

6. Taha H.A., *Operations Research, An introduction*, P.H.I.
7. Wagner H.M., '*Principles of Operations Research with Application to Managerial Decisions'*, P.H.I.

Sessional work assessment

Two Tests = 30

Two Assignments = 20

Total marks = 50

University examination pattern

Q I - 8 short type questions of 5 marks each, 2 from each module

Q II - 2 questions A and B of 15marks each from module I with choice to answer any one

Q III - 2 questions A and B of 15marks each from module II with choice to answer any one

Q IV - 2 questions A and B of 15marks each from module III with choice to answer any one

Q V - 2 questions A and B of 15marks each from module IV with choice to answer any one

2K6ME 705(C): FLEXIBLE MANUFACTURING SYSTEMS

3 hours lecture & 1 hour tutorial per week

MODULE I: (13 hours)

Computer technology-Computer aided design and manufacturing-fundamentals of CAD-the design process-manufacturing database-computer graphics –software configuration-constructing the geometry-transformation-data base structure and content-wire frame and solid models

MODULE II :(13 hours)

Numerical control-basic components of NC systems-NC coordinate systems-motion control system-application of numerical control-NC part programming-punched tape-tape coding and format-manual part programming-computer assisted part programming-APT language-NC programming with interactive graphics

MODULE III: (13 hours)

Manufacturing systems-development of manufacturing system-components of FMS-FMS work station-Job coding and classification-group technology-benefits of FMS-tools and tooling-machining centres-head indexers-pallets-fixtures-work handling equipments-system storage-automated guided vehicles-industrial robots-programming of robots-assembly and inspection.

MODULE IV: (13 hours)

Flexible manufacturing system management-FMS control software-tool management-controlling precision-simulation and analysis of FMS-approaches to modeling for FMS-network simulation-simulation procedure-FMS design-economics of FMS-artificial intelligence.

Text books and References books

1. Groover M.P. *"Automation, Production Systems and Computer Integrated Manufacturing*", Prentice Hall of India
2. Groover, Emory & Zimmers, *"CAD/CAM Computer Aided Design and Manufacturing"*, Prentice Hall of India
3. Joseph Talavage & Hannam, "*Flexible Manufacturing Systems in Practice"*, Marcel Dekker Inc.

4. Kant Vajpayee, *"Principles of Computer Integrated Manufacturing*", Prentice Hall of India.
5. Yoram Koren, *"Computer Control of Manufacturing Systems*", McGraw, Hill Book Company.

Sessional work assessment

Two Tests = 30

Two Assignments = 20

Total marks = 50

University examination pattern

Q I - 8 short type questions of 5 marks each, 2 from each module

Q II - 2 questions A and B of 15marks each from module I with choice to answer any one

Q III - 2 questions A and B of 15marks each from module II with choice to answer any one

Q IV - 2 questions A and B of 15marks each from module III with choice to answer any one

Q V - 2 questions A and B of 15marks each from module IV with choice to answer any one

2K6ME 705(D): ADVANCED FLUID MECHANICS

3 hours lecture & 1 hour tutorial per week

MODULE I: (13 hours)

Basic equations of fluid flow: Reynolds transport equation-integral and differential formations-integral form of equations of the continuity-momentum and energy equations-use of integral equation-differential form of these equations-Stoke's postulates and constitutive equations-Navier-Stokes equations and energy equations for Newtonian fluids.

Non dimensionalisation of the equations of motion and order of magnitude analysis: Choice of characteristic quantities-identification of the non dimensional parameters- classification of flows based on the characteristic Reynolds number-approximate equations for low Re and high Re flows and boundary layer equations-boundary equations.

MODULE II: (13 hours)

Some exact solutions of the Navier-Stokes equations: Couette flows-plane Poisseuille-flow between rotating cylinders-Stokes problems-fully developed flow through circular and non-circular pipes

Approximate solutions: Creeping flow past a sphere-theory of hydrodynamic lubrication-boundary layer on a flat plate-Blassius solution and use of momentum integral equation.

MODULE III: (14 hours)

Introduction to compressible flows: Basic concepts-equations for one dimensional flow through steam tubes-speed of sound and Mach number-qualitiative difference between incompressible, subsonic and supersonic flows-characteristic velocities-adiabatic flow ellipse

Isentropic flow through a duct: Criterion for acceleration and deceleration-stagnation quantities-isentropic relations-use of gas tables-operation of nozzles at off design conditions.

Normal shocks in one dimensional flow: Occurrence of shocks-analysis of normal shocks-Prandtl's equation-Rankine-Hugoniot equation and other normal shock relations-moving shocks.

MODULE IV: (12 hours)

Oblique shocks and expansion waves: Oblique shock relations-θ-β-M relations-shock polar-supersonic flow over a wedge-expansion waves-Prandtl-Meyer function-intersection of shocks-detached shocks-Mach deflection-shock expansion theory.

Flow with friction: Fanno lines and Fanno flow relations-effect of friction on properties-choking-isothermal flows.

Flow with heat transfer: Rayleigh lines-effect of heat addition-thermal choking

Text books and Reference books

1. Muralidhar K. & Biswas G., *Advanced Engineering Fluid Mechanics,* Narosa Publishing House
2. Rathakrishnan E., *Gas Dynamics*, Prentice Hall India
3. Gupta V. & Gupta S., *Fluid Mechanics and its Applications,* Wiley Eastern Ltd.
4. White F.M., *Viscous Fluid Flow,* McGraw Hill
5. Zuckrow M.J. & Hoffman D.H., *Gas Dynamics*, McGraw Hill

Sessional work assessment

Two Tests = 30

Two Assignments = 20

Total marks = 50

University examination pattern

Q I - 8 short type questions of 5 marks each, 2 from each module

Q II - 2 questions A and B of 15marks each from module I with choice to answer any one

Q III - 2 questions A and B of 15marks each from module II with choice to answer any one

Q IV - 2 questions A and B of 15marks each from module III with choice to answer any one

Q V - 2 questions A and B of 15marks each from module IV with choice to answer any one

2K6ME 705(E): MULTI-PHASE FLOW

3 hours lecture & 1 hour tutorial per week

Module I (13 hours)

Basic equations and empirical correlations for multi-phase flow - flow patterns - identification and classification - flow pattern maps and transition - momentum and energy balance - homogeneous and separated flow models - correlations for use with homogeneous and separated flow models - two phase flow through inclined pipes and singularities - void fraction and slip ratio correlations - influence of pressure gradient - empirical treatment of two phase flow - drift flux model - correlations for bubble, slug and annular flows - pressure losses through enlargements, contractions, orifices, bends and values

Module II (13 hours)

Boiling and multiphase heat transfer - vapour-liquid equilibrium mechanisms - pool boiling convective boiling - heat transfer in partial and fully developed sub-cooled boiling - void fraction and pressure drop in sub-cooled boiling - saturated boiling heat transfer - two phase forced convection laminar and turbulent flow solutions for film heat transfer - empirical equations for film boiling and transition boiling - burnout mechanism and correlations - critical coefficient in nucleate and convective boiling

Module III (13 hours)

Condensation - basic processes of condensation - mechanism of evaporation and condensation - film condensation on a planar surface - dropwise condensation - pressure gradient in condensing systems - methods of improving heat transfer coefficient in condensation

Module IV (13 hours)

Critical multiphase flows - mathematical models - critical flow criterion - compatibility conditions and their physical interpretation - experimental observations - propagation of small disturbances - pressure drop limitation effect - graphical representation of critical flow conditions

Text books

Collier J.G., *Convective Boiling and Condensation,* McGraw Hill

Reference books

1. Hsu Y.Y. & Graham R.W., *Transport Processes in Boiling and Two Phase Systems*, Hemisphere
2. Ginoux J.J., *Two Phase Flows and Heat Transfer*, Hemisphere, McGraw Hill
3. Tong L.S., *Boiling Heat Transfer and Two Phase Flow*, Wiley
4. Hewitt G., Delhaye J.M. & Zuber N., *Multiphase Science and Technology*, Vol. I., McGraw Hill

Sessional work assessment

Two Tests = 30

Two Assignments = 20

Total marks = 50

University examination pattern

Q I - 8 short type questions of 5 marks each, 2 from each module

Q II - 2 questions A and B of 15marks each from module I with choice to answer any one

Q III - 2 questions A and B of 15marks each from module II with choice to answer any one

Q IV - 2 questions A and B of 15marks each from module III with choice to answer any one

Q V - 2 questions A and B of 15marks each from module IV with choice to answer any one

2K6ME 706(P): INSTRUMENTATION LAB

3 hours practicals per week

Study on concepts of measurement, types of errors, accuracy, precision, hysterisis, least square curve fitting, study of Stroboscope, transducers, strain gauges, rotometer, slip gauges and various precision measuring instruments.

List of experiments

1. Calibration of Bourden tube pressure gauge.
2. Calibration of LVDT.
3. Calibration of Thermocouple.
4. Calibration of Micrometer and vernier caliper.
5. Measurement of area by planimeter.
6. Preparation of psychrometric chart.
7. Statistical analysis of data.
8. Measurement using Profile projector.
9. Measurement of vibration and analysis.
10. Temperature measurement by pyrometer.
11. Calibration of Tachometer.
12. Determination of PH value.
13. Sound level measurement and analysis.
14. Flaw detection using ultrasonic tester.
15. Analysis of exhaust gas of I C engines.
16. Velocity measurement by Pitot tube.
17. Flaw measurement using Rotometer.
18. Measurement of drag and lift coefficients of an aerofoil using wind tunnel.
19. Experiment on strain gauges.

Sessional work assessment

Lab Practicals and Record = 35

Tests = 15

Total marks = 50

2K6ME 707(P): COMPUTATIONAL LAB

3 hours practicals per week

Study on the following

1. Design and Modeling
2. Mathematical Tools used in Engineering : MATLAB, Excel , etc.
3. Computational Fluid Dynamics, Heat Transfer and Structural Analysis

Programming (at Lab) on the following tools (C , C++ or Fortran)

1 Roots of Algebraic and Transcendental Equations

2 Solutions of Simultaneous Algebraic Equations

3 Curve Fitting and Optimization

4 Numerical Differentiation and Integration

5 Numerical Solution of Partial Differential Equations

Sessional work assessment

Lab Practicals and Record = 35

Tests = 15

Total marks = 50

2K6ME 708(P): MINI PROJECT

4 hours per week

The project work can be a design project, experimental fabrication project or software development project on any of the topics of mechanical engineering interest - it can be allotted as a group project with groups consisting of three or four students

The assessment of all the mini projects should be done by a committee consisting of three or four faculty members specialised in the various fields of **Mechanical Engineering** - the students will present their project work before the committee - the relative gradings and group average marks for the various projects will be fixed by the committee - the guide will award the marks for the individual students in the project maintaining the group average - each group will prepare the project report and submit to the department through the guide - the **Head Of the Department** will certify the copies and keep them in the departmental library

Sessional work assessment

Presentation = 30

Report = 20

Total marks = 50

2K6ME 709(P): PHYSICAL EDUCATION, HEALTH AND FITNESS

Introductory Lectures

Unit I. Health and Fitness: Modern concept of health and fitness, meaning, scope, need and importance of health, fitness and wellness.

Unit II. Exercise and Fitness: Means and methods of developing fitness. Importance of physical activities and exercises in developing and maintaining good health. Physical fitness and wellness.

Unit III. Sports and Physical education: Meaning and scope, role and importance of sports and games in the development of physical fitness and personality. Social values of sports. Rules of major games.

Practical Sessions

(All classes will be conducted after the normal working hours of the college)

50 sessions of minimum 1 hour duration each are envisaged (including Theory and Practical). The student can opt for one of the following activities in line with the specific programme / schedule announced by the faculty.

Athletics, Badminton, Basketball, Cricket, Football, General Fitness, Hockey, Kabaddi, Table Tennis, Ball Badminton, Archery, Volley ball, Yoga (not all activities may be offered in a particular semester. More disciplines will be offered based on the availability of infrastructure and expertise).

In addition, health and fitness assessment such as Height, Weight, Resting Pulse Rate, BMI, Blood Pressure, Physical Fitness Tests assessing various motor qualities of each individuals will be carried out (optional - based on request).

Objectives

1. Basically to inculcate awareness of health, general fitness and attitude to voluntary physical involvement.
2. To promote learning of basic skills in sports activities and secondarily to pave the way for mastering some of the skills through continued future involvement

Scheme of assessment

The student will be continuously assessed on his performance on the field of play. There will not be minimum mark for pass or fail. Total 50 marks will be given assessing their attendance, regularity, punctuality and performance for 50 hours of activity from Ist semester to 7th semester.

EIGHTH SEMESTER

Code	Subject	Hours/Week			Sessional Marks	University Exam	
		L	T	P		Hours	Marks
2K6ME 801	Gas Dynamics	3	1	-	50	3	100
2K6ME 802	Refrigeration and Air conditioning	3	1	-	50	3	100
2K6ME 803	Machine Design II	3	1	-	50	3	100
2K6ME 804	Inventory and Supply Chain Management	3	1	-	50	3	100
2K6ME 805	Elective III	3	1	-	50	3	100
2K6ME 806(P)	Seminar	-	-	4	50	-	-
*2K6ME 807(P)	Project and Industrial Training	-	-	6	100	-	-
2K6ME 808(P)	Viva Voce	-	-	-	-	-	100
TOTAL		**15**	**5**	**10**	**400**	**-**	**600**
Aggregate marks for 8 semesters =8400					**3000**		**5400**

*** 25 Marks is allotted for Industrial Training**

ELECTIVE-111

2K6ME 805(A) : FINITE ELEMENT ANALYSIS

2K6ME 805(B) : NEURAL NETWORKS AND FUZZY LOGIC

2K6ME 805(C) : COMPUTATIONAL FLUID MECHANICS AND HEAT TRANSFER

2K6ME 805(D) : SYSTEM SIMULATION AND MODELING

2K6ME 805(E) : QUALITY ENGINEERING AND MANAGEMENT

2K6ME 801 : GAS DYNAMICS

3 hours lecture & 1 hour tutorial per week

Module 1

Basic equations of fluid flow. Continuity, Momentum, Energy equations. Navier-Stokes equations. Introduction to compressible flow. Equation of state. Entropy Equation, The Stagnation Concept, Stagnation Pressure and Temperature, Consequences of Constant Density. Speed of sound. Mach number and Mach angle.

Module 11

Equations for compressible, one-dimensional duct flows. Sonic Velocity and Mach Number, Wave Propagation, Equations for Perfect Gases in terms of Mach Number, h-s and T-s Diagrams. Steady one dimensional isentropic flow with area change – Governing equations, effect of area change on flow properties, limiting conditions (choking), governing equation for the isentropic flow of a perfect gas, isentropic flow tables for a perfect gas, effect of area change on the flow properties, the converging nozzle. Effect of varying the back pressure and inlet pressure. Converging diverging or De Laval nozzle

Module 111

Shock waves – normal shock waves in perfect gas – governing equations, normal shock wave tables, the Rankine – Hugoniot equation for a normal shock wave, Prandtl's velocity equation, entropy change and shock strength. Oblique shock waves in perfect gas Governing equations, property ratios across an oblique shock wave, Rankine – Hugoniot equation. Expansion waves

Module 1V

Steady one dimensional adiabatic flow with friction in a constant area duct – governing equations, Fanno line, Fanno line equation for perfect gas, friction parameter, relationship between duct length and Mach number, entropy change caused by friction, effect of friction on flow properties, Fanno line tables.

Steady one dimensional flow with heat transfer in a constant area duct – governing equations, Rayleigh line, intersection of Fanno line and Rayleigh line, Rayleigh line equations for a perfect gas, relationship between heat transfer, stagnation temperature and Mach number, effect of heat transfer on flow properties, Rayleigh line tables.

Text books

1. Rathakrishnan. E., Gas dynamics, Prentice Hall India, New Delhi, 1995.
2. Shapiro, A.H., Dynamics & Thermodynamics of Compressible fluid flow, Ronald Press.
3. Zuckrow. M.J. & Hoffman, D.H., Gas Dynamics, McGraw Hill, New York.
4. Zucker R. D. and Biblarz Oscar, "Introduction to Gas Dynamics", John Wiley and Sons. Inc., Second Edition

Sessional work assessment

Two Tests = 30

Two Assignments = 20

Total marks = 50

University examination pattern

Q I - 8 short type questions of 5 marks each, 2 from each module

Q II - 2 questions A and B of 15marks each from module I with choice to answer any one

Q III - 2 questions A and B of 15marks each from module II with choice to answer any one

Q IV - 2 questions A and B of 15marks each from module III with choice to answer any one

Q V - 2 questions A and B of 15marks each from module IV with choice to answer any one

2K6ME 802 : REFRIGERATION AND AIR CONDITIONING

3 hours lecture & 1 hour tutorial per week

MODULE I (12 hours)

Introduction to refrigeration-unit of refrigeration-refrigerator and heat pump-coefficient of performance-reversed Carnot cycle-pressure enthalpy diagram-vapour compression refrigeration cycle-analysis of practical vapour compression cycle-non conventional refrigeration systems-thermo electric refrigeration-vortex tube-pulse tube refrigeration-refrigerant mixtures-cooling by adiabatic demagnetization

MODULE II (12 hours)

Steam jet refrigeration-analysis of steam jet refrigeration system-components-advantages and limitations-air refrigeration systems-thermodynamic analysis of bell coleman cycle-application to air craft refrigeration-absorption refrigeration systems-principle and operation of aqua ammonia and lithium-bromide water systems-electrolux system-comparison between vapour compression and absorption systems-introduction to adsorption refrigeration system-MEMS cooling systems

MODULE III (14 hours)

Refrigerants-thermodynamic physical and chemical properties of refrigerants-selection criteria of refrigerants-refrigerant compressors-reciprocating compressors-single and multi stage compression-effect of clearance-effect of inter cooling-optimum pressure ratios-efficiencies-rotary compressor-screw-vane type compressor-centrifugal compressor-hermetic-semi hermitic and open compressors-condensers-air cooled condensers-water cooled condensers and evaporative condensers-expansion devices-purpose and types-capillary tube-automatic expansion valve-thermostatic expansion valve-evaporators-flooded evaporators-dry expansion systems-natural convection evaporators-forced convection evaporators-shell and tube evaporators-shell and coil evaporators

MODULE IV(14 hours)

Psychrometry-psychrometric properties and relations-psychrometric chart-psychrometric processes-summer air conditioning system-winter air conditioning system-year round air conditioning system-central air conditioning system-unitary air conditioning system-direct

expansion system-all water system-all air system-air water system-design procedure for air conditioning systems-estimation of air conditioning load-noise and noise control-refrigeration and air conditioning controls-high pressure and low pressure cutout-high side and low side float valve-flow regulating devices-thermostats-humidstats

Text Book:

1. Stoecker, "Refrigeration and Air Conditioning.", Mc Graw Hill

Reference Books:

1. Roy J Doosat, " Principles of Refrigeration.", Pearson Education
2. C.P Arora, "Refrigeration and Air Conditioning." TMH
3. Ananthanarayanan, "Basic Refrigeration and Air Conditioning.", Mc Graw Hill
4. McQuston, "Heating, Ventilating and Air Conditioning" John Wiley

Sessional work assessment

Two tests	= 30
Two assignments	= 20
Total marks	= 50

University examination pattern

Q I - 8 short type questions of 5 marks each, 2 from each module

Q II - 2 questions A and B of 15marks each from module I with choice to answer any one

Q III - 2 questions A and B of 15marks each from module II with choice to answer any one

Q IV - 2 questions A and B of 15marks each from module III with choice to answer any one

Q V - 2 questions A and B of 15marks each from module IV with choice to answer any one

2K6ME 803: MACHINE DESIGN 11

3 hours lecture and 1 hour tutorial per week

Module I (13 Hours)

Design of clutches & brakes –friction clutches and brakes – uniform pressure and uniform wear assumptions – design of disc and cone types of clutches and brakes – design of external contracting and internal expanding elements – band type clutches and brakes – centrifugal clutches

Design of belts and chain drives – belt and chain drives of common types – design of flat and V belt drives Selection of roller chains

Module II (13 Hours)

Design of gears – spur, helical, bevel and worm gears – tooth loads – gear materials – design stresses - basic tooth stresses – stress concentration – service factor - velocity factor – bending strength of gear teeth - Buckingham's equation for dynamic load – surface strength and durability - heat dissipation - design for strength and wear.

Module III (13 Hours)

Lubrication & Journal bearing design – types of lubrication and lubricants – viscosity – journal bearing with perfect lubrication – hydrodynamic theory - design considerations – heat balance – journal bearing design – rolling contact bearings – bearing types - bearing life – static and dynamic capacity - selection of bearings with axial and radial loads – selection of tapered roller bearings – lubrication seals, shaft, housing and mounting materials

Module IV (13 Hours)

Product design for manufacturing – general design considerations for rolled sections – forgings – screws machine products –turned parts – machined round holes – parts produced on milling machine – welded parts and castings – modification of design for manufacturing easiness for typical products – preparation of working drawings – working

drawings for manufacture of parts with complete specifications including manufacturing details like tolerance – surface finish etc. – computer applications in the preparation for working drawings.

Text book

Shigley J.E., *Mechanical Engineering Design*, McGraw Hill Book Company

Reference books

1. Siegel, Maleev & Hartman, *Mechanical Design of Machines*, International Book Company
2. Phelan R.M., *Fundamentals of Mechanical Design,* Tata McGraw Hill Publishing Co. Ltd.
3. Doughtie V.L.& Vallance A.V., *Design of Machine Elements*, McGraw Hill Book Company
4. Juvinall R.C. & Marshek K.M., *Fundamentals of Machine Component Design*, John Wiley
5. Bralla J.G., *Handbook of Product Design for Manufacture*, McGraw Hill Book Company

Data hand books (allowed for reference during examinations)

1. Prof. Narayana Iyengar B.R. & Dr Lingaiah K., Machine Design Data Handbook
2. P.S.G., Tech., *Machine Design Data Handbook*

Sessional work assessment

Two tests = 30

Two assignments = 20

Total marks = 50

University examination pattern

Q I - 8 short type questions of 5 marks each, 2 from each module

Q II - 2 questions A and B of 15marks each from module I with choice to answer any one

Q III - 2 questions A and B of 15marks each from module II with choice to answer any one

Q IV - 2 questions A and B of 15marks each from module III with choice to answer any one

Q V - 2 questions A and B of 15marks each from module IV with choice to answer any one

2K6ME 804 :_ INVENTORY & SUPPLY CHAIN MANAGEMENT

3 hours lecture & 1 hour tutorial per week

Module I (12 hours)

Supply chain management (SCM) - concept of logistics and SCM - decision phases - design, planning and operation - decision areas - type of supply chain views - flows in supply chain - supply chain and competitive performance - performance measures for SCM - strategic fit - drivers of supply chain

Module II (12 hours)

Sourcing and procurement - sourcing - factors in source selection - vendor rating - qualitative and quantitative methods - purchasing - objectives and procedure - purchasing systems - tender method - computer based systems/EDI - inventory concept - functions of inventory - selective inventory control techniques - structure of inventory problem - costs associated with materials management - relevant costs

Module III (14 hours)

Independent demand items - probabilistic - single order quantities - payoff matrix - incremental analysis - mathematical formulation of discrete and continuous cases - independent demand items - deterministic and dynamic - deterministic inventory models without and with backordering - sensitivity analysis - quantity discount - all units and incremental discounts

Module IV (14 hours)

Independent demand items - probabilistic and dynamic inventory models - Q and P system models - dependent demand items - deterministic models - lot sizing models - lot by lot - EOQ - part period balancing - wagner-whitin method - concept of just-in-time - kanban - introduction to distribution requirement planning

Text books

1. Dobler D.W. & Burt D.N., *Purchasing and Supply Management: Text and Cases*, Tata McGraw Hill Publishing Company Limited
2. Tersine R.J., *Principles of Inventory and Materials Management*, Prentice-Hall Inc
3. Starr M.K. & Miller D.W., *Inventory Control: Theory and Practice*, Prentice Hall of India
4. Chopra S. & Meindl P., *Supply Chain Management: Strategy, Planning, and Operation,* Pearson Education Asia

Reference books

1. Christopher M., *Logistics and Supply Chain Management*, Pitman Publishing Company
2. John Mortimer (Editor), *Logistics in Manufacturing: An IFS Executive Briefing*, IFS Publications, U.K. & Springer-Verlag
3. Narasimhan S.L., Mcleavy D.W. & Billington P.J., *Production Planning and Inventory Control*, Prentice Hall of India
4. Raghuram G. & Rangaraj N., *Logistics and Supply Chain Management: Cases and Concepts*, Macmillan India Limited

Sessional work assessment

Two tests = 30

Two assignments = 20

Total marks = 50

University examination pattern

Q I - 8 short type questions of 5 marks each, 2 from each module

Q II - 2 questions A and B of 15marks each from module I with choice to answer any one

Q III - 2 questions A and B of 15marks each from module II with choice to answer any one

Q IV - 2 questions A and B of 15marks each from module III with choice to answer any one

Q V - 2 questions A and B of 15marks each from module IV with choice to answer any one

2K6ME 805(A): FINITE ELEMENT ANALYSIS

3 hours lecture and 1 hour tutorial per week

Module I (13 hours)

Linear vector spaces - linear transformations and functionals - linear, bilinear and quadratic forms - theory of normed spaces - theory of inner product spaces - concepts from variational calculus - variational methods of approximation - Ritz method - weighted residual method - Galerkin method - subdomain method - collocation method

Module II (11 hours)

Finite element analysis of one dimensional problems - procedure - one dimensional elements and interpolation functions - analysis of one dimensional second and fourth order equations - approximation errors in the finite element method - computer implementation

Module III (15 hours)

Finite element analysis of two dimensional problems - two dimensional elements and interpolation functions - second order equations involving a scalar valued function - comments on mesh generation and composition of boundary conditions - analysis of plane elasticity and incompressible fluid flow problems - time dependent problems (transient heat transfer) - isoparametric elements and numerical integration

Module IV (13 hours)

Alternative formulations - least square formulation - mixed formulation - Eigenvalue problems - nonlinear problems - three dimensional elements and interpolation functions - formulation of three dimensional problems (two and three dimensional Navier-Stokes equations - three dimensional heat transfer equations)

Text books

1. Reddy J.N., *An Introduction to the Finite Element Method,* McGraw Hill International Edition
2. Reddy J.N., *Applied Functional Analysis and Variational Methods in Engineering*, McGraw Hill, International Edition

Reference books

1. Huebner K.H., *The Finite Element Method for Engineers*, John Wiley
2. Zenkiewicz O., *The Finite Element Method,* McGraw Hill International Edition

Sessional work assessment

Two tests = 30

Two assignments = 20

Total marks = 50

University examination pattern

Q I - 8 short type questions of 5 marks each, 2 from each module

Q II - 2 questions A and B of 15marks each from module I with choice to answer any one

Q III - 2 questions A and B of 15marks each from module II with choice to answer any one

Q IV - 2 questions A and B of 15marks each from module III with choice to answer any one

Q V - 2 questions A and B of 15marks each from module IV with choice to answer any one

2K6ME 805(B): NEURAL NETWORKS & FUZZY LOGIC

3 hours lecture and 1 hour tutorial per week

Module I (13 hours)

Introduction to artificial neural networks - biological neurons - Mc Culloch and Pitts modals of neuron - types of activation function - network architectures - knowledge representation - learning process - error-correction learning - supervised learning - unsupervised learning - single unit mappings and the perceptron - perceptron convergence theorem (with out proof) - method of steepest descent - least mean square algorithms - adaline/medaline units - multilayer perceptrons - derivation of the back-propagation algorithm

Module II (13 hours)

Radial basis and recurrent neural networks - RBF network structure - covers theorem and the separability of patterns - RBF learning strategies - K-means and LMS algorithms - comparison of RBF and MLP networks - recurrent networks - Hopfield networks - energy function - spurious states - error performance - simulated annealing - the Boltzman machine - Boltzman learning rule - the mean field theory machine - MFT learning algorithm - applications of neural network - the XOR problem - traveling salesman problem - image compression using MLPs - character retrieval using Hopfield networks

Module III (13 hours)

Fuzzy logic - fuzzy sets - properties - operations on fuzzy sets - fuzzy relations - operations on fuzzy relations - the extension principle - fuzzy measures - membership functions - fuzzification and defuzzification methods - fuzzy controllers - Mamdani and Sugeno types - design parameters - choice of membership functions - fuzzification and defuzzification methods - applications

Module IV (13 hours)

Introduction to genetic algorithm and hybrid systems - genetic algorithms - natural evolution - properties - classification - GA features - coding - selection - reproduction - cross over and mutation operators basic GA and structure

Introduction to Hybrid systems - concept of neuro-fuzzy and neuro-genetic system

Text books and Refrerence books

1. Simon Haykins, "*Neural Network a - Comprehensive Foundation"*, Macmillan College, Proc, Con, Inc
2. Zurada J.M., "*Introduction to Artificial Neural Systems,* Jaico publishers
3. Driankov D., Hellendoorn H. & Reinfrank M., "*An Introduction to Fuzzy Control*", Norosa Publishing House
4. Ross T.J., *"Fuzzy Logic with Engineering Applications"*, McGraw Hill
5. Bart Kosko. *"Neural Network and Fuzzy Systems"*, Prentice Hall, Inc., Englewood Cliffs
6. Goldberg D.E., *"Genetic Algorithms in Search Optimisation and Machine Learning"*, Addison Wesley
7. Suran Goonatilake & Sukhdev Khebbal (Eds.), *"Intelligent Hybrid Systems*", John Wiley

Sessional work assessment

Two tests = 30

Two assignments = 20

Total marks = 50

University examination pattern

Q I - 8 short type questions of 5 marks each, 2 from each module

Q II - 2 questions of 15marks each from module I with choice to answer any one

Q III - 2 questions of 15marks each from module II with choice to answer any one

Q IV - 2 questions of 15marks each from module III with choice to answer any one

Q V - 2 questions of 15marks each from module IV with choice to answer any one

2K6ME 805(C): COMPUTATIONAL FLUID MECHANICS

3 hours lecture and 1 hour tutorial per week

Module I (12 hours)

Classification of partial differential equations - system of first and second-order partial differential equations - initial and boundary conditions - finite difference formulations - finite difference equations - finite difference approximation of mixed partial derivatives

Module II (12 hours)

Parabolic partial differential equations - explicit methods - implicit methods - parabolic equations in two-space dimensions - consistency, stability, and error analysis of finite difference equations - artificial viscosity

Module III (12 hours)

Elliptic equations - finite difference formulations - solution algorithms - hyperbolic equations - finite difference formulations -splitting methods - multiple-step method

Module IV (16 hours)

Scalar representation of the navier - stokes equations - model equations - numerical algorithms - incompressible navier - stokes equations - primitive variable and vorticity - stream function formulations - poisson equation for pressure - numerical algorithms - boundary conditions - staggered grid

Text book

Hoffmann Klaus A., "*Computational Fluid Dynamics for Engineers - Volume I*", Engineering Education System, Wichita

Reference books

1. Patankar Suhas V., "*Numerical Heat Transfer and Fluid Flow*", Taylor & Francis
2. Fletcher C.A.J., "*Computational Techniques for Fluid Dynamics I*, Springer Verlag
3. Anderson Dale A., Tannehill John C. & Pletcher Richard H., "*Computational Fluid Mechanics and Heat Transfer*", Taylor & Francis

Sessional work assessment

Computer run assignments	= 20
Two tests	= 30
Total	= 50

University examination pattern

Q I - 8 short type questions of 5 marks each, 2 from each module

Q II - 2 questions A and B of 15marks each from module I with choice to answer any one

Q III - 2 questions A and B of 15marks each from module II with choice to answer any one

Q IV - 2 questions A and B of 15marks each from module III with choice to answer any one

Q V - 2 questions A and B of 15marks each from module IV with choice to answer any one

2K6ME 805(D): SYSTEM SIMULATION AND MODELING

3 hours lecture and 1 hour tutorial per week

MODULE I (14 hours)

System concepts-systems and system environment-component of a system-discrete and continous systems-types of system study-system analysis-system design and system postulation-system models-types of models-system simulation-steps in a simulation study-comparison of simulation and analytical models-Monte Carlo simulation –examples of simulation of single server queuing system and simple inventory systems-concepts in discrete event system simulation-event scheduling/time advance algorithms-modeling world views.

MODULE II (12 hours)

Random number generation-techniques for generating random number-linear congruential method-test for random numbers-frequency tests-Kolmogorov-Smirnov test and the Chi-square test-random variate generation-inverse transformation method-exponential, uniform, and empirical discrete and empirical continuous distributions-input modeling for simulation-data collection-identifying the distribution using histograms-parameter estimation-Chi-square goodness of fit test.

MODULE III (13 hours)

Verification and validation of simulation models-verification of simulation models-calibration and validation of models-face validity-validation of model assumption and validating input output transformations-output analysis for a single model-types of simulation with respect to output analysis-measures of performance and their estimation-output analysis for terminating simulation-confidence interval estimation for a fixed number of replication-confidence interval with specified precision-output analysis for steady state simulation-initialization bias-replication methods-sample size determination for a specified precision-batch means method.

MODULE IV (13 hours)

Simulation modelling and analysis of manufacturing systems-objectives-performance measures-issues in simulation of manufacturing systems-simulation of simple job shop manufacturing systems-introduction to simulation software for manufacturing applications-salient features of simulation languages such as general purpose simulation systems(GPSS),

and simulation language for alternative modelling(SLAM)-salient features of simulators such as WITNESS and Arena.

Text book

Banks J., Carson J.S. & Nelson B.L., *Discrete-Event System Simulation,* Prentice Hall of India

Reference books

1. Askin R.G. & Standridge C.R., *Modelling and Analysis of Manufacturing Systems,* John Wiley
2. Deo N., *System Simulation with Digital Computer*, Prentice-Hall of India Private Limited
3. Gordon G., *System Simulation*, Prentice Hall of India Private Limited
4. Law A.W. & Kelton W.D., *Simulation Modelling and Analysis*, Third Edition, McGraw Hill International Editions
5. Kelton W.D., Sadowski R.P. & Sadowski D.A., *Simulation with ARENA*, WCB/McGraw Hill International Editions

Sessional work assessment

Two tests = 30

Two assignments = 20

Total marks = 50

University examination pattern

Q I - 8 short type questions of 5 marks each, 2 from each module

Q II - 2 questions A and B of 15marks each from module I with choice to answer any one

Q III - 2 questions A and B of 15marks each from module II with choice to answer any one

Q IV - 2 questions A and B of 15marks each from module III with choice to answer any one

Q V - 2 questions A and B of 15marks each from module IV with choice to answer any one

2K6ME 805 (E): QUALITY ENGINEERING AND MANAGEMENT

3 hours lecture and 1 hour tutorial per week

Module I (10 hours)

Introduction to the concept of quality - quality control - quality assurance - quality management - quality and total quality - small q and big Q - concept of total quality management - TQM axioms - major contributions of deming, juran and crossby to quality management - enablers for total quality - strategic quality management

Module II (10 hours)

Quality costs - analysis of quality costs - loss function - taguchi methods - total quality tools - pareto chart - fishbone diagram - checksheet - histograms - scatter diagrams - run charts - flow diagram - survey - implementing - total quality - ISO 9000 certification - quality circles- motivation theories

Module III (10 hours)

Customer needs and product quality - market research - product design - quality function deployment - reliability - reliability goals - failure mode, effect, and criticality analysis - design for safety - error proofing design for manufacturability - manufacturing planning for quality - quality responsibilities on the factory floor - total employee involvement and empowerment - benchmarking - continuos improvement strategies - kaizen approach

Module IV (11 hours)

Statistical tools in quality - making predictions using the normal, poisson and binomial probability distributions - statistical process control - control charts for variables - $\bar{X}$, R and σ charts - process capability indices - control charts for attributes - P, np, c and u charts

Module V (11 hours)

Acceptance sampling - lot by lot acceptance using single sampling by attributes - OC curve - average outgoing quality and the AOQL - double sampling - multiple and sequential sampling - dodge - romig sampling tables - ATI and AFI - introduction to life testing and reliability

Text books

1. Juran J.M., Gryna F.M., "*Quality Planning and Analysis*", Tata McGraw Hill Publishing Company
2. Grant E.L. & Leavenworth R.S., "*Statistical Quality Control*", McGraw Hill International Edition
3. Geoetsch D.L. & Davis S.B., "*Introduction to Total Quality: Quality Management for Production, Processing and Services",* Prentice Hall International, Inc.
4. Logothetis N., "*Managing for Total Quality*", Prentice Hall of India Private Limited
5. Bharat Wakhlu, "*Total Quality*", Wheeler Publishing

Sessional work assessment

Two tests	= 30
Two assignments	= 20
Total marks	= 50

University examination pattern

Q I - 8 short type questions of 5 marks each, 2 from each module

Q II - 2 questions A and B of 15marks each from module I with choice to answer any one

Q III - 2 questions A and B of 15marks each from module II with choice to answer any one

Q IV - 2 questions A and B of 15marks each from module III with choice to answer any one

Q V - 2 questions A and B of 15marks each from module IV with choice to answer any one

2K6ME 806(P): SEMINAR

4 hours per week

Individual students should be asked to choose a topic in any field of mechanical engineering, preferably from outside the B.Tech syllabus and give a seminar on that topic for about thirty minutes - a committee consisting of at least three faculty members (preferably specialised in different fields of mechanical engineering) will assess the presentation of the seminars and award the marks to the students - each student should be asked to submit two copies of a write up of his seminar talk - one copy should be returned to the student after duly certifying it by the H O D and the other kept in the departmental library

Sessional work assessment

Presentation	= 30
Report	= 20
Total marks	= 50

2K6ME 807(P): PROJECT AND INDUSTRIAL TRAINING

(6 hours per week)

The project work can be a Modeling and Simulation, Case study, Design or Experiments in the field of Mechanical Engineering. It can be allotted as a group project with groups consisting of 3 to 4 students. The project work started in the seventh semester (mini project) may be continued in this semester - the students should complete the project work in this semester and present it before the assessment committee

The assessment committee will assess the various projects, fix the relative grading and group average marks - the guides will award the marks for the individual students in a project maintaining the group average - each group should submit the copies of the completed project report signed by the guide (in the format prescribed by the department) to the department - the Head Of the Department will certify the copies and return them to the students - one copy will be kept in the departmental library

All students should undergo Industrial Training Programme either by attending a training programme for a minimum of 5 days in a Registered Industry / Research Institute or by visiting at least 5 reputed Industries / Engg Establishments. They have to submit a report of the Industrial Training Programme.

A maximum of 25 marks will be awarded for the Industrial Training.

Sessional work assessment

Project Work = 75

Industrial Training = 25

Total marks = 100

2K6ME 808(P): VIVAVOCE

There is only university examination for VIVA VOCE - the university will appoint examiners for conducting the viva voce examination - the examiners will ask questions from subjects studied for the B.Tech. Course, Mini Project, Project and Industrial Training and Seminar etc. The relative weightage will be as follows :

Subjects	= 30.
Mini Project	= 20
Project and Industrial Training	= 30
Seminar	= 20
Total marks	= 100

KANNUR UNIVERSITY

FACULTY OF ENGINEERING

Curricula, Scheme of Examinations and Syllabi

for

B.Tech Degree(Part-Time) Programme in

MECHANICAL ENGINEERING

V11 and V111 Semesters

With Effect From 2007 Admissions

SEVENTH SEMESTER

Code	Subject	Hours/Week			Sessional Marks	University Exam	
		L	T	P		Hours	Marks
2K6PTME 701	Metrology and Instrumentation	2	-	-	50	3	100
2K6PTME 702	Industrial Management	2	-	-	50	3	100
2K6PTME 703	Machine Design I	2	1	-	50	3	100
2K6PTME 704	Power plant Engineering	2	-	-	50	3	100
2K6PTME 705	Elective II	2	-	-	50	3	100
2K6PTME 706(P)	Instrumentation Lab	-	-	3	50	3	100
2K6PTME 707(P)	Computational Lab	-	-	3	50	3	100
2K6PTME 708(P)	Mini Project	-	-	3	50	-	-
2K6PTME 709(P)	Physical Education, Health and Fitness	-	-	-	50	-	-
TOTAL		**10**	**1**	**9**	**450**	**-**	**700**

ELECTIVE-11

2K6PTME 705 (A) MARKETING MANAGEMENT

2K6PTME 705 (B) OPTIMIZATION TECHNIQUES

2K6PTME 705 (C) FLEXIBLE MANUFACTURING SYSTEMS

2K6PTME 705 (D) ADVANCED FLUID MECHANICS

2K6PTME 705 (E) MULTIPHASE FLOW

2K6PTME 701: METROLOGY AND INSTRUMENTATION

2 hours lecture per week

Module I (13 hours)

Applications of measuring instruments-functional elements of an instrument-instrument as transducer-generalised measuring instrument-generalised mathematical model of measuring systems-zero order, first order and second order instruments-classification of instruments - input/output configurations - methods of correction for spurious inputs-inherent insensitivity - high-gain feed-back - signal - filtering and opposing inputs - static calibration and determination of bias and random error of an instrument- assumption of Gaussian distribution for experimental data-chi-square goodness-of-fit test-method of least squares for curve fitting - static characteristics-accuracy loading effect-backlash-friction-hysteresis-threshold-dead space- resolution-static sensitivity and linearity-problems on friction-loading effect-sensitivity and calibration

Module II (13 hours)

Uncertainty in "computed quantities" from measured values - estimation of permissible uncertainties of instruments for specific purposes - potentiometer transducer as a zero order instrument - analysis of its loading error - mercury-in-glass thermometer as a first order instrument - step, ramp and frequency response of first order instruments - problems - seismic instrument as a second order instrument - step, terminated ramp, ramp and frequency response of second order instruments - slip gages - assembling the blocks - temperature problems - LVDT - comparators: principle of working of mechanical, electrical, pneumatic comparators - measurement of strain: strain gauge classification - unbonded and bonded strain gauges - gage factor - strain gauge rosettes - selection and installation of bonded gauges - ballast, DC bridges and constant current circuits - temperature compensation – calibration

Module III (13 hours)

Measurement of force: multiple lever system for weighing - strain gauge load cells - temperature sensitivity-ballistic weighing-hydraulic & pneumatic load cells-measurement of torque: water brake Heenan & Froude hydraulic dynamometer - general purpose electric dynamometer - measurement of temperature: pressure thermometers-RTDs-compensation for lead resistance-thermistors - thermocouples - series in parallel connected thermocouples -

materials used and there ranges - pyrometry-infrared pyrometry - air pollution measurement: gas chromatography - Orsat's apparatus - nuclear instrumentation: Gieger Muller counter - ionisation chamber - scintillation counters

Module IV (13 hours)

Acoustical measurements: characterisation of sound (noise) - basic acoustical parameters - sound pressure - sound pressure level, power, intensity and power level - combination of sound pressure levels - attenuation with distance - psychoacoustic relationships - micro-phones - sound level meter - principles of automatic control: open and closed loop systems - servo mechanism - process control and regulators - mathematical modelling of mechanical and electrical systems - transfer function of simple systems - time domain analysis of control system: steady state response - steady state error - error coefficients - stability of control systems: concept of stability - method of determining stability of linear control systems - Routh Hurwitz criterion

Text Books and References

1 Beckwith T.G., Marangoni R.D. & Lienhard J.H., "*Mechanical Measurements"*

2 Doebelin E.O., *"Measurement Systems"*, McGraw Hill Publishing Company

3 Holman J.P., *"Experimental Methods for Engineers"*, McGraw Hill Inc.

4 Kuo, *"Automatic Control Systems"*, Asian Student Edition, Prentice Hall of India

Sessional work assessment

Two assignments = 20

Two tests = 30

Total marks = 50

University examination pattern

Q I - 8 short type questions of 5 marks each, 2 from each module

Q II - 2 questions A and B of 15marks each from module I with choice to answer any one

Q III - 2 questions A and B of 15marks each from module II with choice to answer any one

Q IV - 2 questions A and B of 15marks each from module III with choice to answer any one

Q V - 2 questions A and B of 15marks each from module IV with choice to answer any one

2K6PTME 702 : INDUSTRIAL MANAGEMENT

2 hours lecture per week

Module I (14 hours)

Management concepts - system concepts of management - management functions - planning - principles of planning - organizing - organization structures - principles of organizing - span of control - delegation - leadership - directing - controlling

Decision making - strategic and tactical decisions - models of decision making - single stage decisions under risk - multi stage decision making - decision trees - decision making under uncertainty - Baye's decision theory - equally likely - minimax - maximum likelihood - maximin criterion –

Module II (12 hours)

Network techniques - basic concepts - network construction - CPM and PERT networks - algorithm for critical path - slacks and their significance - crashing - network flow problems - the shortest route problem - minimal spanning tree problem - maximal flow in capacitated network

Module III (14 hours)

Production planning and control - scope and objectives - functions of PPC - product consumption cycle - production planning - process planning - material requirement planning - forecasting - methods of forecasting - moving average method - single exponential smoothing - linear regression - linear forecaster - scheduling - objectives - performance measures - priority rules - single machine scheduling - job shop scheduling - 2 jobs N machines - flow shop scheduling - N jobs 2 machines - N jobs 3 machines scheduling

Module IV (12 hours)

Human resources management - job design - job enrichment - job enlargement - job evaluation - merit rating - wages and incentives - work study - method study - time study - work sampling.

Costing - cost concepts - concept of cost accounting - elements of cost - overhead costs - methods of allocation of overhead costs - depreciation - methods of depreciation - financial

management - time value of money - comparison of alternatives - payback period method - net present value method - internal rate of return method - basics of financial accounting - profit and loss account - balance sheet preparation

Text books

1. Koontz H., O'Donnel & Weihrich H., *Essentials of Management*, McGraw Hill Book Company
2 Mazda F., *Engineering Management*, Low Price Edition, Addison Wesley
3. Pandey I.M., *Financial Management*, Eighth Edition, Vikas Publishing House Private Limited
4 Bhattacharya A.K., *Principles and Practice of Cost Accounting,* Wheeler Publishing
5 Venkata Ratnam C.S. & Srivastava B.K., *Personnel Management and Human Resources*, Tata McGraw Hill Publishing Company Limited
6 Barnes., *Motion and Time Study Design and Measurement of Work*, Wiley
7 Jerome D Weist, *A Management Guide to PERT/CPM,* Mc.Graw Hill Co.
8 Samuel Eilon., Elements of Production Planning and Control, Prentice Hall India.

Reference books

1 Chase R.B., Aquilano N.J. & Jacobs F.R., *Production and Operations Management: Manufacturing and Services,* Eighth Edition, Tata McGraw Hill Publishing Company Limited

2 Prasanna Chandra, *Financial Management: Theory and Practice*, Fourth Edition, Tata McGraw Hill Publishing Company Limited

Sessional work assessment

Two assignments = 20

Two tests = 30

Total marks = 50

University examination pattern

Q I - 8 short type questions of 5 marks each, 2 from each module

Q II - 2 questions A and B of 15marks each from module I with choice to answer any one

Q III - 2 questions A and B of 15marks each from module II with choice to answer any one

Q IV - 2 questions A and B of 15marks each from module III with choice to answer any one

Q V - 2 questions A and B of 15marks each from module IV with choice to answer any one

2K6PTME 703: MACHINE DESIGN I

2 hours lecture & 1 hour tutorial per week

Module I (13 Hours)

Introduction to design- Steps in design process –Design factors –Tolerances & fits – principles of standardization – Codes & standards – Selection of materials

Introduction to Computer aided design – Introduction to modeling, drafting, simulation and analysis software packages.

Stress & Strength considerations of mechanical elements – Stress concentration Theories of failure –Impact load – Fatigue loading – consideration of creep and thermal stresses in design.

Module II (13 Hours)

Threaded fasteners –Thread standards – Stresses in screw threads – preloading of bolts – bolted joints – eccentric loading – gasketed joints – Fatigue loading - analysis of power screws.

Keys – types of keys and pins – stresses in keys and pins – design of keys – design of cotter and pin joints

Riveted Joints – stresses in riveted joints – strength analysis – boiler and tank joints – structural joints

Module III (13 Hours)

Welded joints – types of welded joints – stresses in butt and fillet welds – torsion and bending in welded joints- welds subject to fluctuating loads – design of welded machine parts and structural joints.

Springs – Stresses in helical springs- deflection of helical springs – extension, compression and torsion springs- design of helical springs for static and fatigue loading – critical frequency of helical springs – stress analysis and design of leaf springs

Module IV (13 Hours)

Power shafting – stresses in shafts – design for static loads – reversed bending and steady torsion – design for strength and deflection – design for fatigue loading – critical speed of shafts – stresses in couplings – design of couplings

Text books:

1 Joseph Edward Shigley, Mechanical Engineering Design, McGraw Hill Book Company.

2 V B Bhandari, Design of Machine elements, Tata McGraw Hill Publishing Co. Ltd.

Reference books:

1 Stegel, Maleev & Hartman, Mechanical Design of Machines, International Book Company

2 Phelan R. M, Fundamentals of Mechanical Design, Tata McGraw Hill Publishing Co. Ltd.

3 Doughtie V L & Vallance. A V., Design of Machine Elements, McGraw Hill Book Company.

4 Paul H Black & O Eugene Adams Jr., Machine Design, McGraw Hill Book Company.

5 M F Spotts, T E Shoup, Design of Machine elements, Prentice Hall

6 V B Bhandari, Introduction to Machine Design, Tata McGraw Hill Publishing Co. Ltd.

7 Georeg E Dieter, Engineering Design, McGraw Hill Book Company.

8 Jack A Collins, Failure of Materials in Mechanical Design: Analysis, Prediction, Prevention. John Wiley & Sons Inc.

9 Ibrahim Zeid, CAD/CAM theory and practice, McGraw Hill Book Company.

Data hand books (allowed for reference during examinations)

1 Prof. Narayana Iyengar B R & Dr. Lingaiah K, Machine Design Data Hand Book Vol. I & II.

2 P. S. G. Tech, Machine Design Data Handbook

Sessional work assessment

Two tests = 30

Two assignments = 20

Total marks = 50

University examination pattern

Q I - 8 short type questions of 5 marks each, 2 from each module

Q II - 2 questions A and B of 15marks each from module I with choice to answer any one

Q III - 2 questions A and B of 15marks each from module II with choice to answer any one

Q IV - 2 questions A and B of 15marks each from module III with choice to answer any one

Q V - 2 questions A and B of 15marks each from module IV with choice to answer any one

2K6PTME 704 POWER PLANT ENGINEERING

2 hours lecture per week

MODULE I (12 hours)

Steam engineering-temperature entropy diagram-mollier diagram-rankine cycle-modified rankine cycle-reheat and regenerative-binary vapour cycle-steam generators-classifications-cochran boiler-lancashire boiler-cornish boiler-locomotive boiler-babcock and wilcox boiler-stirling boiler-high pressure boilers-boiler mountings and accessories

MODULE II (12 hours)

Steam nozzles-flow through steam nozzles-throat pressure for maximum discharge- effect of friction-super saturated flow-steam turbines-impulse and reaction turbines-velocity diagram-condition for maximum efficiency-compounding-reheat factor-blade height-governing of steam turbines-cogeneration and combined cycle power generation-steam engines-components-compounding-indicator diagram

MODULE III (16 hours)

Thermal power plants-general layout-site selection-fuel handling storage and burning systems-dust and ash handling system-chimney draught-nuclear power plants-classification-components-safety measures-effects of nuclear radiation-nuclear waste disposal-gas turbine power plants-classification-closed open and other systems-hydro electric power plants-combined operation of different power plants-non conventional power generation-solar thermal collection-thermal storage-ocean power-principle of OTEC systems-wind energy-wind turbine-geothermal energy-geothermal electrical power plants-biogas energy-biogas production-design and construction of biogas plants

MODULE IV (12 hours)

Economics of power generation-terms and definitions-estimation of load-load curve-load factor-diversity factor-capacity factor-use factor-economics in plant selection-economics of generation and distribution of power-useful life-tariff for electrical energy-environmental pollution and its control-steam power plant pollutants-control of pollutants-control of particulate matter-control of SO_2- control of NO_2-control of waste water from steam power plants-pollution from nuclear power plants-noise pollution and noise control

Text Book:

1. El Wakil, “Power Plant Technology” McGraw Hill

Reference Books:

1. Nag, “Power Plant Engineering” TMH
2. Ngpal, “Power Plant Engineering” Khanna
3. Vapat & Scrotski, “Power Station Engineering and Economy” TMH
4. John F Lee, “Power Station Engineering and Economy” TMH

Sessional work Assessment

Two Tests	=30
Two Assignments	=20
Total Marks	=50

University examination pattern

Q I - 8 short type questions of 5 marks each, 2 from each module

Q II - 2 questions A and B of 15marks each from module I with choice to answer any one

Q III - 2 questions A and B of 15marks each from module II with choice to answer any one

Q IV - 2 questions A and B of 15marks each from module III with choice to answer any one

Q V - 2 questions A and B of 15marks each from module IV with choice to answer any one

2K6PTME 705 (A): MARKETING MANAGEMENT

2 hours lecture per week

Module I (14 hours)

Introduction to marketing - concept of market and marketing - marketing environment - controllable factors - factors directed by top management - factors directed by marketing - uncontrollable factors - demography, economic conditions, competition, social and cultural forces, political and legal forces, and technology

Module II (14 hours)

Marketing planning - marketing planning process - Boston consultancy group model - marketing mix - marketing mix variables - market segmentation and market targeting - introduction to segmentation - targeting and product positioning

Module III (12 hours)

Marketing research - need and scope - marketing research process - research objectives, developing research plan, collecting information, analysis, and findings - consumer behaviour - factors influencing consumer behaviour - perceived risks - product life cycle - marketing strategies for different stages of product life cycle

Module IV (12 hours)

Marketing communication - marketing mix variables - steps in developing effective communication - identification of target audience - determination of communication objectives - designing the message - selecting the communication channels - promotion mix evaluation - advertising and sales promotion - factors in advertising - sales promotion tools

Text books

1. Kotler P., *Marketing Management: Analysis, Planning, Implementation and Control*, Prentice Hall of India Private Limited
2. Ramaswamy V.S. & Namkumari S., *Marketing Management: Planning, Implementation and Control*, Macmillan India Limited

Reference books

1 Stanton W.J., Etzel M.J. & Walker B.J., *Fundamentals of Marketing,* McGraw Hill International Edition

2 Majumdar R., *Marketing Research*, *Text, Applications and Case Studies*, New Age International (P) Limited Publishers

3 Robert, *Marketing Research,* Prentice Hall of India

Sessional work assessment

Two Tests = 30

Two Assignments = 20

Total marks = 50

University examination pattern

Q I - 8 short type questions of 5 marks each, 2 from each module

Q II - 2 questions A and B of 15marks each from module I with choice to answer any one

Q III - 2 questions A and B of 15marks each from module II with choice to answer any one

Q IV - 2 questions A and B of 15marks each from module III with choice to answer any one

Q V - 2 questions A and B of 15marks each from module IV with choice to answer any one

2K6PTME 705 (B): OPTIMIZATION TECHNIQUES

2 hours lecture per week

MODULE I: Linear Programming I (14 hours)

Systems of linear equations and inequalities-convex sets-convex functions-formulation of linear programming problems-theory of simplex method-simplex algorithm-Big M method and two phase method-degeneracy-duality in linear programming-dual simplex method-optimization software packages-LINDO, LINGO-using LINGO to solve LPPs.

MODULE II: Linear Programming II (14 hours)

Sensitivity analysis-parametric programming-bounded variable problems-Integer programming-transportation problem-development of the method-degeneracy-unbalanced problems-assignment problem-development of the Hungarian method-routing problems.

MODULE III: Non-linear Programming (13 hours)

Mathematical preliminaries of non-linear programming-gradient and Hessian-unimodal functions-local and global optima-convex and concave functions-role of convexity-unconstrained optimization-Fibonacci search-golden section search-optimal gradient method-classical optimization-Legrange multiplier method-Kuhn-Tucker conditions-quadratic programming-separable convex programming-Frank and Wolfe method.

MODULE IV : Dynamic Programming and Metaheauristics (13 hours)

Nature of dynamic programming problem-Bellman's optimality principle-Cargo loading problem-replacement problems-multistage production planning and allocation problems.

Introduction to Genetic Algorithm-steps-coding and selection-reproduction-cross over and mutation

Text books and Reference books

1. Bazarra M.S., Jarvis J.J. & Sherali H.D., '*Linear Programming and Network Problems*', John Wiley
2. Bazarra M.S., Sherali H.D. & Shetty C.M., '*Nonlinear Programming, Theory and Algorithms',* John Wiley
3. Hadley G., '*Linear Programming*', Addison Wesley
4. Hillier F.S. & Lieberman G.J. '*Introduction to Operations Research'*, McGraw Hill
5. Ravindran A., Phillips D.T. & Solberg J.J., *Operations Research Principles and Practice*, John Wiley

6 Taha H.A., *Operations Research, An introduction*, P.H.I.

7 Wagner H.M., '*Principles of Operations Research with Application to Managerial Decisions'*, P.H.I.

Sessional work assessment

Two Tests = 30

Two Assignments = 20

Total marks = 50

University examination pattern

Q I - 8 short type questions of 5 marks each, 2 from each module

Q II - 2 questions A and B of 15marks each from module I with choice to answer any one

Q III - 2 questions A and B of 15marks each from module II with choice to answer any one

Q IV - 2 questions A and B of 15marks each from module III with choice to answer any one

Q V - 2 questions A and B of 15marks each from module IV with choice to answer any one

2K6PTME 705(C): FLEXIBLE MANUFACTURING SYSTEMS

2 hours lecture per week

MODULE I: (13 hours)

Computer technology-Computer aided design and manufacturing-fundamentals of CAD-the design process-manufacturing database-computer graphics –software configuration-constructing the geometry-transformation-data base structure and content-wire frame and solid models

MODULE II :(13 hours)

Numerical control-basic components of NC systems-NC coordinate systems-motion control system-application of numerical control-NC part programming-punched tape-tape coding and format-manual part programming-computer assisted part programming-APT language-NC programming with interactive graphics

MODULE III: (13 hours)

Manufacturing systems-development of manufacturing system-components of FMS-FMS work station-Job coding and classification-group technology-benefits of FMS-tools and tooling-machining centres-head indexers-pallets-fixtures-work handling equipments-system storage-automated guided vehicles-industrial robots-programming of robots-assembly and inspection.

MODULE IV: (13 hours)

Flexible manufacturing system management-FMS control software-tool management-controlling precision-simulation and analysis of FMS-approaches to modeling for FMS-network simulation-simulation procedure-FMS design-economics of FMS-artificial intelligence.

Text book and References books

1 Groover M.P. *"Automation, Production Systems and Computer Integrated Manufacturing*", Prentice Hall of India

2 Groover, Emory & Zimmers, *"CAD/CAM Computer Aided Design and Manufacturing"*, Prentice Hall of India

3 Joseph Talavage & Hannam, "*Flexible Manufacturing Systems in Practice"*, Marcel Dekker Inc.

4 Kant Vajpayee, *"Principles of Computer Integrated Manufacturing*", Prentice Hall of India.

5 Yoram Koren, *"Computer Control of Manufacturing Systems*", McGraw, Hill Book Company.

Sessional work assessment

Two Tests = 30

Two Assignments = 20

Total marks = 50

University examination pattern

Q I - 8 short type questions of 5 marks each, 2 from each module

Q II - 2 questions A and B of 15marks each from module I with choice to answer any one

Q III - 2 questions A and B of 15marks each from module II with choice to answer any one

Q IV - 2 questions A and B of 15marks each from module III with choice to answer any one

Q V - 2 questions A and B of 15marks each from module IV with choice to answer any one

2K6PTME 705(D): ADVANCED FLUID MECHANICS

2 hours lecture per week

MODULE I: (13 hours)

Basic equations of fluid flow: Reynolds transport equation-integral and differential formations-integral form of equations of the continuity-momentum and energy equations-use of integral equation-differential form of these equations-Stoke's postulates and constitutive equations-Navier-Stokes equations and energy equations for Newtonian fluids.

Non dimensionalisation of the equations of motion and order of magnitude analysis: Choice of characteristic quantities-identification of the non dimensional parameters- classification of flows based on the characteristic Reynolds number-approximate equations for low Re and high Re flows and boundary layer equations-boundary equations.

MODULE II: (13 hours)

Some exact solutions of the Navier-Stokes equations: Couette flows-plane Poisseuille-flow between rotating cylinders-Stokes problems-fully developed flow through circular and non-circular pipes

Approximate solutions: Creeping flow past a sphere-theory of hydrodynamic lubrication-boundary layer on a flat plate-Blassius solution and use of momentum integral equation.

MODULE III: (14 hours)

Introduction to compressible flows: Basic concepts-equations for one dimensional flow through steam tubes-speed of sound and Mach number-qualitiative difference between incompressible, subsonic and supersonic flows-characteristic velocities-adiabatic flow ellipse

Isentropic flow through a duct: Criterion for acceleration and deceleration-stagnation quantities-isentropic relations-use of gas tables-operation of nozzles at off design conditions.

Normal shocks in one dimensional flow: Occurrence of shocks-analysis of normal shocks-Prandtl's equation-Rankine-Hugoniot equation and other normal shock relations-moving shocks.

MODULE IV: (12 hours)

Oblique shocks and expansion waves: Oblique shock relations-θ-β-M relations-shock polar-supersonic flow over a wedge-expansion waves-Prandtl-Meyer function-intersection of shocks-detached shocks-Mach deflection-shock expansion theory.

Flow with friction: Fanno lines and Fanno flow relations-effect of friction on properties-choking-isothermal flows.

Flow with heat transfer: Rayleigh lines-effect of heat addition-thermal choking

Text books and Reference books

1 Muralidhar K. & Biswas G., *Advanced Engineering Fluid Mechanics,* Narosa Publishing House

2 Rathakrishnan E., *Gas Dynamics*, Prentice Hall India

3 Gupta V. & Gupta S., *Fluid Mechanics and its Applications,* Wiley Eastern Ltd.

4 White F.M., *Viscous Fluid Flow,* McGraw Hill

5 Zuckrow M.J. & Hoffman D.H., *Gas Dynamics*, McGraw Hill

Sessional work assessment

Two Tests = 30

Two Assignments = 20

Total marks = 50

University examination pattern

Q I - 8 short type questions of 5 marks each, 2 from each module

Q II - 2 questions A and B of 15marks each from module I with choice to answer any one

Q III - 2 questions A and B of 15marks each from module II with choice to answer any one

Q IV - 2 questions A and B of 15marks each from module III with choice to answer any one

Q V - 2 questions A and B of 15marks each from module IV with choice to answer any one

2K6PTME 705(E): MULTI-PHASE FLOW

2 hors lecture per week

Module I (13 hours)

Basic equations and empirical correlations for multi-phase flow - flow patterns - identification and classification - flow pattern maps and transition - momentum and energy balance - homogeneous and separated flow models - correlations for use with homogeneous and separated flow models - two phase flow through inclined pipes and singularities - void fraction and slip ratio correlations - influence of pressure gradient - empirical treatment of two phase flow - drift flux model - correlations for bubble, slug and annular flows - pressure losses through enlargements, contractions, orifices, bends and values

Module II (13 hours)

Boiling and multiphase heat transfer - vapour-liquid equilibrium mechanisms - pool boiling convective boiling - heat transfer in partial and fully developed sub-cooled boiling - void fraction and pressure drop in sub-cooled boiling - saturated boiling heat transfer - two phase forced convection laminar and turbulent flow solutions for film heat transfer - empirical equations for film boiling and transition boiling - burnout mechanism and correlations - critical coefficient in nucleate and convective boiling

Module III (13 hours)

Condensation - basic processes of condensation - mechanism of evaporation and condensation - film condensation on a planar surface - dropwise condensation - pressure gradient in condensing systems - methods of improving heat transfer coefficient in condensation

Module IV (13 hours)

Critical multiphase flows - mathematical models - critical flow criterion - compatibility conditions and their physical interpretation - experimental observations - propagation of small disturbances - pressure drop limitation effect - graphical representation of critical flow conditions

Text books

Collier J.G., *Convective Boiling and Condensation,* McGraw Hill

Reference books

1 Hsu Y.Y. & Graham R.W., *Transport Processes in Boiling and Two Phase Systems*, Hemisphere

2 Ginoux J.J., *Two Phase Flows and Heat Transfer*, Hemisphere, McGraw Hill

3 Tong L.S., *Boiling Heat Transfer and Two Phase Flow*, Wiley

4 Hewitt G., Delhaye J.M. & Zuber N., *Multiphase Science and Technology*, Vol. I., McGraw Hill

Sessional work assessment

Two Tests = 30

Two Assignments = 20

Total marks = 50

University examination pattern

Q I - 8 short type questions of 5 marks each, 2 from each module

Q II - 2 questions A and B of 15marks each from module I with choice to answer any one

Q III - 2 questions A and B of 15marks each from module II with choice to answer any one

Q IV - 2 questions A and B of 15marks each from module III with choice to answer any one

Q V - 2 questions A and B of 15marks each from module IV with choice to answer any one

2K6PTME 706(P): INSTRUMENTATION LAB

3 hours practicals per week

Study on concepts of measurement, types of errors, accuracy, precision, hysterisis, least square curve fitting, study of Stroboscope, transducers, strain gauges, rotometer, slip gauges and various precision measuring instruments.

List of experiments

1 Calibration of Bourden tube pressure gauge.
2 Calibration of LVDT.
3 Calibration of Thermocouple.
4 Calibration of Micrometer and vernier caliper.
5 Measurement of area by planimeter.
6 Preparation of psychrometric chart.
7 Statistical analysis of data.
8 Measurement using Profile projector.
9 Measurement of vibration and analysis.
10 Temperature measurement by pyrometer.
11 Calibration of Tachometer.
12 Determination of PH value.
13 Sound level measurement and analysis.
14 Flaw detection using ultrasonic tester.
15 Analysis of exhaust gas of I C engines.
16 Velocity measurement by Pitot tube.
17. Flaw measurement using Rotometer.
18. Measurement of drag and lift coefficients of an aerofoil using wind tunnel.
19.Experiment on strain gauges.

Sessional work assessment

Lab Practicals and Record = 35
Tests = 15
Total marks =50

2K6PTME 707(P): COMPUTATIONAL LAB

3 hours practicals per week

Study on the following

1 Design and Modeling

2 Mathematical Tools used in Engineering : MATLAB, Excel , etc.

3 Computational Fluid Dynamics, Heat Transfer and Structural Analysis

Programming on the following tools (C , C++ or Fortran)

1 Roots of Algebraic and Transcendental Equations

2 Solutions of Simultaneous Algebraic Equations

3 Curve Fitting and Optimization

4 Numerical Differentiation and Integration

5 Numerical Solution of Partial Differential Equations

Sessional work assessment

Lab Practicals and Record = 35

Tests = 15

Total marks =50

2K6PTME 708(P): MINI PROJECT

3 hours per week

The project work can be a design project, experimental fabrication project or software development project on any of the topics of mechanical engineering interest - it can be allotted as a group project with groups consisting of three or four students

The assessment of all the mini projects should be done by a committee consisting of three or four faculty members specialised in the various fields of **Mechanical Engineering** - the students will present their project work before the committee - the relative gradings and group average marks for the various projects will be fixed by the committee - the guide will award the marks for the individual students in the project maintaining the group average - each group will prepare the project report and submit to the department through the guide - the **Head Of the Department** will certify the copies and keep them in the departmental library

Sessional work assessment

Presentation	= 30
Report	= 20
Total marks	= 50

2K6PTME 709(P): PHYSICAL EDUCATION, HEALTH AND FITNESS

Introductory Lectures

Unit I. Health and Fitness: Modern concept of health and fitness, meaning, scope, need and importance of health, fitness and wellness.

Unit II. Exercise and Fitness: Means and methods of developing fitness. Importance of physical activities and exercises in developing and maintaining good health. Physical fitness and wellness.

Unit III. Sports and Physical education: Meaning and scope, role and importance of sports and games in the development of physical fitness and personality. Social values of sports. Rules of major games.

Practical Sessions

(All classes will be conducted after the normal working hours of the college)

50 sessions of minimum 1 hour duration each are envisaged (including Theory and Practical). The student can opt for one of the following activities in line with the specific programme / schedule announced by the faculty.

Athletics, Badminton, Basketball, Cricket, Football, General Fitness, Hockey, Kabaddi, Table Tennis, Ball Badminton, Archery, Volley ball, Yoga (not all activities may be offered in a particular semester. More disciplines will be offered based on the availability of infrastructure and expertise).

In addition, health and fitness assessment such as Height, Weight, Resting Pulse Rate, BMI, Blood Pressure, Physical Fitness Tests assessing various motor qualities of each individuals will be carried out (optional - based on request).

Objectives

(a) Basically to inculcate awareness of health, general fitness and attitude to voluntary physical involvement.

(b) To promote learning of basic skills in sports activities and secondarily to pave the way for mastering some of the skills through continued future involvement

Scheme of assessment

The student will be continuously assessed on his performance on the field of play. There will not be minimum mark for pass or fail. Total 50 marks will be given assessing their attendance, regularity, punctuality and performance for 50 hours of activity from Ist semester to 7th semester.

EIGHTH SEMESTER

Code	Subject	Hours/Week			Sessional Marks	University Exam	
		L	T	P		Hours	Marks
2K6PTME 801	Gas Dynamics	2	1	-	50	3	100
2K6PTME 802	Refrigeration and Air conditioning	2	1	-	50	3	100
2K6PTME 803	Machine Design II	2	1	-	50	3	100
2K6PTME 804	Inventory and Supply Chain Management	2	-	-	50	3	100
2K6PTME 805	Elective III	2	1	-	50	3	100
2K6PTME 806(P)	Seminar	-	-	3	50	-	-
*2K6PTME 807(P)	Project and Industrial Training	-	-	3	100	-	-
2K6PTME 808(P)	Viva Voce	-	-	-	-	-	100
TOTAL		**10**	**4**	**6**	**400**	**-**	**600**
Aggregate marks for 8 semesters =8300					**2900**		**5400**

*** 25 Marks is allotted for Industrial Training**

ELECTIVE-111

2K6PTME 805(A) : FINITE ELEMENT ANALYSIS

2K6PTME 805(B) : NEURAL NETWORKS AND FUZZY LOGIC

2K6PTME 805(C) : COMPUTATIONAL FLUID MECHANICS AND HEAT TRANSFER

2K6PTME 805(D) : SYSTEM SIMULATION AND MODELING

2K6PTME 805(E) : QUALITY ENGINEERING AND MANAGEMENT

2K6PTME 801 : GAS DYNAMICS

2 hours lecture & 1 hour tutorial per week

Module 1

Basic equations of fluid flow. Continuity, Momentum, Energy equations. Navier-Stokes equations. Introduction to compressible flow. Equation of state. Entropy Equation, The Stagnation Concept, Stagnation Pressure and Temperature, Consequences of Constant Density. Speed of sound. Mach number and Mach angle.

Module 11

Equations for compressible, one-dimensional duct flows. Sonic Velocity and Mach Number, Wave Propagation, Equations for Perfect Gases in terms of Mach Number, h-s and T-s Diagrams. Steady one dimensional isentropic flow with area change – Governing equations, effect of area change on flow properties, limiting conditions (choking), governing equation for the isentropic flow of a perfect gas, isentropic flow tables for a perfect gas, effect of area change on the flow properties, the converging nozzle. Effect of varying the back pressure and inlet pressure. Converging diverging or De Laval nozzle

Module 111

Shock waves – normal shock waves in perfect gas – governing equations, normal shock wave tables, the Rankine – Hugoniot equation for a normal shock wave, Prandtl's velocity equation, entropy change and shock strength. Oblique shock waves in perfect gas Governing equations, property ratios across an oblique shock wave, Rankine – Hugoniot equation. Expansion waves

Module 1V

Steady one dimensional adiabatic flow with friction in a constant area duct – governing equations, Fanno line, Fanno line equation for perfect gas, friction parameter, relationship between duct length and Mach number, entropy change caused by friction, effect of friction on flow properties, Fanno line tables.

Steady one dimensional flow with heat transfer in a constant area duct – governing equations, Rayleigh line, intersection of Fanno line and Rayleigh line, Rayleigh line equations for a

perfect gas, relationship between heat transfer, stagnation temperature and Mach number, effect of heat transfer on flow properties, Rayleigh line tables.

Text books

1. Rathakrishnan. E., Gas dynamics, Prentice Hall India, New Delhi, 1995.
2. Shapiro, A.H., Dynamics & Thermodynamics of Compressible fluid flow, Ronald Press.
3. Zuckrow. M.J. & Hoffman, D.H., Gas Dynamics, McGraw Hill, New York.
4. Zucker R. D. and Biblarz Oscar, "Introduction to Gas Dynamics", John Wiley and Sons. Inc., Second Edition

Sessional work assessment

Two Tests = 30

Two Assignments = 20

Total marks = 50

University examination pattern

Q I - 8 short type questions of 5 marks each, 2 from each module

Q II - 2 questions A and B of 15marks each from module I with choice to answer any one

Q III - 2 questions A and B of 15marks each from module II with choice to answer any one

Q IV - 2 questions A and B of 15marks each from module III with choice to answer any one

Q V - 2 questions A and B of 15marks each from module IV with choice to answer any one

2K6PTME 802 : REFRIGERATION AND AIR CONDITIONING

2 hours lecture & 1 hour tutorial per week

MODULE I (12 hours)

Introduction to refrigeration-unit of refrigeration-refrigerator and heat pump-coefficient of performance-reversed Carnot cycle-pressure enthalpy diagram-vapour compression refrigeration cycle-analysis of practical vapour compression cycle-non conventional refrigeration systems-thermo electric refrigeration-vortex tube-pulse tube refrigeration-refrigerant mixtures-cooling by adiabatic demagnetization

MODULE II (12 hours)

Steam jet refrigeration-analysis of steam jet refrigeration system-components-advantages and limitations-air refrigeration systems-thermodynamic analysis of bell coleman cycle-application to air craft refrigeration-absorption refrigeration systems-principle and operation of aqua ammonia and lithium-bromide water systems-electrolux system-comparison between vapour compression and absorption systems-introduction to adsorption refrigeration system-MEMS cooling systems

MODULE III (14 hours)

Refrigerants-thermodynamic physical and chemical properties of refrigerants-selection criteria of refrigerants-refrigerant compressors-reciprocating compressors-single and multi stage compression-effect of clearance-effect of inter cooling-optimum pressure ratios-efficiencies-rotary compressor-screw-vane type compressor-centrifugal compressor-hermetic-semi hermitic and open compressors-condensers-air cooled condensers-water cooled condensers and evaporative condensers-expansion devices-purpose and types-capillary tube-automatic expansion valve-thermostatic expansion valve-evaporators-flooded evaporators-dry expansion systems-natural convection evaporators-forced convection evaporators-shell and tube evaporators-shell and coil evaporators

MODULE IV(14 hours)

Psychrometry-psychrometric properties and relations-psychrometric chart-psychrometric processes-summer air conditioning system-winter air conditioning system-year round air conditioning system-central air conditioning system-unitary air conditioning system-direct expansion system-all water system-all air system-air water system-design procedure for air conditioning systems-estimation of air conditioning load-noise and noise control-refrigeration and air conditioning controls-high pressure and low pressure cutout-high side and low side float valve-flow regulating devices-thermostats-humidstats

Text Book:

1. Stoecker, "Refrigeration and Air Conditioning.", Mc Graw Hill

Reference Books:

1. Roy J Doosat, " Principles of Refrigeration.", Pearson Education
2. C.P Arora, "Refrigeration and Air Conditioning." TMH
3. Ananthanarayanan, "Basic Refrigeration and Air Conditioning.", Mc Graw Hill
4. McQuston, "Heating, Ventilating and Air Conditioning" John Wiley

Sessional work assessment

Two tests = 30
Two assignments = 20
Total marks = 50

University examination pattern

Q I - 8 short type questions of 5 marks each, 2 from each module
Q II - 2 questions A and B of 15marks each from module I with choice to answer any one
Q III - 2 questions A and B of 15marks each from module II with choice to answer any one
Q IV - 2 questions A and B of 15marks each from module III with choice to answer any one
Q V - 2 questions A and B of 15marks each from module IV with choice to answer any one

2K6PTME 803: MACHINE DESIGN-11

2 hours lecture and 1 hour tutorial per week

Module I (13 Hours)

Design of clutches & brakes –friction clutches and brakes – uniform pressure and uniform wear assumptions – design of disc and cone types of clutches and brakes – design of external contracting and internal expanding elements – band type clutches and brakes – centrifugal clutches

Design of belts and chain drives – belt and chain drives of common types – design of flat and V belt drives Selection of roller chains

Module II (13 Hours)

Design of gears – spur, helical, bevel and worm gears – tooth loads – gear materials – design stresses - basic tooth stresses – stress concentration – service factor - velocity factor – bending strength of gear teeth - Buckingham's equation for dynamic load – surface strength and durability - heat dissipation - design for strength and wear.

Module III (13 Hours)

Lubrication & Journal bearing design – types of lubrication and lubricants – viscosity – journal bearing with perfect lubrication – hydrodynamic theory - design considerations – heat balance – journal bearing design – rolling contact bearings – bearing types - bearing life – static and dynamic capacity - selection of bearings with axial and radial loads – selection of tapered roller bearings – lubrication seals, shaft, housing and mounting materials

Module IV (13 Hours)

Product design for manufacturing – general design considerations for rolled sections – forgings – screws machine products –turned parts – machined round holes – parts

produced on milling machine – welded parts and castings – modification of design for manufacturing easiness for typical products – preparation of working drawings – working drawings for manufacture of parts with complete specifications including manufacturing details like tolerance – surface finish etc. – computer applications in the preparation for working drawings.

Text book

Shigley J.E., *Mechanical Engineering Design*, McGraw Hill Book Company

Reference books

1 Siegel, Maleev & Hartman, *Mechanical Design of Machines*, International Book Company

2 Phelan R.M., *Fundamentals of Mechanical Design*, Tata McGraw Hill Publishing Co. Ltd.

3 Doughtie V.L.& Vallance A.V., *Design of Machine Elements*, McGraw Hill Book Company

4Juvinall R.C. & Marshek K.M., *Fundamentals of Machine Component Design*, John Wiley

5Bralla J.G., *Handbook of Product Design for Manufacture*, McGraw Hill Book Company

Data hand books (allowed for reference during examinations)

1 Prof. Narayana Iyengar B.R. & Dr Lingaiah K., Machine Design Data Handbook

2 P.S.G., Tech., *Machine Design Data Handbook*

Sessional work assessment

Two tests = 30

Two assignments = 20

Total marks = 50

University examination pattern

Q I - 8 short type questions of 5 marks each, 2 from each module

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Q III - 2 questions A and B of 15marks each from module II with choice to answer any one

Q IV - 2 questions A and B of 15marks each from module III with choice to answer any one

Q V - 2 questions A and B of 15marks each from module IV with choice to answer any one

2K6PTME 804 : INVENTORY & SUPPLY CHAIN MANAGEMENT

2 hours lecture per week

Module I (12 hours)

Supply chain management (SCM) - concept of logistics and SCM - decision phases - design, planning and operation - decision areas - type of supply chain views - flows in supply chain - supply chain and competitive performance - performance measures for SCM - strategic fit - drivers of supply chain

Module II (12 hours)

Sourcing and procurement - sourcing - factors in source selection - vendor rating - qualitative and quantitative methods - purchasing - objectives and procedure - purchasing systems - tender method - computer based systems/EDI - inventory concept - functions of inventory - selective inventory control techniques - structure of inventory problem - costs associated with materials management - relevant costs

Module III (14 hours)

Independent demand items - probabilistic - single order quantities - payoff matrix - incremental analysis - mathematical formulation of discrete and continuous cases - independent demand items - deterministic and dynamic - deterministic inventory models without and with backordering - sensitivity analysis - quantity discount - all units and incremental discounts

Module IV (14 hours)

Independent demand items - probabilistic and dynamic inventory models - Q and P system models - dependent demand items - deterministic models - lot sizing models - lot by lot - EOQ - part period balancing - wagner-whitin method - concept of just-in-time - kanban - introduction to distribution requirement planning

Text books

1 Dobler D.W. & Burt D.N., *Purchasing and Supply Management: Text and Cases*, Tata McGraw Hill Publishing Company Limited

2 Tersine R.J., *Principles of Inventory and Materials Management*, Prentice-Hall Inc

3 Starr M.K. & Miller D.W., *Inventory Control: Theory and Practice*, Prentice Hall of India

4 Chopra S. & Meindl P., *Supply Chain Management: Strategy, Planning, and Operation,* Pearson Education Asia

Reference books

1 Christopher M., *Logistics and Supply Chain Management*, Pitman Publishing Company

2 John Mortimer (Editor), *Logistics in Manufacturing: An IFS Executive Briefing*, IFS Publications, U.K. & Springer-Verlag

3 Narasimhan S.L., Mcleavy D.W. & Billington P.J., *Production Planning and Inventory Control*, Prentice Hall of India

4 Raghuram G. & Rangaraj N., *Logistics and Supply Chain Management: Cases and Concepts*, Macmillan India Limited

Sessional work assessment

Two tests = 30

Two assignments = 20

Total marks = 50

University examination pattern

Q I - 8 short type questions of 5 marks each, 2 from each module

Q II - 2 questions A and B of 15marks each from module I with choice to answer any one

Q III - 2 questions A and B of 15marks each from module II with choice to answer any one

Q IV - 2 questions A and B of 15marks each from module III with choice to answer any one

Q V - 2 questions A and B of 15marks each from module IV with choice to answer any one

2K6PTME 805(A): FINITE ELEMENT ANALYSIS

2 hours lecture and 1 hour tutorial per week

Module I (13 hours)

Linear vector spaces - linear transformations and functionals - linear, bilinear and quadratic forms - theory of normed spaces - theory of inner product spaces - concepts from variational calculus - variational methods of approximation - Ritz method - weighted residual method - Galerkin method - subdomain method - collocation method

Module II (11 hours)

Finite element analysis of one dimensional problems - procedure - one dimensional elements and interpolation functions - analysis of one dimensional second and fourth order equations - approximation errors in the finite element method - computer implementation

Module III (15 hours)

Finite element analysis of two dimensional problems - two dimensional elements and interpolation functions - second order equations involving a scalar valued function - comments on mesh generation and composition of boundary conditions - analysis of plane elasticity and incompressible fluid flow problems - time dependent problems (transient heat transfer) - isoparametric elements and numerical integration

Module IV (13 hours)

Alternative formulations - least square formulation - mixed formulation - Eigenvalue problems - nonlinear problems - three dimensional elements and interpolation functions - formulation of three dimensional problems (two and three dimensional Navier-Stokes equations - three dimensional heat transfer equations)

Text books

1 Reddy J.N., *An Introduction to the Finite Element Method,* McGraw Hill International Edition

2 Reddy J.N., *Applied Functional Analysis and Variational Methods in Engineering*, McGraw Hill, International Edition

Reference books

1 Huebner K.H., *The Finite Element Method for Engineers*, John Wiley

2 Zenkiewicz O., *The Finite Element Method,* McGraw Hill International Edition

Sessional work assessment

Two tests = 30

Two assignments = 20

Total marks = 50

University examination pattern

Q I - 8 short type questions of 5 marks each, 2 from each module

Q II - 2 questions A and B of 15marks each from module I with choice to answer any one

Q III - 2 questions A and B of 15marks each from module II with choice to answer any one

Q IV - 2 questions A and B of 15marks each from module III with choice to answer any one

Q V - 2 questions A and B of 15marks each from module IV with choice to answer any one

2K6PTME 805(B): NEURAL NETWORKS & FUZZY LOGIC

2 hours lecture and 1 hour tutorial per week

Module I (13 hours)

Introduction to artificial neural networks - biological neurons - Mc Culloch and Pitts modals of neuron - types of activation function - network architectures - knowledge representation - learning process - error-correction learning - supervised learning - unsupervised learning - single unit mappings and the perceptron - perceptron convergence theorem (with out proof) - method of steepest descent - least mean square algorithms - adaline/medaline units - multilayer perceptrons - derivation of the back-propagation algorithm

Module II (13 hours)

Radial basis and recurrent neural networks - RBF network structure - covers theorem and the separability of patterns - RBF learning strategies - K-means and LMS algorithms - comparison of RBF and MLP networks - recurrent networks - Hopfield networks - energy function - spurious states - error performance - simulated annealing - the Boltzman machine - Boltzman learning rule - the mean field theory machine - MFT learning algorithm - applications of neural network - the XOR problem - traveling salesman problem - image compression using MLPs - character retrieval using Hopfield networks

Module III (13 hours)

Fuzzy logic - fuzzy sets - properties - operations on fuzzy sets - fuzzy relations - operations on fuzzy relations - the extension principle - fuzzy measures - membership functions - fuzzification and defuzzification methods - fuzzy controllers - Mamdani and Sugeno types - design parameters - choice of membership functions - fuzzification and defuzzification methods - applications

Module IV (13 hours)

Introduction to genetic algorithm and hybrid systems - genetic algorithms - natural evolution - properties - classification - GA features - coding - selection - reproduction - cross over and mutation operators basic GA and structure

Introduction to Hybrid systems - concept of neuro-fuzzy and neuro-genetic system

Reference books

1 Simon Haykins, "*Neural Network a - Comprehensive Foundation"*, Macmillan College, Proc, Con, Inc

2 Zurada J.M., "*Introduction to Artificial Neural Systems,* Jaico publishers

3 Driankov D., Hellendoorn H. & Reinfrank M., "*An Introduction to Fuzzy Control*", Norosa Publishing House

4 Ross T.J., *"Fuzzy Logic with Engineering Applications"*, McGraw Hill

5 Bart Kosko. *"Neural Network and Fuzzy Systems"*, Prentice Hall, Inc., Englewood Cliffs

6 Goldberg D.E., *"Genetic Algorithms in Search Optimisation and Machine Learning"*, Addison Wesley

7 Suran Goonatilake & Sukhdev Khebbal (Eds.), "*Intelligent Hybrid Systems*", John Wiley

Sessional work assessment

Two tests = 30

Two assignments = 20

Total marks = 50

University examination pattern

Q I - 8 short type questions of 5 marks each, 2 from each module

Q II - 2 questions of 15marks each from module I with choice to answer any one

Q III - 2 questions of 15marks each from module II with choice to answer any one

Q IV - 2 questions of 15marks each from module III with choice to answer any one

Q V - 2 questions of 15marks each from module IV with choice to answer any one

2K6PTME 805(C): COMPUTATIONAL FLUID MECHANICS

2 hours lecture and 1 hour tutorial per week

Module I (12 hours)

Classification of partial differential equations - system of first and second-order partial differential equations - initial and boundary conditions - finite difference formulations - finite difference equations - finite difference approximation of mixed partial derivatives

Module II (12 hours)

Parabolic partial differential equations - explicit methods - implicit methods - parabolic equations in two-space dimensions - consistency, stability, and error analysis of finite difference equations - artificial viscosity

Module III (12 hours)

Elliptic equations - finite difference formulations - solution algorithms - hyperbolic equations - finite difference formulations -splitting methods - multiple-step method

Module IV (16 hours)

Scalar representation of the navier - stokes equations - model equations - numerical algorithms - incompressible navier - stokes equations - primitive variable and vorticity - stream function formulations - poisson equation for pressure - numerical algorithms - boundary conditions - staggered grid

Text book

Hoffmann Klaus A., "*Computational Fluid Dynamics for Engineers - Volume I*", Engineering Education System, Wichita

Reference books

1 Patankar Suhas V., "*Numerical Heat Transfer and Fluid Flow*", Taylor & Francis

2 Fletcher C.A.J., "*Computational Techniques for Fluid Dynamics I*, Springer Verlag

3 Anderson Dale A., Tannehill John C. & Pletcher Richard H., "*Computational Fluid Mechanics and Heat Transfer*", Taylor & Francis

Sessional work assessment

Computer run assignments	= 20
Two tests	= 30
Total	= 50

University examination pattern

Q I - 8 short type questions of 5 marks each, 2 from each module

Q II - 2 questions A and B of 15marks each from module I with choice to answer any one

Q III - 2 questions A and B of 15marks each from module II with choice to answer any one

Q IV - 2 questions A and B of 15marks each from module III with choice to answer any one

Q V - 2 questions A and B of 15marks each from module IV with choice to answer any one

2K6PTME 805(D): SYSTEM SIMULATION AND MODELING

2 hours lecture and 1 hour tutorial per week

MODULE I (14 hours)

System concepts-systems and system environment-component of a system-discrete and continous systems-types of system study-system analysis-system design and system postulation-system models-types of models-system simulation-steps in a simulation study-comparison of simulation and analytical models-Monte Carlo simulation –examples of simulation of single server queuing system and simple inventory systems-concepts in discrete event system simulation-event scheduling/time advance algorithms-modeling world views.

MODULE II (12 hours)

Random number generation-techniques for generating random number-linear congruential method-test for random numbers-frequency tests-Kolmogorov-Smirnov test and the Chi-square test-random variate generation-inverse transformation method-exponential, uniform, and empirical discrete and empirical continuous distributions-input modeling for simulation-data collection-identifying the distribution using histograms-parameter estimation-Chi-square goodness of fit test.

MODULE III (13 hours)

Verification and validation of simulation models-verification of simulation models-calibration and validation of models-face validity-validation of model assumption and validating input output transformations-output analysis for a single model-types of simulation with respect to output analysis-measures of performance and their estimation-output analysis for terminating simulation-confidence interval estimation for a fixed number of replication-confidence interval with specified precision-output analysis for steady state simulation-initialization bias-replication methods-sample size determination for a specified precision-batch means method.

MODULE IV (13 hours)

Simulation modelling and analysis of manufacturing systems-objectives-performance measures-issues in simulation of manufacturing systems-simulation of simple job shop manufacturing systems-introduction to simulation software for manufacturing applications-salient features of simulation languages such as general purpose simulation systems(GPSS),

and simulation language for alternative modelling(SLAM)-salient features of simulators such as WITNESS and Arena.

Text book

Banks J., Carson J.S. & Nelson B.L., *Discrete-Event System Simulation,* Prentice Hall of India

Reference books

1 Askin R.G. & Standridge C.R., *Modelling and Analysis of Manufacturing Systems,* John Wiley

2 Deo N., *System Simulation with Digital Computer*, Prentice-Hall of India Private Limited

3 Gordon G., *System Simulation*, Prentice Hall of India Private Limited

4 Law A.W. & Kelton W.D., *Simulation Modelling and Analysis*, Third Edition, McGraw Hill International Editions

5 Kelton W.D., Sadowski R.P. & Sadowski D.A., *Simulation with ARENA*, WCB/McGraw Hill International Editions

Sessional work assessment

Two tests = 30

Two assignments = 20

Total marks = 50

University examination pattern

Q I - 8 short type questions of 5 marks each, 2 from each module

Q II - 2 questions A and B of 15marks each from module I with choice to answer any one

Q III - 2 questions A and B of 15marks each from module II with choice to answer any one

Q IV - 2 questions A and B of 15marks each from module III with choice to answer any one

Q V - 2 questions A and B of 15marks each from module IV with choice to answer any one

2K6PTME 805 (E): QUALITY ENGINEERING AND MANAGEMENT

2 hours lecture and 1 hour tutorial per week

Module I (10 hours)

Introduction to the concept of quality - quality control - quality assurance - quality management - quality and total quality - small q and big Q - concept of total quality management - TQM axioms - major contributions of deming, juran and crossby to quality management - enablers for total quality - strategic quality management

Module II (10 hours)

Quality costs - analysis of quality costs - loss function - taguchi methods - total quality tools - pareto chart - fishbone diagram - checksheet - histograms - scatter diagrams - run charts - flow diagram - survey - implementing - total quality - ISO 9000 certification - quality circles- motivation theories

Module III (10 hours)

Customer needs and product quality - market research - product design - quality function deployment - reliability - reliability goals - failure mode, effect, and criticality analysis - design for safety - error proofing design for manufacturability - manufacturing planning for quality - quality responsibilities on the factory floor - total employee involvement and empowerment - benchmarking - continuos improvement strategies - kaizen approach

Module IV (11 hours)

Statistical tools in quality - making predictions using the normal, poisson and binomial probability distributions - statistical process control - control charts for variables - $\bar{X}$, R and σ charts - process capability indices - control charts for attributes - P, np, c and u charts

Module V (11 hours)

Acceptance sampling - lot by lot acceptance using single sampling by attributes - OC curve - average outgoing quality and the AOQL - double sampling - multiple and sequential sampling - dodge - romig sampling tables - ATI and AFI - introduction to life testing and reliability

Text books

1Juran J.M., Gryna F.M., "*Quality Planning and Analysis*", Tata McGraw Hill Publishing Company

2Grant E.L. & Leavenworth R.S., "*Statistical Quality Control*", McGraw Hill International Edition

3 Geoetsch D.L. & Davis S.B., "*Introduction to Total Quality: Quality Management for Production, Processing and Services",* Prentice Hall International, Inc.

4 Logothetis N., "*Managing for Total Quality*", Prentice Hall of India Private Limited

Bharat Wakhlu, "*Total Quality*", Wheeler Publishing

Sessional work assessment

Two tests = 30

Two assignments = 20

Total marks = 50

University examination pattern

Q I - 8 short type questions of 5 marks each, 2 from each module

Q II - 2 questions A and B of 15marks each from module I with choice to answer any one

Q III - 2 questions A and B of 15marks each from module II with choice to answer any one

Q IV - 2 questions A and B of 15marks each from module III with choice to answer any one

Q V - 2 questions A and B of 15marks each from module IV with choice to answer any one

2K6PTME 806(P): SEMINAR

3 hours per week

Individual students should be asked to choose a topic in any field of mechanical engineering, preferably from outside the B.Tech syllabus and give a seminar on that topic for about thirty minutes - a committee consisting of at least three faculty members (preferably specialised in different fields of mechanical engineering) will assess the presentation of the seminars and award the marks to the students - each student should be asked to submit two copies of a write up of his seminar talk - one copy should be returned to the student after duly certifying it by the H O D and the other kept in the departmental library

Sessional work assessment

Presentation	= 30
Report	= 20
Total marks	= 50

2K6PTME 807(P): PROJECT AND INDUSTRIAL TRAINING

(3 hours per week)

The project work can be a Modeling and Simulation, Case study, Design or Experiments in the field of Mechanical Engineering. It can be allotted as a group project with groups consisting of 3 to 4 students. The project work started in the seventh semester (mini project) may be continued in this semester - the students should complete the project work in this semester and present it before the assessment committee

The assessment committee will assess the various projects, fix the relative grading and group average marks - the guides will award the marks for the individual students in a project maintaining the group average - each group should submit the copies of the completed project report signed by the guide (in the format prescribed by the department) to the department - the Head Of the Department will certify the copies and return them to the students - one copy will be kept in the departmental library

All students should undergo Industrial Training Programme either by attending a training programme for a minimum of 5 days in a Registered Industry / Research Institute or by visiting at least 5 reputed Industries / Engg Establishments. They have to submit a report of the Industrial Training Programme.

A maximum of 25 marks will be awarded for the Industrial Training.

Sessional work assessment

Project Work = 75

Industrial Training = 25

Total marks = 100

2K6PTME 808(P): VIVAVOCE

There is only university examination for VIVA VOCE - the university will appoint examiners for conducting the viva voce examination - the examiners will ask questions from subjects studied for the B.Tech. Course, Mini Project, Project and Industrial Training and Seminar etc. The relative weightage will be as follows :

Subjects	= 30.
Mini Project	= 20
Project and Industrial Training	= 30
Seminar	= 20
Total marks	= 100