KANNUR UNIVERSITY

FACULTY OF ENGINEERING

Curricula, Scheme of Examinations & Syllabus for

Semesters V & VI of B.Tech. Degree Programme in

MECHANICAL ENGINEERING

with effect from 2007 Admissions

FIFTH SEMESTER

Code	Subject	Hours/Week			Sessional Marks	University Examination	
		L	T	P/D		Hrs	Marks
2K6 ME 501	Engineering Mathematics IV	2	1	-	50	3	100
2K6 ME 502	Environmental Engineering and Disaster Management	2	-	-	50	3	100
2K6 ME 503	Mechanics of Machinery	2	-	-	50	3	100
2K6 ME 504	Thermal Engineering	2	-	-	50	3	100
2K6 ME 505	CAD/CAM/CAE	2	1	-	50	3	100
2K6 ME 506	Machine Tools	2	-	-	50	3	100
2K6 ME 507(P)	Production Engg Lab II	-	-	3	50	3	100
2K6 ME 508(P)	Thermal Engineering Lab	-	-	3	50	3	100
TOTAL		**12**	**2**	**6**	**400**	**-**	**800**

SIXTH SEMESTER

Code	Subject	Hours/Week			Sessional Marks	University Examination	
		L	T	P/D		Hrs	Marks
2K6 ME 601	Economics and Business Management	2	-	-	50	3	100
2K6 ME 602	Dynamics of Machinery	2	-	-	50	3	100
2K6 ME 603	Heat and Mass Transfer	2	-	-	50	3	100
2K6 ME 604	Advances in Manufacturing Engineering	2	1	-	50	3	100
2K6 ME 605	Operations Research	2	1	-	50	3	100
2K6 ME 606	Elective I	2	-	-	50	3	100
2K6 ME 607(P)	Heat Transfer Lab	-	-	3	50	3	100
2K6 ME 608(P)	CAD/CAM/CAE Lab	-	-	3	50	3	100
TOTAL		**12**	**2**	**6**	**400**	**-**	**800**

Elective I

ELECTIVE-1

2K6 ME 606(A): Numerical Methods
2K6 ME 606(B): Mechatronics
2K6 ME 606(C): CNC Programming
2K6 ME 606(D): Tool Engineering and Design
2K6 ME 606(E): Vibration and Noise Control

2K6 ME 501: ENGINEERING MATHEMATICS –IV

3 hrs. lecture and 1 hour tutorial per week

Module I: Probability distributions (13 hours)

Random variables-Probability distributions - binomial distribution –Poisson distribution-normal distribution –Mean, variance and Moment generating function -Poisson process - chebyshev's theorem- Geometric Distribution-Uniform Distribution, Gamma distribution, Beta Distribution, Exponential Distribution and Hyper-Geometric Distributions.

Module II: Statistical inference (13hours)

Population and Sample-Sampling Distributions of Mean and Variance-Point Estimation-Interval Estimation -Null Hypotheses and Significance tests-Hypotheses concerning one mean- Confidence Intervals of mean and variance -Estimation of Variances-Hypotheses concerning one variance-Hypotheses concerning two variance- Chi square test as test of goodness of fit.

Module III (Series solutions of differential equations (13hours)

Power series method of solving ordinary differential equations - series solution of Bessel's equation – Recurrence formula for Jn(x)-expansions for J_0 and J_1 – value of $J_{1/2}$- generating function for Jn(x) - Orthogonality of Bessel functions - Legendre's equation – series solution of legendary's differential equation -Rodrigues formula-Legendre Polynomials – Generating function for Pn(x)- Recurrence formulae for Pn(x) -Orthogonality of Legendre polynomials

Module IV Quadratic forms and Fourier transforms (13 hours)

Quadratic forms - Matrix associated with a quadratic form - Technique of Diagonalization using row and column transformations on the matrix - Definite, Semidefinite and Indefinite forms - their identification using the Eigen values of the matrix of the quadratic form.

Fourier Transform-Properties of Fourier Transforms-Linearity property-Change of scale property-shifting properties –Modulation property-Transform of the Derivative-simple problems-Fourier Cosine transform-Fourier Sine Transform.

Text Book

1. Johnson RA, Miller & Freund's Probability and Statistics for Engineers, Prentice Hall of India (For Module I and II only)

Reference Books

1. Wylie CR & Barrett LC, Advanced Engineering Mathematics, Mc Graw Hill
2. Kreyszig E, advanced Engineering Mathematics, John Wiley.
3. NP Bali & Manish Goyal, A Text book of Engineering Mathematics, Laxmi Publications
4. Dr.B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers

University Examination Pattern

Q I – 8 short answer type questions of 5 marks, 2 from each module.

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

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

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

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

Sessional Work Assessment

Tests (2X15)	–	30 marks
Assignments (2X10)	–	20 marks
Total	–	50 marks

2K6ME 502 ENVIRONMENTAL ENGINEERING & DISASTER MANAGEMENT

3 hrs. lecture and 1 hour tutorial per week

MODULE I (12 HOURS)

Multidisciplinary nature of Environmental studies – Definition – scope and importance – need for public awareness

Natural resources – renewable and non-renewable resources – natural resources – forest resources - water resources

Mineral resources – food resources – energy resources – Land resources – use, overuse and misuse of these resources with appropriate case studies to substantiate – effect on the environment – role of individual in conservation of natural resources – equitable use of resources for sustainable lifestyle.

MODULE II (12 HOURS)

Ecosystem – concept – structure and function – producers, consumers & decomposers – energy flow in the ecosystem- Ecological successive food chains - food webs (all in brief)

Ecological pyramids – introduction, types and characteristic features, structure and function of forest, grassland, desert and acquatic ecosystems (ponds, lakes, streams, rivers, oceans and estuaries) Biodiversity and its conservation – Introduction – definition : genetic species and ecosystem diversity – Biogeographical classification of India – value of biodiversity – consumptive and productive use, social, ethical, aesthetic and option values – biodiversity at global, national and local levels – india as a mega-diversity nation – hot spots of biodiversity – threats to biodiversity : habitat loss, poaching of wildlife, man-wildlife conflicts – endangered and endemic species of India – conservation of biodiversity : In-situ and Ex-situ conservation of biodiversity.

MODULE III (13 HOURS)

Environmental Pollution – Definition – causes - effects and control measures of : Air Pollution – water Pollution – soil Pollution – marine Pollution – noise Pollution – thermal Pollution – Nuclear hazards .

Solid waste management – causes, effects and control measures of urban and industrial wastes – Role of an individual in preventing Pollution – Environmental Protection Act – Prevention and control of air and water Pollution – Wildlife Protection Act – Forest Conservation Act – Issues involved in Enforcement of Environmental Legislation – Public awareness.

Disaster Management – Principles of disaster management – nature and extent of disasters – natural disasters , hazards, risks and vulnerabilities – man-made disasters – chemical, industrial, nuclear and fire. – preparedness nd mitigation measures for various hazards – financing relief expenditure – legal aspects - post disaster relief – voluntary agencies and community participation at various stages of disaster management – rehabilitation programmes.

MODULE IV (10 HOURS)

Social Issues and the Environment – From unsustainable to sustainable development – urban problems related to energy – water conservation, rain water harvesting , watershed management – resettlement and rehabilitation of people ; its problems and concerns, case studies – environmental ethics : Issues and possible solutions – climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case studies – waste land reclamation – consumerism and waste products.

Human population and the environment – Population growth, variations among nations – population explosion – Family welfare programmes – Environment and human health – Pollution hazards, sanitation and health – Human rights for a clean environment – value education – HIV/AIDS – social concern – Women and Child welfare – role of Information Technology in environment and human health – Case studies.

FIELD WORK (5 HOURS)

- Visit to a local area to document environmental assets – river / forest / grassland / hill / mountain
- Visit to local polluted site – urban / rural / industrial / agricultural
- Study of common plants, insects , birds
- Study of simple ecosystems – pond , river , hill slopes , etc.

University Examination Pattern

Q I – 8 short answer type questions of 5 marks, 2 from each module.

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

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

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

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

Sessional Work Assessment

Tests (2X15)	–	30 marks
Assignments (2X10)	–	20 marks
Total	–	50 marks

Text book

1. Clarke. R.S. Marine Pollution. Clanderson Oress Oxford.`
2. Mhaskar A.K. Matter Hazardous. Techno-Science Publications.
3. Townsend. C., Harper. J. and Michael Begon, Essential of Ecology. Blackwell Science.
4. S. Deswal & A . Deswal, A Basic Course in Environmental Studies, Dhanpat Rai & Co
5. Environmental Studies – Dr. B . S. Chauhan, University Science Press.
6. Kurien Joseph & R. Nagendran, Essentials of Environmental Studies, Pearson Education.
7. Trivedi. R.K. and Goel. P.K. Introduction to air pollution. Techno-Science Publications.

Reference Books

1. Agarwal.K.C. Environmental biology. Nidi Publ.Ltd. Bikaner.
2. Bharucha erach, Biodiversity of India, Mapin Publishing Pvt.Ltd.,.
3. Brunner,R.C.. Hazardous Waste Incineration. McGraw Hill Inc..
4. Cunningham W.P. , Cooper T.H., Gorhani E. & Hepworth M.T. Environmental Encyclopedia ,Jaico Publ.House ,.
5. De A.K. Environmental Chemistry.Wiley Eastern Ltd.
6. Hawkins R.E. Encyclopediaof Indian Natural History, Bombay Natural History Society ,.
7. Heywood V.H. & Watson R.T.. Global Biodiversity Assessment. Cambridge Univ. Press.
8. Jadhav H. & Bhosale V.M.. Environmental Protection and Laws. Himalaya Pub. House,
9. Odum E.P. Fundamentals of Ecology W.B. Saunders Co..
10. Rao M.N. & Datta A.K. Waste Water Treatment. Oxford & IBH Publ. Co. Pvt. Ltd..
11. Sharma B.K.. Environmental Chemistry Goel Publ. House, Meerut
12. Trivedi R.K., Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards, Vol.I & II.Enviro Media.
13. Wagner K.D. Environmental Management. W.B. Saunders Co.

2K6ME 503: MECHANICS OF MACHINERY

3 hrs. lecture and 1 hour tutorial per week

Module I (13 hours)

Introduction to mechanism and machines – Kinematic Pairs – Kinematic Chains and Linkages – Structure and Kinematic Diagrams - Various mechanism – Kinematic inversion - degree of freedom – Displacement analysis – Relative motion – Velocity and Acceleration analysis – Instantaneous centre – Complex number method – Mechanical advantage – Relative acceleration – Coriolis acceleration – graphical and analytical methods – Topics from path curvature theory – Fixed and moving centroides – Inflection points and inflection circle – Euler Savary equation.

Module II (13 hours)

Force analysis of machinery – static and dynamic force analysis of plane motion mechanisms – analytical, graphical and complex method – principle of superposition – matrix method – method of virtual work – complex number method.

Module III (14 hours)

Gears– Gear Tooth Action - The Law of Gearing - Involute spur gears – involutometry – spur gear details – interference – gear standardization – backlash –internal gear – cycloidal gear – non standard gear – theory and details of bevel, helical and worm gearing – Gear trains – simple and compound gear trains – planetary trains – solution of planetary gear train problems – applications – Force analysis in spur – helical – bevel and worm gearing.

Module IV (12 hours)

Kinematic synthesis – tasks of kinematic synthesis – type and dimensional synthesis – graphical synthesis for motion – path and prescribed timing – function generator – overlay method – analytical synthesis techniques – complex number modelling – Freudenstien's equation – loop closure equation technique – one case study in synthesis of mechanism.

Text Book

1. A.Ghosh & A.K.Mallik, Kinematic Analysis and Synthesis of Mechanism, Affiliated East West Press.
2. H.Hamilton,Mabie & Charles F.Reinholtz , Mechanism and dynamics of Machinery, John Wiley & sons.

Reference Books:

1. J.E.Shigley & J.J.Uicker Jr.,Theory of Machines and Mechanisms, Mc Graw Hill.
2. S.S Rattan, Theory of Machines, Tata Mc Graw Hill.
3. V.P. Singh, Theory of Machines, Dhanpat Rai and Co.

University Examination Pattern

Q I – 8 short answer type questions of 5 marks, 2 from each module.

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

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

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

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

Sessional Work Assessment

Tests (2X15)	–	30 marks
Assignments (2X10)	–	20 marks
Total	–	50 marks

2K6ME 504 THERMAL ENGINEERING

3 hrs. lecture and 1 hour tutorial per week

Module I (14 hours)

Internal combustion engines - classification - four stroke and two stroke engines - spark ignition and compression ignition engines - valve timing diagram - thermodynamic analysis of air standard cycles - Otto, diesel and duel combustion cycles - engine testing - performance and characteristics of constant speed and variable speed engines - heat balance test - Morse test - retardation test - actual engine cycles - effect of dissociation - variable specific heats and heat losses - scavenging - objectives - effects and methods

Module II (13 hours)

Systems and components of IC engines - fuel systems - ignition systems - cooling - starting - lubrication - governing of IC engines - supercharging of SI and CI engines - turbocharging - exhaust emissions of IC engines - alternate potential engines - free piston engine - Wankel engine and stratified charged engine - automotive transmission system and its components

Module III (12 hours)

Combustion in IC engines - flame propagation - normal and abnormal combustion - detonation - pre ignition - after burning - HUCR - fuel rating - additives in petrol - combustion chambers of SI engines - combustion in CI engines - phase of normal combustion - diesel knock - effect of engine variables on diesel knock - cetane number - additives in diesel - combustion chambers of CI engines

Module IV (13 hours)

Gas turbine plants - open and closed cycles - thermodynamic cycles - regeneration - reheating - intercooling - efficiency and performance of gas turbines - rotary compressors - analysis - centrifugal and axial flow compressors - combustion chambers of gas turbines - cylindrical - annular and industrial type combustion chamber design - combustion intensity - combustion efficiency - pressure loss combustion process and stability loop - axial flow turbines - elementary and vortex theories - design of nozzles and blades for turbines - limiting factors in turbine design

Text Book and References

1. Rogowsky, *"Elements of Internal Combustion Engines"*, Tata McGraw Hill
2. Gill, Smith & Ziurys, *"Fundamentals of Internal Combustion Engines"*, Oxford and IBH
3. Maleev, "*Internal Combustion Engine Theory and Design*" McGraw Hill
4. Judge, "*Modern Petrol Engines*," Chapman & Hall
5. Benson & Whitehouse, "*Internal Combustion Engines*" Vol. I & II, Pergamon press
6. Mathur & Mehta, "*Thermodynamics and Heat Power Engineering*", Vol. I & II
7. Cohen & Rogers, "*Gas Turbine Theory*," Longmans

University Examination Pattern

Q I – 8 short answer type questions of 5 marks, 2 from each module.

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

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

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

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

Sessional Work Assessment

Tests (2X15)	–	30 marks
Assignments (2X10)	–	20 marks
Total	–	50 marks

2K6ME 505 CAD/CAM/CAE

3 hrs. lecture and 1 hour tutorial per week

Module I (13 hours)

Fundamentals of CAD: Introduction: Design Process: Application of computers in design: Creating manufacturing database: benefits of CAD. Computer Hardware; Graphic input devices; display devices; Graphics output devices; Central processing unit (CPU) Geometric modelling- wireframe and solid modelling, engineering analysis-FEM, design review and evaluation, automated drafting, design data base, softwares used in CAD, data exchange between CAD and CAM. Fundamentals of CAM: Definition of automation, levels of automation, high volume discrete parts production, Detroit type of automation, transfer machines, analysis of automated flow lines, assembly
machines, flow line balancing, line balancing.

Module II (14 hours)

NC/CNC Machine Tools; NC machine tools- basic components, coordinate systems; features of NC machine tools. Computer Numerical Control: basic theory of numerical control, advantages of NC, open and closed loop system, information flow and control theory, classification of CNC machine tools, position control and continuous path control, principles of displacement measurement, digital linear and rotary displacement transducer, analog displacement measuring system. CNC part programming: Manual programming, work piece modelling and computer aided part programming, canned cycles, Computer assisted Part Programming languages, programming in APT.

Module III (13 hours)

Basic concepts of Robotics: Introduction, basic structure of Robots, resolution, accuracy, and repeatability. Classification and structure of Robotic systems: PTP and CP systems, control loops of robotic systems, types of robots Drives and Control systems: hydraulic systems, DC servo motors, control approaches of Robots. Applications of Robots. Programming: manual teaching, lead – through teaching, programming languages. Sensors and Intelligent Robots: introduction to Robotic sensors, vision systems, range detectors, force and torque sensors.

Module IV (12 hours)

Advanced concepts in automation: direct numerical control,Adaptive control, Group Technology (GT): Part families; part classification and coding system: Group technology machine cells: Advantages of GT. Computer Aided Process Planning: Introduction and

benefits of CAPP. Types of CAPP systems, machinability data selection systems in CAPP. CAE, CIM, FMS, computer integrated manufacturing

Text Book and References

1. Groover & Zimmers “CAD/CAM” PHI
2. Rdhakrishnan “CAD/CAM”
3 Mikell P. Groover, “Automation, Production Systems and Computer Aided Manufacturing”, Prentice Hall, 1980
4 Mechatronics : HMT (TMH)
5 CNC Programming made easy: B.K.Jha, Vikas Publishing House
6 Robot Technology – Fundamental: James G Keramas, Vikas Thomson Learning
7 Computer Integrated Design and Manufacturing by D.D. Bedworth, M.RHenderson & P.M. Wolfe, Tata MCGraw Hill Pub. Co.
8. CAD/CAM - theory and Practice by Zeid Ibraham, Tata McGraw Hill Pub Co

University Examination Pattern

Q I – 8 short answer type questions of 5 marks, 2 from each module.

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

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

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

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

Sessional Work Assessment

Tests (2X15)	–	30 marks
Assignments (2X10)	–	20 marks
Total	–	50 marks

2K6ME 506: MACHINE TOOLS

3 hrs. lecture and 1 hour tutorial per week

MODULE I (13 hours)

Basic Concepts of Machine Tools: General requirements of machine tools- tool- work motions on lathe, milling, drilling, shaping, slotting, planing and grinding machines- cutting speeds and feeds- estimation of machining time.

Kinematics of Machine Tools: Selection of range of speeds and feeds- layout of speeds- graphical representation of speed and structure diagram- ray diagram for machine tool gear boxes

Machine Tool Drive: Stepped and step less regulation of speeds- feed and speed mechanisms in lathe, milling and drilling machines- gauging of components.

MODULE II (13 hours)

Cutting Tools: Geometry of cutting tools and tool nomenclature- single point and multipoint cutting tools- tools used for turning, milling, drilling and broaching- tool materials and their properties- grinding wheels and their selection. Production Lathes: Turret lathes- tools and attachments- operations and tools layout- automatic screw machine

Metal Cutting: Mechanics of chip formation- types of chips- orthogonal and oblique cutting- velocity relationships- cutting forces and factors affecting cutting forces- cutting force and power analysis- thermal aspects of machining- cutting fluids and their selection.

MODULE III (13 hours)

Machinability and Tool Life: Tool wear and tool life- tool life equations- tool life specifications and criteria- effect of machining parameters on tool life- variables affecting machinability -Economics of machining: Selection of optimum machining conditions- machine law and tool law

Jigs and fixtures: Basic principles- elements of jigs and fixtures- design principles common to jigs and fixtures.

MODULE IV (13 hours)

Press working: Different types of presses- principles of operation and selection- computation of capacities tonnage- center of pressure- cutting operations- shear action in die cutting operations- compound and progressive dies

Text Book and References

1. HMT, Production Technology, Tata McGraw Hill
2. Ghosh & Mallik, Manufacturing Science, Affiliated East-West Press
3. Juneja & Sekhon, Fundamentals of Metal Cutting and Machine Tools, Wiley Eastern
4. Sharma P C, A Text book of Production Engineering, S Chand & Company
5. ASTME, Fundamentals of Tool Design, Prentice Hall of India
6. Bhattacharya A, Metal Cutting: Theory and Practice, Central Book Publishers
7. Boothroyd, Fundamentals of Metal Machining and Machine Tools, McGraw Hill

University Examination Pattern

Q I – 8 short answer type questions of 5 marks, 2 from each module.

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

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

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

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

Sessional Work Assessment

Tests (2X15)	–	30 marks
Assignments (2X10)	–	20 marks
Total	–	50 marks

2K6ME 507(P): PRODUCTION ENGG LAB II

3 hrs. practical per week

Introduction: limits and fits - horizontal milling machine - vertical milling machine - shaping machine - slotting machine - surface, centreless and cylindrical grinding - spindle drives - milling cutters - indexing head - simple, compound, differential and angular indexing - grinding wheel - drilling - reaming - tool layout

Introduction

Exercises:

1. Multi-start thread
2. Square thread
3. Eccentric turning
4. Exercise on limits and fits
5. Internal thread
6. Spur gear
7. Helical gear by simple and differential indexing
8. Surface, slot and keyway milling
9. Shaper exercise on cube with V-groove, slot and guide ways
10. Grinding
11. Tool grinding

Text Books and References

1. HMT, *Production Technology*, Tata McGraw Hill
2. ASTME, *Tool Engineer's Handbook*
3. Burghardt, Asilered & Anderson, *Machine Tool Operations I & II*, McGraw Hill
4. Chapman W.A.J., *Workshop Technology: Part 2.*, Viva Low Priced Student Edition

Rao R.V., Metal Cutting and Machine Tools, S K Kataria & Sons

Sessional Work Assessment

Laboratory practical and record	–	35 marks
Tests	–	15 marks
Total	–	50 marks

2K6ME 508(P): THERMAL ENGINEERING LAB

3 hrs. practical per week

1. Study of systems and components of petrol and diesel engines
2. Study of automotive parts
3. Study of air compressors, blower and fan
4. Study of boilers and turbines
5. Performance test on refrigeration plant
6. Performance test on air conditioning plant
7. Performance test on boilers
8. Determination of flash and fire points of oils
9. Determination of viscosity of oils
10. Determination of calorific value of fuels
11. Valve timing diagram on petrol and diesel engines
12. Load test on single cylinder four stroke diesel engine
13. Load test on twin cylinder four stroke diesel engine
14. Load test on four cylinder four stroke diesel engine
15. Load test on single cylinder four stroke petrol engine
16 Load test on twin cylinder four stroke petrol engine
17. Load test on four cylinder four stroke petrol engine
18. Load test on two stroke petrol engine
19. Heat balance test on petrol engine
20. Heat balance test on diesel engine
21. Cooling curve test on petrol engine
22. Cooling curve test on diesel engine
23. Morse test on petrol engine
24. Morse test on diesel engine
25. Retardation test on diesel engine
26. Retardation test on petrol engine
27. Variable speed test on petrol engine
28. Variable speed test on diesel engine
29. Performance test on rotary air compressor
30. Performance test on air blower

12 experiments should be done as a minimum depending up on the lab facility.

Text Book and References

1. Rogowsky, *"Elements of Internal Combustion Engines"*, Tata McGraw Hill

2 Gill, Smith & Ziurys, *"Fundamentals of Internal Combustion Engines"*, Oxford and IBH

3 Maleev, "*Internal Combustion Engine Theory and Design*" McGraw Hill

Sessional Work Assessment

Laboratory practical and record	–	35 marks
Tests	–	15 marks
Total	–	50 marks

2K6 ME 601: ECONOMICS AND BUSINESS MANAGEMENT

3 hrs. lecture and 1 hour tutorial per week

Module 1 (12 hours)

Definition of economics – nature and scope of economic science – nature and scope of managerial economics – central problems of an economy – scarcity and choice - opportunity cost – objectives of business firms – forms of business – proprietorship – partnership – joint stock company – co-operative organisation – state enterprise

Module II (14 hours)

Consumption – wants – characteristics of wants – law of diminishing marginal utility – demand – law of demand – elasticity of demand – types of elasticity – factors determining elasticity – measurement – its significance in business – demand forecasting – methods of demand forecasting – supply – law of supply elasticity of supply

Module III (14 hours)

Production – factors of production – features of factors of production – division of labour – production function – Cobb – Douglas production function – production possibility curve – isoquants – marginal rate of technical substitution – properties of isoquants – law of variable proportions – returns to scale – isocost line – least cost combination of factors – expansion path – technical and economic efficiency – linear programming – graphical method – economies of large scale production

Module IV (12 hours)

Market structures and price determination – perfect competition – monopoly – monopolistic competition – oligopoly – kinked demand curve – money and banking – nature and functions of money – money market and capital market – commercial banks – functions – central banking functions – methods of credit control.

Text Book and References

1. Varshney R.L & Maheshwari K.L, Managerial Economics, S Chand & company Ltd.
2. Dwivedi D.N, Managerial Economics, Vikas Publishing House Pvt Ltd.
3. Dewett K.K, Modern Economic Theory, S Chand & Company Ltd.
4. Barthwal A.R, Industrial Economics, New Age International Publishers
   Benga T.R & Sharma S.C, Industrial Organisation And Engineering Economics,
5. Benga T.R & Sharma S.C, Industrial Organisation And Engineering Economics, Khanna Publishing
6. Ahuja H.L, Modern Micro Economics – Theory and Applications, S Chand & Company Ltd.
7. Koutsoyiannis A, Modern Microeconomics, Macmillan Press Ltd.
8. Joel Dean, Managerial Economics, Prentice – Hall of India Pvt. Ltd.
9. Dewett. K.K. & Verma J.D, Elementary Economic Theory, S Chand & Company Ltd.
   Jhingan M.L, Macro Economic Theory, Vrinda Publications Pvt. Ltd.
10. Jhingan M.L, Macro Economic Theory, Vrinda Publications Pvt. Ltd.

University Examination Pattern

Q I – 8 short answer type questions of 5 marks, 2 from each module.

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

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

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

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

Sessional Work Assessment

Tests (2X15)	–	30 marks
Assignments (2X10)	–	20 marks
Total	–	50 marks

2K6ME 602: DYNAMICS OF MACHINERY

3 hrs. lecture and 1 hour tutorial per week

Module I (13 hours)

Introduction to mechanical vibration – free and forced - response of single degree of freedom - linear systems – coulomb damping – support excitation – vibration isolation – whirling of shafts – two degree of freedom systems – coordinate transformations – coupling - natural coordinates – beat phenomenon – undamped vibration - vibration absorbers.

Module II (13 hours)

Multi degree of freedom systems – matrix formulation – influence coefficients – Eigen value problem – expansion theorem – modal analysis – solution methods – general response of discrete linear systems – self exited vibrations – criterion for stability - instability caused by friction – instability in oil film lubricated bearings – galloping of transmission lines – introduction to nonlinear vibration – introduction to random vibration.

Module III (13 hours)

Cam design – cam and follower types – displacement diagrams – Advanced cam profile techniques – cam profile synthesis – graphical and analytical methods – Gyroscope-gyroscopic couple – stability of two wheeler – four wheeler – gyroscopic effect:on aeroplane – steering, rolling and pitching of ships.

Module IV (13 hours)

Flywheel analysis– turning moment diagram – flywheel design – flywheel applications - balancing - static and dynamic balancing – balancing of masses rotating on several planes – balancing of reciprocating masses –balancing of mult-icylinder engines – balancing machines.

Text Book

1 W. T. Thomson, Theory of vibration with applications, Prentice Hall

2. J. P. Den Hartog, Mechanical vibrations, Mc Graw Hill.

3. J.E.Shigley & J.J.Uicker Jr.,Theory of Machines and Mechanisms, Mc Graw Hill.

References

1. S.S Rattan, Theory of Machines, Tata Mc Graw Hill.

2. V.P. Singh, Theory of Machines, Dhanpat Rai and Co..

3. Erdman A.G & Sandor G.N., Mechanism Design: Analysis and Synthesis

4. Leonard Meirovitch, Elements of vibration analysis, Mc Graw Hill

University Examination Pattern

Q I – 8 short answer type questions of 5 marks, 2 from each module.

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

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

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

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

Sessional Work Assessment

Tests (2X15)	–	30 marks
Assignments (2X10)	–	20 marks
Total	–	50 marks

2K6ME 603: HEAT AND MASS TRANSFER

3 hrs. lecture and 1 hour tutorial per week

Module I (16 hrs)

Basic Concepts of Thermodynamics and Heat Transfer. Heat and Other Forms of Energy. Heat Transfer Mechanisms. Simultaneous Heat Transfer Mechanisms.

Heat Conduction: Heat Conduction Equation .One-Dimensional Heat Conduction Equation. General Heat Conduction Equation. Boundary and Initial Conditions. Solution of Steady One-Dimensional Heat Conduction Problems. Heat Generation in a Solid. Variables Thermal Conductivity. Steady Heat Conduction in Plane Walls. Heat Conduction in Cylinders and Spheres. Critical Radius of Insulation. Heat Transfer from Finned Surfaces Transient Heat Conduction. Transient Heat Conduction in Large Plane Walls, Long Cylinders and Spheres. Transient Heat Conduction in Semi-Infinite Solids. Numerical Methods in Heat Conduction. Finite Difference Formulation of Differential Equations. One-Dimensional Steady Heat Conduction. Transient Heat Conduction.

Module 2 (12 hrs)

Convective Heat Transfer: Physical Mechanism of Forced Convection. Velocity Boundary Layer. Thermal Boundary Layer. Empirical relation in forced convection. Flow Over a Flat Plates. Flow across Cylinders and Spheres. Flow in Tubes. Physical Mechanism of Natural Convection. Empirical relation in free convection. Natural Convection over Surfaces, inside Enclosures, and from Finned Surfaces. Combined Natural and Forced Convection.

Module 3 (12 hrs)

Boiling and Condensation: Boiling Heat Transfer. Pool Boiling. Flow Boiling. Critical Heat Flux (CHF). Condensation Heat Transfer. Film Condensation. Film Condensation inside Horizontal Tubes

Heat Exchangers: Type of Heat Exchangers. Temperature Distribution – Overall heat transfer coefficient, Heat Exchange Analysis – LMTD Method and NTU Method.

Module 4 (12 hrs)

Radiation Heat Transfer: Introduction to Physical mechanism. Radiation properties. Thermal Radiation. Blackbody Radiation. Solar Radiation. Radiation laws. The View Factor. Radiation Heat Transfer, Radiation Shields.

Mass Transfer: Introduction. Mass Diffusion. Fick’s law of diffusion. Boundary Conditions. Steady Mass Diffusion through a wall. Mass Convection

Text Book and References

1 Yunus A. Cengel., "Heat Transfer – A practical approach", Second Edition, Tata McGraw-Hill

2. Incropera. F.P.and Dewitt.D.P. "Introduction to Heat Transfer", John Wiley and Sons

3. Holman, J.P. "Heat Transfer", McGraw-Hill Book Co., Inc., New York, 6th Edn.

4. Sachdeva, S.C., "Fundamentals of Engineering Heat & Mass Transfer", Wiley Eastern Ltd., New Delhi

University Examination Pattern

Q I – 8 short answer type questions of 5 marks, 2 from each module.

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

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

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

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

Sessional Work Assessment

Tests (2X15)	–	30 marks
Assignments (2X10)	–	20 marks
Total	–	50 marks

2K6ME 604: ADVANCES IN MANUFACTURING ENGINEERING

3 hrs. lecture and 1 hour tutorial per week

Module I (13 hours)

Computer technology - introduction - CPU - types of memory - input/output devices - computer programming - operating the computer system - mini/micro computers and programmable controllers - computer aided design - fundamentals of CAD - the design process - application of computers for design - manufacturing data base - computer graphics - software configuration - constructing the geometry - transformations - 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 & inspection

Module IV (13 hours)

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

.

.

Text Book and References

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

University Examination Pattern

Q I – 8 short answer type questions of 5 marks, 2 from each module.

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

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

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

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

Sessional Work Assessment

Tests (2X15)	–	30 marks
Assignments (2X10)	–	20 marks
Total	–	50 marks

2K6ME 605: OPERATIONS RESEARCH

3 hrs. lecture and 1 hour tutorial per week

Module I: Linear algebra (13 hours)

Vectors - vector space and Euclidean space - vector operations - matrix operations - unit vector - sum vector - linear dependence - bases - spanning set - rank - simultaneous equations - basic solutions - point sets - lines and hyper planes - linear inequalities - convex sets - extreme points - fundamental theorem of linear programming

Module II: Linear programming (13 hours)

Statement of the LP problem - slack and surplus variables - basic feasible solutions - reduction of a feasible solution to basic feasible solution - artificial variables - optimality conditions - unbounded solutions - Charnes' M method - two phase method - degeneracy - duality

Module III: Transportation, assignment and game problems (13 hours)

Transportation problem - coefficient matrix and its properties - basic set of column vectors - linear combination of basic vectors - tableau format - stepping stone algorithm - UV method - inequality constraints - degeneracy in transportation problems - assignment problem as a maximally degenerate transportation problem - Köning's method - rectangular zero sum games - von Neuman's theorem - saddle points - pure and mixed strategies - formulation of the primal and dual LP problem for fixed strategies - dominance - graphical solutions

Module IV: Queuing theory (13 hours)

Basic structure of queuing models - exponential and Poisson distributions - birth and death processes - queuing models based on Poisson inputs and exponential service times - basic model with constant arrival rate and service rate - finite queue - limited source queue models involving non-exponential distributions - single service model with Poisson arrival and any service time distribution - Poisson arrival with constant service time - Poisson arrival and Erlang service times - priority disciplines - dynamic programming - Bellman's principle of optimality - formulation and solution of simple problems

Text Book

1. Hadley G, Linear Programming, Addison Wesley
2. Hillier & Lieberman, Operations Research, John Wiley
3. Ravindran, Solberg & Phillips, Operations Research, John Wiley

References

1. Saskrieni, Yaspen & Friedman, Operations Research: Methods and Problems, Wiley Toppen
2. Wagner, Principles of Operations Research, Prentice Hall of India

University Examination Pattern

Q I – 8 short answer type questions of 5 marks, 2 from each module.

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

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

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

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

Sessional Work Assessment

Tests (2X15)	–	30 marks
Assignments (2X10)	–	20 marks
Total	–	50 marks

2K6ME 606(A): NUMERICAL METHODS

3 hrs. lecture and 1 hour tutorial per week

MODULE I: **(14 hours)** Systems of equations Introduction to mathematical modeling-algorithms-convergence – rate, order of convergence- errors in numerical algorithms-Finding roots of polynomial equations- bisection method- method of false position-Newton-Raphson method- fixed point iteration-Secant method –Convergence of these methods-Gauss elimination method for systems of linear equation-pivoting strategies-LU decomposition – Iterative techniques for linear systems-Jacobi, Gauss Seidel method-Conjugate gradient method-Non-linear systems of equations-Newton's method –application problems-power method for the determination of Eigen values.

MODULE II (12 hours). Interpolation Lagrange form of the interpolating polynomial-Newton's form of the interpolating polynomial- divided differences- finite difference operators- Newton's forward and backward interpolations- Stirling's interpolation formula-errors of interpolation formulae- Cubic spline interpolation-curve fitting- linear regression.

MODULE III: (**13 hours)**

Numerical differentiation and integration Numerical differentiation- differential formulae in the case of equally spaced points- Richardson extrapolation- Numerical integration –Newton-Cotes quadrature- trapezoidal and Simpson's rules- Gaussian integration-error analysis-Initial value problems of ordinary differential equations- Euler's method-Taylor methods.

MODULE IV: (13 hours) Numerical solution of ordinary differential equations

Runge-Kutta methods –multistep methods-Adam-Bashforth and Adam-Moulton method-Predictor-Corrector schemes-Milne's method-Solution of boundary value problems in ordinary differential equations-finite difference methods for solving two dimensional Laplace equation for a rectangular region- finite difference method of solving heat equation and wave equation with given initial and boundary condition.

Text Book

1.Froberg C.E., *Introduction to Numerical Analysis,* Addison Wesley

2.Gerald C.F., *Applied Numerical Analysis,* Addison Wesley

3.Hildebrand F.B., *Introduction to Numerical Analysis,* T.M.H.

4.James M.L., Smith C.M. & Wolford J.C., *Applied Numerical Methods for Digital Computation,* Harper & Row

5.Mathew J.H., *Numerical Methods for Mathematics, Science and Engineering,* P.H.I

References

1.Bradie Brian, A Friendly Introduction to Numerical Analysis, Pearson Education.

University Examination Pattern

Q I – 8 short answer type questions of 5 marks, 2 from each module.

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

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

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

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

Sessional Work Assessment

Tests (2X15)	–	30 marks
Assignments (2X10)	–	20 marks
Total	–	50 marks

2K6ME 606(B): MECHATRONICS

3 hrs. lecture and 1 hour tutorial per week

MODULE I: (11 hours) Introduction to mechatronics-sensors and transducers-signal conditioning-pneumatic and hydraulic systems-mechanical and electrical systems.

MODULE II: (11 hours) System modeling-mathematical models-mechanical, electrical, fluid and thermal system building blocks-system models- dynamic response of systems- first and second order systems-modeling dynamic systems-systems transfer functions-frequency response-stability.

MODULE III: (15 hours) Controllers Closed loop controllers-continuous and discrete processes-proportional, derivative and integral controls-PID controller-digital controllers-controller tuning-adaptive control.

MODULE IV: (15 hours) Digital circuitsMicro controllers and micro processors-digital logic circuits-micro controller architecture and programming-programmable logic controllers

Text Book

1. Bolton W., *Mechatronics: Electronic Control Systems in Mechanical and Electrical Engineering,* Addison Wesley Longman Limited

References

1. Dorf R.C. & Bishop R.H., *Modern Control Systems*, Addison Wesley
2. Krishna Kant, *Computer Based Industrial Control*, Prentice Hall of Indian Private Limited
3. HMT Limited, *Mechatronics*, Tata McGraw Hill Publishing Company Limited
4. Herbert Taub & Donald Schilling, *Digital Integrated Electronics*, McGraw Hill International Editions

University Examination Pattern

Q I – 8 short answer type questions of 5 marks, 2 from each module.

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

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

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

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

Sessional Work Assessment		
Tests (2X15)	–	30 marks
Assignments (2X10)	–	20 marks
Total	–	50 marks

2K6ME 606(C): CNC PROGRAMMING

3 hrs. lecture and 1 hour tutorial per week

Module I (13hrs)

An Introduction to Numerical Control Machinery: The History of NC, CNC Machines, Input Media, Binary Numbers, Tape Formats, Objectives of Numerical Control, Applications in Industry

Numerical Control Systems: Components, Types of Control Systems, Servomechanisms, Loop Systems, The Cartesian, Coordinate System, Positive and Negative Movement, Positioning Systems, Setting the Machine Origin, Dimensioning

Process Planning and Tool Selection: Process Planning, Tooling for Numerical Control, Tooling for Hole Operations, Milling Cutters Special Inserted Cutters, Speed and Feeds, Tool Changes, Automatic Tool Changers, Tool Storage, Tool Length and Tool Length Offset

Module II (13hrs)

Programming Coordinates: Hole Operations, Milling Operations, Mixing Absolute and Incremental Positioning, Metric Coordinates

Two Axis Programming: Introduction, Parts of a CNC Program, Word Address Format, Absolute Positioning, Incremental Positioning, Milling and Drilling Examples

Three Axis Programming: Introduction, A Programming Task Using Three Axes, Other G-Codes Used in CNC Programming, Using an Indexer, Programming Examples

Math for Numerical Control Programming: Using Trigonometry for Cutter Offsets, Milling and Lathe examples

Linear and Circular Interpolation: Linear Interpolation, Circular Interpolation,

Cutter Diameter Compensation: Definitions and Codes, Program Example, Special Considerations, Fine Tuning with Cutter Diameter Compensation

Module III (13hrs)

Do Loops and Subprograms: Do Loops, Subprograms, Calling a Subprogram, Subroutines for Cutter Diameter Compensation, Nested Loops

Advanced CNC Features: Mirror Imaging, Polar Rotation, Helical Interpolation

The Numerical Control Lathe: Lathe Bed Design, Axis Movement, Tool holders and Tool Changing, Spindle Speeds, Feed rates, Machine Origin and Work Coordinate Systems, Quick setters

Programming CNC Turning Machines: Machine Reference Point, Diameter vs. Radius Programming, Turning and Facing, Taper Turning, Circular Interpolation, Drilling, Threading

Module IV(13hrs)

Use of Computers in Numerical Control Programming: Offline Programming Terminals, Computer-Assisted Programming, Computer-Aided Programming Languages, CAD/CAM Systems, Solid Modeling Systems

The Future of Numerical Control: NC in Prototype and Job Shops, CNC in Manufacturing, Employment Opportunities in NC

Text Book and References

1. Lynch; Computer Numerical Machining, 1992, McGraw-Hill

2 Stanton, George C. Bridgeport Heidenhain CNC Mill: Programming & Operating Instructions.

3 Valentino, J.V. & Goldenberg, J. (2003). *Introduction to computer numerical control (CNC)* (3rd Ed.). Upper Saddle River, NJ: Prentice Hal

University Examination Pattern

Q I – 8 short answer type questions of 5 marks, 2 from each module.

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

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

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

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

Sessional Work Assessment

Tests (2X15)	–	30 marks
Assignments (2X10)	–	20 marks
Total	–	50 marks

2K6ME 606(D): TOOL ENGINEERING AND DESIGN

3 hrs. lecture and 1 hour tutorial per week

MODULE I: (13 hours) Design of chips forming tools

Single point tools-tool geometry-tool materials-milling cutters-drills and reamers-grinding wheels-tipped tools-design of tool holders and boring bars-vibration damping of boring bars-form tools-influence of cutting parameters on cutting force and power-cutting power estimation in turning, milling and drilling.

MODULE II: (13 hours) Press working tools

Power presses-die cutting operations-centre of pressure-punch and die size and press tonnage calculations-scrap-strip layout-compound and progressive dies-die design for simple components-drawing dies-blank development-press tonnage estimation-blank holding pressure-multiple draws-draw dies for simple shells.

MODULE III: (13 hours) Design of fixture

Elements of fixture-standard work holding devices-principles of location and clamping-plain and concentric location-clamping elements-quick acting clamps-design and sketching of fixtures for milling of simple components.

MODULE IV: (13 hours) Design of jigs

Jigs for drilling and reaming-types of jigs-guide bushings-indexing jigs-design and sketching of jigs for simple jobs

Text Book and References

1. Kempster M.H.A., "*An Introduction to Jig and Tool Design"*, ELBS
2. ASTME, *Fundamentals of Tool Design*
3. Grant H.E., "*Jigs and Fixtures - Non Standard Clamping Devices*", Tata McGraw Hill
4. Goroshkin A.K., "*Jigs and Fixtures Hand Book*", MIR Publishers
5. Wilson & Holt, "*Hand book of Fixture Design*", McGraw Hill
6. Colving & Haas, "*Jigs and Fixtures - A Reference Book*", McGraw Hill
7. Cole B., "*Tool Design*", Taraporevala
8. Donaldson, Lecain & Goold, "*Tool Design*", Tata McGraw Hill

University Examination Pattern

Q I – 8 short answer type questions of 5 marks, 2 from each module.

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

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

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

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

Sessional Work Assessment

Tests (2X15)	–	30 marks
Assignments (2X10)	–	20 marks
Total	–	50 marks

2K6ME 606(E): VIBRATION AND NOISE CONTROL

3 hrs. lecture and 1 hour tutorial per week

MODULE I: (13 hours)

Introduction to mechanical vibration-free and forced response of single degree of freedom linear systems-Coulomb damping-support excitation-vibration isolation-whirling of shafts-measurement of vibration-accelerometer-seismometer.

MODULE II: (13 hours)

Two degree of freedom systems-coordinate transformations-coupling natural coordinates-beat phenomenon-undamped vibration absorbers-multi degree of freedom systems-matrix formulation-influence coefficients-Eigen value problem-expansion theorems-model analysis-solution methods-general methods of discrete linear systems.

MODULE III: (13 hours)

Vibration of continuous systems-exact methods-boundary value problem-Eigen value problem-axial vibration of rods-bending vibration of bars-Rayleigh's quotient-response of systems by modal analysis-energy of continuous systems-general elastic waves-formulation and decoupling of equilibrium equations-approximate methods-different methods like Rayleigh's energy method, Rayleigh-Ritz method and Holzer's method

MODULE IV: (13 hours)

Self excited vibrations-criterion of stability-instability caused by friction-instability in oil film lubricated bearings-galloping of transmission lines-introduction to nonlinear vibration-introduction to random vibration-stationary random process-probability density functions-auto correlation function-power spectral density function-noise-sound level meter scale-psychological scale-equivalent sound level-noise and loss of hearing-psychological effects of noise-noise exposure limits-noise control-control at the source-control along the path-control at the receive

Text Book

1. Thomson W.T., *Theory of Vibration with Applications*, Prentice Hall
2. Den Hartog J.P., *Mechanical Vibrations*, McGraw Hill, Self excited vibration, Module IV
3. Sanders M.S. & McCormick E.J., *Human Factors in Engineering and Design*, McGraw Hill, Noise, Module IV

References

1. Leonard Meirovitch, *Elements of Vibration Analysis,* McGraw Hill
2. Amitabha Ghosh & Asok Kumar Mallik, *Theory of Mechanisms and Machines*, Affiliated East-West Press
3. Kinsler L.E. & Fray A.R., *Fundamentals of Acoustics*, John Wiley, Module IV
4. Beranek L.L., *Noise and Vibration Control*, McGraw Hill, Module IV
5. Love AEH, *Treatise on Mathematical Theory of Elasticity, Dover,* Elastic Waves, Module III
6. Constable JER & Constable K.M., *Principles and Practice of Sound Insulation*, Isaac Pitman & Sons

University Examination Pattern

Q I – 8 short answer type questions of 5 marks, 2 from each module.

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

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

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

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

Sessional Work Assessment

Tests (2X15)	–	30 marks
Assignments (2X10)	–	20 marks
Total	–	50 marks

2K6 ME 607(P) HEAT TRANSFER LAB

3 hrs. practicals per week

List of experiments

1. Performance study on parallel flow and counter flow Heat exchanger.
2. Performance study on Shell and tube Heat exchanger.
3. Measurement of emissivity.
4. Measurement of solar radiation.
5. Determination of thermal conductivity of metal rod.
6. Experiment on forced convection heat transfer.
7. Experiment on unsteady state conduction.
8. Experiment on drop wise and film wise condensation.
9. Measurement of critical heat flux.
10. Experiment on natural convection heat transfer.
11. Experiment on boiling heat transfer.
12. Determination of thermal resistance of composite wall
13. Determination of Stefan Boltzman constant.
14. Determination of thermal conductivity of asbestos powder.
15. Determination of effectiveness of fin.

Text Book and References

1 Yunus A. Cengel., "Heat Transfer – A practical approach", Second Edition, Tata McGraw-Hill

2. Incropera. F.P.and Dewitt.D.P. "Introduction to Heat Transfer", John Wiley and Sons

3. Holman, J.P. "Heat Transfer", McGraw-Hill Book Co., Inc., New York, 6th Edn.

4. Sachdeva, S.C., "Fundamentals of Engineering Heat & Mass Transfer", Wiley Eastern Ltd., New Delhi

Sessional Work Assessment

Laboratory practical and record	–	35 marks
Tests	–	15 marks
Total	–	50 marks

2K6 ME 608(P) CAD/CAM/CAE LAB

3 hrs. practicals per week

1. Exercise on solid modeling using available software packages- Concepts of computer aided modeling, design, analysis and manufacturing- Survey of various available software for the above areas– introduction to computer graphics, curves and surface generation, sweep, revolve, loft, extrude, filleting, chamfer, splines etc. Scaling and rotation transformation using commercial solid modeling packages: 2 D drafting and 3 D modeling.
2. Assembly and mechanical design – assembling of various parts and tolerance analysis – synthesis and design of mechanisms - four bar chain, cam and follower, two stroke and four stroke engines – 3D modeling, assembling, animation and analysis using available software packages.
3. Computer aided manufacturing – part programming fundamentals – hands on training in computer controlled machining operations – part programming, simulation and operation on CNC lathe and CNC milling machines- modeling, simulation and programme generation using software packages.
4. Exercises on Finite Element Analysis –introduction to FEM -1 D, 2 D,3 D elements – shape function- processing –boundary conditions, structured and free mesh generation – analysis – linear and nonlinear analysis – static and dynamic analysis – post processing – display , animation, extraction of nodal data –exercises on heat conduction and elasticity using available FEM packages.]
5. Programming of Industrial Robots – introduction to robotics – structure, workspace analysis and various components- actuators – sensors – encoders – end effectors – applications –hands on training on industrial robots – manual and programmed path planning. Programming of Robots using available software packages.
6. Computer aided inspection and quality control- introduction to CMM- classification – structures – components – familiarity with measurement software packages and its modules –demonstration of the capability of coordinate measuring machines using a sample component eg.- engine block.
7. concepts of reverse engineering and rapid prototyping technology

Text Book and References

1. Rogers D.F. & Adams J.A., "*Mathematical Elements for Computer Graphics*", McGraw Hill
2. Rogers David F., "*Procedural Elements for Computer Graphics*", McGraw Hill
3. Cook, Robert Davis et al., "*Concepts and Applications of Finite Element Analysis*", John Wiley
4. Koren Yoram, "*Computer Control of Manufacturing Systems*", McGraw Hill
5. Kundra Rao & Tewari, "*Numerical Control and Computer Aided Manufacturing*", Tata McGraw Hill
6. Ramamurthy V., "*Computer Aided Mechanical Design*", Tata McGraw Hill
7. Fu K.S., Gonzalez R.C. & Lee C.S.G., "*Robotics: Control, Sensing, Vision and Intelligence*", McGraw Hill
8. Koren Yoram, "*Robotics for Engineers*", McGraw Hill
9. Bosch J.A., "*Coordinate Measuring Machines and Systems*", Marcel Decker Inc

Sessional Work Assessment

Laboratory practical and record	–	35 marks
Tests	–	15 marks
Total	–	50 marks