

**HU201: PROFESSIONAL ETHICS AND HUMAN VALUES**  
(Code: HU201 Credit: 02 L-T-P: 2-0-0)

**Engineering Ethics**

Senses of 'engineering ethics' – variety of moral issues – types of inquiry – moral dilemmas – moral autonomy – Kohlberg's theory – Gilligan's theory – consensus and controversy – professions and professionalism – professional ideals and virtues – theories about right action – self-interest – customs and religion – uses of ethical theories

**Engineering as Social Experimentation**

Engineering as experimentation – engineers as responsible experimenters – codes of ethics – a balanced outlook on law – the challenger case study

**Responsibility for Safety**

Safety and risk – assessment of safety and risk – risk benefit analysis – reducing risk.

**Responsibilities and Rights**

Collegiality and loyalty – respect for authority – collective bargaining – confidentiality – conflicts of interest – occupational crime – professional rights – employee rights – intellectual property rights – discrimination

**Global Issues**

Multinational corporations – environmental ethics – computer ethics – weapons development – engineers as managers – consulting engineers – engineers as expert witnesses and advisors – moral leadership – sample code of conduct

**References:**

1. Mike Martin and Roland Schinzinger, "Ethics in Engineering", McGraw Hill, New York, 1996.
2. Charles D Fleddermann, "Engineering Ethics", prentice Hall, New Mexico, 1999.
3. Laura Schlesinger, "How Could You Do That: The Abdication of Character, Courage, and Conscience", Harper Collins, New York, 1996.
4. Stephen Carter, "Integrity", Basic Books, New York, 1996

**CY201: ENGINEERING CHEMISTRY**  
(Code: CY201 Credit: 04 L-T-P: 3-1-0)

**General Chemistry:** Atomic and molecular structure – chemical bonding; Molecular and Crystal structure-Covalent inorganic and Organic Compounds, ionic solids; hybridization, close packing of atoms and ions. Insulator and conductors-electronic structure and properties of solids.

Acid and bases – pH and pKa; Oxidation and Reduction, standard reduction Potential.

Laws and application of thermodynamics - phase Rule, critical behavior of substances, Chemical kinetics, catalysis, Electrolytic conduction and electrolysis.

**Electrochemistry:** Electrochemical Cells – EMF of a cell, Electrodes, reference electrodes, ion-selective electrodes, glass electrodes, Commercial electrochemical cells and batteries: batteries-properties, classification, cell reactions and performance. Lead-acid battery, dry cell, Ni-cd battery, lithium battery, alkaline battery, Fuel cell.

Corrosion and material oxidation – Chemical and electrochemical corrosion, pitting and water line corrosion, passivation of surfaces, protective measures against corrosion- anodizing, galvanizing. Corrosion inhibition.

**Instrumental Methods of Analysis:** Introduction to instrumental metals such as IR, UV,-Vis, NMR and Mass spectrometry.

**Reaction Dynamics:** Reaction laws: rate and order; molecularity; first and second order kinetics; mechanism and theories of reaction rates (Transition state theory, Arrhenius equation).

**Structure and Reactivity of Organic Molecule:** Inductive effect; resonance; hyperconjugation; electrometric effect; carbanion and free radicals; brief study of some addition, elimination and substitution reactions

**Polymerization:** Concepts, classifications and industrial applications; polymerization processes, degree of polymerization (addition and condensation polymerization); preparation, structure and use of some common polymers: plastic (PE, PP, PVC Bakelite), rubber (natural rubber, SBR, NBR), fibre (nylon 6, 6, polyester); conducting and semiconducting polymers.

**Industrial Chemistry:** Solid, liquid and gaseous fuels; constituents of coal, carbonization of coal, coal analysis, proximate and ultimate analysis; classification of coal Petroleum, gasoline, octane number, aviation fuel, diesel, cetane number; natural gas, water gas.

**Text and Reference Books:**

1. Rakshit P. C. Physical Chemistry
2. Dutta R. L. Inorganic Chemistry

**MA201: ENGINEERING MATHEMATICS – II**  
(Code: MA201 Credit: 04 L-T-P: 3-1-0)

**Vector Calculus**

Differentiation of vector functions, scalar and vector fields, gradient of a scalar functions, directional derivative, Divergence and curl of a vector point function, physical interpretation of gradient, divergence and curl, properties of grad, div & curl; Repeated operation by  $\nabla$ ; Integrations of vector functions, Line, surface and Volume integrals, Theorems of Gauss, Stokes and Green.

**Linear Algebra**

Some special type of matrices like Symmetric and Skew-Symmetric, Hermitian and Skew-Hermitian, Idempotent, Nilpotent, Involuntary, Orthogonal, Unitary and their properties. Triangular and Echelon form. Inverse of a matrix. Elementary operations and elementary matrices, equivalent matrices, computation of inverse by elementary transformation. Reduction of matrices to triangular form and normal form. Inverse by partitioning. Rank of a matrix, evaluation of rank.

**Probability & Statistics**

Measures of Central Tendency and measures of Dispersion. Probability: Definition of probability. Laws of probability, Baye's theorem. Random variables. Probability distributions of a discrete random variable, Mean and Variance of a discrete random variable. Probability distribution of a continuous random variable. Expectation and moments. Binomial distribution, Poisson's distribution and Normal distribution.

**Fourier series**

Fourier series expansion of  $f(x)$  in  $c < x < c + 2\pi$ , Dirichlet's conditions, Fourier series for discontinuous functions, change of intervals, half range series.

**Integral Calculus:**

Jacobians. Beta and Gamma functions.

**Texts/ References:**

1. Murray R. Spiegel: *Vector Calculus, Schaum Pub.*
2. Erwin Kreyszig: *Advanced Engg. Mathematics, Wiley Eastern*
3. B.S.Grewal: *Higher Engg. Mathematics, Khanna Publishers*

**ME201: ENGINEERING MECHANICS**  
(Code: ME201 Credit: 04 L-T-P: 3-1-0)

**Forces and Moments**

Force, Moment and Couple, Resultant of forces, Forces in space. Equilibrium, FBD, General equations of equilibrium, Analysis of forces in perfect frames. Brief introduction to vector approach.

**Center of gravity and moment of inertia**

Center of gravity of axes, volume and composite bodies: Area moment of inertia and mass moment of inertia for plane figures and bodies. Introduction to dry friction. Laws of friction, friction of simple machines- inclined planes, Screw jacks.

**Kinetics of rigid bodies**

Plane motion, force, mass, acceleration, work and energy. Impulse and momentum, rotational motion, centrifugal force, torque, angular motion and acceleration, angular momentum, Virtual work.

**Reference books:**

1. *Engineering Mechanics: S Timoshenko & D H Young. McGraw Hill Int.*
2. *Engineering Mechanics: R S Khurmi. S Chand & Co.*
3. *Engineering Mechanics: R K Bansal. Laxmi Publication (P) Ltd*
4. *Engineering Mechanics: K L Kumar. McGraw Hill Publishing Co.*
5. *Engineering Mechanics: Hibble*

**EE201: BASIC ELECTRICAL ENGINEERING**  
(Code: EE201 Credits: 04 L-T-P: 3-1-0)

**DC Networks:** Definitions of active, passive, linear, non-linear circuits elements and networks. Kirchoff's laws. Nodal and mesh analysis. Voltage and current sources. Network theorems – superposition. Thevenin's, Norton's and maximum power transfer.

**Single Phase AC Circuits:** Waveforms of alternating voltages and currents, instantaneous, averages and rms values, form factor and peak factor, forms of representation of alternating quantities, concept of phasor and phasor diagrams, concept of lead and lag, reactance and impedances, AC circuits – resistive, inductive, capacitive, R-L, R-C and R-L-C series, parallel and series-parallel combinations, impedance triangle, admittance, active and reactive power and power factor.

**Magnetic Circuits:** Definition of mmf, flux, flux-density and reluctance, comparison between electric and magnetic circuits, series, parallel and series-parallel circuits and their solutions, energy stored in magnetic circuit, lifting magnets, electromagnetic induction, self and mutual inductance, hysteresis and eddy current losses.

**Three Phase AC Circuits:** Concept of three-phase AC, connections, phase and line values in star and delta connections, solution of simple 3-ph balanced circuits with resistive and reactive loads, 3-ph power, phase sequence.

**Instruments:** Classification of instruments, essentials of indicating type instruments – deflecting torque, controlling torque, damping, types of indicating instruments, MC and MI type ammeters and voltmeters, extension of range-use of shunts and multiplier, errors and compensation.

**Basic of Electrical Installations:** Wirings, types of cables, types of wiring; circuit layouts – single-phase AC mains to DB; 3-ph connections; fuse, MCB etc. Testing of a wiring installation, the Megger; Earthing- purpose and methods; Indian Electricity Rules regarding electrical installation.

**Text / References:**

1. *Nagrath: Basic Electrical Engineering*
2. *Fitzgerald, D.E; A Grabel: Basic Electrical Engineering, McGraw Hill*
3. *Edward Hughes: Electrical Technology, Longman*
4. *S.K. Bhattacharjee: Experiments in Basic Electrical Engineering*
5. *Thereja B.L.: A Text Book of Electrical Technology, S. Chand & Co., New Delhi*
6. *Dobey: Fundamentals of Electrical Machines, Narosa Publishing House, 2<sup>nd</sup> Ed.*
7. *H. Cotton: Advanced Electrical Technology, Wheeler Publishing, Allahabad, 1999*

**EC201: BASIC ELECTRONICS**

**(Code: EC201 Credits: 04 L-T-P: 3-1-0)**

**Semiconductor Physics:** Basic concepts, Intrinsic and extrinsic semiconductors, diffusion and drift currents, p-n junction under open-circuit, reverse bias and forward-bias conditions, p-n junction in the breakdown region, Ideal diode and characteristics.

**Rectifiers:** Half wave, Full wave, Bridge (calculation of ripple factor and rectification efficiency), Filters (L, C, LC,  $\pi$ ), Clipping and Clamping circuits.

**Bipolar Junction Transistor:** Basic working principle, Input and Output Characteristics, Basic Configurations, Biasing, Operating point, Load line, Stabilization of Operating point, Self-Bias Arrangement.

**Field Effect Transistors:** JFET, basic working principle, I/O Characteristics, pinch off voltage, parameters, MOSFET, basic working principle, Characteristics.

**Amplifiers:** Introduction to different types of amplifiers and their characteristics, principle of amplification, Frequency response of RC coupled amplifiers, amplifier bandwidth and concept of Cascaded Amplifiers, Feedback amplifiers, Effect of positive and negative feedback on amplifier and bandwidth.

**Oscillators:** Criteria for oscillations, Qualitative analysis of LC, RC and Crystal Oscillators, Study of Wein Bridge Oscillators.

**Operational Amplifiers:** Op-amps, its characteristics and its applications. Power Suppliers: Introduction and Working of Switched Mode Power Supply (SMPS), Voltage Regulator, Introduction to Inverters and UPS.

**Digital Electronics:** Binary, Octal and Hexadecimal number systems and conversions, Boolean algebra, Truth Tables of logic gates (AND, OR, NOT), NAND, NOR as universal gates, Difference between combinational circuits and sequential circuits, Introduction to flip-flops (S-R & J-K).

**Basic Measuring Instrumentations:** Regulated power supply, Analogue and Digital Multimeter, Cathode Ray Oscilloscope, Function Generator (functional block diagram, basic working principle, measuring quantities).

**Displays:** Seven segment display, fourteen segment display, Dot matrix display. LED Display: Introduction, Construction, Advantage of LEDs in electronics display. LCD Display: Introduction; Types of LCD display:- Dynamic scattering and field effect type; Types of liquid crystal cells:- Transmitting type and reflective type; Advantage & disadvantage of LCD display common applications.

**Books Recommended:**

1. Sedra A S and Smith K C, “Microelectronics Circuits” 4<sup>th</sup> Ed., New York, Oxford University Press, New York (1997).
2. Tocci R J and Widmer N S, “Digital Systems – Principles and Applications”, 8<sup>th</sup> Ed., Pearson Education India, New Delhi (2001).
3. Cooper and Helfrick, “Modern Electronic Instrumentation and Measuring Techniques”, 4<sup>th</sup> print, Printice Hall of India, New Delhi (1996).
4. Boylestad and Nashelsky, “Electronic Devices and Circuit Theory”, 8<sup>th</sup> Ed, Pearson Education India, New Delhi (2002).
5. Millman and Grabel, “Microelectronics”, 2<sup>nd</sup> Ed. Tata McGraw Hill (1999).