

B Tech - (Design & Manufacturing)

Semester 1

	<i>Course Name</i>	<i>L</i>	<i>T</i>	<i>P</i>	<i>C</i>	<i>Cat</i>
MAT101	Calculus	3	0	0	3	SMA
PHY101	Physics I	3	0	0	3	SPH
CHY101	Macromolecules in Engg. Materials	3	0	0	3	SCY
MEC101	Thermodynamics	3	0	0	3	BET
MEC102	Material Science and Technology	3	0	0	3	PMT
WOR101	Workshop I	0	0	3	2	BES
PHY102	Physics Lab I	0	0	3	2	SPH
MEC103	Graphic Art	0	0	3	2	BES
	NSS					
	Total	15	0	9	21	

Semester 2

	<i>Course Name</i>	<i>L</i>	<i>T</i>	<i>P</i>	<i>C</i>	<i>Cat</i>
COM101	Computational Engineering	3	0	0	3	BES
MAN101	Technology, Invention & Innovation	2	0	0	2	HSS
MAT102	Solutions of ODEs	3	0	0	3	SMA
PHY103	Physics II	3	0	0	3	SPH
MEC104	Functional and Conceptual Design	3	0	0	3	PMT
WOR102	Workshop II	0	0	3	2	BES
PHY104	Physics Lab II	0	0	3	2	SPH
MEC105	Engineering Drawing	1	0	3	3	BES
	Total	15	0	9	21	

Semester 3

	<i>Course Name</i>	<i>L</i>	<i>T</i>	<i>P</i>	<i>C</i>	<i>Cat</i>
MAT201	Linear Algebra and Optimization	3	0	0	3	SMA
ELE201	Analog and Digital Circuits	3	0	0	3	PMT
MEC201	Manufacturing Technology	3	0	0	3	PMT
MEC202	Fluid Mechanics and Heat Transfer	3	0	0	3	PMT
MEC203	Statics and Strength of Materials	3	1	0	4	BET
ELE 202	Electrical CAD Lab	0	0	3	2	PML
MEC204	Machine Drawing Practice	1	0	3	3	PML
MEC205	Applied Mechanics Lab	0	0	3	2	PML
	Total	16	1	9	23	

Semester 4

	<i>Course Name</i>	<i>L</i>	<i>T</i>	<i>P</i>	<i>C</i>	<i>Cat</i>
MAT202	PDEs and Numerical Methods	3	0	0	3	SMA
ELE203	Control Systems	3	0	0	3	PMT
MEC206	Mechanical Design Concepts	3	0	0	3	PMT
MEC207	Electromech. Drives and Actuators	4	0	0	4	PMT
MEC208	Kinematics and Dynamics	3	1	0	4	PMT
ELE204	Controls Lab	0	0	3	2	PML
MEC209	Engineering Simulations I	1	0	3	3	PML
MEC210	Electromechanical Drives and Actuators Lab.	0	0	3	2	PML
	Total	17	1	9	24	

Semester 5

Course No	Course Name	L	T	P	C	Cat
IND301	Ecology and Environment	2	0	0	2	BET
ELE301	Embedded Controllers	3	0	0	3	PMT
MEC301	Design of Machine Elements	3	0	0	3	PMT
MEC302	Applied Thermal Engineering	4	0	0	4	PMT
MEC303	Precision Mfg. and Metrology	3	0	0	3	PMT
ELE302	Microprocessor Lab	0	0	3	2	PML
MEC304	Machine Tool and Metrology Lab	0	0	3	2	PML
MEC305	Instrumentation Theory and Practice	1	0	3	3	PML
Total		16	0	9	22	

Semester 6

Course No	Course Name	L	T	P	C	Cat
MAN301	Management of Fin, Mktg. and Persnl.	3	0	0	3	HSS
MEC306	Geometric Modelling and CAD	3	0	0	3	PMT
MEC307	Finite Element Analysis	3	0	0	3	PMT
	Elective I	3	0	0	3	PMT
MEC309	Robotics and Automation	3	0	0	3	PMT
MEC310	Product Design Lab	0	0	3	2	PML
MEC311	Thermal Engineering Lab	0	0	3	2	PML
MEC312	Advanced Manufacturing Lab	0	0	3	2	PML
INT301	Industrial Training (Summer)	0	0	0	1	PIT
Total		15	0	9	22	

Semester 7

Course No	Course Name	L	T	P	C	Cat
MAN401	Professional Ethics	2	0	0	2	HSS
MAN402	Industrial Engineering	3	0	0	3	PMT
MAN403	Tech Commn and Report Writing	3	0	0	3	HSS
	Elective II (Humanities)	3	0	0	3	HSS
	Elective III	3	0	0	3	PMT
MEC401	Engineering Simulations II	1	0	3	3	PML
INL401	Industrial Lecture	0	0	3	1	PIL
PRO401	Project I	0	0	6	4	PMP
Total		15	0	12	22	

Semester 8

Course No	Course Name	L	T	P	C	Cat
	Elective IV	3	0	0	3	PMT
	Elective V	3	0	0	3	PMT
PRO402	Project II	0	0	24	16	PMP
Total		6	0	24	22	

SPH	SCY	SMA	BET	BES	PMT	PML	PIT	PIL	PMP	HSS	TOTAL
10	3	12	9	12	66	30	1	1	20	13	177

COURSE CONTENTS
B TECH (DESIGN AND MANUFACTURING)
2007 & 2008 Batch
(Numbers in the paranthesis indicate L T P C)

MAT101 CALCULUS **(3 0 0 3)**

Sequences, definite integral as the limit of al sum, mean value theorem, fundamental theorem of the integral calculus, applications.

Functions of several variables, geometric representation partial and total increments, partial derivatives, derivatives of composite functions, directional derivatives, gradient, divergence and curl, Taylor formula, Lagrange multipliers, optimization problems.

Multiple integrals, line integrals and surface integrals and their evaluation, Greens, Gauss and Stokes theorems.

References:

1. Piskunov, N., Differential and Integral Calculus, Volumes I and II, Mir. Publishers 1981
2. Kreyszig, E., Advanced Engineering Mathematics, Wiley Eastern 2007

PHY101 PHYSICS I **(3 0 0 3)**

Use of vectors in practical mechanics. Unit vectors in spherical and cylindrical polar coordinates. Conservative vector fields and their potential functions - gravitational and electrostatic examples. Gradient of a scalar field. Equipotentials, states of equilibrium. Work and energy, conservation of energy. Motion in a central force and conservation of angular momentum. Physics concepts in vector fields, Continuity equations and conservation principles for matter, energy and electrical charge. Flux, divergence of a vector. Gauss' theorem, physical applications in gravitation and electrostatics. Irrotational versus rotational vector fields. Physical significance of circulation, curl of a field. `Stokes' theorem, physical applications. Oscillatory motion, Wave motion in one dimension. Wave equation and travelling wave solutions. Wave velocity, group velocity and dispersion. Shallow water waves. Wave equation in three dimensions, spherical waves.

References:

1. Kittel C., Knight W.O. and Ruderman M.A., Mechanics-Berkeley Physics Course, Vol.1, Tata McGraw-Hill
2. Purcell E.M. Electricity and Magnetism-Berkeley Physics Course, Vol.2, Tata McGraw-Hill
3. Crawford F.S-Waves and Oscillations, Berkely Physics Course, Vol.3, McGraw-Hill, 2008
4. Feynman R.P., Leighton R.B and Sands M., (Narosa) The Feynman Lectures on Physics, Vol 1 and 2 Narosa publishing, 2008

CHY101 MACROMOLECULES IN ENGINEERING MATERIALS (3 0 0 3)

Concepts - Small molecules to macromolecules. Definitions and nomenclature. Classification of polymers, types of polymerizations (chain growth, step growth and living), molecular weights and distribution. An elementary tour of physical methods of determining molecular weights and distribution.

Synthesis of Macromolecules - Thermodynamics and kinetics of chain polymerization with reference to industrially important polymers such as polyethylene, polypropylene, polystyrene, poly(vinyl chloride). Thermodynamics and kinetics of step polymerization with reference to specialty polymers such as PET, Nylon, PC, and PU. Step growth polymerizations involving cross linking (gelation) or formation of insoluble polymer mass. Determination of polymer structure via IR and NMR spectroscopies.

Characterization of polymer structure in the solid state - Characteristics of Amorphous and semicrystalline polymers. Viscoelasticity. Glass transition temperature and elementary theories of glass transition. Rubber elasticity and thermodynamic theory of rubber elasticity.

Applications - Engineering and specialty polymers, high performance fibres (Kevlar), Composite materials (BMC and SMC), conducting plastics. Polymers for separation science, biomedical devices, electronics and photonics.

References:

1. Joel R. Fried Polymer Science and Technology, Prentice Hall of India Pvt. Ltd. 1999.
2. Fred W. Billmeyer Jr, Textbook of Polymer Science, 4th Ed, Wiley-Interscience, New York, 1999.
3. Principle of Polymerization by George Odian, 4th Ed, Wiley-Interscience, New York, 1999.

MEC101 THERMODYNAMICS

(3 0 0 3)

Fundamentals - System & Control volume, Property, State & Process, Exact & Inexact differentials; Work - Thermodynamic definition of work; examples, Displacement work, Path dependence of displacement work and illustrations for simple processes, Fully resisted, partially resisted and unresisted process, Other forms of work - gravitational, electrical, magnetic, spring and shaft; Temperature - Definition of thermal equilibrium, Zeroth law, Definition of temperature and temperature scales, Various Thermometers; Heat - Definition; examples of heat/work interaction in systems. First Law - Cyclic & Non-cyclic processes, Concept of total energy E, Demonstration that E is a property, Various modes of energy; Pure substance - Two property rule, Enthalpy and internal energy; Ideal Gases and Mixtures of Ideal Gases; Properties of water-steam system - Const. temperature and Const. pressure heating, Definitions of saturated states, P-v-T surface, Use of steam tables-Saturation tables, Superheated tables, Identification of states & determination of properties; First Law for Flow Processes - Derivation of general energy equation for a control volume, Steady state steady flow

processes, Examples of steady flow devices, Unsteady processes; Second law - Definitions of direct and reverse heat engines - Definitions of thermal efficiency and COP, Kelvin-Planck and Clausius statements, Definition of reversible process, Internal and external irreversibilities, Carnot cycle, Absolute temperature scale; Entropy - Clausius inequality, Definition of entropy S, Demonstration that entropy S is a property, S for solids, liquids, and ideal gases undergoing various Δ Evaluation of processes, Determination of s from steam tables, Examples - Turbine, compressor, pump, nozzle, diffuser, Definition of Isentropic efficiency, Available and Unavailable energy, Concept of Irreversibility and Lost work; Thermodynamic cycles - Basic Rankine cycle, Basic Brayton cycle, Basic vapor compression cycle.

References:

1. Spalding, D. B. and Cole, E.H., Engineering Thermodynamics, Edward Arnold, 1976.
2. Nag, P.K, Engineering Thermodynamics, Tata McGraw-Hill, 2005.
3. Jones, J.B. and Shapiro, H.N., Fundamentals of Engineering Thermodynamics, John Wiley, 1999.
4. Moran, M.J. and Shapiro, H.N., Fundamentals of Engineering Thermodynamics, John Wiley, 2003.
5. Sonnag, R.E, Borgnakke, C and Van Wyan, G.J., Fundamentals of Thermodynamics, Sixth Ed, John Wiley, 2003.

MEC102 MATERIAL SCIENCE AND TECHNOLOGY

(3 0 0 3)

Crystal structure of metals, defects in metallic structure, plastic, deformation of metals, slip systems, equilibrium diagrams, the iron-carbon equilibrium diagram, steel, cast iron and non-ferrous alloys, their properties and applications.

Polymer, Ceramics and Composites; engineering properties and applications.

Mechanical properties of materials, testing of materials, heat treatment of steels, surface modifications of metals for specific engineering applications, tribological properties of metals and non-metals.

References:

1. Raymond A. Higgins, Engineering Metallurgy Part I - ELBS/ Edward Arnold London, 1983.
2. James, F. Shackelford, Introduction to Material Science for Engg, McMillan, NY 1995.
3. George Dieter, Mechanical Metallurgy, McGraw Hill, NY 1986.

WOR101 WORKSHOP I

(0 0 3 2)

Fitting, Machine shop - turning, Foundry, Welding

PHY102 PHYSICS LAB I

(0 0 3 2)

Experiments in Mechanical Properties Materials, Heat, Electromagnetism and Optics.

MEC103 GRAPHIC ART

(0 0 3 2)

Skilled base course with focuses on Drawing as a medium for expression and communication through drawn images. It will enhance the ability to represent images, ideas and concepts as observations and thinking process.

Studies will include: Interrelatedness of visual forms in terms of size, scale and overall proportion. Understanding basics principles of perception including depth and its representation. Introduction to different media, tools and instruments to create surface textures.

Assignments will include:

1. Skill enhancing assignments in developing basic drawing of lines - straight, curvilinear, angular, thick, thin, plane, volume etc.
2. Nature drawing - including Human/Animal/Birds - to study shapes and forms
3. Representation of basic 3-dimensional forms - Cubes, Cylinders, Cones, Spheres etc. in different combinations and sizes to understand principles of perspectives.
4. Some assignments in drawing and quick sketching.

References:

1. Thomas C Wang, Pencil Sketching, John Wiley & Sons 2002.
2. Itten Johannes, Design and Form, John Wiley & Sons 1975.
3. Kasprin Ron, Design Media - Techniques for Water Colour, Pen and Ink Pastel and colored markers, John Wiley & Sons 1999.

COM101 COMPUTATIONAL ENGINEERING

(3 0 0 3)

Computer Organization - Personal Computing - Distributed Computing - Client/server Computing - Higher Level languages - C environment - C Standard Library - Structured programming - Selection and repetition structure - Break, exit and continue statements - program control - functions - arrays - pointers - structures - Formatted I/O. Numerical Methods -round off and truncation errors - Approximations - Order of Convergence - non Linear equations - regular falsi; bisection, Newton - Raphson methods - matrices - Gauss eliminations - LU Decomposition - iterative methods for linear systems - interpolation - case studies illustrating the applicability of these techniques in general engineering, chemical, Civil, Mechanical and Electrical Engineering problems Computer Modeling and simulation - Discrete & Continuous approaches - Systems approach to problem solving - Models from various Engineering disciplines - Limitations of simulation.

References:

1. Deitel, P.J. Deitel, C: How to Program, H.M. Prentice Hall, 2007.
2. J.R. Rice, Numerical Methods, Software and Analysis, Mc-graw Hill, 1993.
3. S.C. Chaptra, R.P Canale, Numerical Methods for Engineers, Mc-graw Hill, 2006.
4. Francis Neelamuavil, Computer Simulation and Modelling, John Wiley & Sons, 1987.

5. William H. Press, Saul A. Teukolsky William T. Vetterling, Brian P. Numerical Recipes in C- Flannery, Manas Saikia for Foundation Books, 1993.
6. Delores M. Etter, Engineering problems solving with ANSI C- Prentice Hall.

MAN101 TECHNOLOGY, INVENTION AND INNOVATION**(2 0 0 2)**

Technology and Invention - An Introduction; Technological Change; Technology Forecasting (TF); Technology Assessment (TA) and Impact Analysis; Trade in Technology; Strategic Management of Technology; Thinking for Invention and Innovation; The Innovation Mindset; Case Studies in Technology and Innovation Management

References:

1. Forbes, Naushad and David Wield; From Followers to Leaders - Managing technology and innovation; Routledge, London, 2002
2. Harrison, Norma and Danny Samson; Technology Management; McGraw Hill, New York, 2002
3. Ford, David and Michael Sare; Managing and Marketing Technology; Thomson Learning, Singapore, 2001
4. Khalil, Tarek M.; Management of Technology - The key to competitiveness and wealth creation; McGraw Hill, Singapore, 2000
5. Burgelman, Robert A., et al; Strategic Management of Technology and Innovation; Second Ed, Irwin, Chicago, 1996
6. Gaynor, Gerard H.; Hand book of Technology Management; McGraw Hill, New York, 1996
7. Betz, Frederick; Strategic Technology Management; McGraw Hill, Singapore, 1994

MAT102 SOLUTIONS OF ODEs**(3 0 0 3)**

Linear ordinary differential equations with constant, coefficients, method of variation of parameters, linear systems of ordinary differential equations.

Infinite series, tests for convergence, alternating series, functional series, uniform convergence, power series and Fourier series.

Singular points of ordinary differential equations, series solutions, Bessel and Legendre differential equations, Properties of Bessel functions and Legendre polynomials.

Laplace transforms elementary properties of Laplace transforms, inversion by partial fractions, convolution theorem and applications to ordinary differential equations.

References:

1. Piskunov, N., Differential and Integral Calculus, Integral Press 1997
2. Kreyszig, E., Advanced Engineering Mathematics, Wiley Eastern 2007

PHY103 PHYSICS II**(3 0 0 3)**

Electrostatic potential and field due to discrete and continuous charge distributions. Dipole and quadrupole moments. Energy density in an electric field. Dielectric polarization. Conductors and capacitors. Electric displacement vector, dielectric susceptibility. Biot-Savart's law and Ampere's law in magneto statics. Magnetic induction due to configurations of current-carrying conductors. Magnetization and surface currents. Energy density in a magnetic field. Magnetic permeability and susceptibility. Force on a charged particle in electric and magnetic fields. Time-varying fields. Faradays' law of electromagnetic induction. Self and mutual inductance. Resonance and oscillations in electrical circuits. Displacement current. Maxwell's equations in free space and in linear media. Scalar and vector potentials, gauges. Plane electromagnetic waves. Electromagnetic energy density, Pointing vector. Wave guides.

References:

1. E.M. Purcell-Electricity and Magnetism- Berkely Physics Course, Vol.20, Tata McGraw-Hill, 2007
2. Feynman R.P., Leighton R.B. and Sands M. The Feynman Lectures of Physics, Vol.2 Narosa publication, 2008
3. Griffith D. JH., Introduction to Electrodynamics, Practice Hall, India, 1999
4. Reitz J.R. et al, Foundations of Electromagnetic Theory, Narosa publication 1998.
5. Wangsness R.K., Electromagnetic Fields, Wiley 1986.

MEC104 FUNCTIONAL AND CONCEPTUAL DESIGN**(3 0 0 3)**

The purpose of this course is to introduce to the undergraduate student the fundamental principles of Engineering Design which is very important and relevant in the context of to-days engineering professionals. The course will be generic to all engineering disciplines and will not require specialized preparation or pre-requisites in any of the individual engineering disciplines. The course introduces the students to the following aspects of design. 1. Philosophy of Engineering Design. 2. Engineering Design Process. 3. Identification and Analysis of needs. 4. Organization of Design Concept. 5. Design Methods. 6. Considerations in Engineering Design. 7. Design decisions. 8. Development of design. Case studies from field situations and real products will be used to illustrate these principles. Software support will be provided for self-learning by students

References

1. K.Otto and K. Wood, Product Design, Pearson Education, 2001.
2. D.G. Ullman, The Mechanical Design Process, McGraw- Hill, 1997
3. G. Pahl and W.Beitz, Engineering Design, Springer, 1996.

WOR 102 WORKSHOP II**(0 0 3 2)**

Pneumatics and Hydraulics: Carpentry: Processing of Plastics: Fabrication of FRP components.

PHY104 PHYSICS LAB II**(0 0 3 2)**

Experiments in Electricity, Magnetism, Optics.

References:

1. Smith E.V. Manual of Experimental in Applied Physics, London, Butterworth, 1970
2. Workshop B.L., and Flinit H.P. Advanced Practical Physics for Students, Methuen and Co. Ltd. London
3. Jerrad H.G and Mc Neil D.B, Theoretical and Experimental Physics
4. Fretter W.B, Introduction to Experimental Physics, Blackiee

MEC105 ENGINEERING DRAWING**(1 0 3 3)**

Manual drawing: Introduction to Engineering drawing and graphics. Construction of plane curves. Coordinate system projection of lines and planes. Projection of right regular solids. Section and intersection of solids and development of surfaces. Computer Aided Drafting: Systems of projections - principles, conventions and applications of orthographic and isometric projections. Dimensioning principles and conventional representations.

References:

1. Luzadder. W.J., Fundamentals of Engineering Drawing, Prentice Hall India, 1992
2. French and Vierk., Fundamentals of Engineering Drawing, McGraw Hill, 1996
3. Narayana. K.L., and Kannaiah. P., Engineering Drawing, Charaotar Publ House, 1998
4. Venugopal. K., Engineering Drawing, New Age International, 2004
5. Natarajan. K.V., A text book of Engineering Drawing, Classic Prints, 2000
6. Gopalakrishnan. K.R., Engineering Drawing, Subash Stores, 2002
7. Bhatt. N.D., Engineering Drawings, New Age International, 2007

MAT201 LINEAR ALGEBRA AND OPTIMIZATION**(3 0 0 3)**

Vector Spaces, subspaces, basis, dimension. Linear Transformation and their representation by Matrices. Matrices: Review of Matrix Algebra; Rank of matrix; Eigen-values and Eigen-vectors; Diagonalisation; Systems of Linear Equations; Quadratic surfaces. Inner Product Spaces, Orthonormal Sets, Gram Schmidt orthogonalisation process and its applications to the method of least squares and QR algorithm. Introduction to Optimization problems. Nature of Solutions and Algorithms.

References:

1. C.W. Curtis, Linear Algebra: An Introductory Approach. Springer, 1994.
2. G. Strang, Introduction to Linear Algebra. Wellesley, MA: Wellesley-Cambridge Press, 1993.
3. D.G. Luenberger, Linear and Nonlinear Programming, Addison - Wesley, 2003.
4. A.D. Belegundu and T.R. Chandrupatla, Optimization Concepts and Applications in Engineering, Pearson Education Asia, 2002.

ELE201 ANALOG AND DIGITAL CIRCUITS

(3 0 0 3)

Basic Semiconductor Devices: Characteristics of Junction Diode, Bipolar Junction Transistor (BJT), Field Effect Transistor (FET) and MOSFET. Amplifiers: Transistor as an amplifier, Common Emitter configuration, Differential amplifier, Operational Amplifier. Feedback circuits: Concept of feedback, Negative feedback and its effect on: Bandwidth, Input & Output impedances, stability, Positive feedback and Oscillators. Operational based circuits: Amplifiers, Instrumentation amplifiers and filters, Analog to digital and digital to analog converter. Introduction to digital electronics: Number systems, Digital Codes, Boolean Algebra. Combinational logic: Gates, Truth tables and Karnaugh Map, Solving digital problems with maps, Sum-of-products and Product-of-sum map reduction, Incompletely specified functions, Multiple-output minimization. Sequential logic: Flip-flops, State machine concept, Counters, Registers, Shift registers, Arithmetic and Logic Unit and Programmable Logic Devices.

References:

1. Mottershead A., Electronic Devices and Circuits, Prentice-Hall of India Pvt. Ltd, 2003.
2. Malvino, A. P., Electronic Principles. Tata Mc-Graw Hill
3. Horowitz and Hill, The Art of Electronics, 1989.
4. Ramakant A. Gayakwad, Op-Amps and Linear Integrated Circuit Technology, Prentice Hall India Ltd
5. William H.Gothmann, Digital Electronics : An Introduction to theory and practice, Prentice Hall India Ltd 1982
6. Malvino A.P., Leach, D.P. "Digital Principles and Applications", Tata McGraw-Hill, 1990.
7. Morris M. Mano, Digital Logic and Computer Design, Prentice Hall, 1979.

MEC201 MANUFACTURING TECHNOLOGY

(3 0 0 3)

Manufacturing Process: Overview - Primary and Secondary processes, basis for selecting manufacturing processes. Fundamentals of Metals casting - Solidification, structure and melting furnaces. An overview of different metal casting processes and applications. Fundamentals of Bulk forming Process - Forging, Extrusion and Rolling - Applications with case studies. Sheet Metal Forming - Shearing, Deep drawing, Stretch forming etc. Formability of sheet metals. Case studies. Machining Processes used to produce round shapes - Turning, drilling, reaming, tapping etc. Case studies. Machining Processes to produce non circular parts - Milling, Planning, broaching etc. Applications. An overview of finishing operations. An Introduction to NC machines.

References:

1. Roy A. Lindberg, Processes and Materials of Manufacture, Prentice-Hall of India, 1998.
2. Serope Kalpakjian and Steven Schmidt, Manufacturing, Engineering and Technology, Prentice Hall, 2006.
3. Serope Kalpakjian and Steven Schmidt, Manufacturing Processes for Engineering Materials, Prentice Hall, 2007.

MEC202 FLUID MECHANICS AND HEAT TRANSFER**(3 0 0 3)**

Fluid Mechanics - Classification of fluid motion.- Basic Equations of Hydrostatics. - Analysis of submerged surfaces. - Buoyancy and Stability. Conservation of mass, momentum and energy - Applications. Introduction and Classification of Fluid Machines - Analysis of Turbo machinery flows - Performance characteristics of turbo machines. Heat Transfer: Conduction - General Conduction Equation - One dimensional Steady state conduction- Fins and Extended Surfaces - Transient conduction of lumped and distributed systems. Convection: Boundary Layers - dimensionless group for convection - Forced Convection - Laminar flow in a pipe - flow over cylinders, spheres Elements of free convection. Turbulent flow in pipes - Introduction to the analysis of heat exchangers. Elements of Radiative Heat Transfer

References :

1. Fox and McDonald, Introduction to Fluid Mechanics, Fifth Ed, John Wiley, 2008.
2. C.A. Long, Essential of Heat Transfer, Longman 2000.
3. S.P. Venkatesan, A First Course in Heat Transfer, ANE Books, 2004.

MEC203 STATICS AND STRENGTH OF MATERIALS**(3 1 0 4)**

Review of Vector algebra and Equivalent force systems. Equilibrium of rigid bodies Analysis of Trusses. Friction forces. Properties of Surfaces. Virtual Work and Energy . Analysis of stress and strain- Hooke's law and relation between elastic constants. Euler Beams- Derivation of relations between load, shear force and bending moments Euler Beams- Bending and shear stress distribution Deflection of beams by successive integration and moment area method. Torsion of circular cross-section. Transformation of stresses; Principal stresses and strains; Mohr's Circle . Thin walled pressure vessels; Elastic stability for Euler Columns.

References:

1. Shames I. H., Engineering Mechanics: Statics and dynamics, 4th Ed, PHI, 2007.
2. Beer. F. P and Johnston, E. R. Vector Mechanics for Engineers, Vol I - Statics, 2005.
3. Meriam J. L. and . Kraige L. G, Engineering Mechanics, Vol I - Statics, 2007.
4. Hibbler R. C., Engineering Mechanics, Vol I and II, Pearson Press, 2006.
5. Andy ruina and Rudra Pratap, Introduction to Statics and Dynamics 2002.
6. Crandall S. C., Dahl N. C., and Lardner T. J., An Introduction to the Mechanics of Solids, 2e, McGraw Hill, 1978.
7. Popov, E. P., Engineering Mechanics of Solids, Prentice Hall, 1998
8. Shames, I. H., Introduction to Solid Mechanics, 2 Ed, Prentice Hall, 1999
9. Timoshenko, S. P., Strength of Materials, vols. 1 & 2, CBS publ., 1986

ELE202 ELECTRICAL CAD LAB**(0 0 3 2)**

Circuit simulation using SPICE, Problem solving using SCILAB, Object-oriented programming using Java, Digital circuit design and testing using TK Gate.

References:

1. Tutorials on SPICE and SCILAB in the www.ee.iitm.ac.in website.
2. Introducing UNIX system, V.R. Morgan, H. McGilton, McGraw- Hill 1983.
3. C and UNIX - tools for software design M.C. Barrett, C.H. Iwagner, JohnWiley, Singapore, 1996.
4. Java, The complete reference, P. Naughton, H. Schildt, Tata McGraw Hill, 1999.

MEC204 MACHINE DRAWING PRACTICE

(1 0 3 3)

Advanced assembly drawings, detailed manufacturing drawing, specifications like fits and tolerances, surface finish, welding symbols, production methods. Introduction to functional design.

References:

1. Bhatt N.D., Machine Drawing, Charotar Book Stall, Anand, 2007.
2. Sidheswar N., Kanniah P. and Sastry V.V.S., Machine Drawing, Tata McGraw Hill, 1997.
3. SP 46: 1988 Engineering Drawing Practice for School & Colleges. Bureau of Indian Standards
4. Users Manual, CAE Packages

MEC205 APPLIED MECHANICS LAB

(0 0 3 2)

Laminar and turbulent flow. Venturi principle. Friction coefficient in pipe flow. Flow visualization. Measuring instruments to measure velocity and pressure in fluid flow. Measurement of pressure distribution over body contour. Experiments designed to cover the above. Mechanical extensometers. Uniaxial tension. Diffractogauge. Deflection and bending stress in beams. Spring constants. Impact test. Stress concentration. Photoelasticity Experiments designed to cover the above.

References:

1. Frank M. White, Fluid Mechanics, 4 Ed, McGraw-Hill, 2006
2. Fox R.W. and McDonald A.T, Introduction to Fluid Mechanics 5 Ed, John Wiley, 2008.
3. J.F. Douglas, J.M. Gasiorek, and J.A. Swafield, Fluid Mechanics, 4 Ed, Pearson Education.2005.
4. Shames, I. H., Introduction to Solid Mechanics, 2 Ed, Prentice Hall, 1999.
5. Timoshenko, S. P., Strength of Materials, vols. 1 & 2, CBS publication, 2002.

MAT202 PDEs AND NUMERICAL METHODS

(3 0 0 3)

First order linear and non-linear PDEs, Classification of linear second order PDE; Reduction to canonical forms. Solution of first order equations. Important partial differential equations - Wave, Laplace, Poisson and diffusion equations and their solutions. Green function and application. Numerical integration. Numerical solutions of ODEs and PDEs.

References:

1. Kreyszig E, Advanced Engineering Mathematics, Wiley Eastern, 2007.
2. Ian Sneddon, Elements of Partial Differential Equations - McGraw-Hill, 1960.

ELE203 CONTROL SYSTEMS

(3 0 0 3)

The Control problem: Models of physical systems: Differential equations, transfer functions and state-variable models; block diagram, signal flow graph and Mason's gain formula; time and frequency response of first and second order systems. Control system characteristics: Stability, sensitivity and disturbance rejection and steady-state accuracy; stability analysis: Routh-Hurwitz test; root locus analysis; frequency response plots and Nyquist criterion. Design of control systems: Classical design- root-locus and frequency response based design for phase-lead, phase-lag and PID controllers; modern design: Pole-placement design, controllability and observability; Introduction to Digital control systems: applications, sampled data systems, stability analysis in z-plane; Case studies.

References:

1. Ogata K., Modern Control Engineering, Prentice-Hall of India, 2006.
2. Kuo B.C, Automatic Control Systems; Prentice Hall India, 2003.
3. Dorf R. and Bishop R.H., Modern Control Systems, Pearson Education, 2008.
4. Franklin G.F., Powell J.D. and Emami-Naeini A.E., Feedback Control of Dynamic Systems, Prentice Hall Inc., 2002.
5. Nagrath I.J., Gopal M., Control Systems Engineering; New Age International, 2008.
6. Norman S. Nise, Control Systems Engineering, Wiley, 2007.
7. DiStefano J.J., Stubberud A.R., Williams I.J., Feedback and Control Systems, Tata McGraw-Hill NewDelhi, 2008.

MEC206 MECHANICAL DESIGN CONCEPTS

(3 0 0 3)

Principles of mechanical design- Factor of safety, strength, rigidity, fracture, wear and material considerations, stress concentrations- Limits and fits- standardization - Design for fatigue Design of shafts under static and fatigue loadings. Design of springs-helical compression, tension, torsional and leaf springs. Design of joints-threaded fasteners, welded and riveted joints. Rigid and flexible couplings.

References:

1. Shigley. J. E., Mechanical Engineering Design, McGraw Hill, 2006.
2. Design Data, PSG Tech, Coimbatore, 1995
3. Spotts. M. F., Design of Machine Elements, 6th Ed, Prentice Hall, 2003.
4. Burr, H. and Cheatham. J. B., Mechanical Analysis and Design, 2nd Ed, Prentice Hall, 1997.
5. Bhandari. V.B., Design of Machine Elements, Tata McGraw Hill Publishing Company Ltd., 1994.

MEC207 ELECTROMECHANICAL DRIVES AND ACTUATORS

(4 0 0 4)

Introduction to Electrical circuits, Magnetic circuits, Introduction to transformers, electromechanical transducers, devices for rotary linear conversion, solenoids.

Basic machine types: dc, induction, synchronous, BLDC motor, torque motors, stepper motors, Characteristics and control.

Introduction to fluid power, pumps and compressors, control valves, cylinders, hydraulic motors, air motors, limited rotation motors, Fluid power symbols, circuits illustrating control functions and applications, Electro pneumatics, Interfacing to PLC's and Microprocessors.

References:

1. Hambley. A.R., Electrical Engineering Principles & Applications, Prentice Hall, 2004.
2. Stephen. J. Chapmann, Electrical Machinery Fundamentals, 4th ed, McGraw-Hill Science Engineering, 2004.
3. P. C. Krause, O. Wasynczuk, and S. D. Sudhoff, Analysis of electric machinery and drive systems, 2nd Ed., New York: Wiley-IEEE, 2002.
4. Nagrath and Kothari, Electrical Machines, Tata McGraw Hill, 2004.
5. Fitzgerald, A. E., Charled Kingsley Jr., and Stephen D. Umans, Electric Machinery, McGraw- Hill, New York, 2007.
6. Sergey Edward Lyshevski, Electromechanical Systems, Electric Machines, and Applied Mechatronics (Electric Power Engineering Series), CRC Press, USA, 2000.
7. Bhattacharya S.K., Electrical Machines, Tata McGraw Hill, 2009.
8. Antony Esposito, Fluid power with applications, Prentice Hall of India, 2008,
9. John S. Cundiff, Fluid Power Circuits and Controls: Fundamentals and Applications (Mechanical Engineering Series), CRC Press, 2002.
10. Peter Rohner, Fluid Power Logic circuit design, Macmillan Press, 1994.

MEC208 KINEMATICS AND DYNAMICS

(3 1 0 4)

Review of classical mechanics, general notions; Introduction to mechanisms-joints, pairs and couplings; Constraints, mobility and degree of freedom, Kutzbach and Grubler criterion, Grashof's law, Dyads.

Kinematics (Position, Velocity and Acceleration) of rigid bodies-analytical, graphical, vector and matrix methods; Kinematic synthesis of mechanisms, gears and cams.

Dynamics of rigid bodies and mechanisms-planar and spatial, D'Alembert's principle, Euler's equation of rotational motion and inertia tensor.

Basic concepts of vibration, Harmonic motion, Free vibration of single degree of freedom systems, Harmonically excited vibration, Vibration isolation and measurement.

References:

1. Uicker. J.J., Pennock G.R, Shigley. J. E. Theory of Machines and Mechanisms, Oxford University Press, 2008.
2. Beer. F.P. and Russell Johnson. E, Vector Mechanics for Engineers, Statics and Dynamics, Tata McGraw-Hill, 2007.
3. J. S. Rao and Dukkipati. R. V., Mechanism and Machine Theory, New Age International, 2007.

4. Shames. I.H, Engineering Mechanics, Statics and Dynamics, Prentice-Hall, 2008.
5. Mallik. A., Ghosh, A., Theory of Machines and Mechanisms, East-West Press, 1998.
6. Thomsom. W. T. and Dahleh. M. D., Theory of Vibration with Applications, Pearson Education, 2007.
7. S.S. Rao, Mechanical Vibrations, Pearson Education, 2004.

ELE204 CONTROLS LAB
(0 0 3 2)

Instrumentation and control: Proportional, integral, PI, PD, and PID controllers, lead, lag, and lag-lead compensators, hydraulic, pneumatic, and electronic controllers

Experiments with Thermal process systems, magnetic levitation (non linear control), Inverted pendulum, Flow measurements and control. PLC programming

MEC209 ENGINEERING SIMULATIONS I
(1 0 3 3)

Vectors and Matrices in engineering simulations, Simulation of First and Second order systems, Implementation of ODE solutions, Numerical Algorithms-Accuracy, tolerance, numerical stability, Development of graphical animations, Simulation of Stress, Strain, Bending, Torsion and deflections. Simulation of mechanisms.

References:

1. Michael R Hatch, Vibration Simulation using MATLAB and ANSYS, CRC Press, 2001.
 2. Delores M. Etter, Engineering Problem Solving with MATLAB, Prentice Hall
 3. Harold Klee, Simulation of Dynamic Systems with MATLAB and Simulink, CRC Press, 2007
 4. Steven Karris, Introduction to Simulink with Engineering Applications, Orchard Publications, Second Ed, 2008.
 5. Bingen Yang, Stress, Strain, and Structural Dynamics: An Interactive Handbook of Formulas, solutions, and MATLAB Tool boxes with CDRAM, Academic Press, 2005.
 6. John F. Gardner, Simulation of Machines using MATLAB and Simulink, Thomson Engineering, USA, 2001.
 7. Tamara Bechtold, Evgenii B. Rudnyi, Jan G. Korvink, Fast Simulation of Electro-Thermal MEMS: Efficient Dynamic Compact Models, Springer, 2006.
 8. Ernest Doebelin, System Dynamics: Modeling, Analysis, Simulation, Design, CRC Press, 1998
 9. Bunks C., Engineering and scientific computing with Scilab, Birkhäuser Boston, 1999.
 10. Stepman Campbell, Modeling and Simulation in Scilab/Scicos, Springer, 2005.
 11. Gilberto Urroz, Numerical and Statistical Methods with SCILAB for Science and Engineering, BookSurge Publishing, 2001.
 12. Manuals (Matlab/Simulink/Ansys/Scilab)
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MEC210 ELECTROMECHANICAL DRIVES AND ACTUATORS LAB.**(0 0 3 2)**

Experiments on Transformers and electrical drives.

Experiments on Pneumatics and electropneumatics and with PLC, Simulation of pneumatic and Hydraulic circuits.

IND301 ECOLOGY AND ENVIRONMENT**(2 0 0 2)**

Introduction to environment and ecology - Ecosystems - principles concepts, components and function - Atmospheric, aquatic and terrestrial ecosystems, Biogeochemical cycles and limiting factor concepts - Impacts of natural and human activities on ecosystems. Environmental policies, acts and standards. Sustainable development and environmental impact assessment - Institutional frame work and procedures for EIA - Methods for impact identification-matrices. Networks and Check lists, Environmental settings, indices and indicators. Prediction and assessment of the impacts on air, water, land, noise and biological environments, Assessment of impacts of the cultural, socioeconomic and ecosensitive environments. Mitigation measures, economic evaluation, Public participation and design making- Preparation of Environmental statement.

References:

1. Ecology-Rugene P.Odum, Oxford, IBH Publishing Co. 1975
2. Concepts of ecology - Edward J. Kennedy, Prentice Hall of India Pvt. Ltd., 1995.
3. Ecology-Principles and applications - J.L. Chapman and M.J. Reins, Cambridge Century Press, 1998.
4. Environmental Impact Assessment; Lorry W. Carter McGraw Hill, New York, 1996.

ELE 301 EMBEDDED CONTROLLERS**(3 0 0 3)**

Architecture and Programming of 8085 and 8086 Microprocessors

Introduction -- standalone computers versus computers as components -- examples of Embedded computing systems

Modeling of embedded systems -- The Unified Modeling Language (UML) and its variations such as Real time UML. Examples of application of UML

Basics of feedback control and signal processing for embedded controller design. Elements of embedded controllers such as A/D converters, PWM circuits and timers

Implementation of embedded controllers -- microcontroller-based embedded system development. Introduction to the 8051 and MC68HC11 microcontrollers- Embedded Processors- processor examples - ARM, PIC, etc

Introduction to hardware accelerators -- Basics of Field Programmable Gate Arrays and Hardware Description Languages; Simulations using Verilog HDL

Networked Embedded Systems: special networking protocols (CAN, Bluetooth), Applications.

References:

1. Ramesh S. Gaonkar, Microprocessor Architecture, Programming, and Applications With the 8085/8080A, Penram International Publishing House, 2002
2. Y C Liu and G A Gibson, Microcomputer Systems: the 8086/8088 family. Prentice Hall of India, 2002.
3. J Uffenbeck, The 8086/ 8088 family: Design, Programming and Interfacing, Prentice Hall of India, 2002.
4. W. Wolf, Computers as Components: Principles of Embedded Computing Systems Design, Morgan Kaufmann, 2001
5. F. Vahid and T. Givargis, Embedded System Design, John Wiley and Sons, 2002
6. W. Wolf, FPGA-based System Design, Pearson Education, 2004.
7. K. Ayala, The 8051 Microcontroller, Thomson, 2007
8. S. Palnitkar, Verilog HDL, Pearson Education, 2003
9. Labrosse, Embedding system building blocks, CMP publishers, 1995
10. Raj Kamal Embedded Systems, TMH, 2003.
11. David E. Simon, An Embedded Software Primer, Pearson Education, 1999.

MEC301 DESIGN OF MACHINE ELEMENTS

(3 0 0 3)

Theory of friction drives- Design and selection of chain and belt drives. Design of brakes- self-actuating, disc, fixed link and anchor drum brakes, Design of automobile clutches. Design of Gears- Law of gearing, interference, corrected gears, Force analysis -Tooth stresses - Dynamic effects - Contact and bending fatigue strength-Gear accuracy. Gear box design: Geometric - Ray diagram, kinematic layout. Tribology, - Lubricant theories - Design of Hydrodynamic and Hydro-static bearings. Design and selection of roller bearings

References:

1. Shigley J. E., Mechanical Engineering Design, McGraw Hill, 2006.
2. Design Data, PSG Tech, Coimbatore, 1995
3. Spotts. M. F., Design of Machine Elements, 6th Ed, Prentice Hall, 2003
4. Burr A. H. and Cheatham J. B., Mechanical Analysis and Design, 2nd ed., Prentice Hall, 1997.
5. Maitra G.M., Handbook of gear design, Tata McGraw-Hill, New Delhi 2003.

MEC302 APPLIED THERMAL ENGINEERING

(4 0 0 4)

Definition and classification of turbomachines; Energy transfer in turbomachines; Flow mechanism through the impeller - velocity triangles - ideal and actual flows, Degree of reaction - impulse and reaction stages; Significance of impeller vane angle, Losses and inefficiencies, Steam turbines - flow through nozzles, Gas turbines, Hydraulic turbines - Pelton, Francis and Kaplan turbines - performance

and regulation of hydraulic turbines; Performance characteristics of pumps and blowers; Wind turbines; Fluid couplings and torque converters.

Ideal and actual cycles of operations, Fuels, stoichiometry, Combustion in SI and CI engines and combustion chambers, ignition, lubrication and cooling systems, exhaust emissions, and control, supercharging and turbo charging.

Energy sources- Power Plant Cycles - Reheat - Regenerative - Supercritical cycles - Cogeneration Plants, Energy concepts of power plants-Solid fuels and Fluidized bed combustion, Analysis and sizing of Power Plant Components, Nuclear Power Plants - Recent trends in power production.

Methods of Refrigeration - Vapour Compression cycle - Thermodynamic analysis - Brief description of components (Compressors, Condensers, Expansion devices and Evaporators) - Refrigerants and their nomenclature-Ozone depletion and global warming- Vapour absorption refrigeration systems and its thermodynamic analysis - Basics of Air-conditioning processes.

References

1. Jones, J B and Dugan, R E, Engineering Thermodynamics, Prentice Hall, 2004.
2. Stone, R, Introduction to Internal Combustion Engines, Macmillan, 1992.
3. Jagdish Lal, Hydraulic Machines including Fluidics, Metropolitan Book, 2003.
4. Sayers A T, Hydraulic and Compressible Flow Turbomachines, McGraw Hill, 1990.
5. Turbomachinery, 7th Reprint, Wiley Eastern, 1997.
6. Gopalakrishnan, G and D Prithvi Raj, A Treatise on Turbomachines, Scitech Publication, 2003
7. Wright.T, Fluid Machinery: Performance, Analysis and Design, CRC Press, 1999.
8. W F Stoecker, and J W Jones, Refrigeration & Air-conditioning, Tata McGraw Hill, 2001
9. Arora, C P, Refrigeration and Air-conditioning, Tata McGraw Hill, 2nd Edn, 2008.
10. A W Culp, Principles of Energy Conversion, Tata McGraw Hill, 2001.
11. M M Elwakil, Power Plant Technology, McGraw Hill, 2001.
12. P K Nag, Power Plant Engineering, Tata McGraw Hill, 2007.

MEC303 PRECISION MANUFACTURING AND METROLOGY

(3 0 0 3)

Introduction to Numerical Control - Components and types of CNC system. Drives and Controls - Interpolators for CNC machine tools - Design considerations - Tooling for CNC - Sensors for Adaptive Control of CNC machine tools. CNC part programming - Manual and computer assisted part programming. Metrological concepts - Abbe's principle, Errors, Length Standards, Gauging, Comparators, Fits and Tolerances; Role of metrology in quality assurance; Linear and angular measurements; Optical metrology and laser interferometer; Slip gauges; Form measurements Flatness, Straightness, Form errors; Surface finish measurements;

Coordinate measuring machines; Vision applications in Metrology; Nano measurements.

References:

1. Jon Stenerson and Kelly Curran, Computer Numerical Control, Prentice Hall International, 2005
2. Jain R.K., Engineering Metrology, Khanna Publishers, New Delhi, 2008.
3. Gaylor, Shotbolt and Sharp, Metrology for Engineers, O.R.Cassel, London, 1993.
4. Thomas, Engineering Metrology Butthinson & Co., 1984.
5. Ibrahim Zeid, CAD - CAM Theory and Practice, Tata McGraw-Hill Publishing Co.Ltd., 2006.
6. Yoram Koren, Computer Control of Manufacturing Systems, McGraw-Hill Book Company, 1986.
7. P.Radhakrishnan, Computer Numerical Control, New Central Book Agency, 2007.
8. G.T.Smith, CNC - Machining, Techniques - Vol. 1, 2 & 3, Verlag, 1993.

ELE302 MICROPROCESSOR LAB

(0 0 3 2)

Assembly language programming for 8085/8086; interfacing of 8085/8086: Interfacing Digital I/O device, timer / counter, ADC and DAC. External Communication - Serial and CAN bus communication. Debugging tools. Building an application with microprocessor toolkit. Memory interfacing, design of I/O modules and interfacing of different peripherals, 8051-based control of stepper motor.

MEC304 MACHINE TOOL AND METROLOGY LAB

(0 0 3 2)

Simple machining exercises in lathe, shaping, slotting, milling and grinding machines.

Use of various measuring instruments - length, angle, surface finish threads and gear measurements. Shop floor standards and their calibration

MEC305 INSTRUMENTATION THEORY AND PRACTICE

(1 0 3 3)

Sensors overview, Measurement methodologies, data acquisition and detection techniques, signal conversion, instrumentation, signal processing, signal generation, calibration, PC-based Instrumentation Systems.

Transducers, transducer sensing and functions, Passive and active - Resistance, inductance and capacitance, Strain Gauges, Hall effect sensors, Optical sensors, Measurement of non electrical quantities such as displacement/velocity/acceleration, pressure, force, flow and temperature.

References:

1. Bruce Mihura, LabVIEW for Data Acquisition (National Instruments Virtual Instrumentation Series), Prentice Hall, 2001.

2. Howard Austerlitz, Data acquisition techniques using PCs, Academic Press, 2002, 2nd Ed.
3. Beckwith, T.G. and Buck, N.L., Mechanical Measurements, Addison Wesley, 1995.
4. Sawhney Ak, Puneet Sawhney, A Course in Mechanical Measurements and Instrumentation, Dhanpat Rai, 2005.
5. W. Bolton, Instrumentation & Process Measurements, Orient Longman, 2004.
6. Doebelin, E.O., Measurement Systems Application and Design, Tata McGraw Hill, 5th Edn.
7. Holmen J.P., Experimental methods for Engineers, Tata McGraw Hill, 2004

MAN301 MANAGEMENT OF FINANCE, MARKETING AND PERSONAL (3 0 0 3)

Finance function: Structure of Income Statement and Balance Sheet: Financial Ratios. Scope and goal of finance function. Capital budgeting decision; Techniques of capital. Budgeting - accounting rate of return, playback period. Method and discounted - cash flow methods. Capital structure decision: Major financial instruments to raise corporate capital; Debt. Equity mix. Concept of working capital.

Marketing function: Introduction to marketing management consumer Market and Buyer behavior Industrial market and buyer behavior

THE ASSEMBLING OF MIX: a) Product Decision b) Price Decision c) Promotion Decision and d) Place Decision. Magamarketing strategy - strategies for entering into blocked markets.

Personal function: Management of People - Organization and Administration Manpower planning and staffing. Work motivation performance Appraisal wage and Salary Administration - Employee Benefits and welfare measures. Trade Unions. - Industrial relations Negotiations and collective bargaining Worker's participation in management.

MEC306 GEOMETRIC MODELING AND CAD (3 0 0 3)

Introduction - CAD/CAM process, tools and applications. Computer Hardware - System, Standards for system evaluation, input and output devices. CAD/CAM software: Overview- Solid modeler, surface modeling and drafting. Geometric Modeling: Space curves - Bezier and B-Spline curves, Surfaces - Description and Generation. Mathematical Representation of Solids - B-rep, CSG, solid manipulations. Data Exchange in CAD/CAM systems.

References:

1. Zeid. I. CAD/CAM Theory and Practice, Tata McGraw-Hill, 2006.
2. Rogers. D.F and Adams. J.A., Mathematical Elements for Computer Graphics, McGraw-Hill, 2002.
3. Hoschek. J. and Lasser. D. Computer Aided Geometric Design, AK Peters, 1996.

4. Mortenson. M. E., Geometric Modeling, John Wiley & Sons, 1997.
5. Mortenson. M. E., Mathematics for Computer Graphics Applications, 2nd Ed, Industrial Press, 1999.
6. Ryan. D. L., Computer-Aided Graphics and Design, Marcel Dekker Inc, 1994.
7. Lee. K., Principles of CAD/CAM/CAE systems, Addison Wesley, 1999.

MEC307 FINITE ELEMENT ANALYSIS
(3 0 0 3)

Basic Equations of Solid Mechanics - Review of equilibrium conditions, Strain-displacement relations, Stress - Strain relations, Principle of Virtual work & Stationery potential energy and variational formulation. Approximate methods - Rayleigh-Ritz, Weighted residual (Galerkin) and finite difference methods. Finite Element Method: Displacement model - Shape functions - Lagrange and serendipity elements, Element properties - Isoparametric elements - numerical integration, technique, Assemblage of elements and solution techniques for static analysis. Analysis of framed Structures - 2D and 3D truss and beam elements and applications. Analysis of plane stress/strain and axisymmetric solids triangular, quadrilateral and isoparametric elements, incompatible models. Three dimensional stress analysis - Isoparametric eight and twenty noded elements. Analysis of plate bending Basic equations of thin plate theory. Reissner-Mindlin theory - Plate elements and applications. Analysis of shells - degenerated shell elements. Finite element programming and FEA Software.

References:

1. Reddy. J. N., An introduction to the Finite Element Method, McGraw-Hill, New York, 2005.
2. Cook. R. D., Malkus. D. S and Plesha. M. E., Concepts and Applications of Finite Element Analysis, 3d Ed, John Wiley, New York, 2001.
3. Bathe. K. J, Finite Element Procedures in Engineering Analysis, Prentice-Hall, Englewood Cliffs, NJ, 1996.
4. Hughes. T. J. T., The Finite Element Method, Prentice-Hall, Englewood Cliffs, NJ, 1987.
5. Zienkiewicz O. C. and Taylor. R. L, he Finite Element Method, 3d Ed. McGraw-Hill, 2005.

MEC309 ROBOTICS AND AUTOMATION
(3 0 0 3)

Introduction to robotics, robot classifications, robot anatomy, serial-parallel concept, workspace.

Kinematics- Direct and Inverse Kinematics, Denavit-Hartenberg matrix transformations, Differential motion and jacobians

Dynamics and position control, Path planning - Trajectory Planning and Control - Slew, Joint interpolated and straight line motion. Newton-Euler formulations, Lagrangian mechanics.

Hardware: Various drives and their relative merits. Robot sensors and endeffectors, Tool handling and work handling and special devices like harmonic drives, stepper motors, servo drives. Ball screws, linear motion bearings, indexing mechanisms, tool magazines, transfer systems. Robot Programming concepts. Microprocessors and controllers and PLCs.

Robot applications-material handling, processing, assembly, inspection and medical applications.

Introduction to cooperative robots, micro and nano robots.

References:

1. Boucher, T. O., Computer automation in manufacturing - an Introduction, Chapman and Hall, 1996.
2. Groover, M.P., Automation production systems, and computer-integrated manufacturing, Prentice-Hall of India, New Delhi, 2007.
3. Fu K. S., Gonzalez R. C. and Lee C.S.G., ROBOTICS: Control, Sensing, Vision and Intelligence, McGraw-Hill, 2008.
4. B. K. P. Horn, Robot Vision, MIT Press, Cambridge, 1986.
5. Craig J. J., Introduction to Robotics, Addison-Wesley, 2009.
6. Koren Y., Robotics for Engineers, McGraw Hill, 1985.
7. P.A. Janakiraman, Robotics and Image Processing An Introduction, Tata-McGraw Hill, 1994.
8. Saeed B. Niku, Introduction to Robotics: Analysis, Systems, Applications, Pearson Education India, 2003.

MEC310 PRODUCT DESIGN LAB

(0 0 3 2)

Experiments using building blocks, mechanisms, small motor mechanisms and build a product working model etc.

Dissection using dissection modules. Dissection of common consumer product and mapping of function, concept and form

Design project from concept to product. Emphasis will be on making a small product, using the existing toolkit and other materials like wood, polystyrene and plastics. Use of rapid prototyping in the development of a product

MEC311 THERMAL ENGINEERING LAB

(0 0 3 2)

Conduction, convection and radiation heat transfer experiments, Mass flow measurement, Flow measurement using Pitot tube, Experiments on IC Engines, Steam power system, Centrifugal pump & turbines and Refrigeration and Air conditioning.

MEC312 ADVANCED MANUFACTURING LAB

(0 0 3 2)

Study of the chip formation and determination of cutting forces in turning-Condition monitoring in machining processes. Experiments in unconventional manufacturing processes - Inspection of parts using tool makers microscope,

roughness and form tester- Programming on various CNC machine tools, PLC and robots.

INT301 INDUSTRIAL TRAINING (SUMMER) (0 0 0 1)

The student should undergo in plant training in engineering industries.

MAN401 PROFESSIONAL ETHICS (2 0 0 2)

Concepts of profession and highlights its difference from occupation or job- The vital role of ethics in professional-The importance of ethical codes in professional and the prerequisites of an ethical professional-The nature of engineering ethics, the value of ethical practices in engineering and the virtues of an ethical engineer

References:

1. Velasquez, Manuel G: 2002, Business Ethics and Cases, Fifth Ed, New Jersey, Prentice Hall.
2. Harris, Charles, E Jr, Michael S Pritchard, Michael J Rabins, 1995, Engineering Ethics; Concepts and Cases, Belmont, Wadsworth publishing Company.
3. Supplement Reading Materials(SM)
4. Sekhar, R.C, Ethical Choices in Business Response- Sage publication, 2002.

MAN402 INDUSTRIAL ENGINEERING (3 0 0 3)

Quality Control, Maintenance of Plant and Machinery Social and Economic impacts of productivity measurement. Work systems design Methods Engineering principles of techniques. Work measurement. Predetermined motion time systems. Introduction to human factors in engineering design and man-machine systems. Effects of environment of human performance. Production Planning and Control: Types of Production systems and function of PPC, Gantt charts, Flow shop and job shop scheduling. Priority Dispatching rules, Project scheduling with PERT/CPM, Crashing and resource leveling. Plant Location and Plant Layout, social and economic factors for Plant Location, Types of Layout, Design of Plant Layout, Materials handling and Statistical.

References:

1. Narasimhan. S. L., McLeavey. D. W., Billington. P. J., Production, Planning and Inventory Control, Prentice Hall, 1997.
2. Riggs. J. L., Production Systems: Planning, Analysis and Control, Wiley, 3rd Ed, 1981.
3. Muhlemann. A., Oakland. J and Lockyer. K, Productions and Operations Management, Pitman publishing, 1993.
4. Taha. H.A, Operations Research - An Introduction, Prentice Hall of India, 2006.
5. Sharma. J K, Operations Research, Macmillan, 2008.

MAN403 TECHNICAL COMMUNICATION AND REPORT WRITING (3 0 0 3)

The course aims to equip students with skills of documentation and editing. Technical Documents: An introduction, Writing Skills - voice, nominalizations,

parallelisms etc., Using visuals, Sources of Data - primary and secondary Editing and Planning, Instructions and Manuals, Specifications - some key rules.

References:

1. Barnum, Carol M. and Carliner, Saul (eds), Techniques for Technical communicators, Macmillan, New York, 1993.
2. Boiarsky, Carolyn R., Technical Writing: Contexts, Audiences and Communities, Allyn and Bacon Needham Heights, Mass, 1992.
3. Chandler, Harry.E Technical Writer's Handbook American Society for Metals, Metals Park, Ohio, 1983.
4. Eisenberg, Ann, Writing Well for the Technical Professions, Harper and Row, New York, 1989
5. Flaherty, Stephen M. Technical and Business Writing: A Reader - Friendly Approach Englewood Cliffs, New Jersey: Prentice Hall, 1990.
6. Fox, Roy, Technical Communication: Problem and Solutions, Harper & CoMins, New York, 1994.
7. Neufield, Jacqueline K. A Handbook for Technical Communication Engle wood Cliffs, Prentice Hall, New Jersey, 1987.
8. Rew, Lois J Introduction to Technical Writing: Process and Practice St.Martin's Press, New York, 1993.
9. Sims, Brenda. R, Technical Writing: A Handbook of Examples University of North Texas Press, Denton, Texas, 1993.

MEC401 ENGINEERING SIMULATIONS II

(1 0 3 3)

Simulation of mechanical and electromechanical systems with mechanical, electrical, thermal and electromagnetic loads.

References:

1. Michael R Hatch, Vibration Simulation using MATLAB and ANSYS, CRC Press, 2001.
2. Delores M. Etter, Engineering Problem Solving with MATLAB, Prentice Hall
3. Harold Klee, Simulation of Dynamic Systems with MATLAB and Simulink, CRC Press, 2007
4. Steven Karris, Introduction to Simulink with Engineering Applications, Orchard Publications, Second Ed, 2008.
5. Bingen Yang, Stress, Strain, and Structural Dynamics: An Interactive Handbook of Formulas, solutions, and MATLAB Tool boxes with CDRAM, Academic Press, 2005.
6. John F. Gardner, Simulation of Machines using MATLAB and Simulink, Thomson Engineering, USA, 2001.
7. Tamara Bechtold, Evgenii B. Rudnyi, Jan G. Korvink, Fast Simulation of Electro-Thermal MEMS: Efficient Dynamic Compact Models, . Springer, 2006.
8. Ernest Doebelin, System Dynamics: Modeling, Analysis, Simulation, Design, CRC Press, 1998
9. Bunks C., Engineering and scientific computing with Scilab, Birkhäuser Boston, 1999.
10. Stepman Campbell, Modeling and Simulation in Scilab/Scicos, Springer, 2005.

11. Gilberto Urroz, Numerical and Statistical Methods with SCILAB for Science and Engineering, BookSurge Publishing, 2001.
12. Manuals (Matlab/Simulink/Ansys/Scilab)

INL401 INDUSTRIAL LECTURE	(0 0 3 1)
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PRO401 PROJECT I	(0 0 6 4)
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A multidisciplinary project with the student working in a group/individual. Each student has a well defined individual responsibility.

PRO402 PROJECT II	(0 0 24 16)
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ELECTIVE COURSE CONTENTS

ELC OPTIMIZATION METHODS

(3 0 0 3)

Models in Operation Research; Linear Programming, Graphical method
Simplex method; Duality Theory; The Primal - Dual algorithm
Assignment, Transportation, Network Flow problems
Dynamic Programming; Non-linear Programming; Quadratic Programs
Introduction to Genetic Algorithms
Mathematical Foundations - Simple Genetic Algorithm Operators - Selection,
Crossover and Mutation - Schema Theorem
Applications of Genetic Algorithms
Advanced Operators and Search Techniques

Text Books:

1. Ravindran. A, Phillips. T. D., Solberg. J. J., Operation Research, Wiley-india, 2007.
2. Goldberg. D. E, Genetic Algorithms in Search, Optimization, and Machine Learning, Addison-Wesley, 2009.

References:

1. Taha. H. A, Operation Research, Prentice Hall, 2006.
2. Deb. K, Optimization for Engineering Design - Algorithms and Examples, Prentice-Hall of India, 2004.