Semester I

MA105 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 1985

CY105 Macromolecules as 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. (6 hours)

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 crosslinking (gelation) or formation of insoluble polymer mass. Determination of polymer structure via IR and NMR spectroscopies. (12 hours)

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. (9 hours)

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. (9 hours)

References:

1. Polymer Science and Technology by Joel R. Fried, Prentice Hall of India Pvt. Ltd. 1999.
2. Textbook of Polymer Science, by Fred W. Billmeyer Jr. Fourth Edition, 1999. Wiley-Interscience, New York.
3. Principle of Polymerization by George Odian, Fourth Edition, Wiley-Interscience, New York 1999.
4. Polymer Science, By V.R. Gowarikar, N.V. Viswanathan and S. Jayadev.

BT 101 Life Sciences 2-0-0-2

Course Overview- Evolution & Origin of Life, Theories for origin of life –Darwinian selection, Diversity of Life; Cell structure- Prokaryotic and Eukaryotic Cell Structures, Functions of Organelles, Mitosis and Meiosis; Classical Genetics - Mendel's laws and Patterns of Inheritance.

Structures of Bio-molecules - DNA, RNA, Protein, Carbohydrates and Lipids; Molecular Genetics - Overview of Information Flow in Biological Systems; Techniques in Cell & Molecular biology

Structure and Regulation of Cellular Metabolism; Energy Flow - Photosynthesis, Cell Respiration, Cellular Oxidation of Glucose; Membrane biology - Cellular Transport and Signal Processing
Overview of Developmental Biology, Human physiology, Behavioral biology.

Text Books:

1. Life: the Science of Biology - William K. Purves, David Sadava, Gordon H. Orians, H. Craig Heller. 6th edition, W. H. Freeman & Company (2000)

2. Biology - Neil A Campbell & Jane B. Reece, 6th edition Pearson Higher Education (2001)

AM 110 Engineering Mechanics 4-0-0-4

Equilibrium of rigid bodies, free body diagram, Analysis of beams and trusses, Equilibrium of continuous systems -derivation of relation between load, shear force and bending moment. Energy conservation in rigid bodies -potential energy and elastic energy. Virtual work in multibody assemblies.

Lumped mass models in Dynamics -Particle motion in cylindrical c0ordinates, engineering applications of central force motion. Kinetics of rigid bodies -translation and rotation motion of a rigid body, relative motion with translating and rotating axes and Coriolis acceleration. Kinematics of rigid bodies -3-D properties of sections, angular momentum of rigid bodies and energy relations for rigid bodies. Mechanical vibrations of

single degree of freedom systems -free vibration of rigid bodies, general equations of motion and response to forced sinusoidal loading.

References:

1. Beer F.P. and Johnston E.R., Vector Mechanics for Engineers - Volume I - Statics, Volume II - Dynamics, McGraw Hill, New York.
2. Merlam J.L and Kraige L.G., Engineering Mechanics, Volume I - statics, Volume 11-dynamics, John Wiley & Sons, New York.
3. Shames L.H., Engineering Mechanics, Prentice Hall, New Delhi

ME110 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, Evaluation of S for solids, liquids, and ideal gases undergoing various 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, 1995.
3. Jones, J. B. and Dugan, R. E., Engineering Thermodynamics, Prentice-Hall India, 1996.
4. Moran, M.J. and Shapiro, H.N., Fundamentals of Engineering Thermodynamics, John Wiley, 1999.
5. Sonntag, R. E, Borgnakke, C. and Van Wylen, G. J., Sixth Edition, Fundamentals of Thermodynamics, John Wiley, 2003.

MM103 Materials Science & 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 Amold London, 1983.
2. James , F. Shackelford, Introduction to Material Science for Engg, McMillan, NY 1995.
3. George Dieter, Mechanical Metallurgy, McGraw Hill, NY 1983.

ED130 Graphic Art I **0-0-3-1**

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:

Thomas C Wang, Pencil Sketching, John Wiley & Sons 1997
Itten Johannes, Design and Form, John Wiley & Sons 1975
Kasprin Ron, Design Media – Techniques for Water Colour, Pen and Ink Pastel and colored markers, John Wiley & Sons 1999

WS 103 Workshop I **0-0-3-1**

1. Fitting
2. Machine shop – turning
3. Foundry
4. Welding

Second Semester:

MA 106 Solutions of Ordinary Differential Equations 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 transorms, 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, Volumes I and II, Mir. Publishers 1981

2. Kreyszig, E., advanced Engineering Mathematics, Wiley Eastern1985

PH106 Electromagnetic Field Theory 3-0-0-3

Classical Electrodynamics – Electrostatics and Magnetostatics – Coulomb's law and Ampere's law. Electrodynamics – Maxwell Lorenz equations and Faradays' Law of Induction.
Wave Equations in Electromagnetics and Electromagnetic potentials
Special theory of Relativity, Lorentz transformation, Lorentz space and Minkowski space
Electromagnetic fields and particles
Electromagnetic fields and matter – Electric polarization and displacement, Magnetisation and magnetizing field, Energy and momentum

References:

1. J.D. Jackson, Classical Electrodynamics, 3rd Edn. John Wiley, 1998
2. W.K.H. Panofsky and M. Philips Classical Electricity and Magnetism Addison – Wesley, 1962
3. Griffith D.JH., Introduction to Electrodynamics - (Prentice Hall, India)

4. L.D. Landau and E.M. Lifshitz , The Classical Theory of Fields, fourth revised English ed., vol. 2 of Course of Theoretical Physics, Pergamon Press, Ltd., Oxford, 1975.

ED110 Functional and Conceptual Design 3-0-0-3

Overview of the Design Process – Philosophy of Engineering Design, Steps involved in the Design Process S curves, Communications during design process.

Understanding the customer need – Steps involved in developing Engineering Design Specifications. The technique of Quality Function Deployment. Case studies in QFD.

Functional Design – Functions in engineering Design. Basics of Function Structure – Functional Basis , Functional decomposition and flow.

Product Concept – Various methods of concept generation. The method of TRIZ. Concept Selection and methods of evaluation.

An introduction to product metrics. Product Evaluation techniques.

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.

CS110 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 - printers - 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 problem

Computer Modeling and simulation - Discrete & Continuous approaches - Systems approach to problem solving - Models from various Engineering disciplines - Limitations of simulation.

References:

1. C: How to program, H. M. Deitel, P. J. Deitel, Prentice Hall, 1997.
2. Numerical Methods, Software and Analysis, J. R. Rice, Mc-Graw Hill, 1993.
3. Numerical Methods for Engineers, S. C. Chapra, R. P. Canale, Mc-Graw Hill, 1989.
4. Computer simulation and Modeling - Francis Neelamuavil, John Wiley & Sons, 1987
5. Numerical Recipes in C - William H. Press, Saul A. Teukolsky William T. Vellerling, Brain P. Flannery, Manas Saikia for Foundation Books, 1993.
6. Engineering problem solving with ANSI C - Delores M. Etter, Prentice Hall

EE 110 Basic Electrical Engineering 3 0 0 3

DC Circuits – AC Circuits – True and reactive power in AC circuits

Electro-mechanical energy conversion – Power systems

Opams and their applications – Basic digital systems – Microprocessors – Computer networking fundamentals

Principles of communication – Basics of Signal Processing

References:

1. *Vincent Del Toro : Electrical Engineering Fundamentals*, Prentice Hall India, 1989.
2. *Paul Horowitz & Winfield Hill, The Art of Electronics*, Cambridge University Press, 1992
3. *Taub & Schilling, Digital Integrated Electronics*, McGraw-Hill,
4. *Ralph J Smith, "Circuits Devices and Systems"*, John Wiley & Sons, 1989.

MS110 Technology, Invention and Innovation 2-0-0-2

Technology and Invention - An Introduction

- Definitions;
- Classifications;
- Brief history of developments in agriculture, food, construction, energy, manufacturing, transport, communications, health-care, and information technologies;
- Global/macro-issues;
- Organizational/micro-issues.

Technological Change

- Technology characteristics;
- Functional capabilities and change indicators;

- Technology life-cycles;
- Time scales of technology development;
- Innovation, substitution and diffusion models.

Technology Forecasting (TF)

- Importance;
- Overview and classification of forecasting methodologies;
- Exploratory and Normative TF;
- Technology generations and inter-generational interactions.

Technology Assessment (TA) and Impact Analysis

- Assessment objectives and types;
- Components and conduct of technology assessment;
- Techniques of impact analysis;
- Impact evaluation.

Thinking for Invention and Innovation

- Types of thinking;
- Idea-generation frameworks and methods;
- Idea-evaluation frameworks and methods;
- Idea-implementation frameworks and methods.

The Innovation Mindset

- Understanding the consumer;
- Leadership and organization for innovation;
- Managing the innovation process;
- Nurturing a culture of innovation.

Case Studies in Technology Innovation

References:

1. Forbes, Naushad and David Wield; From Followers to Leaders - Managing technology and innovation; Routledge, London, 2002.
2. Ford, David and Michael Sare; Managing and Marketing Technology; Thomson Learning, Singapore, 2001.
3. Burgelman, Robert A., et al; Strategic Management of Technology and Innovation; Second Edition, Irwin, Chicago, 1996.
4. Lumsdaine, Edward and Monika Lumsdaine; Creative Problem Solving - Thinking Skills for a changing world; McGraw-Hill; New York. 1995.
5. Ray, Michael and Rochelle Myers; Creativity in Business; Doubleday; New York. 1986.
6. Kuczmarski, Thomas D.; Innovation – Leadership strategies for the competitive edge; American Marketing Association, Chicago, 1996.
7. Kiernan, Matthew J.; Get Innovative or Get Dead; Synergy Books, Kuala Lumpur. 2000.
8. All India Management Association; Innovation – Strategy for corporate renaissance; Excel Books, New Delhi. 1996.

9. Christensen, Clayton M.; The Innovator's Dilemma; Harper Business, New York. 2000

PH104 Physics Laboratory II **0-0-3-1**

Experiments in Electricity, Magnetism, Optics and Atomic.

References:

1. Smith E.V. - Manual of Experiments in Applied Physics, London, Butterworth, 1970.
2. Workshop B.L., and Flint 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, 5. M. Nelkon and J.M. Ogborn -Advanced Level Practical Physics,English Language Book Society, 1955.

ME112 Engineering Drawing **1-0-3-2**

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, 1990.
2. French and Vierk., Fundamentals of Engineering Drawing, McGraw Hill, 1996.
3. Narayana.K.L., & Kannaiah.P.,Engineering Drawing, Charotar Publishing House, 1998.
4. Venugopal.K., Engineering Drawing, New Age International, 2000.
5. Natarajan.K.V., A text book on Engineering Drawing, Classic Prints, 2000.
6. Gopalakrishna.K.R., Engineering Drawing. Subash Stores, 2000.
7. Bhatt.N.D., Engineering Drawing, New Age International. 2000.

WS 102 Workshop II **0-0-3-1**

Milling & shaping; FRP, Plastics, Pneumatics & Hydraulics; Electrical ; Electronics

Semester III:

ID 120 – Ecology and Environment **2 0 0 2**

Biotechnology – 2 hrs duration

1. Modern approaches to explore bio-diversity and conservation.

Text Books:

1. Environment Problems and Solutions, D A Asthana and Meera Asthana, S Chand and Co 2001

Chemical Engg – 6 hrs duration

1. Control of particulate pollution	:	1 hr
2. Control of gaseous pollution	:	1 hr
3. Definitions & Classification of hazardous waste	:	1 hr
4. Treatment of a typical hazardous waste	:	1 hr
5. Advanced concepts in ecological conservation	:	2 hrs

Chemistry – 5 hrs duration

Atmosphere: Chemical and physical aspects of Air Pollution – Chemical and photochemical reactions, ions & radicals, reactions of atmospheric constituents (oxygen, nitrogen, carbon dioxide, particulates), inorganic pollutants, global warming and acid rain (1 hr)

Organic Pollutants: Primary and secondary pollutants, chlorofluorocarbons and halons, stratospheric ozone depletion, its consequences and preventive measures, Smog – origin, effects and control (1 hr)

Air Pollutants: Analysis – chemical principles, major constituents and trace pollutants, detection and estimation, conventional and instrumental approaches (1 hr)

Water Pollutants: Analysis - chemical principles, suspended & dissolved species, detection and estimation, wet and instrumental approaches (1 hr)

Soil: Composition variety, acid-base and ion exchange reactions, macro and micronutrients, wastes and pollutants, soil erosion (1 hr)

Civil Engg – 5 hrs duration

Water: General effects of contaminants in water on human health. WHO standards for drinking water (1 hr)

Waste Water: Origin of waste water (Municipal & Industrial), their effects on limnological and ecological systems (1 hr)

Effluent standards, basic concepts of environmental impact assessment (1 hr)

Solid Waste Management: Effects of municipal solid waste (MSW) on ground water and general environment. Hidden costs of environment pollution (1 hr)

Source segregation, basic principles of land filling, composting and vermiculture (1 hr)

Reference Books:

1. Environmental Pollution Control Engg., C S Rao, Wiley Easter Ltd Pub
2. Introduction to Environmental Engg., M L Davis, D A Cornwell, McGraw Mill International Pub.

Humanities & Social Sciences – 4 hrs duration

Environmental Ethics: Anthropocentric and biocentric systems of ecoethics. the nature of values and the values of nature.

Ecological Thinking: The deep ecology movement and its concerns.

Environmental Economics: Nature as resource, renewability; rural/urban imbalances; Gandhi Economics; Sustainable development.

Environmental Policy Making: International Regulations; Environmental law making: land use, forest conservation, coastal settlements; Industries: Size, location, hazards, enforcement, services, training and education.

Prescribed Text:

Bernard J Nebel, Richard T Wright; Environmental Science: The way the world works, New Jersey 1998

Recommended Reading:

Wendell Berry: The Unsettling of America, Culture & Agriculture, New York 1978
M K Gandhi, Hind Swaraj (any edition)
Ramachandra Guha: (Ed) Social Ecology, New Delhi 1994
Ramachandra Guha: Environmentalism: A Global History, New Delhi 2000
Lawrence E Johnson: A Morally Deep World: An Essay on Moral
Significance and Environmental Ethics, Cambridge 1991
Freya Mathews: The Ecological Self, London 1991
Arine Naess: Ecology, Community and Lifestyle, Outline of an Ecosophy, Cambridge 1989
Rodrick Frazier Nash: The Rights of Nature, A History of Environmental Ethics, Madison (Wisconsin) 1983
Bryan G Norton: Why Preserve Natural Variety, New Jersey 1987
Paul W Taylor: Respect for Nature, A Theory of Environment Ethics, Princeton 1986
Michael Tobias: Deep Ecology An Anthrology, San Diego 1985

Physics: 2 hrs duration

Physics of environment, physical techniques of monitoring pollution

Video shows common for all

ED 201 History of Art and Art Appreciation 2 0 0 2

Overview and History of Western Art:
Prehistoric Art & Mesopotamian Art; Egyptian Art; Classical and Medieval Art; Renaissance and Baroque Art; Nineteenth Century Art; Twentieth Century Art – Modern and Post Modern Period.

Overview and History of Indian Art:
Prehistoric & Indus art; Buddhist, Hindu & Jaina Art; Islamic Art; Modern Art in India & Contemporary Art.

References:

1. Tansey, Richard G & F.S. Kleiner, Gardner's Art through the ages, 12th Edition, Harcourt, Brace Cottage, Fortworth 1996.
2. Tomory Edith, A history of fine Arts in India and the West, Orient Longmans, Chennai, 1982.
3. Rowland Benjamin, Art and Architecture of India, Penguin, Middlesex, 1953.

PH 203 Waves and Oscillations 3 0 0 3

Simple harmonic motion in one, two and three degrees of freedom. Linearity. Superposition principle. Damping, damped oscillations. Forcing, driven damped linear harmonic oscillator. Resonance.

Modes of vibration of n point masses coupled by springs. Normal modes. Fourier analysis.

Periodic, quasi-periodic and aperiodic motion. Time series analysis and power spectra. Wavelet analysis.

Transverse oscillations of a string. Wave equation in one dimension and its general solution. Standing waves and traveling waves. Dispersion, dispersion relations.

Wave or phase velocity and group velocity. Wave packets and pulse propagation.

Wave equation in two and three dimensions. Nature of solutions. Circular, cylindrical and spherical waves.

Longitudinal and transverse waves. Pressure waves and sound. Waves in elastic media. Phonons in crystals. Ultrasonic attenuation. Surface acoustic waves, Shear waves, Mach waves. Shock waves in gases. Rankine-Hugoniot equation. Seismic waves: Rayleigh waves, P-waves, S-waves, Love waves.

Water waves. Dispersion relation. Capillary waves. Surface waves. Gravity waves. Freak waves. Tsunamis.

Electromagnetic waves. Interference, diffraction and polarization. Electromagnetic waves in dielectric media. Waveguides, Birefringence.

Nonlinear Oscillators

Relaxation oscillators, Gunn diodes, Negative resistance oscillators.

Chemical reactions, chemical clocks. Belousov-Zhabotinsky reaction. Spatial patterns. Scroll waves. Excitable media. Biological oscillations. Biological clocks. Circadian rhythms Arrhythmia and chaos.

Waves in plasmas. Plasma oscillations. Ion acoustic waves. Alfven waves.

Non linear waves. Solitary waves. Solitons. Optical solitons and optical communication. Gravitational radiation.

References:

1. F.S. Crawford, *Waves, Berkeley physics course – Vol.3*, McGraw-Hill, New York 1973.
2. H.J. Pain, *The Physics of vibrations and waves*, 5th ed., Wiley, New York, 1999.
3. G.B. Witham, *Linear and Nonlinear waves*, Wiley, New York, 1974.
4. G. Bekefi and H. Barrett, *Electromagnetic vibrations, waves and radiation*, MIT Press, Cambridge, Mass., 1977
5. C.M.R. Fowler, *The Solid Earth: An introduction to Global Geophysics*, 2nd ed., MIT Press, Cambridge, 1990.
6. L. Glass and M.C. Mackey, *From clocks to chaos: The rhythms of life*, Princeton university press, Cambridge, 1990.
7. A.T. Winfree, *The geometry of biological time*, 2nd ed., Springer-Verlag, New York, 2000.
8. S.K. Scott, *Chemical chaos*, Oxford university press, Oxford, 1994
9. E. Infeld and G. Rowlands, *Nonlinear waves, solitons and chaos*, 2nd ed., Cambridge university press, cambridge, 2000
10. P.G. Drazin and R.S. Jhonson, *Soliotns: An introduction*, Cambridge university press, Cambridge, 1989.

MA 215 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, 1984.

2. G. Strang Introduction to Linear Algebra. Wellesley, MA: Wellesley-Cambridge Press, 1993.

3. D.G. Luenberger, Linear and Nonlinear Programming , Addison – Wesley, 1984.

4. A.D. Belegundu and T.R. Chandrupatla Optimization Concepts and Applications in Engineering, Pearson Education Asia, 2002.

ED 203 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. (4 hrs.)
Conservation of mass, momentum and energy - Applications (8 hrs.)
Introduction and Classification of Fluid Machines – Analysis of Turbo machinery flows - Performance characteristics of turbo machines (8 hrs)
Heat Transfer: Conduction – General Conduction Equation - One dimensional Steady state conduction- Fins and Extended Surfaces - Transient conduction of lumped and distributed systems. (7 hrs.)
Convection: Boundary Layers - dimensionless group for convection - Forced Convection – Laminar flow in a pipe –flow over cylinders, spheres Elements of free convection – (7 hrs.)
Turbulent flow in pipes – Introduction to the analysis of heat exchangers (3 hrs.)
Elements of Radiative Heat Transfer (3 hrs.)

References :

1. Fox and McDOnald, Introduction to Fluid Mechanics, Fifth Edition, John Wiley, 2003.
2. C.A. Long, Essential of Heat Transfer, Longman 1999.
3. S.P. Venkatesan, A First Course in Heat Transfer, ANE Books, 2004.

ED 205 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.
Feed back 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, “Electronic Devices and Circuits”, Prentice-Hall of India Pvt. Ltd.
2. P.Malvino, "Electronic Principles". Tata Mc-Graw Hill Publishing. Co
3. Horowitz and Hill, The Art of Electronics

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,
6. Prentice Hall India Ltd
7. A.P. Malvino, D.P. Leach, "Digital Principles and Applications", Tata McGraw-Hill Publishing Co.Ltd.
8. Morris M. Mano, Digital Logic and Computer Design, Prentice Hall

ED 207 Manufacturing Science 3 0 0 3

Manufacturing Process: Overview – Primary and Secondary processes, basis for selecting manufacturing processes (3 hrs)
Fundamentals of Metals casting – Solidification, structure and melting furnaces. An overview of different metal casting processes and applications, (5 hrs)
Fundamentals of Bulk forming Process – Forging, Extrusion and Rolling – Applications with case studies. (3 hrs).
Sheet Metal Forming – Shearing, Deep drawing, Stretch forming etc. Formability of sheet metals. Case studies (3 hrs)
Machining Processes used to produce round shapes – Turning, drilling, reaming, tapping etc. Case studies. (5 hrs).
Machining Processes to produce non circular parts – Milling, Planning, broaching etc. Applications. (5 hrs)
An overview of finishing operations. An Introduction to NC machines. (4 hrs)
Engineering Metrology – Gages, measuring straightness, flatness, roundness and profile. Coordinate Measuring Machine. (5 hrs)
An overview of Surface treatment processes . Case Studies. (3 hrs)
Rapid Prototyping Process (3 hrs)

References:

1. Roy A. Lindberg, "*Processes and Materials of Manufacture,*" Prentice-Hall of India, 1990.
2. Serope Kalpakjian and Steven Schmid, "*Manufacturing, Engineering and Technology,"* Prentice Hall, 2006.
3. Serope Kalpakjian and Steven Schmid, "*Manufacturing Processes for Engineering Materials,"* Prentice Hall, 2003.

ME 205 – Machine Drawing Practice 1 0 6 3

Advanced assembly drawings, detailed manufacturing drawing, specifications like fits and tolerances, surface finish, welding symbols, production methods

Introduction to functional design

References:

Luzadder W. J., "Fundamentals of Engineering Drawing", Prentice Hall India, 1990.

French and Vierk, "Fundamentals of Engineering Drawing", McGraw Hill, 1996.

Narayana K. L. and Kannaiah P., "Engineering Drawing", Charotar Publishing House, 1998.

Bhatt N. D., "Engineering Drawing", New Age International, 2000.

ED 211 – Graphic Arts II **0-0-3-1**

Communicating ideas and concepts using various means of drawing and illustration techniques including computer based illustration packages

Exploring different media and techniques including pen an dink, poster, paints, water color, pastels etc.

Introduction to the use of computer based drawing application packages including Adobe Freehand and Illustrator

SLR Photography and digital photography techniques in image making

Composition, cropping, depth of field in relation to visual images. Study of critical processes in image making and printing

References:

Carson Graves, The elements of B&W Photography, Focal Press, 2001
Tom Ang, Digital Photography, Mitchell Beazley, 1999
Azriel Rosenfeld and Avinash C Kak, Digfital Picture Processing, Academic Press 1962
Jack Buchan, Step by step Airbrushing, Hamlyn, 1993
Ching, Francis D K Design Drawing, John Wiley & Sons, 1998
Porter, Tom, Design Drawing Techniques for Architects
Graphic Designers and Artists Architectural Press, 1999

Semester IV :

CE 231 Mechanics of Materials 3 0 0 3

Stress and Strain: Tension, Compression and Shear, Uniaxial, Biaxial and general state of deformation; Basic equations of elasticity for plane elasticity problems; Elastic constants and their relations; Strain energy, Principal stresses and strains; Mohr's Circle, Membrane Stresses in thin and thick cylinders and simple shells; Theories of failure; Impact and cyclic loading; Bending, Shear and Compression; Classical Theory, various cross-sectional; shapes of beams; shear stresses in beams; Unsymmetrical bending and shear center; Deflection of beams; Double integration of governing differential equation; Euler buckling load of columns; Torsion: Torsion of circular shaft, close coiled helical springs; Torsion of thin walled open and closed sections and non-circular sections (formulae only without derivation)

References:

1. Beer, F.P., and Johnston, JR., "Mechanics of Materials", (2^{nd} Edition), McGraw Hill, 1992

2. Boresi, A.P., Schmidt, R.J. and Sidebottom, O.M., Advanced Mechanics of Materials (4^{th} Edition), John Wiley and Sons, 1993.

3. Popov, E.P., Mechanics of Materials, Prentice Hall of India Private Limited, 1976

4. Pytel, A. and Singer, F.L., Strength of Materials (4^{th} Edition), Harper Collins Publishers, Singapore, 1987

5. Srinath, I.S., Desayl, P. Murthy, N.S. and Anantha Ramu, S., Strength of Materials, McMilan India Ltd., 1997

6. Timoshenko, S. and Young, D.M. Element of Strength of Materials (5^{th} Edition), Affiliated East-West Private Limited, 1968.

MA 216 Partial Differential Equations 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:

E. Kreyszig : Advanced Engineering Mathematics, Wiley Eastern, 1990.

Ian Sneddon : Elements of Partial Differential Equations – McGraw-Hill, 1960.

AM 271 Dynamics of Machinery 3 1 0 4

Kinematics of machinery; Definition, condition of constrained motion, inversion; Velocity and acceleration diagrams of machines; Instantaneous center Theory of cams; Theory of Gears and gear trains

ED 202 Applications of Microprocessors and Microcontrollers 3 0 0 3

Introduction: Building blocks of the Digital computer, CPU functions, Memory types, Input / Output Devices, Stored program concept, History of Microprocessors.
Intel 8085 Microprocessor: Internal architecture, Hardware description, Interrupts and interrupts servicing and Interfacing the memory.
Assembly Language Programming: 8085- Addressing modes & Instruction set, Flow charts, Assembly language programming and assembler directives, Linker and its operation, Programming examples.

Interfacing the Input / Output devices**:** i8255 Programmable Peripheral Interface, i8253 Programmable Interval Timer, i8251 Universal Synchronous /Asynchronous Receiver Transmitter, i8259 Programmable Interrupt Controller and i8279 Programmable Keyboard / Display interface device.

Interfacing the Data Converters**:** Digital-to-Analog Converters, Interfacing DAC with 8085 microprocessor, Analog-to-Digital Converters, Interfacing ADC with 8085.
Advanced Microprocessors**:** Intel 8086 family microprocessors, Programming model, Memory paging, Virtual memory concept, Advanced features of 80386/486/Pentium Processors.

Microcontroller: Introduction to Microcontrollers, Intel-8051: Architecture, Hardware description, Memory organization, Addressing Modes.

Programming the i8051: Instruction set, Assembly language programming, Interrupt structure and interrupt priorities, Interfacing with external devices and Programming examples.

References :

1. Ramesh S.Gaonkar, Microprocessor, Architecture, Programming and Applications with the 8085, Penram International

2. Douglas V.Hall, Microprocessors and Interfacing Programming and Hardware, McGraw Hill International

3. Kenneth J.Ayala, The 8051 Microcontroller architecture, programming and applications, Penram International

ED 204 Control Systems 3 0 0 3

Introduction and Overview, Mathematical preliminaries – complex variables, Laplace transform; Modeling of dynamic systems, Analysis of transient response of first and second order linear time invariant systems, Basic control actions, Routh-Hurwitz stability criterion, Root locus analysis and control system design based on it, Frequency response analysis – Bode plots, Nyquist plots; Nyquist stability criterion, Control system design via frequency response – lead, lag and lag-lead compensation techniques; PID controllers, Introduction to state space approach.

References:

1. Katsuhiko Ogata, Modern Control Engineering, Prentice Hall.
2. Gene Franklin, J.D. Powell, and Abbas Emami-Naeini, Feedback Control of Dynamic Systems, Pearson Education.
3. Benjamin C. Kuo, Automatic Control Systems, Prentice Hall.
4. Eronini I. Umez-Eronini, System Dynamics and Control, Thomson Brooks/Cole.

ED 209 Geometric Modelling and Computer Aided Design 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 Modelling : Space curves – Bezier and B-Spline curves, Surfaces – Description and Generation.

Mathematical Representation of Solids – B-rep, CSG, solid manuplations.

Data Exchange in CAD/CAM systems.

References:

I. Zeid, CAD/CAM Theory and Practice, Tata McGrawhill, 2001.

D.F. Rogers and J.A. Adams, Mathematical Elements for Computer Graphics, McGraw-Hill, 1990.

J.Hoschek and D. Lasser, Computer Aided Geometric Design, AK Peters, 1993.

EN 210 Electrical Sciences **1 0 3 2**

ED 206 Product Design Lab I **0 0 3 1**

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

ED 208 Microprocessor Applications Lab **0 0 3 1**

Assembly Language programming using 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.

V semester

ED 301 Human Factors and Aesthetics in Design **3 0 3 4**

History of Human Performance; Human Factors and Systems; Human Psychology and performance; Human Limits and Differences; Sensors, Body and performance; Environmental conditions – influence on human performance; Fundamentals of biomechanics (biostatics, biodynamics), Musculo-skeletal system; force analysis during bending, lifting, carrying; Ergonomics

Designing for People; Workplace design based on anthropometry, bio-mechanics, ergonomics; Human operator control (virtual environments, haptic controls), Human computer Interface

Human factors in automobile, aircraft and medical systems design and representative case studies
Aesthetics in Design – Development of form in Product Design, Creative form Synthesis, Colour and texture as elements of design.

References:

1. Mark S. Sanders and Ernest J. McCormick, “Human Factors in Engineering and Design”, McGraw-Hill, 1992
2. Robert W. Bailey, “ Human Performance Engineering” A Guide for System Desigers”, Prentice-Hall, 1982
3. “Human Factors in Automotive Design”, SAE International SP 1591, SAE, Warrendale, USA, 2001.
4. Phillips, C.A., “Human Factors Engineering”, John Wiley & Sons, 2000.
5. “Human Engineering, Design Criteria Standard”, MIL-STD-1472F, Department of Defense, USA, 1999
6. Bahr, N., *System safety engineering and risk assessment: A practical approach*. Washington DC, Taylor and Francis; 1997

ED 303 Detail Design 3 1 0 4

Stress, Strength and deflection in Engineering Design – Case Studies.
Design of Shafts, keys and couplings. Bearings in Engineering Design – Types and applications. Design of Belt and Chain drives.
Gear Design: Spur, helical, Bevel etc.
Design of Clutches, brakes. Selection of Fasteners (hydraulic and pneumatic design)

References :

1. R.L. Norton, Machine Design – An Integrated Approach, Second Edition, Pearson, 2000.
2. J.R. Shigley and C.R. Mischke, Mechanical Engineering Design, Mc Graw – Hill, 1989.

ED 305 Design for Strength 3 0 0 3

Theories of “Failure” in Engineering Design. Reliability in Engineering Design
Design for Fatigue: Fatigue Mechanisms, Fatigue Tests. Fatigue life prediction methods.

Design for Surface Integrity: Engineering models for wear, Design guidelines for wear.

Design for Creep: Mechanisms and Methodology.

Introduction to Fracture Mechanics: LEFM, Fracture toughness determination. Fatigue Crack growth

References :

1. R.C. Juvinall, Engineering Considerations of Stress, Strain and Strength, McGraw-Hill, New York, 1967.
2. R.I. Stephen et.al., Metal Fatigue in Engineering, John Wiley, 2001.

3. R.G. Bayer, Engineering Design for Wear, Marcell Dekker, 2004.

ED 309 Introduction to Systems Design 3 0 0 3

Synthesis in Engineering Design: Theories- Function based synthesis, shape synthesis, Microsystem design, etc. System integration Concepts.

Engineering economics- cost , analysis and control, evaluation of economic alternatives

Statistical tools for engineering design- Statistical design of experiments, Design for reliability

System modelling using tools such as Bond graph methods

References:

1. EK Antonson and J Cagan (Ed.) Formal engineering design synthesis, Cambridge University press, 2001.

2. A Ertas and J C Jones, The engineering Design process, John Wiley 1996

ED 794 Introduction to Automotive Systems 3 0 0 3

Introduction and Overview – History of automobiles and an overview of a modern car.

Engines – An Introduction to SI and Diesel Engines.

Transmission and Drivelines – Clutches, Manual Transmission and Automatic Transmission, Transmission matching.

Steering System and Steering Dynamics – Mechanism, wheel alignment and steering dynamics.

Suspensions – Components and type of suspension, roll center analysis, tires and its roll in handling and ride.

Brake Systems : Principles, Dynamics and Components. Antilock Brake System.

References :

1. Richard Stone and J.K. Ball Automotive Engineering Fundamentals, SAE International, 2004.

2. D. B Astow, G. Howard and J. P. Whitehead, Car Suspension and Handling, SAE International, 2004.

3. K.Newton, W. Steeds and K. Garrett, The Motor Vehicle, Butterworths, 1989.

ED 311 Product Design Lab II 0 0 3 1

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

ED 313 Controls Lab. 0 0 3 1

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

VI Semester:

ME 795 Vehicle Component Design 3 0 0 3

Suspension System : Types of Front and Rear Suspensions. Design, Analysis using Multibody dynamics, Characteristics of Dampers and adaptive damping. Suspension testing.

Steering : Layout, Design of steering systems. Introduction to shimmy

Design principles for differentials and CV joints. Drive line vibrations.
Selection / Design of gearbox, clutch, drivelines, axles and its integration.

Braking System Design – Principles, Standards and testing. Design of ABS system

References:

1. J.Happian-Smith, An Introduction to Modern Vehicle Design, 2nd Edition, Butterworth- Heinemann, 2001
2. R.Limpert, Brake Design and Safety, SAE 1999
3. W.Matschinsky, Road Vehicle Suspensions, PEP, 2000
4. J.Y. Wong, Theory of Ground Vehicles, 2nd Edition, John Wiley, 1993
5. V.M. Faires, Design of Machine Elements, Macmillan
6. H.Heisler, Vehicle and Engine Technology, 2nd Edition, Arnold, 1999

ME 796 Vehicle Dynamics 3 0 0 3

Vehicle System- Forces and its effect. Tires- its mechanics, models and resistance to motion.

Vehicle Handling – Models for a rigid vehicle – Simple linearized models, Steady State Cornering, Stability – Derivatives, Understeer & OverSteer.

Vehicle Dynamics testing – Instrumentation, ISO Standards in testing.
Ride – Perception to Ride. Introduction to Random Process. Road Excitation and Characterization. Models for vehicle ride and ride comfort.

Chassis Control systems -Review of current developments, Braking, steering, driveline and suspension.(leading to ABS, Active suspension, traction control etc.)

References:

1. Gillespie, T. D., 1992. *Fundamentals of Vehicle Dynamics*, SAE International, Pennsylvania.
2. Wong, J. Y., 1989. *Terramechanics and Off road Vehicles*", Elsevier Science, Amsterdam.
3. Cossalter Vittore, 2002, Motor Cycle Dynamics, Race Dynamics, Inc. Greendale.
4. Pacejka, H B, Tyre and Vehicle Dynamics, Butterworth – Heinemann, Woburn, MA, 2002.

ME 740 Mechatronic Systems 3 0 0 3

Introduction – Definition of Mechanical Systems, Philosophy and approach.

Embedded Microprocessor Systems – Hardware Structure, Software Design and Communication, Programmable Logic Devices, Application Specific ICs, Automatic Control and Real Time Control Systems

Systems and Design – Mechatronic approach, Integrated Product Design, Modeling, Analysis and Simulation, Man-machine Interface.

Sensors and transducers – classification, development in Transducer Technology – Semiconductors, Thick film and Thin film elements, Signal processing, Opto-electronics – Shaft encoders, CD Sensors, Optical probe for Metrology, Vision System etc.

Derives and Actuators – Hydraulic and Pneumatic drives, Electrical Actuators such as servo motor and Stepper motor – Drive circuits, open and closed loop control; Piezoelectric and Magnetostrictive Actuators – Materials, Static and Dynamic Characteristics, illustrative examples for positioning, Vibration isolation etc.

Micromechatronic systems – Microsensors, Microactuators, Smart Instrumentation, Micro-fabrication techniques – Lithography, etching, Micro-joining etc; Application examples.

Case studies – Examples of Mechatronic Systems from Robotics, Manufacturing, Machine Diagnostics, Road Vehicles and Medical Technology.

ED 302 Design for X **3 0 0 3**

General definition and overview of Design for X

Design for Manufacture: Design for Injection Molding, Sheet Metal Working, Die casting, Powder Metal Processing, Sand Casting, Investment Casting, Hot Forging, Computer aided Design.

Design for Assembly: Definition, Assembly requirements and key characteristics, Significance of dimensioning and tolerance for assembly parts, Assembly sequence analysis. Design for Manual Assembly, High speed automatic assembly, Robotic assembly.

Design for electronic boards, Electrical connections and wire harshness assembly. Design for Modularity

Design for Environment: Eco-design and design strategies, Design for waste minimization, Re-cycling, Life Cycle concepts.

Design for Quality: Faults and Fault-tree analysis, Failure Mode Effect Criticality Analysis

References:

1. O Molloy, E A. Warman, S Tilley, "Design for Manufacturing and Assembly: Concepts, Architectures and Implementation"**,** Chapman & Hall, 1998.
2. Geoffrey Boothroyd, Peter Dewhurst, "Product Design for Manufacture and Assembly", Winston Knight, Mercel Dekker, 2001
3. G. Pahl and W. Beitz, "Engineering Design, A Systematic Approach", Springer, 1999.
4. Daniel E. Whitney "Mechanical Assemblies" Oxford University Press, 2004.
5. Helen Lewis, John Gertsakis, Tim Grant, Nicola Morelli, Andrew Sweatman, "Design and Environment: A Global Guide to Designing Greener Goods", Greenleaf Publications, 2001

OE304 Vibration of Marine Structures and Acoustics **3 0 0 3**

Analysis of single degree of freedom systems - Time & Frequency domain methods continuous system - Modes of vibration - Natural and forced vibration - vibration of beams - Sources of vibration - propeller excited, wave-induced and machinery - Random vibrations - Calculation procedure for torsional vibration of propulsion systems - empirical methods.

Hull grider vibration.

Vibration and sound instrumentation - sound transmission and absorption - Acoustic materials - Origin and nature of machinery noise and their control - Effect of noise on human behaviour - Noise limits and legislations.

ED 312 Mechatronics Lab **0 0 3 1**

Study of Automotive Transducers, Experiments with microcontrollers, Interfacing Stepper motors, servo & other actuators, Study of Torque speed characteristics of motors using tandem dynamometers. Servo Controllers.

ED 314 Automotive Lab **0 0 3 1**

Study of automotive subsystems such as engine, power train, suspension, chassis etc and its integration in small and medium passenger cars, Sports Utility vehicles. Study of two wheelers.

VII Semester:

CE 561 Finite Element Analysis **3 1 0 4**

Basic equations of Solid Mechanics – Review of equilibrium conditions, Strain-displacement relations, Stress –strain relations, Principle of Virtual work and 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, Analysis of framed structures – 2D and 3D truss and beam elements and applications. Analysis of plane stress / strain and axisymmetic solids triangular, quadrilaterial and isoparametric elements, incompatible models. Three dimensional stress analysis – Isoparametric eight and twenty nodded 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.

ED 401 Automotive Structures **3 0 0 3**

Review of the behaviour of thin walled beams – in bending and torsion, with examples from Vehicle structures. Load Cases and load factors in vehicle design
Open and Closed Structures – Analysis of Chassis, body shell analysis. Simple Structural Surface Method and the Finite element method.
Safety against Crash – Design methods, standards and the effects of materials. Finite Elements in crashworthiness studies.
Introduction to NVH – Body Structural vibration, body and engine mountings, Use of Sandwich panels etc for NVH.
Case studies involving advanced materials.

References :

1. John Fenton: Handbook of Vehicle Design Analysis, SAE International 1996.
2. J.C. Brown et.al. Motor Vehicle Structures, Butterworth Heinemann Publishers, Oxford, England,
3. J. Pawlowski, Vehicle body Engineering, Business Books, 1969.

HS 105 Principles of Economics **3 1 0 4**

This course will provide an introduction to the subject matter of economics which is highly relevant to understanding the functioning of the economy and the world around us. The course will consider basic economic principles that govern consumer and producers behaviour. It will examine how markets work and how supply and demand interact to determine prices, characteristic and types of market, market failure and role of government in the economy, macro economic issues and measurement, inflation and unemployment, money banking and international trade and macro policies.

Type of Economies and Economic Institutions – Production Possibility Frontiers, opportunity costs and circular flow- Supply and Demand – Theory of the firm, market structure and market failure – The Government in the economy – Macro Economic issues – Macro Policies, Money-International Trade and Finance.

ED 411 Vehicle Dynamics Lab. **0 0 3 1**

Experiments in three range of automobiles for ride and handling with ISO standards test using Steering robot and vehicle measurement systems. Development of Mumuro plots. Testing of braking system, fuel efficiency etc.

ED 413 IC Engines Lab **0 0 3 1**

Performance and Exhaust emissions of a four stroke multi cylinder SI engine equipped with a catalytic converter.
Tests on a CI engine to determine the effect of BMEP on performance and emissions at constant speed.
Study of the effect of air fuel ratio and spark timing on the performance and emissions of a four stroke SI engine.
Heat balance test on a four stroke CI engine.
Effect of compression ratio on the thermal efficiency and emissions of a four stroke SI engine.
Determination of the frictional losses of an IC Engine under variable speed and Torque conditions.

VIII semester:

ED 450 Design Project in the Industry 0 0 0 9

Project in the Industry. The student to participate in an industrial design project with well defined responsibility. The project to be completed from end to end, concept to manufacture.

IX semester:

ED 501 Computer Aided Manufacturing 2 0 0 3

Introduction to NC and CNC machines – Control Unit, Tool changing systems, work holding devices, interpolators and controllers.
Part Programming – Computer Assisted Part Programming, use of integrated CAD/CAM packages.
Sculptured Surface Machining – Rough and Finish Machining strategies.
Rapid Prototyping – Machine and procedures, Coordinate Measuring Machine
Advanced Manufacturing Process

References:

1. James Madison, CNC Machining Handbook, Industrial Press, New York, 1996.
2. B.K. Choi, R.B. Jerard, Sculptured Surface Machining, Kluwer Academic, 1998.
3. I. Zeid, CAD / CAM Theory and Practice, McGraw Hill, 1991

HS Foreign language 3 0 0 3

HS 305 Professional Ethics 2 0 0 2

Concept of Profession and highlight its difference from occupation or job

The vital role of ethics in professions

The importance of ethical codes in professions and the prerequisites of an ethical professional

The nature of engineering ethics, the value of ethnical practices in engineering and the virtues of an ethical engineer

Texts:

1. Velasquez, Manuel G: 2002, Business Ethics: Concepts and Cases, Fifth edition, 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)

References:

1. Sekhar, R.C.,: 1997, Ethical Choices in Business Response Books, New Delhi, Sage Publications.
2. Kitson, Alan and Campebell, Robert: 1996. The Ethical Organisation, Great Britain Macmillan Press Ltd.
3. Pinkus, Rosa Lyun B., Larry J Shulman, Norman Phummon, Harvey Wolfe: 1997, Engineering Ethics New York, Cambridge Uty., Press
4. Erwann, M. David, Williams, Masy B and Guiterrez, Claudio: 1990, Computers, Ethics and Society, Oxford, Oxford Uty., Press
5. Langford, Duncan (EDT): 2000, Internet Ethics, London, Macmillan Press Ltd., 2000.

ED 550 Industrial Lecture **0 0 3 1**

X semester:

ED 590 Project **0 0 0 11**

A multidisciplinary project with the student working in a group. Each student has a well defined individual responsibility

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