

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B.TECH. MECHANICAL ENGINEERING (MECHATRONICS)

COURSE STRUCTURE & SYLLABUS (2016-17)

II YEAR I SEMESTER

S. No	Course Code	Course Title	L	T	P	Credits
1	MA301BS	Mathematics - IV	4	1	0	4
2	EI302ES	Electronic Devices & Circuits	3	0	0	3
3	ME303ES	Mechanics of Solids	3	0	0	3
4	MT304ES	Thermal Science	4	0	0	4
5	ME305ES	Metallurgy & Material Science	4	0	0	4
6	ME307ES	Mechanics of Solids Lab	0	0	3	2
7	MM308ES	Metallurgy Lab	0	0	3	2
8	EC306ES	Electronic Devices & Circuits Lab	0	0	3	2
9	*MC300HS	Gender Sensitization Lab	0	0	3	0
		Total Credits	18	0	12	24

II YEAR II SEMESTER

S. No	Course Code	Course Title	L	T	P	Credits
1	MT401ES	Electrical Engineering	4	0	0	4
2	MT402ES	Fluid Mechanics & Heat Transfer	4	0	0	4
3	ME402ES	Kinematics of Machinery	4	1	0	4
4	SM405MS	Business Economic and Financial Analysis	3	0	0	3
5	EC401ES	Switching Theory and Logic Design	3	0	0	3
6	ME407ES	Fluid Mechanics and Hydraulic Machines Lab	0	0	3	2
7	MT406ES	Thermal Engineering Lab	0	0	3	2
8	MT408ES	Electrical Engineering Lab	0	0	3	2
9	*MC400ES	Environmental Science and Technology	3	0	0	0
		Total Credits	21	1	9	24

MA301BS: MATHEMATICS - IV
(Complex Variables and Fourier Analysis)

B.Tech. II Year I Sem.

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Prerequisites: Foundation course (No Prerequisites).

Course Objectives: To learn

- differentiation and integration of complex valued functions
- evaluation of integrals using Cauchy's integral formula
- Laurent's series expansion of complex functions
- evaluation of integrals using Residue theorem
- express a periodic function by Fourier series and a non-periodic function by Fourier transform
- to analyze the displacements of one dimensional wave and distribution of one dimensional heat equation

Course Outcomes: After learning the contents of this paper the student must be able to

- analyze the complex functions with reference to their analyticity, integration using Cauchy's integral theorem
- find the Taylor's and Laurent's series expansion of complex functions
- the bilinear transformation
- express any periodic function in term of sines and cosines
- express a non-periodic function as integral representation
- analyze one dimensional wave and heat equation

UNIT – I

Functions of a complex variable: Introduction, Continuity, Differentiability, Analyticity, properties, Cauchy, Riemann equations in Cartesian and polar coordinates. Harmonic and conjugate harmonic functions-Milne-Thompson method

UNIT - II

Complex integration: Line integral, Cauchy's integral theorem, Cauchy's integral formula, and Generalized Cauchy's integral formula, Power series: Taylor's series- Laurent series, Singular points, isolated singular points, pole of order m – essential singularity, Residue, Cauchy Residue theorem (Without proof).

UNIT-III

Evaluation of Integrals: Types of real integrals:

(a) Improper real integrals $\int_{-\infty}^{\infty} f(x)dx$ (b) $\int_c^{c+2\pi} f(\cos \theta, \sin \theta)d\theta$

Bilinear transformation- fixed point- cross ratio- properties- invariance of circles.

UNIT – IV

Fourier series and Transforms: Introduction, Periodic functions, Fourier series of periodic function, Dirichlet's conditions, Even and odd functions, Change of interval, Half range sine and cosine series.

Fourier integral theorem (without proof), Fourier sine and cosine integrals, sine and cosine, transforms, properties, inverse transforms, Finite Fourier transforms.

UNIT-V

Applications of PDE: Classification of second order partial differential equations, method of separation of variables, Solution of one dimensional wave and heat equations.

TEXT BOOKS:

1. A first course in complex analysis with applications by Dennis G. Zill and Patrick Shanahan, Johns and Bartlett Publishers.
2. Higher Engineering Mathematics by Dr. B. S. Grewal, Khanna Publishers.
3. Advanced engineering Mathematics with MATLAB by Dean G. Duffy

REFERENCES:

1. Fundamentals of Complex Analysis by Saff, E. B. and A. D. Snider, Pearson.
2. Advanced Engineering Mathematics by Louis C. Barrett, McGraw Hill.

ME303ES: MECHANICS OF SOLIDS

B.Tech. II Year I Sem.

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UNIT – I

Simple Stresses & Strains: Elasticity and plasticity – Types of stresses & strains–Hooke's law– stress – strain diagram for mild steel – Working stress – Factor of safety – Lateral strain, Poisson's ratio & volumetric strain – Elastic moduli & the relationship between them – Bars of varying section – composite bars – Temperature stresses. Strain energy – Resilience – Gradual, sudden, impact and shock loadings.

UNIT – II

Shear Force and Bending Moment : Definition of beam – Types of beams – Concept of shear force and bending moment – S.F and B.M diagrams for cantilever, simply supported and overhanging beams subjected to point loads, u.d.l., uniformly varying loads and combination of these loads – Point of contra flexure – Relation between S.F., B.M and rate of loading at a section of a beam.

UNIT – III

Flexural Stresses : Theory of simple bending – Assumptions – Derivation of bending equation: $M/I = f/y = E/R$ Neutral axis – Determination bending stresses – section modulus of rectangular and circular sections (Solid and Hollow), I, T, Angle and Channel sections – Design of simple beam sections.

Shear Stresses: Derivation of formula – Shear stress distribution across various beams sections like rectangular, circular, triangular, I, T angle sections.

UNIT - IV

Principal Stresses and Strains: Introduction – Stresses on an inclined section of a bar under axial loading – compound stresses – Normal and tangential stresses on an inclined plane for biaxial stresses – Two perpendicular normal stresses accompanied by a state of simple shear – Mohr's circle of stresses – Principal stresses and strains – Analytical and graphical solutions.

Theories of Failure: Introduction – Various theories of failure - Maximum Principal Stress Theory, Maximum Principal Strain Theory, Strain Energy and Shear Strain Energy Theory (Von Mises Theory).

UNIT – V

Torsion of Circular Shafts : Theory of pure torsion – Derivation of Torsion equations : $T/J = q/r = N\theta/L$ – Assumptions made in the theory of pure torsion – Torsional moment of resistance – Polar section modulus – Power transmitted by shafts – Combined bending and torsion and end thrust – Design of shafts according to theories of failure.

Thin Cylinders: Thin seamless cylindrical shells – Derivation of formula for longitudinal and circumferential stresses – hoop, longitudinal and Volumetric strains – changes in dia, and volume of thin cylinders– Thin spherical shells.

TEXT BOOKS:

1. Strength of materials – R.S. Kurmi and Gupta.
2. Solid Mechanics, by Popov
3. Strength of Materials – Ryder. G.H.; Macmillan Long Man Pub.
4. Strength of Materials – W.A. Nash, TMH

REFERENCES:

1. Strength of Materials -By Jindal, Umesh Publications.
2. Analysis of structures by Vazirani and Ratwani.
3. Mechanics of Structures Vol –I by H. J. Shah and S. B. Junnarkar, Charotar Publishing House Pvt. Ltd.
4. Strength of Materials by D.S Prakash Rao, Universities Press Pvt. Ltd.
5. Strength of Materials by S. S. Rattan, Tata McGraw Hill Education Pvt. Ltd.
6. Fundamentals of Solid Mechanics by M. L. Gambhir, PHI Learning Pvt. Ltd
7. Strength of Materials by R.K Rajput, S. Chand & Company Ltd.

EI302ES: ELECTRONIC DEVICES AND CIRCUITS

B.Tech. II Year I Sem.

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Course Objectives: This is a fundamental course, basic knowledge of which is required by all the circuit branch engineers. This course focuses:

- To familiarize the student with the principle of operation, analysis and design of Junction diode, BJT and FET transistors and amplifier circuits.
- To understand diode as rectifier.
- To study basic principle of filter circuits and various types.

Course Outcomes: At the end of the course, the student will be able to:

- Understand and Analyse the different types of diodes, operation and its characteristics
- Design and analyse the DC bias circuitry of BJT and FET
- Design biasing circuits using diodes and transistors.
- To analyze and design diode application circuits, amplifier circuits and oscillators employing BJT, FET devices.

UNIT - I

P-N Junction Diode Qualitative Theory of P-N Junction, P-N Junction as a Diode, Diode Equation, Volt-Ampere Characteristics, Temperature dependence of VI characteristic, Ideal versus Practical – Resistance levels (Static and Dynamic), Transition and Diffusion Capacitances, Diode Equivalent Circuits, Load Line Analysis, Breakdown Mechanisms in Semiconductor Diodes, Zener Diode Characteristics.

Special Purpose Electronic Devices: Principle of Operation and Characteristics of Tunnel Diode (with the help of Energy Band Diagram), Varactor Diode, SCR and Semiconductor Photo Diode.

UNIT - II

Rectifiers and Filters : The P-N junction as a Rectifier, Half wave Rectifier, Full wave Rectifier, Bridge Rectifier, Harmonic components in a Rectifier Circuit, Inductor Filters, Capacitor Filters, L- Section Filters, π - Section Filters, Comparison of Filters, Voltage Regulation using Zener Diode.

UNIT - III

Bipolar Junction Transistor and UJT: The Junction Transistor, Transistor Current Components, Transistor as an Amplifier, Transistor Construction, BJT Operation, BJT Symbol, Common Base, Common Emitter and Common Collector Configurations, Limits of Operation , BJT Specifications, BJT Hybrid Model, Determination of h-parameters from Transistor Characteristics, Comparison of CB, CE, and CC Amplifier Configurations, UJT and Characteristics.

UNIT - IV

Transistor Biasing and Stabilization: Operating Point, The DC and AC Load lines, Need for Biasing, Fixed Bias, Collector Feedback Bias, Emitter Feedback Bias, Collector - Emitter Feedback Bias, Voltage Divider Bias, Bias Stability, Stabilization Factors, Stabilization against variations in V_{BE} and β , Bias Compensation using Diodes and Transistors, Thermal Runaway, Thermal Stability, Analysis of a Transistor Amplifier Circuit using h-Parameters.

UNIT - V

Field Effect Transistor and FET Amplifiers

Field Effect Transistor: The Junction Field Effect Transistor (Construction, principle of operation, symbol) – Pinch-off Voltage - Volt-Ampere characteristics, The JFET Small Signal Model, MOSFET (Construction, principle of operation, symbol), MOSFET Characteristics in Enhancement and Depletion modes.

FET Amplifiers: FET Common Source Amplifier, Common Drain Amplifier, Generalized FET Amplifier, Biasing FET, FET as Voltage Variable Resistor, Comparison of BJT and FET.

TEXT BOOKS:

1. Millman's Electronic Devices and Circuits – J. Millman, C.C. Halkias, and Satyabrata Jit, 2 Ed, 1998, TMH.
2. Electronic Devices and Circuits – Mohammad Rashid, Cengage Learning, 2013
3. Electronic Devices and Circuits – David A. Bell, 5 Ed, Oxford

REFERENCE BOOKS:

1. Integrated Electronics – J. Millman and Christos C. Halkias, 1991 Ed., 2008, TMH.
2. Electronic Devices and Circuits – R.L. Boylestad and Louis Nashelsky, 9 Ed., 2006, PEI/PHI.
3. Electronic Devices and Circuits – B. P. Singh, Rekha Singh, Pearson, 2 Ed, 2013.
4. Electronic Devices and Circuits - K. Lal Kishore, 2 Ed., 2005, BSP.
5. Electronic Devices and Circuits – Anil K. Maini, Varsha Agarwal, 1 Ed., 2009, Wiley India Pvt. Ltd.
6. Electronic Devices and Circuits – S. Salivahanan, N. Suresh Kumar, A. Vallavaraj, 2 Ed., 2008, TMH.

MT304ES: THERMAL SCIENCE

B.Tech. II Year I Sem.

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UNIT - I

Introduction: Basic Concepts: System, Control Volume, Surrounding, Boundaries, Universe, Types of Systems, Macroscopic and Microscopic viewpoints, Concept of Continuum, Thermodynamic Equilibrium, State Property, Process, Cycle – Reversibility – Quasi – static Process, Irreversible Process Work and Heat, Point and Path function.

UNIT - II

ZerOTH Law of Thermodynamics: Concept of quality of Temperature – Principles of Thermometry – Reference Points – Const. Volume gas Thermometer – Scales of Temperature, Ideal Gas Scale – PMM I - Joule's Experiments – First law of Thermodynamics – Corollaries – First law applied to a Process – applied to a flow system – Steady Flow Energy Equation. Limitations of the First Law

UNIT – III

Second Law of Thermodynamics: Kelvin-Planck and Clausius Statements and their Equivalence / Corollaries, PMM of Second kind, Carnot's principle, Carnot cycle and its specialties, Thermodynamic scale of Temperature, Clausius Inequality, Entropy, Principle of Entropy Increase – Energy Equation, Statement of Third Law of Thermodynamics.

UNIT - IV

Power Cycles: Otto, Diesel, Dual Combustion cycles, – Description, and representation on P–V and T-S diagram, Thermal Efficiency, Mean Effective Pressures on Air standard basis – comparison with Ideal and Actual Cycles.

UNIT - V

I.C. Engines: Classification – Two & Four Stroke Engines, Working principles, Valve and Port Timing Diagrams, - Types Engine arrangement systems. Fuels used, Modes of fuel Admission to engine cylinder, carburetor, Fuel Injector, Ignition, Cooling and Lubrication systems.

TEXT BOOKS:

1. Thermal Engineering / Rajput / Lakshmi Publications
2. Engineering Thermodynamics – P.K Nag, TMH
3. I.C. Engines – V. Ganesan, TMH
4. Thermal Sciences – Merle C. Potter, Elaine P. Scott, Cengage Learning

REFERENCE BOOKS:

1. Engineering Thermodynamics – Jones & Dugan
2. Thermodynamics – An Engineering Approach – Yunus Cengel & Boles /TMH
3. Thermodynamics – J. P. Holman / Mc Graw Hill
4. An introduction to Thermodynamics / YVC Rao / University Press

ME305ES: METALLURGY AND MATERIALS SCIENCE

B.Tech. II Year I Sem.

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UNIT – I

Structure of Metals: Crystallography, Miller's indices, Packing Efficiency, Density calculations. Grains and Grain Boundaries. Effect of grain size on the properties. Determination of grain size by different methods. **Constitution of Alloys:** Necessity of alloying, Types of solid solutions, Hume - Rothery rules, Intermediate alloy phases.

UNIT –II

Phase Diagrams: Construction and interpretation of phase diagrams, Phase rule. Lever rule. Binary phase Diagrams, Isomorphous, Eutectic and Eutectoid transformations with examples.

UNIT – III

Engineering Materials –I Steels: Iron-Carbon Phase Diagram and Heat Treatment: Study of Fe-Fe₃C phase diagram. Construction of TTT diagrams. Annealing, Normalizing, Hardening, and Tempering of steels, Hardenability. Alloy steels.

UNIT –IV

Engineering Materials –II: Cast Irons: Structure and properties of White Cast iron, Malleable Cast iron, Grey cast iron. **Engineering Materials-III: Non-ferrous Metals and Alloys:** Structure and properties of copper and its alloys, Aluminium and its alloys, Al-Cu phase diagram, Titanium and its alloys.

UNIT – V

Engineering Materials –IV: Ceramics, Polymers and Composites: Crystalline ceramics, glasses, cermets: structure, properties and applications. Classification, properties, and applications of composites. Classification, Properties, and applications of Polymers.

TEXT BOOKS:

1. Material Science and Metallurgy/ Kodgire
2. Essentials of Materials Science and engineering / Donald R. Askeland / Thomson.

REFERENCES:

1. Introduction to Physical Metallurgy / Sidney H. Avner.
2. Materials Science and engineering / William and Callister.
3. Elements of Material science / V. Rahghavan
4. Engineering Material and Metallurgy – Er Amandeep Singh Wadhva
5. Materials Science for Engineering Students- Traugott Fischer 2009 Edition.

ME307ES: MECHANICS OF SOLIDS LAB

B.Tech. II Year I Sem.

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Course Objectives:

The objective is to learn the fundamental concepts of stress, strain, and deformation of solids with applications to bars, beams, and columns. Detailed study of engineering properties of materials is also of interest. Fundamentals of applying equilibrium, compatibility, and force-deformation relationships to structural elements are emphasized. The students are introduced to advanced concepts of flexibility and stiffness method of structural analysis. The course builds on the fundamental concepts of engineering mechanics course.

The students will advance the students' development of the following broad capabilities:

1. Students will be able to understand basic concepts of stress, strain and their relations based on linear elasticity. Material behaviors due to different types of loading will be discussed.
2. Students will be able to understand and know how to calculate stresses and deformation of a bar due to an axial loading under uniform and non-uniform conditions.
3. Students will understand how to develop shear-moment diagrams of a beam and find the maximum moment/shear and their locations
4. Students will understand how to calculate normal and shear stresses on any cross-section of a beam. Different cross-sections (including I-beam) will be discussed and applied
Continuous Assessment Test 10 marks Mid Semester Test 15 marks End

Course Outcomes

1. Analyze the behavior of the solid bodies subjected to various types of loading.
2. Apply knowledge of materials and structural elements to the analysis of simple structures.
3. Undertake problem identification, formulation and solution using a range of analytical methods
4. Analyze and interpret laboratory data relating to behavior of structures and the materials they are made of, and undertake associated laboratory work individually and in teams.
5. Expectation and capacity to undertake lifelong learning.

Any 10 experiments from the following

1. Direct tension test
2. Bending test on Simple supported beam
- 3 Bending test on Cantilever beam
4. Torsion test
5. Brinell hardness test

6. Rockwell hardness test
7. Test on springs
8. Compression test on cube
9. Izod Impact test
- 10 .Charpy Impact test
11. Punch shear test

MM308ES: METALLURGY LAB

B.Tech. II Year I Sem.

L	T	P	C
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Conduct any 10 experiments:

1. Study of Metallographic Specimen preparation
2. Study of the Micro Structure of pure ferrous metals
3. Study of the Micro Structure of pure Non ferrous metals
4. Study of the Microstructure of plain carbon steels.
5. Study of the Micro Structures of Cast Irons.
6. Study of the Micro Structures of Non-Ferrous alloys.
7. To carry out the annealing treatment to the given plain carbon steel and study of the Micro structures and hardness
8. To carry out the Normalizing treatment to the given plain carbon steel and study of the Micro structures and hardness
9. To carry out the Hardening treatment to the given plain carbon steel and study of the Micro structures and hardness
10. To carry out the tempering treatment to the given hardened plain carbon steel and study of the Micro structures and hardness
11. Determine Hardenability of a given steels by Jominy End Quench Test.

EC306ES: ELECTRONIC DEVICES AND CIRCUITS LAB

B.Tech. II Year I Sem.

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Course Objectives:

- To identify various components and testing of active devices.
- To study and operation of millimeters, function generators ,regulated power supplies and CRO To know the characteristics of various active devices.
- To study frequency response amplifier.

Course Outcomes:

- After Completion of the course the student is able to Apply various devices to real time problems.
- Compute frequency response of various amplifiers.

PART A: (Only for Viva-voce Examination)

Electronic Workshop Practice (In 3 Lab Sessions):

1. Identification, Specifications, Testing of R, L, C Components (Color Codes), Potentiometers, Switches (SPDT, DPDT, and DIP), Coils, Gang Condensers, Relays, Bread Boards, PCB's
2. Identification, Specifications and Testing of Active Devices, Diodes, BJT's, Low power JFET's, MOSFET's, Power Transistors, LED's, LCD's, SCR, UJT.
3. Study and operation of
 - i. Multimeters (Analog and Digital)
 - ii. Function Generator
 - iii. Regulated Power Supplies
 - iv. CRO.

PART B: (For Laboratory Examination – Minimum of 10 experiments)

1. Forward & Reverse Bias Characteristics of PN Junction Diode.
2. Zener diode characteristics and Zener as voltage Regulator.
3. Input & Output Characteristics of Transistor in CB Configuration and h-parameter calculations.
4. Input & Output Characteristics of Transistor in CE Configuration and h-parameter calculations.
5. Half Wave Rectifier with & without filters.
6. Full Wave Rectifier with & without filters.
7. FET characteristics.
8. Design of Self-bias circuit.
9. Frequency Response of CC Amplifier.
10. Frequency Response of CE Amplifier.
11. Frequency Response of Common Source FET amplifier.
12. SCR characteristics.
13. UJT Characteristics

PART C: Equipment required for Laboratory:

1. Regulated Power supplies (RPS) : 0-30 V
2. CRO's : 0-20 MHz.
3. Function Generators : 0-1 MHz.
4. Multimeters
5. Decade Resistance Boxes/Rheostats
6. Decade Capacitance Boxes
7. Ammeters (Analog or Digital) : 0-20 μ A, 0-50 μ A, 0-100 μ A, 0-200 μ A, 10 mA.
8. Voltmeters (Analog or Digital) : 0-50V, 0-100V, 0-250V
9. Electronic Components : Resistors, Capacitors, BJTs, LCDs, SCRs, UJTs, FETs, LEDs, MOSFETs, Diodes-Ge & Si type, Transistors – NPN, PNP type.

MC300HS: GENDER SENSITIZATION LAB

B.Tech. II Year I Sem.

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Course Objectives:

- To develop students' sensibility with regard to issues of gender in contemporary India.
- To provide a critical perspective on the socialization of men and women.
- To introduce students to information about some key biological aspects of genders.
- To expose the students to debates on the politics and economics of work.
- To help students reflect critically on gender violence.
- To expose students to more egalitarian interactions between men and women.

Course Outcomes:

- Students will have developed a better understanding of important issues related to gender in contemporary India.
- Students will be sensitized to basic dimensions of the biological, sociological, psychological and legal aspects of gender. This will be achieved through discussion of materials derived from research, facts, everyday life, literature, and film.
- Students will attain a finer grasp of how gender discrimination works in our society and how to counter it.
- Students will acquire insight into the gendered division of labour and its relation to politics and economics.
- Men and women students and professionals will be better equipped to work and live together as equals.
- Students will develop a sense of appreciation of women in all walks of life.
- Through providing accounts of studies and movements as well as the new laws that provide protection and relief to women, the textbook will empower students to understand and respond to gender violence.

UNIT-I

UNDERSTANDING GENDER

Gender: Why Should We Study It? (*Towards a World of Equals*: Unit -1)

Socialization: Making Women, Making Men (*Towards a World of Equals*: Unit -2)

Introduction. Preparing for Womanhood. Growing up Male. First lessons in Caste. Different Masculinities.

UNIT-II

GENDER AND BIOLOGY

Missing Women: Sex Selection and Its Consequences (*Towards a World of Equals*: Unit -4)
Declining Sex Ratio. Demographic Consequences.

Gender Spectrum: Beyond the Binary (*Towards a World of Equals*: Unit -10)

Two or Many? Struggles with Discrimination.

UNIT-III

GENDER AND LABOUR

Housework: the Invisible Labour (*Towards a World of Equals*: Unit -3)

“My Mother doesn’t Work.” “Share the Load.”

Women’s Work: Its Politics and Economics (*Towards a World of Equals*: Unit -7)

Fact and Fiction. Unrecognized and Unaccounted work. Additional Reading: Wages and Conditions of Work.

UNIT-IV

ISSUES OF VIOLENCE

Sexual Harassment: Say No! (*Towards a World of Equals*: Unit -6)

Sexual Harassment, not Eve-teasing- Coping with Everyday Harassment- Further Reading: “Chupulu”.

Domestic Violence: Speaking Out (*Towards a World of Equals*: Unit -8)

Is Home a Safe Place? -When Women Unite [Film]. Rebuilding Lives. Additional Reading: New Forums for Justice.

Thinking about Sexual Violence (*Towards a World of Equals*: Unit -11)

Blaming the Victim-“I Fought for my Life....” - Additional Reading: The Caste Face of Violence.

UNIT-V

GENDER: CO - EXISTENCE

Just Relationships: Being Together as Equals (*Towards a World of Equals*: Unit -12)

Mary Kom and Onler. Love and Acid just do not Mix. Love Letters. Mothers and Fathers. Additional Reading: Rosa Parks-The Brave Heart.

TEXTBOOK

All the five Units in the Textbook, “*Towards a World of Equals: A Bilingual Textbook on Gender*” written by A. Suneetha, Uma Bhrugubanda, Duggirala Vasanta, Rama Melkote, Vasudha Nagaraj, Asma Rasheed, Gogu Shyamala, Deepa Sreenivas and Susie Tharu and published by **Telugu Akademi, Hyderabad**, Telangana State in the year **2015**.

Note: Since it is an Interdisciplinary Course, Resource Persons can be drawn from the fields of English Literature or Sociology or Political Science or any other qualified faculty who has expertise in this field from engineering departments.

REFERENCE BOOKS:

1. Menon, Nivedita. Seeing like a Feminist. New Delhi: Zubaan-Penguin Books, 2012
2. Abdulali Sohaila. “*I Fought For My Life...and Won.*” Available online at: <http://www.thealternative.in/lifestyle/i-fought-for-my-lifeand-won-sohaila-abdulal/>

MT401ES: ELECTRICAL ENGINEERING

B.Tech. II Year II Sem.

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Course Objective: This course introduces the concepts of electrical DC and AC circuits, basic law's of electricity, instruments to measure the electrical quantities, different methods to solve the electrical networks, construction operational features of energy conversion devices i.e. DC machines, transformers, induction motors and synchronous machines.

Course Outcome: After going through this course the student gets a thorough knowledge on basic electrical circuits, parameters, and operation of the transformers in the energy conversion process, electromechanical energy conversion, construction operation characteristics different types applications of DC and AC machines and the constructional features and operation of measuring instruments like voltmeter, ammeter, wattmeter etc..., With which he/she can able to apply the above conceptual things to real-world electrical and electronics problems and applications.

UNIT - I

Introduction: SI Unit's ohm's law, series, and parallel circuits, Kirchhoff's laws, Star-delta transformation (Simple Problems)– Force on a current carrying conductor in magnetic field– electromagnetic induction, Faraday's law, Lenz's law – Self and mutual inductances.

Electrical Instruments: Basic principles of indicating instruments – moving coil and moving iron instruments (Ammeters and voltmeters).

UNIT - II

Single Phase AC Circuits: Generation of an alternating EMF – average and RMS values of alternating quantity – representation of alternating quantities by phasors – single phase series and parallel circuits (simple problems)– series and parallel resonance – three phase balanced systems – single and three phase power calculations.

UNIT - III

DC Generators: Principle of operation of DC machines – EMF equation – types of generators – Magnetization and Load characteristics of DC generators

DC Motors: Principle of operation of DC Motor, Types of Motors, Back EMF Equation, Characteristics of DC motor, Torque Equation, DC Motor Starter (Three Point starter), Efficiency Calculation, Swinburne's Test and speed control.

UNIT-IV

Transformers: Construction and principle of operation of single phase transformer –EMF equation O.C. & S.C. tests – efficiency and regulation.

Induction Motors: Principle and operation of three phase induction motors – types of motors, Squirrel cage and slip ring motor – slip torque characteristics.

UNIT-V

Alternators: Principle and operation of alternators – O.C. & S.C. tests – regulation by synchronous impedance method.

TEXT BOOKS:

1. Basic concepts of Electrical Engineering, PS Subramanyam, BS Publications.
2. Basic Electrical Engineering, S.N. Singh, PHI.

REFERENCE BOOKS:

1. Basic Electrical Engineering, Abhijit Chakrabarthy, Sudipta nath, Chandrakumar Chanda, Tata-McGraw-Hill.
2. Principles of Electrical Engineering, V.K Mehta, Rohit Mehta, S.Chand Publications.
3. Basic Electrical Engineering, T.K.Nagasarkar and M.S. Sukhija, Oxford University Press.
4. Fundamentals of Electrical Engineering, RajendraPrasad, PHI.
5. Basic Electrical Engineering by D.P.Kothari , I.J. Nagrath, McGraw-Hill.

MT402ES: FLUID MECHANICS AND HEAT TRANSFER

B.Tech. II Year II Sem.

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UNIT-I

Properties of fluids, Measurement of pressure. fluid kinematics - Streamline, path line and streak lines and stream tube, classification of flows, steady, unsteady, uniform, non-uniform, laminar, turbulent. Rotational and irrotational flows – Equation of continuity for one dimensional flows – Stream and velocity potential functions

UNIT-II

Fluid Dynamics: Surface and body forces – Euler's and Bernoulli's equations for flow along a stream line. Bernoulli's equations for real fluids, Flow measurement by Venturimeter and orifice meter.

UNIT-III

Conduction: Modes of Heat Transfer, Fourier heat conduction equation, general heat condition equation, conduction through homogeneous slab, cylinder and sphere, Heat Transfer through Composite structures as plane wall, cylinder.

UNIT-IV

Convection: Dimensional analysis, Rayleigh and Buckingham methods applied to heat transfer, Non- dimensional members in heat transfer. Thermal and velocity boundary layer, Mean temperature for evaluation of fluid properties. Forced convection of laminar flow inside ducts and over bodies. Local and average heat transfer coefficients.

UNIT-V

Radiation: Emission characteristics and laws of Black body radiation, Incident radiation, total and Monochromatic quantities. Laws of black, Kirchoff, Lambert, Stephan and Boltzman. concept of shape factor, Emissivity. Classification of heat exchangers – overall heat transfer Coefficient and fouling factor – Concepts of LMTD and NTU methods

TEXT BOOKS

1. Heat Transfer – Sachdev - TMH
2. Heat Transfer - PK Nag – TMH
3. Fluid Mechanics and Hydraulics Machines by Dr.R.K.Bansal

REFERENCE TEXT BOOKS:

1. Heat Transfer / Sukhatme.
2. Heat Transfer – A Practical Approach – Yunus Cengel, Boles / TMH.
3. Fundamentals of Engineering Thermodynamics / Michael J Moran / John Wiley & Sons
4. Engineering Fluid Mechanics by K.L.Kumar, S.Chand & Co.

ME402ES: KINEMATICS OF MACHINERY

B.Tech. II Year II Sem.

L	T	P	C
4	1	0	4

UNIT – I

Mechanisms: Elements or Links – Classification – Rigid Link, flexible and fluid link – Types of kinematics pairs –Types of constrained motion-kinetic chain-. Mechanism-machine-Structure - inversions of mechanism – inversions of quadric cycle chain, single and double slider crank chains, Mechanical Advantage-Grubler’s Criterion.

UNIT – II

Kinematics: Velocity and acceleration – Motion of link in machine – Determination of Velocity and acceleration – Graphical method – Application of relative velocity method.

Plane Motion of Body: Instantaneous center of rotation- centrodes and axodes – Three centers in line theorem – Graphical determination of instantaneous center, determination of angular velocity of points and links by instantaneous center method.

Kliens construction - Coriolis acceleration - determination of Coriolis component of acceleration

Analysis of Mechanisms: Analysis of slider crank chain for displacement- velocity and acceleration of slider – Acceleration diagram for a given mechanism.

UNIT – III

Straight-Line Motion Mechanisms: Exact and approximate copied and generated types – Peaucellier - Hart - Scott Russel – Grasshopper – Watt -Tchebicheff’s and Robert Mechanism - Pantographs

Steering Gears: Conditions for correct steering – Davis Steering gear, Ackerman’s steering gear.

Hooke’s Joint: Single and double Hooke’s joint –velocity ratio – application – problems.

UNIT – IV

CAMS: Definitions of cam and followers – their uses – Types of followers and cams – Terminology – Types of follower motion - Uniform velocity, Simple harmonic motion and uniform acceleration and retardation. Maximum velocity and maximum acceleration during outward and return strokes in the above 3 cases.

Analysis of Motion Of Followers: Tangent cam with Roller follower – circular arc cam with straight, concave and convex flanks.

UNIT – V

Higher Pair: Friction wheels and toothed gears – types – law of gearing, condition for constant velocity ratio for transmission of motion – velocity of sliding

Forms of teeth, cycloidal and involutes profiles – phenomena of interferences – Methods of interference. Condition for minimum number of teeth to avoid interference – expressions for

arc of contact and path of contact of Pinion & Gear and Pinion & Rack Arrangements–
Introduction to Helical – Bevel and worm gearing

Gear Trains: Introduction – Types – Simple – compound and reverted gear trains –
Epicyclic gear train. Methods of finding train value or velocity ratio of Epicyclic gear trains.
Selection of gear box - Differential gear for an automobile

TEXT BOOKS:

1. Theory of Machines and Mechanisms/JOSEPH E. SHIGLEY/Oxford/3rd Edition/International Edition
2. Theory of Machines / Thomas Bevan/Pearson/3rd Edition

REFERENCE BOOKS:

1. Theory of Mechanism and Machines /Jagdish Lal/Metropolitan Book Company
2. Theory of Machines /S.S.Rattan / Tata McGraw Hill Publishers.
3. Kinematics & Dynamics Of machinery/Norton/TMH
4. Theory of Machines / Sadhu Singh / Pearson.
5. Mechanism and Machine Theory / JS Rao and RV Duggipati / New Age
6. Theory of Machines by / R.K. Bansal (Lakshmi Publications).

SM405MS: BUSINESS ECONOMICS AND FINANCIAL ANALYSIS

B.Tech. II Year II Sem.

L	T	P	C
3	0	0	3

Course Objective: To learn the basic Business types, impact of the Economy on Business and Firms specifically. To analyze the Business from the Financial Perspective.

Course Outcome: The students will understand the various Forms of Business and the impact of economic variables on the Business. The Demand, Supply, Production, Cost, Market Structure, Pricing aspects are learnt. The Students can study the firm's financial position by analysing the Financial Statements of a Company.

UNIT – I

Introduction to Business and Economics:

Business: Structure of Business Firm, Theory of Firm, Types of Business Entities, Limited Liability Companies, Sources of Capital for a Company, Non-Conventional Sources of Finance.

Economics: Significance of Economics, Micro and Macro Economic Concepts, Concepts and Importance of National Income, Inflation, Money Supply in Inflation, Business Cycle, Features and Phases of Business Cycle. Nature and Scope of Business Economics, Role of Business Economist, Multidisciplinary nature of Business Economics.

UNIT – II

Demand and Supply Analysis:

Elasticity of Demand: Elasticity, Types of Elasticity, Law of Demand, Measurement and Significance of Elasticity of Demand, Factors affecting Elasticity of Demand, Elasticity of Demand in decision making, Demand Forecasting: Characteristics of Good Demand Forecasting, Steps in Demand Forecasting, Methods of Demand Forecasting.

Supply Analysis: Determinants of Supply, Supply Function & Law of Supply.

UNIT- III

Production, Cost, Market Structures & Pricing:

Production Analysis: Factors of Production, Production Function, Production Function with one variable input, two variable inputs, Returns to Scale, Different Types of Production Functions.

Cost analysis: Types of Costs, Short run and Long run Cost Functions.

Market Structures: Nature of Competition, Features of Perfect competition, Monopoly, Oligopoly, and Monopolistic Competition.

Pricing: Types of Pricing, Product Life Cycle based Pricing, Break Even Analysis, and Cost Volume Profit Analysis.

UNIT-IV

Financial Accounting: Accounting concepts and Conventions, Accounting Equation, Double-Entry system of Accounting, Rules for maintaining Books of Accounts, Journal, Posting to Ledger, Preparation of Trial Balance, Elements of Financial Statements, Preparation of Final Accounts.

UNIT -V

Financial Analysis through Ratios:

Concept of Ratio Analysis, Liquidity Ratios, Turnover Ratios, Profitability Ratios, Proprietary Ratios, Solvency, Leverage Ratios (simple problems).

Introduction to Fund Flow and Cash Flow Analysis (simple problems).

TEXT BOOKS:

1. D. D. Chaturvedi, S. L. Gupta, Business Economics - Theory and Applications, International Book House Pvt. Ltd. 2013.
2. Dhanesh K Khatri, Financial Accounting, Tata Mc –Graw Hill, 2011.
3. Geethika Ghosh, Piyali Gosh, Purba Roy Choudhury, Managerial Economics, 2e, Tata Mc Graw Hill Education Pvt. Ltd. 2012.

REFERENCES:

1. Paresh Shah, Financial Accounting for Management 2e, Oxford Press, 2015.
2. S. N. Maheshwari, Sunil K Maheshwari, Sharad K Maheshwari, Financial Accounting, 5e, Vikas Publications, 2013.

EC401ES: SWITCHING THEORY AND LOGIC DESIGN

B.Tech. II Year II Sem.

L	T	P	C
3	0	0	3

Course Objectives: This course provides in-depth knowledge of switching theory and the design techniques of digital circuits, which is the basis for design of any digital circuit. The main objectives are:

- To learn basic techniques for the design of digital circuits and fundamental concepts used in the design of digital systems.
- To understand common forms of number representation in digital electronic circuits and to be able to convert between different representations.
- To implement simple logical operations using combinational logic circuits
- To design combinational logic circuits, sequential logic circuits.
- To impart to student the concepts of sequential circuits, enabling them to analyze sequential systems in terms of state machines.
- To implement synchronous state machines using flip-flops.

Course Outcomes: Upon completion of the course, students should possess the following skills:

- Be able to manipulate numeric information in different forms, e.g. different bases, signed integers, various codes such as ASCII, Gray, and BCD.
- Be able to manipulate simple Boolean expressions using the theorems and postulates of Boolean algebra and to minimize combinational functions.
- Be able to design and analyse small combinational circuits and to use standard combinational functions/building blocks to build larger more complex circuits.
- Be able to design and analyze small sequential circuits and devices and to use standard sequential functions/building blocks to build larger more complex circuits.

UNIT -I

Number System and Boolean Algebra And Switching Functions: Number Systems, Base Conversion Methods, Complements of Numbers, Codes- Binary Codes, Binary Coded Decimal Code and its Properties, Unit Distance Codes, Alpha Numeric Codes, Error Detecting and Correcting Codes.

Boolean Algebra: Basic Theorems and Properties, Switching Functions, Canonical and Standard Form, Algebraic Simplification of Digital Logic Gates, Properties of XOR Gates, Universal Gates, Multilevel NAND/NOR realizations.

UNIT - II

Minimization and Design of Combinational Circuits: Introduction, The Minimization with theorem, The Karnaugh Map Method, Five and Six Variable Maps, Prime and Essential Implications, Don't Care Map Entries, Using the Maps for Simplifying, Tabular Method, Partially Specified Expressions, Multi-output Minimization, Minimization and

Combinational Design, Arithmetic Circuits, Comparator, Multiplexers, Code Converters, Wired Logic, Tristate Bus System, Practical Aspects related to Combinational Logic Design, Hazards and Hazard Free Relations.

UNIT - III

Sequential Machines Fundamentals: Introduction, Basic Architectural Distinctions between Combinational and Sequential circuits, The Binary Cell, Fundamentals of Sequential Machine Operation, The Flip-Flop, The D-Latch Flip-Flop, The “Clocked T” Flip-Flop, The “Clocked J-K” Flip-Flop, Design of a Clocked Flip-Flop, Conversion from one type of Flip-Flop to another, Timing and Triggering Consideration, Clock Skew.

UNIT - IV

Sequential Circuit Design and Analysis: Introduction, State Diagram, Analysis of Synchronous Sequential Circuits, Approaches to the Design of Synchronous Sequential Finite State Machines, Design Aspects, State Reduction, Design Steps, Realization using Flip-Flops Counters - Design of Single mode Counter, Ripple Counter, Ring Counter, Shift Register, Shift Register Sequences, Ring Counter Using Shift Register.

UNIT - V

Sequential Circuits: Finite state machine-capabilities and limitations, Mealy and Moore models-minimization of completely specified and incompletely specified sequential machines, Partition techniques, and Merger chart methods-concept of minimal cover table.
Algorithmic State Machines: Salient features of the ASM chart-Simple examples-System design using data path and control subsystems-control implementations-examples of Weighing machine and Binary multiplier.

TEXT BOOKS:

1. Switching and Finite Automata Theory- Zvi Kohavi & Niraj K. Jha, 3rd Edition, Cambridge.
2. Digital Design- Morris Mano, PHI, 3rd Edition.

REFERENCE BOOKS:

1. Introduction to Switching Theory and Logic Design – Fredriac J. Hill, Gerald R. Peterson, 3rd Ed, John Wiley & Sons Inc.
2. Digital Fundamentals – A Systems Approach – Thomas L. Floyd, Pearson, 2013.
3. Digital Logic Design - Ye Brian and Holds Worth, Elsevier.
4. Fundamentals of Logic Design- Charles H. Roth, Cengage Learning, 5th, Edition, 2004.
5. Digital Logic Applications and Design- John M. Yarbrough, Thomson Publications, 2006.
6. Digital Logic and State Machine Design – Comer, 3rd, Oxford, 2013.

ME407ES: FLUID MECHANICS AND HYDRAULIC MACHINES LAB

B.Tech. II Year II Sem.

L	T	P	C
0	0	3	2

List of Experiments:

1. Study of Impact of jets on Vanes.
2. Performance Test on Pelton Wheel.
3. Performance Test on Francis Turbine.
4. Performance Test on Kaplan Turbine
5. Verification of Bernoulli's theorem
6. Study and Calibration of Venturimeter.
7. Study and Calibration of Orifice meter.
8. Determination of friction factor for a given pipe.
9. Study and Calibration of V-Notch and rectangular notches
10. Performance test on single stage centrifugal pump.
11. Performance test on multi stage centrifugal pump.
12. Performance test on reciprocating pump

Note: Conduct any TEN experiments of the above.

MT406ES: THERMAL ENGINEERING LAB

B.Tech. II Year II Sem.

L	T	P	C
0	0	3	2

List of Experiments.

1. I.C. Engines Performance Test of 4 -S single cylinder Diesel Engine
2. Heat Balance test on 4-S single cylinder Diesel Engine
3. I.C. Engines Performance Test of 4 -S double cylinder Diesel Engine
4. I.C. Engines - Determination of A/F Ratio and Volumetric Efficiency
5. Performance Test on Variable Compression Ratio Engines.
6. I C Engine Performance test on 2-Stroke SI Engine
7. I C Engine Morse and retardation Test
8. Performance Test on Reciprocating Air Compressor
9. Study of I.C. Engines Valve / Port Timing Diagrams
10. Performance test on Air-Conditioning Unit
11. Dis-Assembly and Assembly of a automobile vehicle
12. Study of Boiler Models

NOTE: Perform any ten out of twelve experiments from the above.

MT408ES: ELECTRICAL ENGINEERING LAB

B.Tech. II Year II Sem.

L	T	P	C
0	0	3	2

List of Experiments.

1. Verification of KVL and KCL.
2. Serial and Parallel Resonance.
3. Time response of first order RC/RL network for periodic non-sinusoidal inputs – time constant and steady state error determination.
4. Verification of Superposition theorem.
5. Verification of Reciprocity theorem.
6. Verification of maximum power transfer theorem.
7. Verification of Thevenin's theorem.
8. Verification of compensation theorem.
9. Verification of Milliman's theorem.
10. Verification of Norton's theorem.
11. Magnetization characteristics of D.C. Shunt generator.
12. Swinburne's Test on DC shunt machine.
13. Brake test on DC shunt motor.
14. OC & SC tests on Single-phase transformer.
15. Load Test on Single Phase Transformer.

Note: Any 12 of the above experiments are to be conducted.

MC400ES: ENVIRONMENTAL STUDIES

B.Tech. II Year II Sem.

L	T	P	C
3	0	0	0

Course Objectives:

1. Understanding the importance of ecological balance for sustainable development.
2. Understanding the impacts of developmental activities and mitigation measures.
3. Understanding the environmental policies and regulations

Course Outcomes:

1. Based on this course, the Engineering graduate will understand /evaluate / develop technologies on the basis of ecological principles and environmental regulations which in turn helps in sustainable development

UNIT-I

Ecosystems: Definition, Scope and Importance of ecosystem. Classification, structure, and function of an ecosystem, Food chains, food webs, and ecological pyramids. Flow of energy, Biogeochemical cycles, Bioaccumulation, Biomagnification, ecosystem value, services and carrying capacity, Field visits.

UNIT-II

Natural Resources: Classification of Resources: Living and Non-Living resources, **water resources:** use and over utilization of surface and ground water, floods and droughts, Dams: benefits and problems. **Mineral resources:** use and exploitation, environmental effects of extracting and using mineral resources, **Land resources:** Forest resources, **Energy resources:** growing energy needs, renewable and non renewable energy sources, use of alternate energy source, case studies.

UNIT-III

Biodiversity And Biotic Resources: Introduction, Definition, genetic, species and ecosystem diversity. Value of biodiversity; consumptive use, productive use, social, ethical, aesthetic and optional values. India as a mega diversity nation, Hot spots of biodiversity. Field visit. Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts; conservation of biodiversity: In-Situ and Ex-situ conservation. National Biodiversity act.

UNIT-IV

Environmental Pollution and Control Technologies: Environmental Pollution: Classification of pollution, **Air Pollution:** Primary and secondary pollutants, Automobile and Industrial pollution, Ambient air quality standards. **Water pollution:** Sources and types of pollution, drinking water quality standards. **Soil Pollution:** Sources and types, Impacts of modern agriculture, degradation of soil. **Noise Pollution:** Sources and Health hazards, standards, **Solid waste:** Municipal Solid Waste management, composition and characteristics

of e-Waste and its management. **Pollution control technologies:** Wastewater Treatment methods: Primary, secondary and Tertiary.

Overview of air pollution control technologies, Concepts of bioremediation. **Global Environmental Problems and Global Efforts:** Climate change and impacts on human environment. Ozone depletion and Ozone depleting substances (ODS). Deforestation and desertification. International conventions / Protocols: Earth summit, Kyoto protocol, and Montréal Protocol.

UNIT-V

Environmental Policy, Legislation & EIA: Environmental Protection act, Legal aspects Air Act- 1981, Water Act, Forest Act, Wild life Act, Municipal solid waste management and handling rules, biomedical waste management and handling rules, hazardous waste management and handling rules. EIA: EIA structure, methods of baseline data acquisition. Overview on Impacts of air, water, biological and Socio-economical aspects. Strategies for risk assessment, Concepts of Environmental Management Plan (EMP). **Towards Sustainable Future:** Concept of Sustainable Development, Population and its explosion, Crazy Consumerism, Environmental Education, Urban Sprawl, Human health, Environmental Ethics, Concept of Green Building, Ecological Foot Print, Life Cycle assessment (LCA), Low carbon life style.

TEXT BOOKS:

- 1 Textbook of Environmental Studies for Undergraduate Courses by Erach Bharucha for University Grants Commission.
- 2 Environmental Studies by R. Rajagopalan, Oxford University Press.

REFERENCE BOOKS:

1. Environmental Science: towards a sustainable future by Richard T. Wright. 2008 PHL Learning Private Ltd. New Delhi.
2. Environmental Engineering and science by Gilbert M. Masters and Wendell P. Ela . 2008 PHI Learning Pvt. Ltd.
3. Environmental Science by Daniel B. Botkin & Edward A. Keller, Wiley INDIA edition.
4. Environmental Studies by Anubha Kaushik, 4th Edition, New age international publishers.
5. Text book of Environmental Science and Technology - Dr. M. Anji Reddy 2007, BS Publications.