T K R COLLEGE OF ENGINEERING & TECHNOLOGY
(Autonomous)

MECHANICAL ENGINEERING

COURSE STRUCTURE & SYLLABUS

Semester III

S. No.	Course Code	Course Title	L	T	P	Credits
1	A33BS1	Mathematics – IV	4	1	0	4
2	A33PC2	Thermodynamics	4	1	0	4
3	A33PC3	Kinematics of Machinery	4	1	0	4
4	A33PC4	Metallurgy and Material Science	3	0	0	3
5	A33PC5	Mechanics of Solids	3	1	0	3
6	A33PC6	Fuels and Lubricants Lab	0	0	3	2
7	A33PC7	Mechanics of Solids Lab	0	0	3	2
8	A33PC8	Metallurgy and Material Science Lab	0	0	3	2
9	A33MC9	*Gender Sensitization Lab	0	0	3	0
		Total Credits	**18**	**4**	**12**	**24**

*Mandatory course, Satisfactory/Unsatisfactory

SEMESTER IV

S. No.	Course Code	Cour	L	T	P	Credits
1	A34PC1	Dynamics of Machinery	3	1	0	4
2	A34PC2	Fluid Mechanics and Hydraulic Machines	4	1	0	4
3	A34ES3	Machine Drawing	2	0	4	4
4	A34ES4	Manufacturing Process	3	0	0	3
5	A34HS5	Business Economics and Financial	3	0	0	3
6	A34PC6	Kinematics and Dynamics Lab	0	0	3	2
7	A34PC7	Fluid Mechanics and Hydraulic Machines Lab	0	0	3	2
8	A34ES8	Manufacturing Process Lab	0	0	3	2
9	A34MC9	*Environmental Science and Technology	3	0	0	0
		Total Credits	**18**	**2**	**15**	**24**

*Mandatory course, Satisfactory/Unsatisfactory

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B.Tech III Semester **L/T/P/C**
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MATHEMATICS- IV (A33HS1)

Course Objectives:
To learn
1. Differentiation and integration of complex valued functions
2. Evaluation of integrals using Cauchy's integral formula and residue theorem.
3. Laurent's series expansion of complex functions
4. Express a periodic function by Fourier series
5. Express a non-periodic function by Fourier transform

Course Outcomes:
After learning the contents of this paper the student must be able to
1. Analyse the complex functions with reference to their analyticity, integration using Cauchy's integral theorem
2. Find the Taylor's and Laurent's series expansion of complex functions
3. The bilinear transformation
4. Finding any periodic function in term of sine's and cosines
5. Finding a non-periodic function as integral representation

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

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

UNIT–III
Evaluation of integrals:
Singular points, isolated singular points, pole of order m – essential singularity, Residue, Cauchy Residue theorem (Without proof).
Types of real integrals:
a) Improper real integrals $\int_{-\infty}^{\infty} f(x)dx$ b) $\int_{c}^{c+2\Pi} f(cos\theta, sin\theta)dx$

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

UNIT–V

Fourier transforms

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

Applications Fourier Transforms: Heat Equation and Wave Equation

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

Reference Books:

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

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THERMODYNAMICS (A33PC2)

Course Objective

To understand the treatment of classical Thermodynamics and to apply the First and Second laws of Thermodynamics to engineering applications.

Course Outcomes

At the end of the course, the student should be able to

- Understand and differentiate between different thermodynamic systems and processes.
- Understand and apply the laws of Thermodynamics to different types of systems undergoing various processes and to perform thermodynamic analysis.
- Understand and analyze the Thermodynamic cycles and evaluate performance parameters.

Tables/Codes: Steam Tables and Mollier Chart, Refrigeration Tables

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, Exact & Inexact Differentials, Cycle – Reversibility – Quasi – static Process, Irreversible Process, Causes of Irreversibility – Energy in State and in Transition, Types, Displacement & Other forms of Work, Heat, Point and Path functions, Zeroth Law of Thermodynamics – Concept of Temperature – Principles of Thermometry – Reference Points – Const. Volume gas Thermometer – Scales of Temperature, Ideal Gas Scale.

UNIT - II

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 – Thermal Reservoir, Heat Engine, Heat pump , Parameters of performance, 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, Availability and Irreversibility – Thermodynamic Potentials, Gibbs and Helmholtz Functions, Maxwell Relations – Elementary Treatment of the Third Law of Thermodynamics.

UNIT – III

Pure Substances, p-V-T- surfaces, T-S and h-s diagrams, Mollier Charts, Phase Transformations – Triple point at critical state properties during change of phase, Dryness Fraction – Clausius – Clapeyron Equation Property tables. Mollier charts – Various Thermodynamic processes and energy Transfer – Steam Calorimetry.

Perfect Gas Laws – Equation of State, specific and Universal Gas constants – various Non- flow processes, properties, end states, Heat and Work Transfer, changes in Internal Energy – Throttling and Free Expansion Processes – Flow processes

UNIT - IV

Deviations from perfect Gas Model – Vader Waals Equation of State Compressibility charts – variable specific Heats – Gas Tables

Mixtures of perfect Gases – Mole Fraction, Mass friction Gravimetric and volumetric Analysis – Dalton's Law of partial pressure, Avogadro's Laws of additive volumes – Mole fraction , Volume fraction and partial pressure, Equivalent Gas const. And Molecular Internal Energy, Enthalpy, sp. Heats and Entropy of Mixture of perfect Gases and Vapour, Atmospheric air - Psychrometric Properties – Dry bulb Temperature, Wet Bulb Temperature, Dew point Temperature, Thermodynamic Wet Bulb Temperature, Specific Humidity, Relative Humidity, saturated Air, Vapour pressure, Degree of saturation – Adiabatic Saturation , Carrier's Equation – Psychrometric chart.

UNIT - V

Power Cycles

Otto, Diesel, Dual Combustion cycles, Sterling Cycle, Atkinson Cycle, Ericsson Cycle, Lenoir Cycle – Description and representation on P–V and T-S diagram, Thermal Efficiency, Mean Effective Pressures on Air standard basis – comparison of Cycles.

Refrigeration Cycles

Brayton and Rankine cycles – Performance Evaluation – combined cycles, Bell-Coleman cycle, Vapour compression cycle-performance Evaluation.

TEXT BOOKS

1. Engg. Thermodynamics – D.S. Kumar ; SK.Kataria and suns
2. Engineering Thermodynamics by R,K.Rajput ; Laxmi publishers

REFERENCE BOOKS

1. Atext book of engineering thermodynamics by VM.Domakundavar;Dhanpat Rai
2. Egineering Thermodynamics / PK Nag / Mc Graw Hill
3. Thermodynamics for Engineers / Kenneth A. Kroos ; Merle C. Potter/ Cengage
4. Engineering Thermodynamics / P.Chattopadhyay/ Oxford
5. Engineering Thermodynamics / Rogers / Pearson
6. Thermodynamics Anup Goel, Siddu Patil, Technical publications

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KINEMATICS OF MACHINERY (A33PC3)

Course Objectives

The objective is to study the relative motion, velocity, and accelerations of the various elements in a mechanism. In mechanical Engineering we come across number of mechanisms such as four bar/slider crank/double slider crank/straight line motion mechanism etc. Mechanism deals with only relative motions. Once we make a study considering for us also there it is called kinetics. The first course deals with mechanisms, their inversions straight line motion mechanisms steering mechanisms etc. Also study of cams/gears & gear trains & belts are also introduced.

Course Outcomes

The main purpose is to give an idea about the relative motions obtained in all the above type of components used in mechanical Engineering.

UNIT – I

Mechanisms

Elements or Links – Classification – Rigid Link, flexible and fluid link Types of kinematics pairs – sliding, turning, rolling, screw and spherical pairs – lower and higher pairs – closed and open pairs – constrained motion – completely, partially or successfully and incompletely constrained.

Mechanism and Machines

Mobility of Mechanisms Grubler's criterion, classification of machines – kinematics chain – inversions of mechanism – inversions of quadric cycle chain, single and double slider crank chains, Mechanical Advantage.

UNIT – II

Kinematics

Velocity and acceleration – Motion of link in machine – Determination of Velocity and acceleration – Graphical method, Application of relative velocity method: Four bar Chain.

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. Kieines Construction.

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 – R.K.Bansal; Laxmi Publishers.
2) Theory of Machines. R.S.Kurmi, J.K.Guptha- Chand Publications.

REFERENCE BOOKS

1) Kinematics of Machinery: Anup Goel ; Technical Publications.
2) Theory of Machines and Mechanisms/JOSEPH E. SHIGLEY/ Oxford
3) Theory of Machines / Sadhu Singh / Pearson.
4) Theory of Machines – V.P.Singh – Dhanpath Rai
5) Kinematics and Dynamics of machinery – R.L.Norton – TMH
6) Theory of Machines / S.S.Rattan / Mc Graw Hill Publishers
7)Theory of mechanisms and machines- Ghosh. A. and Malik A.K. – East west Publishers
8) Theory of mechanisms and machines – Jagadish Lal- Metropolyton Books
9) Theory of Machines / Thomas Bevan /CBS

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B.Tech III Semester **L/T/P/C**
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METALLURGY AND MATERIAL SCIENCE (A33PC4)

Course Objectives

Builds on the Material Science and conserned with selection of engineering materials.
Basic Principles of material science is introduced.

Course outcomes

- Principles of Physical science and Chemistry are applied to understand materials and their properties.
- Understand the feasibility, sustainability in using the different materials in construction, fabrication and errection.
- To understand the relationship and properties of different alloy metals.
- Undersatand Ceramics, refractories, Nano- materials and their practical applications.

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, Aluminum and its alloys, Al-Cu phase diagram, Titanium and its alloys. Principles of Poweder metallurgy**.**

UNIT – V

Engineering Materials –IV

Ceramics, Polymers and Composites

Crystalline ceramics, glasses, cements: structure, properties and applications. Classification, properties, and applications of composites. Classification, Properties, and applications of Polymers. Properties and applications of FRP. Introduction of Nano Materials.

TEXT BOOKS

1) Elements of Material science / V. Rahghavan.

2) Material Science and Metallurgy/ Kodgire.

REFERENCES

1. Introduction to Physical Metallurgy / Sidney H. Avner.- TMH.
2. Materials Science and engineering / William and callister.
3. Engineering Material and Metallurgy – Er Amandeep Singh, Wadhva.
4. Materials Science for Engineering Students- Traugott Fischer 2009 Edition.
5. Mechanics of Composite materials – Robert M.Jones- Taylor and Francis- USA.
6. ASM hand book – Volume -1.
7. Material Science- S.L.Kulakarni and Amith Kakani – New age Publications.
8. Essentials of Materials Science and engineering / Donald R. Askeland / Thomson.

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B.Tech III Semester **L/T/P/C**
3/0/0/3

MECHANICS OF SOLIDS (A33PC5)

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.

This course will advance the students' development of the following broad capabilities:

- 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.
- 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.
- Students will understand how to develop shear-moment diagrams of a beam and find the maximum moment/shear and their locations
- Students will understand how to calculate normal and shear stresses.

Course Outcomes

- Analyze the behavior of the solid bodies subjected to various types of loading;
- Apply knowledge of materials and structural elements to the analysis of simple structures;
- Undertake problem identification, formulation and solution using a range of analytical methods;
- 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.
- Expectation and capacity to undertake lifelong learning.

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 tresses – hoop, longitudinal and volumetric strains – changes in dia, and volume of thin cylinders– Thin spherical shells.

TEXT BOOKS

1) Strength of materials – 17^{th} edition – Ramamrutham – Dhanpath Rai
2) Strength of materials – Bhavkati SS – Vikas publications

REFERENCES

1. Strength of materials – R.S. Kurmi and Gupta
2. Strength of Materials by R.K.Bansal – Laxmi Publications
3. Strength of Materials -By Jindal, Umesh Publications.
4. Analysis of structures by Vazirani and Ratwani.
5. Mechanics of Structures Vol –I by H. J. Shah and S. B. Junnarkar, Charotar Publishing House Pvt. Ltd.
6. Strength of Materials by D.S Prakash Rao, Universities Press Pvt. Ltd.
7. Strength of Materials by S. S. Rattan, Tata McGraw Hill Education Pvt. Ltd.
8. Fundamentals of Solid Mechanics by M. L. Gambhir, PHI Learning Pvt. Ltd
   Strength of Materials by R.K Rajput, S. Chand & Company Ltd.
9. Solid Mechanics, by Popov.
10. Strength of Materials – Ryder. G.H.; Macmillan Long Man Publications.
11. Strength of Materials – W.A. Nash, TMH.
12. Strength of Materials by R.K Rajput, S. Chand & Company Ltd.

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FUELS AND LUBRICANTS LAB (A33PC6)

Course Objectives

To understand the fuel and lubricants properties.

List of Experiments

1. Determination of Flash and Fire points of Liquid fuels/Lubricants using: Abels Apparatus
2. Determination of Flash and Fire points of Liquid fuels/Lubricants using: Pensky Martens Apparatus
3. Carbon residue test: Liquid fuels.
4. Determination of Viscosity of Liquid lubricants and Fuels using: Saybolt Viscometer.
5. Determination of Viscosity of Liquid lubricants and Fuels using: Redwood Viscometer
6. Determination of Viscosity of Liquid lubricants and Fuels using: Engler Viscometer
7. Determination of Calorific value: of Gaseous fuels using: Junkers Gas Calorimeter.
8. Determination of Calorific value: Solid/Liquid/ fuels using: Bomb Calorimeter.
9. Drop point and Penetration Apparatus for Grease.
10. ASTM Distillation Test Apparatus.
11. Cloud and Pour point Apparatus.

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MECHANICS OF SOLIDS LAB (A33PC7)

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:

- 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.
- 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.
- Students will understand how to develop shear-moment diagrams of a beam and find the maximum moment/shear and their locations.
- Students will understand how to calculate normal and shear stresses on any cross- section of a beam. Different cross-sections (including I-beam).

Course Outcomes

- Analyze the behavior of the solid bodies subjected to various types of loading.
- Apply knowledge of materials and structural elements to the analysis of simple structures.
- Undertake problem identification, formulation and solution using a range of analytical methods
- 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.
- 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

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METALURGY AND MATERIAL SCIENCE LAB (A33PC8)

Course Objective

The purpose of this course is to make the students learn the concepts of Metallurgy and Material Science role in all manufacturing processes which convert raw materials into useful products adapted to human needs.

Course Outcomes

The Primary focus of the Metallurgy and Material science program is to provide undergraduates with a fundamental knowledge based associated materials properties, and their selection and application. Upon graduation, students would have acquired and developed the necessary background and skills for successful careers in the materials-related industries. Furthermore, after completing the program, the student should be well prepared for management positions in industry or continued education toward a graduate degree.

List of Experiments

1. Preparation and study of crystal models for simple cubic, body centred cubic, face centred cubic and hexagonal close packed structures.
2. Preparation and study of the Microstructure of pure metals like Iron, Cu and Al.
3. Grain size measurement by different methods.
4. Preparation and study of the Microstructure of Mild steels, low carbon steels, high – C steels.
5. Study of the Microstructures of Cast Irons.
6. Study of Microstructures of different alloy steels.
7. Study of the Microstructures of Non-Ferrous alloys.
8. Study of the Microstructures of Heat treated steels.
9. Hardenability of steels by Jominy End Quench Test.
10. To find out the hardness of various heat treated and untreated plain carbon steels.

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0/3/0/0

GENDER SENSITIZATION LAB (A33MC3)

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**.

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/
3. www.worldofequals.org.in

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DYNAMICS OF MACHINARY (A34PC1)

Course Objectives

The objective is to introduce some of the components mainly used in IC Engines and make analysis of various forces involved. Subject deals with topics like inertia forces in slider crank mechanism; IC Engine components & the analysis like governors is introduced. It also deals with balancing of rotating & reciprocating parts. Studies are made about balancing of multi cylinder engines, Radial engines etc. study of primary & secondary forces are considered while balancing. Finally they are introduced to the topic of vibrations. The study deals with linear, longitudinal, & torsional vibrations. The idea is to introduce the concept of natural frequency and the importance of resonance and critical speeds.

Course Outcome

The study of KOM& DOM are necessary to have an idea while designing the various machine members like shafts, bearings, gears, belts & chains and various I.C. Engine Components & Machine tool parts.

UNIT – I

Precession

Gyroscopes – effect of precession – motion on the stability of moving vehicles such as motorcycle – motorcar – aero planes and ships.

Static and Dynamic Force Analysis

Static force analysis of planar mechanisms – Analytical Method – Dynamic Force Analysis – D'Alembert's principle, Dynamic Analysis of 4-link mechanism, Slider Crank Mechanism.

UNIT – II

Turning Moment Diagram and Flywheels

Engine Force Analysis – Piston Effort, Crank Effort, etc., Inertia Force in Reciprocating Engine – Graphical Method - Turning moment diagram –fluctuation of energy – flywheels and their design - Inertia of connecting rod- inertia force in reciprocating engines – crank effort and torque diagrams.-.

UNIT – III

Friction

Pivots and collars – uniform pressure, uniform wear – friction circle and friction axis: lubricated surfaces– boundary friction – film lubrication. Clutches – Types Single plate, multi-plate and cone clutches.

Brakes and Dynamometers

Types of brakes: Simple block brake, band and block brake- internal expanding shoe brake-effect of braking of a vehicle. Dynamometers – absorption and transmission types. General description and methods of operation.

UNIT – IV

Governors

Types of governors - Watt, Porter and Proell governors. Spring loaded governors – Hartnell and Hartung with auxiliary springs. Sensitiveness, isochronisms and hunting – stability – effort and power of the governors.

Balancing

Balancing of rotating masses- Primary, Secondary, and higher balancing of reciprocating masses. Analytical and graphical methods. Unbalanced forces and couples. Examination of "V" and multi cylinder in-line and radial engines for primary and secondary balancing- locomotive balancing – Hammer blow – Swaying couple – variation of tractive effort.

UNIT – V

Vibrations

Free Vibration of mass attached to vertical spring – Transverse loads – vibrations of beams with concentrated and distributed loads. Dunkerly's method – Raleigh's method. Whirling of shafts – critical speed – torsional vibrations – one, two and three rotor systems.

Text Books

1) Theory of Machines – V.P.Singh – Dhanpat Rai
2) Theory of Machines – Thomas Bevan.
3) Theory of machines – R.K.Bansal – Laxmi publications.

Reference Books

1) Theory of Machines and Mechanisms/Joseph E. Shigley / Oxford
2) Theory of Machines / Rao, J.S / New Age
3) Theory of Machines /S.S.Rattan / Mc Graw Hill.
4) Theory of Machines /Sadhu Singh/ Pearson
5) Kinematics and Dynamics- of Macinery- RL Norton – TMH
6) Theory of mechanisms and machines, Ghosh A and Malik A, K

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MECHANICAL ENGINEERING

B.Tech IV Semester **L/T/P/C 4/1/0/4**

FLUID MECHANICS AND HYDRAULIC MACHINES (A34PC2)

Course Objectives

The objectives of the course are to enable the student;

- To understand the basic principles of fluid mechanics.
- To identify various types of flows.
- To understand boundary layer concepts and flow through pipes.
- To evaluate the performance of hydraulic turbines.
- To understand the functioning and characteristic curves of pumps.

Course Outcomes

- Able to explain the effect of fluid properties on a flow system.
- Able to identify type of fluid flow patterns and describe continuity equation.
- To analyse a variety of practical fluid flow and measuring devices and utilize fluid Mechanics principles in design.
- To select and analyze an appropriate turbine with reference to given situation in power plants.
- To estimate performance parameters of a given Centrifugal and Reciprocating pump.
- Able to demonstrate boundary layer concepts.

UNIT - I

Fluid statics:

Dimensions and units: physical properties of fluids- specific gravity, viscosity, and surface tension - vapour pressure and their influence on fluid motion- atmospheric, gauge and vacuum pressures – measurement of pressure- Piezometer, U-tube and differential manometers.

UNIT - II

Fluid kinematics

Stream line, path line and streak lines and stream tube, classification of flows-steady & unsteady, uniform & non uniform, laminar & turbulent, rotational & irrotational flows-equation of continuity for one dimensional flow and three dimensional flows.

Fluid dynamics

Surface and body forces –Euler's and Bernoulli's equations for flow along a stream line, momentum equation and its application on force on pipe bend.

UNIT - III

Boundary Layer Concepts

Definition, thicknesses, characteristics along thin plate, laminar and turbulent boundary layers (No derivation) boundary layer in transition, separation of boundary layer, submerged objects – drag and lift.

Closed conduit flow

Reynolds experiment- Darcy Weisbach equation- Minor losses in pipes- pipes in series and pipes in parallel- total energy line-hydraulic gradient line. Measurement of flow: Pitot tube, venturi meter, and orifice meter, Flow nozzle

UNIT - IV

Basics of turbo machinery

Hydrodynamic force of jets on stationary and moving flat, inclined, and curved vanes, jet striking centrally and at tip, velocity diagrams, work done and efficiency, flow over radial vanes.

Hydraulic Turbines

Classification of turbines, Heads and efficiencies, impulse and reaction turbines, Pelton wheel, Francis turbine and Kaplan turbine-working proportions, work done, efficiencies , hydraulic design –draft tube theory- functions and efficiency.

Performance of hydraulic turbines

Geometric similarity, Unit and specific quantities, characteristic curves, governing of turbines, selection of type of turbine, cavitation, surge tank, water hammer.

UNIT - V

Centrifugal pumps

Classification, working, work done barometric head- losses and efficiencies specific speed- performance characteristic curves, NPSH.

Reciprocating pumps

Working, Discharge, slip, indicator diagrams.

TEXT BOOKS:

1) Hydraulics, fluid mechanics and Hydraulic machinery MODI and SETH. - Standard publications
2) Fluid Mechanics and Hydraulic Machines by R.K. Rajput Chand publications
3) Fluid Mechanics and Fluid Power Engineering by D.S. Kumar, Kotaria & Sons.

REFERENCES

1. Fluid Mechanics and Machinery by D. Rama Durgaiah, New Age International.
2. Hydraulic Machines by Banga & Sharma, Khanna Publishers.
3. Fluid mechanics – Yunus A Cenegal, John Climbale – TMH.
4) Fluid mechanics and Hydraulic machines – R.K.Bansal- Laxmi publications.
5) Fluid Mechanics and Hydraulic Machinery by Jagdish Lal
6) Fluid mechanics – John F.Dauglas- Pearson.
7) Fluid mechanics – Frank White- TMH.

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MACHINE DRAWING (A34PC3)

Course objectives

To familiarize with the standard conventions for different materials and machine parts in working drawings. To make part drawings including sectional views for various machine elements. To prepare assembly drawings given the details of part drawings.

Course Outcomes

- Preparation of engineering and working drawings with dimensions and bill of material during design and development. Developing assembly drawings using part drawings of machine components.
- Conventional representation of materials, common machine elements and parts such as screws, nuts, bolts, keys, gears, webs, ribs.
- Types of sections – selection of section planes and drawing of sections and auxiliary sectional views. Parts not usually sectioned.
- Methods of dimensioning, general rules for sizes and placement of dimensions for holes, centers, curved and tapered features.
- Title boxes, their size, location and details - common abbreviations and their liberal usage
- Types of Drawings – working drawings for machine parts.

Drawing of Machine Elements and simple parts

Selection of Views, additional views for the following machine elements and parts with every drawing proportion.

1. Popular forms of Screw threads, bolts, nuts, stud bolts, tap bolts, set screws.
2. Keys, cottered joints and knuckle joint.
3. Rivetted joints for plates
4. Shaft coupling, spigot and socket pipe joint.
5. Journal, pivot and collar and foot step bearings.

Assembly Drawings

Drawings of assembled views for the part drawings of the following using conventions and easy drawing proportions.

1. Steam engine parts – stuffing boxes, cross heads, Eccentrics.
2. Machine tool parts: Tail stock, Tool Post, Machine Vices.
3. Other machine parts - Screws jacks, Petrol engine connecting rod, Plummer block
4. Simple designs of steam stop valve, spring loaded safety valve, feed check valve and air cock.

NOTE: First angle projection to be adopted. The student should be able to provide working drawings of actual parts.

TEXT BOOKS

1. Machine drawing- N.Siddeswar, P.Kannaih and VVS Sastry – TMH.
2. Machine Drawing by / Bhattacharyya / Oxford.
3. Machine Drawing with Auto CAD / Goutham Pohit, Goutam Ghosh / Pearson.

REFERENCE BOOKS

1. Machine Drawing / Ajeet Singh / Mc Graw Hill.
2. Machine Drawing / N.D. Bhat / Charotar.

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MANUFACTURING PROCESS (A34PC4)

Course Objectives

- To teach the process-level dependence of manufacturing systems through tolerances
- To expose the students to a variety of manufacturing processes including their typical use and capabilities.
- To teach the important effects that manufacturing processes may have on the material properties of the processed part with a focus on the most common processes.
- To teach the thermal and mechanical aspects, such as force, stress, strain, and temperature, of the most common processes.
- To provide a technical understanding of common processes to aid in appropriate process selection for the material and required tolerances
- To provide a technical understanding of common processes to aid in appropriate material selection for a predetermined process.

Course Outcomes

- Understand the idea for selecting materials for patterns. Types and allowances of patterns used in casting and analyze the components of moulds.
- Design core, core print and gating system in metal casting processes
- Understand arc, gas, solid state and resistance welding processes.
- Develop process-maps for metal forming processes using plasticity principles.
- Identify the effect of process variables to manufacture defect free products.

UNIT – I

Casting

Steps involved in making a casting – Advantage of casting and its applications; Patterns - Pattern making, Types, Materials used for patterns, pattern allowances and their construction; Properties of moulding sands. Methods of Melting - Crucible melting and cupola operation – Defects in castings; Casting processes – Types – Sand moulding, Centrifugal casting, die- casting, Investment casting, shell moulding; Principles of Gating – Requirements – Types of gates, Design of gating systems – Riser – Function, types of Riser and Riser design. Solidification of casting – Solidification of pure metal Nucleation and grain growth, casting design considerations

UNIT – II

Welding

Classification – Types of welds and welded joints; Gas welding - Types, oxy-fuel gas cutting – standard time and cost calculations. Arc welding, forge welding, submerged arc welding, Resistance welding, Thermit welding.

UNIT – III

Inert Gas Welding

TIG Welding, MIG welding, Friction welding, induction welding, explosive welding, Laser Welding; Soldering and Brazing; Heat affected zone in welding. Welding defects – causes and remedies; destructive and non- destructive testing of welds.

UNIT – IV

Hot working, cold working, strain hardening, recovery, recrystallization and grain growth. Rolling fundamentals – theory of rolling, types of Rolling mills and products. Forces in rolling and power requirements Stamping, forming and other cold working processes. Blanking and piercing – Bending and forming – Drawing and its types – wire drawing and Tube drawing – coining – Hot and cold spinning. Types of presses and press tools. Forces and power requirement in the above operations.

UNIT – V

Extrusion of Metals

Basic extrusion process and its characteristics. Hot extrusion and cold extrusion -Forward extrusion and backward extrusion – Impact extrusion – Extruding equipment – Tube extrusion and pipe making, Hydrostatic extrusion. Forces in extrusion **Forging Processes:** Forging operations and principles – Tools – Forging methods – Smith forging, Drop Forging – Roll forging – Forging hammers: Rotary forging – forging defects – cold forging, swaging, Forces in forging operations.

TEXT BOOKS:

1. Manufacturing Science – Ghosh and Malik- TMH
2. Production Technology –R.K.Jain – Khanna Publisher.
3. Manufacturing Technology / P.N. Rao Vol.1 & 2 / Mc Graw Hill

REFERENCE BOOKS

1) A course in work shop technology – Volime 2- S .Raghu vamsi Dhanpat Rai
2) Metal Casting / T.V Ramana Rao / New A g e
3) Production Technology / G. Thirupathi Reddy / SciTech
4) Manufacturing Engineering & Technology / Serope Kalpakjian / Steven R. Schmid / Pearson

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BUSINESS ECONOMICS AND FINANCIAL ANALYSIS (A34HS5)

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

REFERENCES

1. Financial Accounting for Management 2e, Paresh Shah Oxford Press, 2015.
2. Financial Accounting; S. N. Maheshwari, Sunil K Maheshwari, Sharad Maheshwari,, 5e, Vikas Publications, 2013.
3. Managerial Economics and Financial analysis – Arya sri - TMH
4. Financial Accounting for Management; Ambrish Guptha – Pearson
5. Managerial Economics in a Global Economy- Domick Salvatore, Thomson

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KINEMATICS AND DYNAMICS LAB (A34PC6)

Course Objectives

The objective of the lab is to understand the kinematics and dynamics of mechanical elements such as linkages, gears, cams and learn to design such elements to accomplish desired motions or tasks.

Course Outcomes

Upon successful completion of this lab, students should be able to:

- Understand types of motion
- Analyze forces and torques of components in linkages
- Understand static and dynamic balance
- Understand forward and inverse kinematics of open-loop mechanisms.

Experiments

(A Minimum of 10 experiments are to be conducted)

1. To determine the state of balance of machines for primary and secondary forces.
2. To determine the frequency of torsional vibration of a given rod.
3. Determine the effect of varying mass on the centre of sleeve in porter and proell governor.
4. Find the motion of the follower if the given profile of the cam.
5. The balance masses statically and dynamically for single rotating mass systems.
6. Determine the critical speed of a given shaft for different n-conditions.
7. For a simple pendulum determine time period and its natural frequency.
8. For a compound pendulum determine time period and its natural frequency.
9. Determine the effect of gyroscope for different motions.
10. Determine time period, amplitude and frequency of undamped free longitudinal vibration of single degree spring mass systems.
11. Determine the pressure distribution of lubricating oil at various load and speed of a Journal bearing.
12. Determine time period, amplitude and frequency of damped free longitudinal vibration of single degree spring mass systems.

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FLUID MECHANICS AND HYDRAULIC MACHINES LAB (A34PC7)

Course Objectives

- To understand the basic principles of fluid mechanics.
- To identify various types of flows.
- To understand boundary layer concepts and flow through pipes.
- To evaluate the performance of hydraulic turbines.
- To understand the functioning and characteristic curves of pumps.

Course Outcomes

- Able to explain the effect of fluid properties on a flow system.
- Able to identify type of fluid flow patterns and describe continuity equation.
- To analyze a variety of practical fluid flow and measuring devices and utilize fluid mechanics principles in design.
- To select and analyze an appropriate turbine with reference to given situation in power plants.
- To estimate performance parameters of a given Centrifugal and Reciprocating pump.
- Able to demonstrate boundary layer concepts.

List of Experiments

1. Impact of jets on Vanes.
2. Performance Test on Pelton Wheel.
3. Performance Test on Francis Turbine.
4. Performance Test on Kaplan Turbine.
5. Performance Test on Single Stage Centrifugal Pump.
6. Performance Test on Multi Stage Centrifugal Pump.
7. Performance Test on Reciprocating Pump.
8. Calibration of Venturimeter.
9. Calibration of Orifice meter.
10. Determination of friction factor for a given pipe line.
11. Determination of loss of head due to sudden contraction in a pipeline.
12. Verification of Bernoulli's Theorems

Note: Any 10 of the above 12 experiments are to be conducted.

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MANUFACTURING PROCESSING LAB (A34PC8)

Course Objectives

- Know about the basic Physical, Chemical Properties of materials
- Explain why some material(s) are better to be used in a product for given design requirements
- Learn the basic operation of various manufacturing processes
- Learn how various products are made using traditional, non-traditional, or Electronics manufacturing processes
- Design simple process plans for parts and products
- Understand how process conditions are set for optimization of production
- Learn how CNC machines work
- Write and execute CNC machining programs to cut parts on a milling machine
- Measure a given manufactured part to evaluate its size, tolerances and surface finish
- Design and fabricate a simple product

Course Outcomes

Understanding the properties of moulding sands and pattern making. Fabricate joints using gas welding and arc welding. Evaluate the quality of welded joints. Basic idea of press working tools and performs moulding studies on plastics.

Minimum of 12 Exercises need to be performed

I. Metal Casting Lab:

1. Pattern Design and making - for one casting drawing.
2. Sand properties testing - Exercise -for strengths, and permeability – 1
3. Moulding Melting and Casting - 1 Exercise

II. Welding Lab:

1. ARC Welding Lap & Butt Joint - 2 Exercises
2. Spot Welding - 1 Exercise
3. TIG Welding - 1 Exercise
4. Plasma welding and Brazing - 2 Exercises (Water Plasma Device)

III. Mechanical Press Working:

1. Blanking & Piercing operation and study of simple, compound and progressive press tool.
2. Hydraulic Press: Deep drawing and extrusion operation.
3. Bending and other operations

IV. Processing Of Plastics

1. Injection Moulding
2. Blow Moulding

REFERENCE BOOK

1. Dictionary of Mechanical Engineering – G.H.F. Nayler, Jaico Publishing House.

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ENVIRONMENT SCIENCE AND TECHNOLOGY (A34MC4)

Course Objectives

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

Course Outcomes

Based on this course, the Engineering graduate will understand /evaluate / develop technologies on the basis of ecological principles and environmental regulations which inturn 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

Waste water 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-economic 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, 4^{th} Edition, New age international publishers.
5. Text book of Environmental Science and Technology - Dr. M. Anji Reddy 2007, BS Publications.