# CURRICULUM


**B Tech – Mechanical Engineering (Design & Manufacturing)**
**[2008 Batch Onwards]**

## INDIAN INSTITUTE OF INFORMATION TECHNOLOGY, DESIGN & MANUFACTURING, KANCHEEPURAM

## B. TECH – MECHANICAL ENGINEERING (DESIGN & MANUFACTURING)
## [2008Batchonwards]

**Semester 1**

| Course No | Course Name | L | T | P | C | Cat | NEW CAT |
|---|---|---|---|---|---|---|---|
| ELE 101 | Basic Electrical & Electronics Engineering | 3 | 0 | 0 | 3 | BEC | AEC |
| MAT 101 | Calculus | 3 | 0 | 0 | 3 | SMA | BSC |
| COM 102 | Computational Engineering | 3 | 0 | 0 | 3 | BEC | AEC |
| PHY 105 | Mechanics and Wave | 3 | 0 | 0 | 3 | SPH | BSC |
| MEC 106 | Basic Thermal Engineering | 3 | 0 | 0 | 3 | BEC | BEC |
| INT 101 | Graphic Art Practice | 0 | 0 | 3 | 2 | BEC | DES |
| INT 102 | Basic Engineering Practice | 0 | 0 | 3 | 2 | BEC | BEC |
| COM 102P | Computational Engineering Practice | 0 | 0 | 3 | 2 | BEC | AEC |
| PHY 105P | Mechanics and Wave Practice | 0 | 0 | 3 | 2 | SPH | BSC |
| | **Total** | **15** | **0** | **12** | **23** | | |

**Semester 2**

| Course No | Course Name | L | T | P | C | Cat | NEW CAT |
|---|---|---|---|---|---|---|---|
| MAT 103 | ODEs & PDEs | 3 | 0 | 0 | 3 | SMA | BSC |
| INT 104 | English for Communication | 2 | 0 | 0 | 2 | HSS | HMC |
| PHY 106 | Electromagnetics and Quantum Mechanics | 3 | 0 | 0 | 3 | SPH | BSC |
| MEC 108 | Materials Engineering | 3 | 0 | 0 | 3 | PMC | PEC |
| MEC 109 | Statics and Strength of Materials | 3 | 1 | 0 | 4 | BEC | BEC |
| INT 105 | Engineering Drawing | 1 | 0 | 3 | 3 | BEC | BEC |
| INT 106 | Mechanical Engineering Practice | 0 | 0 | 3 | 2 | BEC | BEC |
| PHY 106P | Electromag. and Quantum Mech. Practice | 0 | 0 | 3 | 2 | SPH | BSC |
| | **Total** | **15** | **1** | **9** | **22** | | |

**Semester 3**

| Course No | Course Name | L | T | P | C | Cat | NEW CAT |
|---|---|---|---|---|---|---|---|
| INT 201 | Concepts in Engineering Design | 3 | 0 | 0 | 3 | BEC | DES |
| MAT 201 | Linear Algebra and Optimization | 3 | 0 | 0 | 3 | SMA | BSC |
| MEC 201 | Manufacturing Technology | 3 | 0 | 0 | 3 | PMC | PEC |
| ELE 205 | Electrical Drives | 3 | 0 | 0 | 3 | PMC | AEC |
| MEC 208 | Kinematics and Dynamics | 3 | 1 | 0 | 4 | PMC | PEC |
| MEC 204 | Machine Drawing Practice | 1 | 0 | 3 | 3 | PMC | PEC |
| ELE 205P | Electrical Drives Practice | 0 | 0 | 3 | 2 | PMC | AEC |
| MEC 211 | Applied Mechanics Practice | 0 | 0 | 3 | 2 | PMC | PEC |
| | **Total** | **16** | **1** | **9** | **23** | | |

**Semester 4**

| Course No | Course Name | L | T | P | C | Cat | NEW CAT |
|---|---|---|---|---|---|---|---|
| MEC 202 | Fluid Mechanics and Heat Transfer | 3 | 0 | 0 | 3 | PMC | PEC |
| MAT 203 | Probability and Statistics | 3 | 0 | 0 | 3 | SMA | BSC |
| ELE 210 | Electronic Circuit Design | 3 | 0 | 0 | 3 | PMC | AEC |
| ELE 211 | Control Engineering | 3 | 0 | 0 | 3 | PMC | AEC |
| MEC 212 | Mechanical Design Concepts | 3 | 0 | 0 | 3 | PMC | PEC |
| MEC 209 | Engineering Simulations I | 1 | 0 | 3 | 3 | PMC | PEC |
| ELE 210P | Electronic Circuit Design Practice | 0 | 0 | 3 | 2 | PMC | AEC |
| ELE 211P | Control Engineering Practice | 0 | 0 | 3 | 2 | PMC | AEC |
| | **Total** | **16** | **0** | **9** | **22** | | |

**Semester 5**

| Course No | Course Name | L | T | P | C | Cat | NEW CAT |
|---|---|---|---|---|---|---|---|
| INT 302 | Ecology and Environment | 2 | 0 | 0 | 2 | HSS | HMC |
| ELE 303 | Microprocessor & Embedded Controllers | 3 | 0 | 0 | 3 | PMC | AEC |
| MEC 303 | Precision Manufacturing and Metrology | 3 | 0 | 0 | 3 | PMC | PEC |
| MEC 313 | Machine Elements Design | 3 | 0 | 0 | 3 | PMC | PEC |
| ELE 303P | Microprocessor & Embedded Controllers Practice | 0 | 0 | 3 | 2 | PMC | AEC |
| MEC 303P | Precision Mfg. and Metrology Practice | 0 | 0 | 3 | 2 | PMC | PEC |
| ELE 304 | Instrumentation Practice | 1 | 0 | 3 | 3 | PMC | AEC |
| | Elective 1 | 3 | 0 | 0 | 3 | ELE | PEC |
| | **Total** | **15** | **0** | **9** | **21** | | |

**Semester 6**

| Course No | Course Name | L | T | P | C | Cat | NEW CAT |
|---|---|---|---|---|---|---|---|
| MAN 302 | Quality and Reliability Management | 3 | 0 | 0 | 3 | HSS | HMC |
| MEC 306 | Geometric Modeling and CAD | 3 | 0 | 0 | 3 | PMC | PEC |
| MEC 314 | Finite Element Analysis | 3 | 0 | 0 | 3 | PMC | PEC |
| MEC 315 | Applied Thermal Engineering | 4 | 0 | 0 | 4 | PMC | PEC |
| INT 303 | Product Design and Practice | 0 | 0 | 3 | 2 | PMC | DES |
| MEC 315P | Applied Thermal Engineering Practice | 0 | 0 | 3 | 2 | PMC | PEC |
| | Elective 2 | 3 | 0 | 0 | 3 | ELE | PEC |
| | **Total** | **16** | **0** | **6** | **20** | | |

**Semester 7**

| Course No | Course Name | L | T | P | C | Cat | NEW CAT |
|---|---|---|---|---|---|---|---|
| MAN 401 | Professional Ethics | 2 | 0 | 0 | 2 | HSS | HMC |
| MEC 402 | Robotics and Automation | 3 | 0 | 0 | 3 | PMC | PEC |
| MEC 403 | Production Engineering Management | 3 | 0 | 0 | 3 | PMC | PEC |
| MEC 401 | Engineering Simulations II | 1 | 0 | 3 | 3 | PMC | PEC |
| MEC 402P | Robotics and Automation Practice | 0 | 0 | 3 | 2 | PMC | PEC |
| INT 401 | Mini Project | 0 | 0 | 3 | 2 | PMP | PEC |
| | Elective 3 | 3 | 0 | 0 | 3 | ELE | PEC |
| | Elective 4 | 3 | 0 | 0 | 3 | ELE | PEC |
| | **Total** | **15** | **0** | **9** | **21** | | |

**Semester 8**

| Course No | Course Name | L | T | P | C | Cat | NEW CAT |
|---|---|---|---|---|---|---|---|
| MAN 404 | Finance Management | 3 | 0 | 0 | 3 | HSS | HMC |
| INT 402 | Project | 0 | 0 | 24 | 16 | PMP | PEC |
| | Elective 5 | 3 | 0 | 0 | 3 | ELE | PEC |
| | **Total** | **6** | **0** | **24** | **22** | | |

**Compulsory Activities**: Summer Internship(2nd or 3rdyear vacation), Industrial Lecture, NSS/NCC/Yoga

| BSC | BEC | PEC | HMC | AEC | DES | Total |
|---|---|---|---|---|---|---|
| **22** | **14** | **88** | **12** | **31** | **07** | **174** |

## COURSE CONTENTS

## B. TECH - MECHANICAL ENGINEERING (DESIGN AND MANUFACTURING)

*(Numbers in the parenthesis indicate L T P C)*

**ELE 101 BASIC ELECTRICAL AND ELECTRONICS ENGINEERING (3 0 0 3)**

DC circuits, Independent and dependent sources, Mesh and nodal analysis
Step response and transients, RC, RL and RLC circuits
Sinusoidal AC sources steady state analysis, Phasor diagram
Power in single and 3–phase AC circuits, star–delta transformation
Magnetic circuit – Magnetic fields, currents, magnetic flux density, inductance, Faraday's Laws– Examples
Semiconductors, P–N Diodes, rectifiers and filters, clipping and clamping circuits
Bipolar and field effect transistors and power devices

**Text Books:**

1. Hughes Edward, Electrical & Electronic Technology, Pearson Education, 2007.
2. Hayt. W. W, Kemmerly. J.E, and Durbin. S.M, Engineering Circuits Analysis, Tata McGraw Hill, 2008.

**References:**

1. Hambley. A, Electrical Engineering Principles and Applications: International Version, Pearson Education, 4 Edn, 2007.
2. Alexander.C. K. & Mathew. N. O. Sadiku, Fundamentals of Electrical circuits, Tata McGraw Hill, 2008.

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**MAT 101 CALCULUS (3 0 0 3)**

Sequences and series
Definite integral as the limit of sum – Mean value theorem – Fundamental theorem of integral calculus and its 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 – Evaluation of line and surface integrals
Greens, Gauss, and Stokes theorems

**Text Books:**

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

**Reference:**

1. Thomas. G.B, and Finney R.L, Calculus, Person Education, 2007.

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**COM 102 COMPUTATIONAL ENGINEERING (3 0 0 3)**

Introduction to computer science – Computer organization basics – Problem solving strategies – Higher level languages – Program design and development – Phases of program development
Basic programming constructs in C – Data types in C – Input output statements – Operators



control structures in C – Types – Sequential, selection and repetition – Variants of selection and repetition – Single/Double and multiple selection structures – Types of repetition structures – for, do–while and while – break and continue
Functions in C – Function declaration, definition – Built and user defined functions – Storage classes and scope – Recursive functions – Arrays in C – Passing arrays to functions multidimensional arrays – String manipulations – Library support – Introduction to pointers in C – Operators – Passing arguments by reference – Pointer expressions and arithmetic – Pointers & arrays relationship –Function pointers
Formatted input output – Aggregated data types – Structures and unions– Definition and member access – File processing in C – Sequential and random access file creation and read – Dynamic memory allocation – Variable length argument lists – Command line arguments – Separating interfaces from implementation
Non linear equations – Regular falsi – Bisection, Newton raphson methods

**Text Book:**

1. Deitel P.J, and Deitel H.M, C: How to Program, Prentice Hall, 2007.

**References:**

1. Kernighan, Ritchie D, The C Programming Language, Prentice Hall, 2 Edn, 1988.
2. Chapra S.C and Canale R.P, Numerical Methods for Engineers, McGraw Hill, 2006.

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**PHY 105 MECHANICS AND WAVES (3 0 0 3)**

Vectors - an introduction, use of vectors in practical mechanics, Unit vectors in spherical and cylindrical polar co-ordinates, Concept of vector fields, Gradient of a scalar field, Equipotentials, flux, divergence of a vector, Gauss's theorem
Physical applications of Gauss's law—in gravitation, electrostatics and magnetostatics, Continuity equations and conservation principles for matter, energy and electrical charge, Curl –rotational and irrotational vector fields, Stoke's theorem— physical applications
Oscillatory motion—simple harmonic motion, damped oscillation and forced oscillation, Degrees of freedom, Constraints, Generalized co-ordinate, D'Alambert principle, Lagrangian Lagranges' equation of motion—examples, Hamiltonian—Hamilton's equation of motion — examples
Motion in a central force -- reduction of two-body system to one body system, and conservation of angular momentum, Application to planetary motions (Kepler's law)
Classification of waves -- optical and acoustic wave, Superposition -- phase velocity, group velocity, group index, dispersion, Interference phenomena and Diffraction
Polarization, Acoustooptic effects and devices -- Raman-Nath diffraction, Bragg diffraction, Acoustooptic modulator

**Text Books:**

1. Kittle. C, Mechanics – Berkley Physics Course, Vol. 1, Tata McGraw Hill, 2008.
2. Hecht. E, Optics, Cambridge University Press, 2002.

**References:**

1. Crawford. F, Waves – Berkley Physics Course, Vol. 03, Tata McGraw Hill, 2008.
2. Ghatak. A and Thyagarajan. K, Optical Electronics, Cambridge University Press, 2002.
3. Davis. D, Classical Mechanics, Academic Press, 1986.

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**MEC 106 BASIC THERMAL ENGINEERING** **(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 – Full, partial and un-resisted 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 – Constant temperature and Constant 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 irreversibility – Carnot cycle – Absolute temperature scale
Entropy – Clausius inequality – Definition of entropy S – Demonstration that entropy S is a property – Entropy for solids, liquids, and ideal gases undergoing various $\Delta E$ – Valuation 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

**Text Books:**

1. Moran. M.J. and Shapiro. H.N, Fundamentals of Engineering Thermodynamics, John Wiley, 2003.
2. Nag. P.K, Engineering Thermodynamics, Tata McGraw-Hill, 2005.

**References:**

1. Spalding. D. B. and Cole. E.H., Engineering Thermodynamics, Edward Arnold, 1976.
2. Sonnag. R.E, Borgnakke. C and Van Wyan. G.J, Fundamentals of Thermodynamics, 6 Edn, John Wiley, 2003.

**INT 101 GRAPHIC ART PRACTICE** **(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 includes: Skill enhancing assignments in developing basic drawing of lines – straight, curvilinear, angular, thick, thin, plane, volume etc – Nature drawing – including



Human/Animal/Birds – to study shapes and forms – Representation of basic 3-dimensional forms – Cubes, Cylinders, Cones, Spheres etc. in different combinations and sizes to understand principles of perspectives – Some assignments in drawing and quick sketching.

**Text Books:**

1. Thomas C Wang, Pencil Sketching, John Wiley, 2002.
2. Itten Johannes, Design and Form, John Wiley, 1975.

**Reference:**

1. Kasprin Ron, Design Media – Techniques for Water Colour, Pen and Ink Pastel and colored markers, John Wiley,1999.

**INT 102 BASIC ENGINEERING PRACTICE** **(0 0 3 2)**

Students get trained in following common engineering practices:
Basic manufacturing processes – Turning – Drilling – Assembling – Electrical wiring – Computer hardware – Software installations.

**COM 102P COMPUTATIONAL ENGINEERING PRACTICE** **(0 0 3 2)**

Learning operating system commands - editors – compilation - Assignments on using the operating system and open office suite - Programs involving output statements, input statements and expression evaluation - Assignments covering If-then-else statement iterative statements - Programs using arrays and functions based approach – Recursion sorting (bubble Sort) on a set of integers and a set of strings and linear search over a set of integers and a set of strings - structures and files in C - Implementation of a grading system computation of $e^x$, sin(x) and cos(x) - Bisection and Newton Raphson methods in C.

**PHY 105P MECHANICS AND WAVES PRACTICE** **(0 0 3 2)**

Practice session include determination of refractive index of the material of the prism, wavelength of a monochromatic light by forming Newton's ring, wavelength of the laser beam using stainless steel scale as diffraction grating, wavelength of the monochromatic light beam by Fresnel's bi-prism method, wavelength of the spectral lines of Mercury spectrum using transmission grating, width of the slit using Fraunhoffer diffraction pattern with the help of laser, numerical aperture and modal field diameter of a single mode fiber, diameter of a thin wire, couple per unit twist of suspension wire using torsional pendulum and value of g using angular pendulum.

**MAT 103 ODEs & PDEs** **(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 solution of ordinary differential equations and Singular points
Bessel and Legendre differential equations; properties of Bessel functions and Legendre polynomials
Fourier series

Laplace transforms elementary properties of Laplace transforms, inversion by partial fractions, convolution theorem and its applications to ordinary differential equations
Introduction to partial differential equations, wave equation, heat equation, diffusion equation, Green functions and its applications

**Text Books:**

1. Simmons. G.F, Differential Equations, Tata McGraw Hill, 2003.
2. Kreyszig. E, Advanced Engineering Mathematics, Wiley, 2007.

**References:**

1. William. E. Boyce and R. C. Diprima, Elementary Differential Equations and Boundary Value Problems, John Wiley, 8 Edn, 2004.
2. Sneddon. I, Elements of Partial Differential Equations, Tata McGraw Hill, 1972.
3. Ross. L.S, Differential Equations, Wiley, 2007.

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**INT 104 ENGLISH FOR COMMUNICATION** **(2 0 0 2)**

Structure of english – Remedial grammar
Reading – Comprehension and analysis
Writing – Memos, letters, reports, reviews
Study Skills – Dictionary, thesaurus & reference
Note Taking – Listening comprehension
Presentation Skills – Oral presentation, presentation aid
Presentation of Ideas – Organization, articulation and correctness – writing – Speaking Skills

**References:**

1. Sharon. J. Gerson and Steven M. Gerson, Technical Writing – Process and Product, Pearson Education Pvt. Ltd., 2004.
2. Wood, A Remedial Grammar of English, Macmillan India, 1969.
3. Thomson and Martinet , Practical English Grammar, Oxford University Press, 1986.
4. Allen and Stannard. W, Living English Structure, Orient Longman, 1997.
5. Leech, Geoffrey & Jan Svartvik, A Communicative Grammar of English,Longman, 2003.

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**PHY 106 ELECTROMAGNETICS AND QUANTUM MECHANNICS** **(3 0 0 3)**

Electrostatic potential and field due to discrete and continuous charge distributions, Dipole and quadrupole moments, Energy stored in a charge distribution, 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 magnetostatics
Magnetic induction due to configurations of current-carrying conductors, Magnetization and surface currents, Energy density in a magnetic field
Magnetic permeability and susceptibility, Time-varying fields, Faradays' law of electromagnetic induction, Self and mutual inductance
Displacement current, Maxwell's equations in free space and in linear media
Scalar and vector potentials, gauges, Plane electromagnetic waves—reflection and refraction, Electromagnetic energy density, Poynting vector
Particles and waves, Dual nature of electromagnetic radiation, Compton scattering, De-



Broglie waves, Davisson–Germer experiment, interpretation of wave function, operator, eigenvalue/ eigenfunction, expectation value of observable.
Uncertainty principle, Time dependent and time independent Schrödinger's equation, Bound state problem, formation of energy band in solid. Barrier penetration, Scanning Tunneling Microscope

**Text Books:**

1. Grifiths. D. J, Introduction to Electrodynamics, Prentice Hall, 2007.
2. Gasiorowicz. S, Quantum Mechanics, John Wiley & Sons, 2003.

**References:**

1. Purcell. E.M, Electricity and Magnetism – Berkley Physics Course, Vol. 2, Tata McGraw Hill, 2008.
2. Feynman. R.P, Leighton. R.B, Sands. M, The Feynman Lectures on Physics, Narosa Publishing House, Vol. II & III, 2008.
3. Ajoy Ghatak, Basic Quantum Mechanics, Macmilan Publishers India, 2002.
4. Wichmann. E. H, Quantum Physics – Berkley Physics Course, Vol. 04, Tata McGraw Hill, 2008.

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**MEC 108 MATERIALS ENGINEERING** **(3 0 0 3)**

Crystal structure of metals – Defects in metallic structure – Plastic deformation of metals – Slip systems – Equilibrium diagrams – The crystalline state: Atomic bonding – Bravais lattices – Miller indices – X-ray crystallography – Structural imperfections – Binary phase diagram – Microstructure
Iron-carbon equilibrium diagram – Properties & Applications of Steel, Cast iron and non-ferrous metals & alloys
Properties & Applications of Polymers, Ceramics and Composite Materials
Mechanical Properties of materials – Testing of materials
Heat treatment of steels – Surface modifications of metals for specific engineering application – Tribological properties of materials
Magnetic materials: Dia, Para, Anti-ferro, Ferro- and ferri-magnetism – Soft and hard magnetic materials – Metallic glasses – Electron theory of solids: free electron theory of metals – Zone and band theory of solids – Brillouin zones – Classification of conductors, semiconductors, insulators
Superconducting materials: Zero resistance and Meisner effect – Soft and hard superconductor – Josephson junction – High Tc-super conductor – Dielectric materials: Polarisation mechanisms – Behaviour under switching power frequency and D.C. voltages – Piezoelectric and ferroelectric materials and their applications

**Text Books:**

1. Callister. D. W, Materials Science Engineering – An Introduction, Wiley, 2006.
2. Courtney. T. H, Mechanical Behavior of Materials, Overseas Press, 2006.

**References:**

1. Ashby. M, Materials – Engineering, Science, Processing and Design, Elsevier, 2007.
2. Murray. G. T, Introduction to Engineering Materials, Dekker Inc., 1993.
3. Hosford. W. F, Mechanical Behavior of Materials, Cambridge, 2005.

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**MEC 109 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
Bending and shear stress distribution – Deflection of beams – Successive integration and moment area method
Transformation of stresses – Principal stresses and strains – Mohr's circle
Torsion of circular cross-section – Thin walled pressure vessels – Elastic stability for Euler columns

**Text Books:**

1. Beer. F. P and Johnston. E. R, Vector Mechanics for Engineers, Vol I – Statics, 2005.
2. Meriam. J. L and Kraige. L. G, Engineering Mechanics, Vol. I – Statics, 2007.

**References:**

1. Popov. E. P, Engineering Mechanics of Solids, Prentice Hall, 1998.
2. Shames. I. H, Introduction to Solid Mechanics, 2 Ed, Prentice Hall, 1999.
3. Timoshenko. S. P, Strength of Materials, vols. 1 & 2, CBS Pub., 1986.

**INT 105 ENGINEERING DRAWING** **(1 0 3 3)**

Introduction to engineering drawing and Computer Aided Drafting (CAD) – Dimensioning principles and conventional representations
Construction of plane curves
Coordinate systems – Projection of points, lines and planes
Projection of right regular solids – Section of solids
Systems of projections – Principles, conventions and applications of orthographic projection
Principles, conventions and applications of isometric projection
Intersection of solids – Development of surfaces

**Text Books:**

1. Narayana. K.L, and Kannaiah. P, Engineering Drawing, Charaotar Publ House, 1998.
2. Bhatt. N.D, Engineering Drawing, New Age International, 2007.

**References:**

1. Gopalakrishnan. K.R, Engineering Drawing, Subash Stores, 2002.
2. Natarajan. K.V, A text book of Engineering Drawing, Classic Prints, 2000.

**INT 106 MECHANICAL ENGINEERING PRACTICE** **(0 0 3 2)**

Students get trained in following mechanical engineering practices:
Usage of power tools for machining – Turning – Milling – Joining – Sheet metal working – Pneumatics – Composites processing – Automation and control

**PHY 106P ELECTROMAGNETICS AND QUANTUM MECHANNICS PRACTICE** **(0 0 3 2)**

Practice session includes determination of the dielectric constant of a liquid and a solid from capacitance measurement using digital LCR, characteristics of PN Junction Diode, Plotting



the graph showing the variation of magnetic field with distance along the axis of a circular coil carrying current, determination of the energy band gap of the material of the thermistor, value of Planck's constant by photovoltaic effect, characteristics of a PNP junction transistor in common emitter configuration, Young's modulus of a half meter wooden scale using a strain gauge, thermal conductivity of a good conductor by Forbes' method, verification of the Stefan's Law, use the CRO for voltage and frequency measurements and study the waveshapes/Lissajous figures.

**INT 201 CONCEPTS IN ENGINEERING 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. 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.

This course introduces the students to the following aspects of design.
Philosophy of engineering design,
Engineering design process
Identification and analysis of needs
Organization of design concept and design methods
Considerations in engineering design
Design decisions and development of design
Case studies

**Text Books:**

1. Otto. K and Wood, K, Product Design, Pearson Education, 2001.
2. Pahl. G and Beitz. G, Engineering Design, Springer, 1996.

**Reference:**

1. Ullman. D. G, The Mechanical Design Process, McGraw- Hill, 1997.

**MAT 201 LINEAR ALGEBRA AND OPTIMIZATION** **(3 0 0 3)**

Vector spaces, subspaces, basis and dimension
Linear transformation and their representation by matrices
Rank of matrix – Eigenvalues, eigenvectors and diagonlization
Systems of linear equations – Quadratic surfaces – Inner product spaces
Orthonormal sets, Gram Schmidt orthogonalization process and its applications to the method of least squares and QR algorithm
Introduction to optimization problems: nature of its solutions and algorithms

**Text Books:**

1. Strang. G, Introduction to Linear Algebra. Wellesley, MA: Wellesley-Cambridge Press, 1993.
2. Curtis. C. G, Linear Algebra: An Introductory Approach, Springer, 1994.

**References:**

1. Krishnamurthy. V, Mainara. V. P and Arora. J. I, An Introduction to Linear Algebra, Affiliated East-west Press, 1976.

2. Luenberger. D. G, Linear and Nonlinear Programming, Addison Wesley, 2003.
3. Belegundu. A. D and Chandrupatla. T. R, Optimization Concepts and Applications in Engineering, Pearson Education Asia, 2002.

**MEC 201 MANUFACTURING TECHNOLOGY** **(3 0 0 3)**

Manufacturing process overview – Primary and secondary processes – Basis for selecting manufacturing processes
Fundamentals of metals casting – Solidification structure – melting furnaces – Overview of different metal casting processes and applications
Fundamentals of bulk forming process – Forging – Extrusion – Rolling – Applications with case studies
Sheet Metal Forming – Shearing – Deep drawing – Stretch forming & allied processes – Formability of sheet metals – Case studies
Machining processes used to produce round shapes – Turning – Drilling, reaming and tapping – Case studies
Machining processes to produce non circular parts – Milling – Planning – Broaching – Applications
Overview of finishing operations – Introduction to NC machines

**Text Books:**

1. Roy A. Lindberg, Processes and Materials of Manufacture, Prentice Hall, 1998.
2. Amitabha Ghosh and Malik. A.K, Manufacturing Science, Ellis Horwood Pub., 2001.

**References:**

1. Serope Kalpakjian and Steven Schmidt, Manufacturing Processes for Engineering Materials, Prentice Hall, 2007.
2. Hajra Choudhary. S.K and Hajra Choudhary. A. K, Elements of Workshop Technology, Vol. I & II, Media Promoters,1986.

**ELE 205 ELECTRICAL DRIVERS** **(3 0 0 3)**

Energy conversion principles, Introduction to Transformers and Electrical Drives
Electromechanical Transducers, devices for rotary linear conversion, solenoids
Characteristics and control of Basic machine types:
DC motor
Three phase Induction motor
Synchronous motor, BLDC motor
Servo motor, torque motor, stepper motor

**Text Books**

1. Ned Mohan, Electric Drives: An Integrative Approach, MNPERE, 2003.

**References**

1. Nagrath and Kothari, Electrical Machines, Tata McGraw Hill, 2004.
2. I. Boldea, S. A. Nasar, Electric drives, CRC Press, 2006.



**MEC 208 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
Kinematic analysis of 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

**Text Books:**

1. Uicker. J.J, Pennock, G.R, Shigley, J. E, Theory of Machines and Mechanisms, Oxford University Press, 2008.
2. Rao. J.S, and Dukkipati, R. V, Mechanism and Machine Theory, New Age International, 2007.

**References:**

1. Beer. F.P, and Russell Johnson. E, Vector Mechanics for Engineers, Statics and Dynamics, Tata McGraw-Hill, 2007.
2. Shames. I.H, Engineering Mechanics, Statics and Dynamics, Prentice Hall, 2008.
3. Thomsom. W. T. and Dahleh. M. D, Theory of Vibration with Applications, Pearson Education, 2007.

**MEC 204 MACHINE DRAWING PRACTICE** **(1 0 3 3)**

Advanced assembly – Detailed manufacturing – Fits and tolerances – Surface finish – Welding symbols – Production methods – Introduction to functional design

**Text Books:**

1. Bhatt. N.D, Machine Drawing, Charotar Book Stall, Anand, 2007.
2. Junnarkar. N.D, Machine Drawing, Pearson Education, 2007.

**References:**

1. Narayana. K. L, Machine Drawing, New Age International, 2006.
2. Sadhu. Singh and Sha. P. L, Fundementals of Machine Drawing, Prentice Hall, 2004.

**ELE 205P ELECTRICAL DRIVERS PRACTICE** **(0 0 3 2)**

Open Circuit, Short Circuit and Load Tests and Sumpner's Test on Single Phase Transformer – Swinbernes test/ Speed Control/ Load test of DC Shunt Motor – Hopkinsons Test – No-Load Test, Blocked Rotor Test and Load Test on Single Phase/Three phase Induction Motor.

**MEC 211 APPLIED MECHANICS PRACTICE** **(0 0 3 2)**

In this practical course experiments are designed to give deep understanding of basic concepts from statics & dynamics, strength of materials, material testing & kinematics of machines. Experiments includes : Uni-axial tensile testing of metals & non-metals – Hardness testing – Spring test – Strain gauge principles & usage – Three point bending test –

Friction test – Compound pendulum – Un-damped free vibration – Torsional vibration – Synthesis of mechanisms & its inversions – Development of gear box, Cam & follower

**References:**


1. Beer & Johnston, Mechanics of Materials, Tata McGraw Hill, 2008.
2. Shames. I. H., Introduction to Solid Mechanics, 2 Edn, Prentice Hall, 1999.
3. Timoshenko. S. P., Strength of Materials, vols. 1 & 2, CBS Publication, 2002.
4. Shigley. J. E, Theory of Machines and Mechanisms, Oxford Univ. Press, 2008.


## MEC 202 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
Conductive heat transfer – General conduction equation – One dimensional Steady state conduction – Fins and extended surfaces – Transient conduction of lumped and distributed systems
Convective heat transfer – Boundary Layers – Dimensionless group for convection – Forced convection – Elements of free convection
Laminar & Turbulent flow in a pipe – Flow over cylinders & spheres – Introduction to the analysis of heat exchangers
Elements of Radiation heat transfer

**Text Books:**


1. Fox and McDonald, Introduction to Fluid Mechanics, 5 Edn, John Wiley, 2008.
2. Incropera. F.P, *et. al*, Fundamentals of Heat and Mass Transfer, John Wiley, 2006.
3. White. F.W, Fluid Mechanics, 6 Edn, Tata McGraw Hill, 2008.
4. Holman. J.P, Heat Transfer, 9 Edn, Tata McGraw Hill, 2002.


**References:**


1. Venkatesan. S.P, A First Course in Heat Transfer, ANE Books, 2004.
2. Long. C.A, Essential of Heat Transfer, Longman, 2000.


## MAT 203 PROBABILITY AND STATISTICS (3 0 0 3)

Introduction to probability – Probability measure and random processes
Conditional probability, independence and Baye's theorem
Discrete and continuous random variables; probability density function, concepts of mean, variance and moment generating function of a few standard discrete and continuous distributions: binomial, Poisson, exponential and normal
Central limit theorem and its implications for the normal distribution
Purpose and the nature of sampling; nature of estimates, point estimates and interval estimates
Maximum likelihood principle approach, least squares approach and confidence intervals
Nature of hypothesis formulation, null and alternate hypotheses, testing hypotheses; criteria for acceptance of hypothesis t-test, chi-squared test



**Text Book:**


1. J. S. Milton, J. C. Arnold, Introduction to Probability and Statistics, Tata McGraw Hill, 4 Edn,2002.


**Reference:**


2. Richard A Johnson, Miller and Freunds, Probability and Statistics for Engineers, Pearson Edu., 6 Edn, 2001.


## ELE 210 ELECTRONIC CIRCUIT DESIGN (3 0 0 3)

Transistor amplifiers, Concept of feedback, Negative feedback and its effect on bandwidth, input and output impedances, stability, positive feedback and oscillators; differential amplifier
Operational Amplifier: Operational amplifier based circuits, instrumentation amplifiers and filters
Sampling of analog signals, aliasing, quantization, analog to digital and digital to analog converters
Introduction to digital electronics: Number systems, Boolean algebra, Combinational logic gates, truth table, Karnaugh maps, Multiple output minimization, multiplexer, demultiplexer, encoder, decoder
Sequential logic: Flip flops, state machine concept, counters, shift registers, arithmetic and logic unit and programmable logic devices

**Text Books:**


1. Malvino. A. P, Electronic Principles. Tata McGraw Hill, 1993.
2. Morris M. Mano, Digital Logic and Computer Design, Prentice Hall, 1979.
3. Malvino. A.P. and Leach, D.P., Digital Principles and Applications, Tata McGraw Hill, 1990.


**References:**


1. Gothmann W. H, Digital Electronics: An Introduction to Theory and Practice, Prentice Hall, 1982.
2. Mottershead. A, Electronic Devices and Circuits, Prentice Hall, 2003.


## ELE 211 CONTROL ENGINEERING (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 fain 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, controllability and observability
Introduction to digital control systems – Applications, sampled data systems, stability analysis in Z plane, case studies

**Text Book:**


1. Norman S. Nise, Control Systems Engineering, Wiley, 2007.

**References:**

1. Ogata. K, Modern Control Engineering, Prentice-Hall of India, 2006.
2. Nagrath. I.J and Gopal. M, Control Systems Engineering, New Age International, 2008.

**MEC 212 MECHANICAL DESIGN CONCEPTS** **(3 0 0 3)**

Principles of mechanical design – Factor of safety – Strength – Rigidity
Failure Modes –Material & Design considerations
Static theories of failure – Stress concentration
Fits & Tolerances – Geometric Tolerances
Design for fatigue – Design of shafts: under static and fatigue loadings
Design of springs: Helical compression & tension – Torsional – Leaf spring
Design of joints – Threaded fasteners – Welded & Riveted joints
Design of Coupling: Rigid & flexible

**Text Books:**

1. Shigley. J. E, Mechanical Engineering Design, McGraw Hill, 2006.
2. Norton. R. L, Machine Design, Pearson Education, 2007.

**Reference:**

1. Burr. H and Cheatham. J. B, Mechanical Analysis and Design, 2 Edn, Prentice Hall, 1997.
2. Bhandari. V.B, Design of Machine Elements, Tata McGraw Hill, 2009.

**MEC 209 ENGINEERING SIMULATIONS I** **(1 0 3 3)**

Vectors and Matrices in engineering simulations
Development of graphical animations
Simulation of first and second order systems – Implementation of ODE solutions
Numerical algorithms-accuracy, tolerance, numerical stability
Simulation of stress, strain, bending, torsion and deflections
Simulation of mechanisms
Analysis of machines

**Text Books:**

1. Schilling. R. J, and Harris. S. L, Applied Numerical Methods for Engineers, Cengage learning, 2007.
2. Campbell. S.L, *et al.*, Modeling and Simulation in Scilab/Scicos, Springer, 2005.

**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 Johnston. E. R. Vector Mechanics for Engineers, Statics & Dynamics, 8 Edn, 2007.

**ELE 210P ELECTRONIC CIRCUIT DESIGN PRACTICE** **(0 0 3 2)**

Static characteristics of diodes, BJTs and FETs, Rectifiers and filters, Clipping and clamping circuits – Biasing of BJTs and FETs, Op Amp circuits, Oscillators, ADC/DAC – Simulation using



SPICE – Half and full addres, Mux/DeMux, Encoder/Decoder circuits, Flip flops, counters, shift registers, Arithmetic logic unit.

**ELE 211P CONTROL ENGINEERING PRACTICE** **(0 0 3 2)**

Lead Lag Network – P, PI and PID Controllers – Closed loop controller – DC and AC Servo motor Controller – Bode Plot, Root Locus and Nyquist Plot – MIMO – Impulse and Step Response – Synchro.

**INT 302 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. Rubin. E. S, Introduction to Engineering and the Environment, McGraw Hill, 2000.
2. Masters. G. M., Introduction to Environmental Engineering & Science, Prentice Hall, 1997.
3. Henry. J. G, and Heike, G. W, Environmental Science & Engineering, Prentice Hall International, 1996.
4. Dhameja. S. K, Environmental Engineering and Management, S. K. Kataria and Sons, 1999.
5. Shyam Divan and Armin Rosancranz, Environmental Law and Policy in India, Cases, Materials and Statutes, Oxford University Press, 2001.

**ELE 303 MICROPROCESSORS AND EMBEDDED CONTROLLERS** **(3 0 0 3)**

Architecture and Programming of 8085 and 8086 Microprocessors, interfacing of 8085/8086
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
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 microcontrollers and interfacing
Introduction to hardware accelerators – Basics of Field Programmable Gate Arrays and Hardware Description Languages – Simulations using Verilog HDL

**Text Books:**

1. Liu. Y.C and Gibson. G. A, Microcomputer Systems: the 8086/8088 family, Prentice Hall, 2002.
2. Wolf. W, Computers as Components: Principles of Embedded Computing Systems Design, Morgan Kaufmann, 2001.
3. Ayala. K, The 8051 Microcontroller, Thomson, 2007.

**References:**

1. Uffenbeck. J, The 8086/ 8088 family: Design, Programming and Interfacing, Prentice Hall, 2002.
2. Kamal. R, Embedded Systems, Tata McGraw Hill, 2003.

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**MEC 303 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 – Laser interferometer – Slip gauges – Form measurements Flatness – Straightness – Form errors
Surface finish measurements – Coordinate measuring machines – Vision applications in Metrology – Nano measurements

**Text Books:**

1. Jain. R.K, Engineering Metrology, Khanna Publishers, New Delhi, 2008.
2. Groover. M. P, Automation, Production Systems & Computer Integrated Manufacturing, 3 Edn, Prentice Hall, 2008.

**References:**

1. Jon Stenerson and Kelly Curran, Computer Numerical Control, Prentice Hall, 2005.
2. Ibrahim Zeid, CAD - CAM Theory and Practice, Tata McGraw Hill, 2006.
3. Thomas, Engineering Metrology, Butthinson & Co., 1984.

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**MEC 306 GEOMETRIC MODELLING 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

**Text Books:**

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.



**References:**

1. Hoschek. J and Lasser. D, Computer Aided Geometric Design, AK Peters, 1996.
2. Mortenson. M. E, Geometric Modeling, John Wiley, 1997.
3. Lee. K, Principles of CAD/CAM/CAE systems, Addison Wesley, 1999.

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**MEC 313 MACHINE ELEMENTS DESIGN (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

**Text Books:**

1. Shigley. J. E, Mechanical Engineering Design, McGraw Hill, 2006.
2. Norton. R. L, Machine Design, Pearson Education, 2007.

**References:**

1. Bhandari. V.B, Design of Machine Elements, Tata McGraw Hill, 2009.
2. Burr. H, and Cheatham. J.B., Mechanical Analysis and Design, Prentice Hall, 1997.
3. Maitra. G.M, Handbook of gear design, Tata McGraw-Hill, New Delhi 2003.

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**ELE 303P MICROPROCESSORS AND EMBEDDED CONTROLLERS PRACTICE (0 0 3 2)**

Programming examples to familiarize the assembly language concept covering various addressing modes and instructions of 8085, 8086 and 8051 – Use of assembler/disassembler and emulators – Interfacing examples with 8085, 8086 and 8051 kits (DAC/ADC, Seven segment display, traffic light, stepper motor, etc. – Interrupts and subroutines – Simple programming exercises with Verilog HDL on FPGA.

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**MEC 303P PRECISION MANUFACTURING AND METROLOGY PRACTICE (0 0 3 2)**

CNC part programming – CNC lathe and CNC milling operations - Calibration of various measuring instruments - Linear and angular measurement using tool maker's microscope, profile projector etc., - Measurement of straightness and flatness - Roundness measurement - Measurement of effective diameter of a screw thread – Measurement of roughness – Gear tooth measurement – Measurement of dimensions using CMM.

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**ELE 304 INSTRUMENTATION PRACTICE (1 0 3 3)**

Sensors overview, Measurement methodologies, calibration
Signal generation: Sine, square and triangular waveform generators
Differential and instrumentation amplifiers, Integrator, differentiator and filter circuits
Data acquisition and detection techniques, Signal conversion, 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

Practice includes experiments from following topics:
Signal generation – Instrumentation amplifiers – Signal conversion and processing – Calibration of meters – Measurement of physical quantities – Characteristics of Transducers

**Text Books:**

1. Alan S. Morris, Measurement and Instrumentation Principles, Elsevier, 2001.
2. Sawhney. A. K, Course In Electrical & Electronics Measurement & Instrumentation, Dhanpat Rai, 2007.

**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, 2nd Ed. 2002.

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**MAN 302 QUALITY AND RELIABILITY MANAGEMENT** **(3 0 0 3)**

Definition of Quality – Dimensions of quality – Quality control
Seven statistical tools of quality
Control charts for variables and attributes
New seven management tools – Process capability concepts – Concept of six sigma – Concept of Product Life cycle
Basic concept of ISO 9000 and other quality systems
Reliability – Introduction – Definitions – Reliability evaluation
Failure data analysis – Mean Time to Failure, Maintainability & Availability concepts – Reliability improvement techniques – Design for reliability

**Text Books:**

1. Montgomery, D. C., Introduction to Statistical Quality Control, 5 Edn, John Wiley, 2004.
2. Srinath. L. S, Reliability Engineering, 3 Edn , East-West Press, 1991.

**References:**

1. Burr. J. T, Elementary Statistical Quality Control, CRC Press, 2004.
2. Bromley. R, *et al.*, Practical Reliability engineering, 4 Edn, John Wiley, 2002.

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**MEC 308 MECHATRONICS** **(3 0 0 3)**

Introduction – Sensors and transducers – Classification – Development in transducer technology
Embedded microprocessor systems – Hardware structure, software, design, and Communication
Programmable Logic Devices – Application Specific ICs – Automatic control and real time Control Systems
Integrated Product Design – Modeling, analysis and simulation – Man-Machine Interface
Semiconductors – Thick film and Thin film Elements – Signal processing – Opto-electronics
Shaft Encoders – CD Sensors – Optical probe for metrology – Vision system



Drives and Actuators – Drive circuits – Open and closed loop control – Smart actuators – Shape memory – Piezoelectric and Magnetostrictive

**Text Books:**

1. Bolton. W, Mechatronics, Prentice Hall, 2008.
2. Michael. B. H and Alciatore. G. D, Introduction to Mechatronics and Measurement Systems, McGraw Hill, 2007.

**References:**

1. HMT Ltd., Mechatronics, Tata McGraw Hill, 2008.
2. Gaonkar, S. R, Microprocessor Architecture Programming and Applications, Wiley Eastern, 2002.
3. Dan Necsulescu, Mechatronics, Pearson Education, 2002.

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**MEC 314 FINITE ELEMENT ANALYSIS THEORY AND PRACTICE** **(3 0 0 3)**

Introduction to finite element method
Basic Concepts: Weighted residual technique – Galerkin's method and Energy approach – Raleigh-Ritz method
Finite element for discrete systems: Trusses, beams and frames – Element stiffness matrix and assembly technique for Global stiffness matrix
Treatment of boundary conditions, load vector, matrix algebra and solution techniques
Finite element for continuous system: Element formulation – Higher order elements – Natural co-ordinate system
Numerical integration
Application: Solids-plane and structural dynamics problems, potential fluid flow, electrical and magnetic field problems, Heat transfer – steady state and transient heat conduction problems, Coupled field-thermal stress analysis

**Text Books:**

1. Chandrupatla.T.R, and Belegundu. A.D, Introduction to Finite Elements in Engineering, 3 Edn, Pearson Education, 2005.
2. Hutton. D. V,Fundamentals of Finite Element Analysis, Tata McGraw Hill, 2005.

**References:**

1. Reddy. J. N, An introduction to the Finite Element Method, McGraw Hill, 2005.
2 Cook. R. D., Malkus. D. S and Plesha. M. E., Concepts and Applications of Finite Element Analysis, 3 Edn, John Wiley, 2001.
3. Bathe. K. J, Finite Element Procedures in Engineering Analysis, Prentice Hall, 1996.

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**MEC 315 APPLIED THERMAL ENGINEERING** **(4 0 0 4)**

Definition and classification of turbo-machines – Energy transfer in turbo-machines – 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
Hydraulic turbines: Pelton, Francis and Kaplan turbines – Performance and regulation of hydraulic turbines – Performance characteristics of pumps and blowers
Steam turbines – Flow through nozzles – Gas turbines – Wind turbines – Fluid couplings – Torque converters

Ideal and actual cycles of operations – Fuels – Stoichiometry – Combustion in SI and CI engines – Combustion chambers – Ignition – Lubrication and cooling systems – Exhaust emissions & control – Supercharging and turbo charging
Energy sources – Power Plant Cycles – Reheat – Regenerative – Supercritical cycles – Cogeneration Plants – Energy concepts of power plants – Solid fuels – Fluidized bed combustion
Analysis and sizing of Power Plant Components – Nuclear power plants - Recent trends in power production
Methods of Refrigeration – Vapor compression cycle – Thermodynamic analysis – Compressors, Condensers, Expansion devices and Evaporators – Refrigerants and their nomenclature – Ozone depletion and global warming – Vapor absorption refrigeration systems and its thermodynamic analysis – Basics of Air-conditioning processes

**Text Books and 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. Gopalakrishnan. G and Prithvi Raj. D, A Treatise on Turbomachines, Scitech Publication, 2003.
6. Wright. T, Fluid Machinery: Performance, Analysis and Design, CRC Press, 1999.
7. Stoecker. W. F, and Jones. J. W, Refrigeration & Air-conditioning, Tata McGraw Hill, 2001.
8. Arora. C. P, Refrigeration and Air-conditioning, 2 Edn, Tata McGraw Hill, 2008.
9. Culp. A. W, Principles of Energy Conversion, Tata McGraw Hill, 2001.
10. Elwakil. M. M, Power Plant Technology, McGraw Hill, 2001.
11. Nag. P. K, Power Plant Engineering, Tata McGraw Hill, 2007.


**INT 303 PRODUCT DESIGN AND PRACTICE** **(0 0 3 3)**

This is an interdisciplinary team-based product design course. The concept of the course is to provide a broad hands-on learning experience in interdisciplinary fields of Engineering and exposure to the context of a "real" product design problems. In this course students will design a product by following the systematic product design process.

A team consist of students from different discipline will choose their own product and while designing, students will consider many issues like market opportunities, formal requirements and constraints, the environment in which the product will be used, product look and feel; technical legitimacy, and manufacturing considerations for the products.

During the course student will learn and put into practice Teaming, Project Management, Product Realization, Ethical and other skills practiced by product developers in industry. Throughout the semester, the student teams have several opportunities to present their progress to their fellow students and faculty.

**MEC 314P FINITE ELEMENT ANALYSIS PRACTICE** **(0 0 3 2)**

Introduction, Preprocessing: Modeling tools and mesh generation, Analysis: Solid mechanics – Truss, Beam and Plane problems. Heat transfer – Steady state and transient heat



conduction. Fluid mechanics – Potential flow, Post processing: Result presentation and analysis, tabultation, contour plotting and animation.

**MEC 315P APPLIED THERMAL ENGINEERING PRACTICE** **(0 0 3 2)**

Laminar and turbulent flow, venture 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. mass flow measurement, Flow measurement using Pitot tube, Conduction, Convection and radiation heat transfer experiments, Experiments on IC Engines, Steam power systems, Centrifugal pump & turbines and Refrigeration and Air conditioning.

**MAN 401 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. M. G, Business Ethics and Cases, 5 Edn, Prentice Hall, 2002.
2. Harris. *et al.*, Engineering Ethics: Concepts and Cases, Belmont Wadsworth, 1995.
3. Sekha. R.C, Ethical Choices in Business Response, Sage Publication, 2002.
4. Mike Martin and Roland Schinzinger, Ethics in Engineering, McGraw Hill, 1996.
5. Fleddermann. C. D, Engineering Ethics, Prentice Hall, 1999.


**MEC 402 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

**Text Books:**


1. Groover. M.P, Automation Production Systems, and Computer Integrated manufacturing, Prentice Hall, 2007.
2. Craig J. J, Introduction to Robotics, Addison Wesley, 2009.

**References:**


1. Fu K. S, Gonzalez R. C and Lee C.S.G, Robotics: Control, Sensing, Vision and Intelligence, McGraw-Hill, 2008.
2. Saeed B. N, Introduction to Robotics: Analysis, Systems, Applications, Pearson Education, 2003.


## MAN 403 PRODUCTION ENGINEERING MANAGEMENT (3 0 0 3)

Introduction, scope and objectives of Production Management – Work System Design – Process planning – Methods study
Facilities layout – Line Balancing – Work Measurement – Work sampling and its applications
Production Planning and Control: Types of Production systems – 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
Work Flow Systems: Pull and push systems, MRP, MRP-II, JIT, Cellular and FMS. Automated production lines – Manufacturing Planning and Control – Aggregate production planning
Service Operations Management: Bottlenecks and balance matching demand and supply – Logistics, Location and franchising – Capacity Management – Management of professional services.

**Text Books:**


1. Martand Telsang, Industrial Engineering and Production Management, S Chand & Co, 2004.
2. James Dilworth, Production and Operation Management, McGraw Hill, 1996.
3. Adam. E. E, Ebert. R. J, Production and Operation Management, 5 Edn, Prentice Hall Englewood Cliff, 1992.


**References:**


1. Riggs. J. L, Production System, Planning, Analysis and Control, 2 Edn, John Wiley, 1976.
2. Buffa. E.S, Modern Production and Operation Management, Wiley, 1987.


## MEC 401 ENGINEERING SIMULATIONS II (1 0 3 3)

Simulation of mechanical and electromechanical systems with mechanical, electrical, thermal, electromagnetic and Combination of loads
Data acquisition and control simulations

**References:**


1. Schilling. R. J, and Harris, S. L, Applied Numerical Methods for Engineers, Cengage learning, 2007.
2. Campbell. S.L, *et al.*, Modeling and Simulation in Scilab/Scicos, Springer, 2005
3. Harold Klee, Simulation of Dynamic Systems with MATLAB and Simulink, CRC Press, 2007.
4. Ernest Doebelin, System Dynamics: Modeling, Analysis, Simulation, Design, CRC Press, 1998.




## MEC 402P ROBOTICS AND AUTOMATION PRACTICE (0 0 3 2)

Robot programming – Experiments with robot work cell – Advanced CNC programming – PLC programming – Experiments in advanced pneumatics and hydraulics – Experiments using CMM.

## MAN 404 FINANCE MANAGEMENT (3 0 0 3)

Engineering and uncertainty –Engineering processes – Strategies, Proposals, Decision making
Economic concepts – Utility, value, cost, consumers – Supply and demand
Costs: Initial, maintenance, fixed, variable, and marginal costs
Interest rates: Simple and compound interest
Money value – Past, present, and future values
Cash flow – Present and future worth – Payback periods

**Text Books:**


1. Shim. J. K and Siegel. J. G, Financial Management, Schaum's Outline Series, 2009.
2. Barathwal. R. R, Engineering Economics, McGraw Hill, 1997.


**References:**


1. Crabaugh. R. J, International Economics, South Western College Pub., 2004.
2. Pepall, Richards and Norman, Industrial Organization: Contemporary Theory and Practice, Thomson South Western, 2005.
3. Martin. S, Advanced Industrial Economics, Blackwell Pub., 2002.