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(Autonomous)
Course structure for Four Year Regular B.Tech. Degree Program
(Effective for the batches admitted from 2020-21)
MECHANICAL ENGINEERING (ME)

Semester III (Second year)

Sl. No.	Category	Course Code	Course Title	Hours per week			Credits	Scheme of Examination (Max. Marks)		
				L	T	P	C	CIE	SEE	Total
1	Basic Science courses	20ABS9913	Probability & Statistics, PDE	3	0	0	3	30	70	100
2	Professional Core Course	20APC0308	Thermodynamics	3	0	0	3	30	70	100
3	Professional Core courses	20APC0301	Engineering Mechanics	3	0	0	3	30	70	100
4	Professional Core courses	20APC0306	Material Science and Engineering	3	0	0	3	30	70	100
5	Professional Core courses	20APC0303	Machine Drawing	3	0	0	3	30	70	100
6	Professional Core courses (LAB)	20APC0307	Material Science and Engineering Lab	0	0	3	1.5	30	70	100
7	Professional Core courses (LAB)	20APC0313	Mechanical Engineering Workshop Practice	0	0	3	1.5	30	70	100
8	Professional Core courses (LAB)	20APC0324	CAD Lab	0	0	3	1.5	30	70	100
	Skill oriented course*	20ASC0301	CATIA Lab	1	0	2	2	100	-	100
	Mandatory course (AICTE suggested)	20AMC9903	Environmental Studies	2	0	0	0	30	-	30
			Total credits				21.5	370	560	930

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Year : II B.Tech	Semester: I	Branch of Study: CE and ME		
Subject Code:20ABS9913	**Subject Name: Probability & Statistics, PDE**	**L** **3**	**T** **0**	**P** **0**	**Credits** **3**

Course Outcomes:
1) Understand the concepts of Central Tendency, Correlation, Regression concepts.
2) Apply discrete and continuous probability distributions
3) Design the components of a classical hypothesis test for large samples.
4) Infer the statistical inferential methods based on small sampling tests.
5) Find the general solution of the PDEs bearing applications

Unit I: Descriptive statistics :
Measures of Central tendency, Measures of Variability (spread or variance), correlation, correlation coefficient, rank correlation, regression coefficients, method of least squares, regression lines

Unit II: Probability
probability axioms, addition law and multiplicative law of probability, conditional probability, Baye's theorem, random variables (discrete and continuous)**,** probability distribution: Binomial - Poisson approximation to the binomial distribution and normal distribution-their properties.

Unit III: Testing of Hypothesis
Formulation of null hypothesis, critical regions, level of significance. Large sample tests: test for single proportion, difference of proportions, test for single mean and difference of means.

Unit IV: Small Sample Tests
Student t-distribution (single mean, two means and paired t-test), Testing of equality of variances (F-test), χ^2 - test for goodness of fit.

Unit V: Applications of Partial Differential Equations
Method of separation of variables, solution of 1D-wave, 1D-heat and 2D-Laplace's equation in Cartesian coordinates

Text Books:

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 43/e, 2010.
2. Erwin kreyszig, Advanced Engineering Mathematics, 9/e, John Wiley & Sons, 2006.

References:

1. S.Chand ,Engineering Mathematics-II by Dr.T.K.V.Iyengar, Dr.B.Krishna Gandhi, S.Ranganatham, Dr.M.V.S.S.N.Prasad
2. W. E. Boyce and R. C. DiPrima, Elementary Differential Equations and Boundary Value Problems, 9/e, Wiley India, 2009.
3. E. A. Coddington, An Introduction to Ordinary Differential Equations, Prentice Hall India,1995.
4. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, 2008.

List of COs	PO no. and keyword	Competency Indicator	Performance Indicator
CO1	PO1: Apply the knowledge of mathematics	1.1	1.1.1
CO2	PO1: Apply the knowledge of mathematics	1.1	1.1.1

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CO3	PO1: Apply the knowledge of mathematics	1.1	1.1.1
CO4	PO1: Knowledge of Engineering fundamentals	**1.2**	**1.2.2**
CO5	PO2: First principles of mathematics	2.4	2.4.1

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Year : II   **Semester** : I   **Branch of Study : ME**

Subject Code	Subject Name	L	T	P	Credits
20APC0308	Thermodynamics	3	0	0	3

Course Outcomes:
1 Explain the importance of thermodynamic properties related to conversion of heat energy into work.
2 Apply the laws of thermodynamics to boilers, heat pumps, refrigerators, heat engines, compressors and nozzles.
3 To understand concept of Entropy and Availability of system
4 Utilize steam properties to design steam based components.
5 Compare thermodynamic relations and air standard cycles.

UNIT I
Introduction: Basic Concepts: Macroscopic and microscopic viewpoints, definitions of thermodynamic terms, quasi – static process, point and path function, forms of energy, ideal gas and real gas, Zeroth law of thermodynamics.
Properties of Steam and use of Steam Tables: Pure Substances, P-V-T surfaces, T-s and h-s diagram, Mollier chart, dryness fraction, property tables, analysis of steam undergoing various thermodynamic processes using Mollier chart– steam calorimetry

UNIT II
First law of Thermodynamics: Joule's experiment - first law of thermodynamics, corollaries-perpetual motion machines of first kind, first law applied to non-flow and flow process- limitations of first law of thermodynamics.
Second Law of Thermodynamics: Kelvin - Planck statement and Clausius statement and their equivalence, corollaries - perpetual motion machines of second kind - reversibility and irreversibility, cause of irreversibility - Carnot cycle, heat engine, heat pump and refrigerator, Carnot theorem, Carnot efficiency

UNIT III
Entropy: Clausius inequality - Concept of Entropy- entropy equation for different processes and systems
Availability and Irreversibility: Definition of exergy and energy, expressions for availability and irreversibility. Availability in steady flow, non-flow processes and irreversibility.

UNIT IV
Avogadro's law, equation of state, ideal gas equation, Vander Waal's equation, reduced properties, law of corresponding states, compressibility chart. Gibbs-Dalton law, volumetric analysis of gas mixture, apparent molecular weight and gas constant, specific heat of a gas mixture, adiabatic mixing of perfect gases, gas and vapour mixtures.

UNIT V
Thermodynamic Relations: Maxwell relations, TdS equations, difference in heat capacities, ratio of heat capacities, Energy equation, Joule Thompson coefficient, Clausius-Clapeyron equation. Reactive mixture of gases

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Text Books:
1. P. K. Nag, Engineering Thermodynamics, 5/e, Tata McGraw Hill, 2013.
2. Yunus A. Cengel, Michaela A. Boles, Thermodynamics, 7/e, Tata McGraw Hill, 2011.

Reference Books:
1. J. B. Jones and G. A. Hawkins, Introduction to Thermodynamics, 2/e, John Wiley & Sons, 2012.
2. Moran, Michael J. and Howard N. Shapiro, Fundamentals of Engineering Thermodynamics, 3/e, Wiley, 2015
3. Claus Borgnakke Richard E. Sonntag, Fundamentals of Thermodynamics, 7/e, Wiley, 2009
4. R. K. Rajput, S. Chand & Co., Thermal Engineering, 6/e, Laxmi publications, 2010.

List of COs	PO no. and keyword	Competency Indicator	Performance Indicator
CO: 1	PO 2: Problem analysis	2.5	2.1.3
CO: 2	PO 1: Engineering knowledge PO 2: Problem analysis	2.2	2.2.3
CO: 3	PO 1: Engineering knowledge PO 2: Problem analysis	2.1	2.1.3
CO: 4	PO 1: Engineering knowledge PO 2: Problem analysis PO 3: Design/development of solutions	2.2	2.2.3
CO: 5	PO 1: Engineering knowledge PO 2: Problem analysis	2.4	2.4.3

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Year : II   **Semester** : I   **Branch of Study : ME**

Subject Code	Subject Name	L	T	P	Credits
20APC0301	Engineering Mechanics	3	0	0	3

Course Outcomes:
1 Resolve forces and moments in mechanical systems.
2 Identify the frictional forces and its influence on equilibrium.
3 Find the centre of gravity and moment of inertia for various geometric shapes
4 Demonstrations of equilibrium of ideal systems and estimation of the work done by the force and the couple
5 Determine the displacement, velocity and acceleration relations in dynamic systems

UNIT I

Introduction to Engineering Mechanics: Composition and resolution of forces, parallelogram law, principle of transmissibility, types of force systems - concurrent and concurrent coplanar forces, resultant of coplanar force systems couple, moment of a force Varignon's theorem, concept of equilibrium of coplanar force systems.

UNIT II

Friction: Laws of friction, types of friction, equilibrium of force systems involving frictional forces. Free body diagrams involving frictional forces.
Analysis of Structures: Introduction to plane trusses, analysis of plane trusses by method of joints.

UNIT III

Properties of Surfaces and Volumes: Centroid and center of gravity, derivation of centroids from first moment of area, centroids of composite sections, center of gravity of common volumes - cylinder, cone, sphere, theorem of Pappus-guldinus.

Moment of Inertia: Area moment of inertia of plane and composite shapes, parallel axis theorem, perpendicular axis theorem, polar moment of inertia, mass moment of inertia of common volumes thin plates, cylinder, cone, sphere, rectangular prism, radius of gyration

UNIT IV

Virtual Work: Equilibrium of ideal systems, work done by a force, work done by a couple, principle of virtual work.
Kinematics: Equations of motion for rigid bodies, constant and variable acceleration, rectilinear and curvilinear motion and motion under gravity -projectile motion, use of rectangular coordinates, radius of curvature, rotation of a rigid body about a fixed axis.

UNIT V

Kinetics: Principles of dynamics - Newton's Laws of motion, D'Alembert's principle in rectilinear translation, principle of work and energy.
Ideal Systems: Principle of conservation of energy, concept of power, conservation of linear and angular momentum, principle of momentum and impulse, impact - types of impact.

Text Books:
1. N H Dubey, Engineering Mechanics: Statics and Dynamics, McGraw Hill, 2014.
2. S Timoshenko, DH Young, JV Rao, Sukumar Pati, Engineering Mechanics (in SI units), 5/e, McGraw Hill, 2013.
3. S S Bhavikatti, Engineering Mechanics, 4/e, New Age International, 2008

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References:

1. Irving Shames, G K M Rao, Engineering Mechanics: Statics and Dynamics, 4/e, Pearson, 2009.

2. K L Kumar, Veenu Kumar, Engineering Mechanics, 4/e, Tata McGraw Hill, 2010.

List of COs	PO no. and keyword	Competency	Performance Indicator
CO: 1	PO1: Engineering knowledge	1.3	1.3.1
CO: 2	PO2: Modern tool usage	2.1	2.1.3
CO: 3	PO4: Conduct investigations of complex problems	4.1	4.1.2
CO: 4	PO2: Problem analysis	2.1	2.1.2
CO: 5	PO7: Environment and sustainability:	7.1	7.1.2

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Year : II   **Semester** : I   **Branch of Study : ME**

Subject Code	Subject Name	L	T	P	Credits
20APC0306	Material Science and Engineering	3	0	0	3

Course Outcomes:
1 Explain the principles of binary phases
2 Apply heat treatment to different applications and its defects
3 Select steels and cast irons for a given application
4 Utilize non ferrous metals and alloys in engineering
5 Choose composites for various applications. Assess the properties of Nano-materials and their applications

UNIT I

Structure of Metals: Crystal Structures: Unit cells, Metallic crystal structures, Imperfection in solids: Point, Line, interstitial and volume defects; dislocation strengthening mechanisms and slip systems.

Constitution of Alloys: Necessity of Alloying, substitutional and interstitial solid solutions-Phase diagrams: Interpretation of binary phase diagrams and microstructure development; Iron-Iron carbide diagram and microstructural aspects of ferrite, cementite, austenite, ledeburite, andcastiron.

UNIT II

Heat Treatment of Steels: Annealing, tempering, normalizing and spheroidizing, Continuous cooling curves and interpretation of final micro structures and properties austempering, mar tempering, casehardening, carburizing, nitriding, cyaniding, carbo-nitriding, flame and induction hardening.

UNIT III

Steels: Plain carbon steels, used limitations of plain carbon steels. AISI & BIS classification of steels. Classification, Microstructure, properties and applications of alloy steels and tool steels.

Cast irons: Micro structure, properties and applications of white cast iron, malleable cast iron, grey cast iron, nodular cast iron and alloy cast iron.

UNIT IV

Non-ferrous Metals and Alloys: Micro structure, properties and applications of copper, bearing materials and its alloys, aluminum and its alloys. Study of Al-Cu phase diagram, precipitation hardening. Microstructure, properties and applications of titanium and its alloys

UNIT V
Ceramics, Polymers and Composites: Structure, properties and applications of ceramics, polymers and Composites. Introduction to super alloys and Nano materials.
Text Books:

1. Sydney H. Avner, Introduction to Physical Metallurgy, 2/e, Tata McGraw- Hill, 1997.
2. George E. Dieter, Mechanical Metallurgy, 3/e, McGraw-Hill, 2013.
Reference Books:
1. V. Raghavan, Material Science and Engineering, 5/e, Prentice Hall of India, 2004.
2. R. Balasubramaniam, Callister's Material Science and Engineering, 2/e, Wiley India, 2014.
3. Y. Lakhtin, Engineering Physical Metallurgy, University Press of the Pacific, 2000.
L. H.Van Vlack, Elements of Material Science and Engineering, 6/e, Pearson Education, 2008

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List of COs	PO no. and keyword	Competency Indicator	Performance Indicator
CO: 1	PO 1: Engineering knowledge	1.3	1.3.1
CO: 2	PO 5: Modern tool usage	5.2	5.2.2
CO: 3	PO 5: Modern tool usage	5.2	5.1.2
CO: 4	PO 5: Modern tool usage	5.2	5.2.2
CO: 5	PO 1: Engineering knowledge	1.6	1.3.1
	PO 7: Environment and sustainability	7.4	7.2.1

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Year : II   **Semester** : I   **Branch of Study : ME**

Subject Code	Subject Name	L	T	P	Credits
20APC0303	Machine Drawing	3	0	0	3

Course Outcomes:
1 Understand the Concepts of Conventional Representation of Materials & Machine Elements
2 Draw the Machine Elements and simple parts
3 Draw the assembled views for the part drawings of the Engine parts
4 Draw the assembled views for the part drawings of the other machine parts – Screws jacks, Machine Vices Plummer block, Tailstock.
5 Draw the assembled views for the part drawings of the Valves

UNIT I
Machine Drawing Conventions: Need for drawing conventions-conventional representation of material, common machine elements and parts such as screws, nuts, bolts, keys.

Methods of dimensioning, general rules for sizes and placement of dimensions for holes, centers, curved and tapered features.

Title boxes, their sizes, location and details - common abbreviations& their liberal usage.

UNIT II
Design of Machine elements and simple parts:
Selection of views, additional views for the following machine elements and parts with drawing proportions
Popular forms of Screw threads, bolts, nuts, stud bolts, tap bolts, set screws, keys, cottered joints and knuckle joint, riveted joints for plates, flanged and protected flanged joint. Shaft coupling, spigot and socket joint, journal and foot step bearing.

UNIT III
Assembly Drawings: Drawings of assembled views for the part drawings of the following.
Engine parts- stuffing boxes, Cross heads, Eccentrics, Petrol Engine-connecting rod, piston assembly.
Other Machine parts- Screw jack, machine vice, single tool post.
Valves: Steam stop valve, feed check valve. Non- return value

Textbooks:
1. Machine Drawing- K.L. Narayana, P.Kannaiah & K.Venkata Reddy, New Age Publishers, 4th Edition, 2012.
2. Machine Drawing / N.D. Bhatt / Charotar
3. Machine Drawing – N Siddeswar, P. Kannaiah, VVS Sastry, Mc Graw Hill,2015.

References:
1. Machine Drawing- P.S. Gill, S.K. Kataria & Sons, 17th Edition, 2012
2. Machine Drawing- Dhawan, S.Chand Publications, 1st Revised Edition,1998.
3. Machine Drawing – Ajeet Singh, McGraw Hill, 2012
4. Machine Drawing- Luzzader, PHI Publishers,11th Edition

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List of COs	PO No. and keyword	Competency Indicator	Performance Indicator
CO: 1	PO 3: Design/development of solutions	3.4	3.4.2
CO: 2	PO 2: Problem analysis	2.1	2.1.2
CO: 3	PO 3: Design/development of solutions	3.3	3.3.1
CO: 4	PO 5: Modern tool usage	5.1	5.1.2
CO: 5	PO 1: Engineering knowledge	1.1	1.1.2

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Year : II   **Semester** : I   **Branch of Study : ME**

Subject Code	Subject Name	L	T	P	Credits
20APC0307	Material Science and Engineering Lab	0	0	3	1.5

Course Outcomes:
1. Identify various microstructures of steels and cast irons.
2. Visualize grains and grain boundaries
3. Evaluate hardness of treated and untreated steels.
4. Summarize the importance of hardening of steels.
5. Study the Micro structure of Heat treated steels.

List of Experiments:
1. Study of microstructure of pure metals – Iron, copper and aluminum.
2. Study of microstructure of low carbon steel, mild steel and high carbon steel.
3. Study of microstructure of cast irons.
4. Study of microstructure of non-ferrous alloys – aluminum, copper, titanium, nickel and their alloys.
5. Study hardenability of steels by Jominy End Quench Test.
6. Study of microstructure of heat treated steels.
7. Find hardness of various untreated and treated steels.
8. Study of microstructure of ceramics, polymeric materials.

List of COs	PO No. and keyword	Competency Indicator	Performance Indicator
CO: 1	PO 5: Modern tool usage	5.5	5.5.2
CO: 2	PO 4: Conduct investigations of complex problems	4.1	4.1.2
CO: 3	PO 4: Conduct investigations of complex problems	4.3	4.3.1
CO: 4	PO 4: Conduct investigations of complex problems	4.1	4.1.4
CO: 5	PO 5: Modern tool usage	5.5	5.5.2

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Year : II   **Semester** : I   **Branch of Study : ME**

Subject Code	Subject Name	L	T	P	Credits
20APC0313	Mechanical Engineering Workshop Practice	0	0	3	1.5

Course Outcomes:

CO: 1   Make moulds for sand casting
CO: 2   Develop different weld joints
CO: 3   Assemble or disassemble of machine components
CO: 4   Make plastic components
CO: 5   Use power tools and find applications of hydraulic and pneumatic
            circuits

I   Foundry Practice: (2 Sessions)

1. (a) Determination of average grain size for sand sample using sieve shaker

   (b) Preparation of a green sand mould using single piece pattern

2. Preparation of a green sand mould using split piece pattern with core and demonstration of casting.

II   Welding Practice: (2 Sessions)

      i) Lap joint, butt joint and T joint using arc welding.

      ii) Lap joint using resistance spot welding

      iii) Lap and butt joints using gas welding

III   Assembling/Disassembling Practice: (3 Sessions)

      i) Bicycle

      ii) Clutch and carburetor

      iii) Two wheeler engine

IV   Manufacture of a Plastic Component (2 Sessions)

      i) Use of injection moulding machine

      ii) Joining of plastic components

V   Use of Power Tools (2 Sessions)

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Year : II   **Semester** : I   **Branch of Study : ME**

Subject Code	Subject Name	L	T	P	Credits
20APC0324	COMPUTER AIDED DRAFTING Lab	0	0	3	1.5

Course Outcomes:

1 Understand the CAD software
2 Understand the elements of CAD tools
3 Design the draw, modify toolbar
4 Design the solids, intersection in 3D
5 Analyze the perceptive views and orthographic views

LIST OF EXPERIMENTS:

I Introduction to Computer Aided Drafting software packages.
II. Practice on basic elements of a Computer Aided Drafting packages
III. Practice on features of a Computer Aided Drafting package
IV Drafting of Solids, Intersection of Solids
V Drafting of Perspective views
VI Drafting of Orthographic views of simple parts

Note: Any of the standard Software Packages like – AUTO CAD, Pro-E, Uni – Graphics, Catia …. Etc may be used

COs	PO No. and keyword	Competency Indicator	Performance Indicator
CO: 1	PO 3: Design/development of solutions	3.4	3.4.2
CO: 2	PO 2: Problem analysis	2.1	2.1.2
CO: 3	PO 3: Design/development of solutions	3.3	3.3.1
CO: 4	PO 5: Modern tool usage	5.1	5.1.2
CO: 5	PO 1: Engineering knowledge	1.1	1.1.2

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Year : II   **Semester** : I   **Branch of Study : ME**

Subject Code	Subject Name	L	T	P	Credits
20ASC0301	CATIA Lab	1	0	2	2

Course Outcomes:
  1 Design of 2D models using software
  2 Design of 3D models and analysis
  3 Create simulation of any simple components
  4 Design and simulation of machine components
  5 Analysis of any components using software

List of experiments:

1. Any simple 2D drawing using CATIA.
2. 3D modelling using CATIA, Creo, Solid works, etc.,
3. Simulation of simple 3D models.

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Year : II   **Semester** : I   **Branch of Study : ME**

Subject Code	Subject Name	L	T	P	Credits
20AMC9903	Environmental Studies	2	0	0	0

Course Outcomes:

1 Students get sufficient information that clarifies modern environmental concepts like equitable use of natural resources, more sustainable life styles etc.

2 Students realize the need to change their approach, so as to perceive our own environmental issues correctly, using practical approach based on observation and self-learning.

3 Students become conversant with the fact that there is a need to create a concern for our environment that will trigger pro-environmental action; including simple activities we can do in our daily life to protect it.

4 . Interpretation of different types of environmental pollution problems and designing of new solid waste management techniques usage

5 To get knowledge on various environmental acts and to engage all the students life - long learning of rain water harvesting

UNIT – I

18Hr

Multidisciplinary Nature o**f Environmental Studies:** Introduction – Multidisciplinary Nature of Environmental Studies – Definition, Scope and Importance – Need for Public Awareness.

Natural Resources: Renewable and non-renewable energy resources – Natural resources and associated problems.

Forest resources: Use and over – exploitation, deforestation, case studies – Timber extraction – Mining, dams and other effects on forest and tribal people.

Water resources: Use and over utilization of surface and sub-surface – Floods, drought, conflicts over water, dams – benefits and problems.

Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies.

Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticides problems, water logging, salinity, case studies.

Energy resources: Renewable and non-renewable energy resources.

UNIT – II

20Hr

Ecosystems: Concept of an ecosystem. – Structure and functions of an ecosystem – Producers, consumers and decomposers – Energy flow in the ecosystem – Ecological succession – Food chains, food webs and ecological pyramids – Introduction, types, characteristic features, structure and function of the following ecosystem: Forest ecosystem, Grassland ecosystem, Desert ecosystem and Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries).

Biodiversity And Its Conservation : Introduction- Definition: genetic, species and ecosystem diversity – Value of biodiversity: consumptive use, Productive use, social, ethical, aesthetic and option values – Biodiversity at global, National and local levels – India as a mega-diversity nation – Hot-sports of biodiversity – Threats to biodiversity: habitat loss, poaching of wildlife, man – wildlife conflicts – Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

UNIT – III

10Hr

Environmental Pollution: Definition, Causes, effects and its control measures of : Air Pollution, Water pollution, Soil pollution, Marine pollution, Noise pollution, Thermal pollution and Nuclear hazards.

Solid Waste Management: Causes**,** effects and control measures of urban and industrial wastes – Role of an individual in prevention of pollution – Pollution case studies – Disaster management: floods, earthquake, cyclone, Tsunami and landslides.

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UNIT – IV

15Hr

Social Issues and the Environment: From Unsustainable to Sustainable development – Urban problems related to energy – Water conservation, rain water harvesting and watershed management – Resettlement and rehabilitation of people – Case studies – Environmental ethics: Issues and possible solutions – Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case Studies– Wasteland reclamation. – Consumerism and waste products. – Environment Protection Act. – Air (Prevention and Control of Pollution) Act. – Water (Prevention and control of Pollution) Act – Wildlife Protection Act – Forest Conservation Act – Public awareness.

UNIT – V

10Hr

Human Population and the Environment: Population growth, variation among nations. Population explosion – Family Welfare Programmed. – Environment and human health – Human Rights – Value Education – HIV/AIDS – Women and Child Welfare – Role of information Technology in Environment and human health – Case studies.

TEXT BOOKS:

1. Text book of Environmental Studies for Undergraduate Courses by Erach Bharucha for University Grants Commission, Universities Press.
2. Environmental Studies by Kaushik, New Age Publishers.
3. Environmental Studies by Sri Krishna Hitech publishing Pvt. Ltd.

REFERENCES:

1. Environmental studies by R.Rajagopalan, Oxford University Press.
2. Comprehensive Environmental studies by J.P.Sharma, Laxmi publications.
3. Introduction to Environmental engineering and science by Gilbert M. Masters and Wendell P. Ela - Printice hall of India Private limited.
4. Environmental studies by A. Ravi Krishnan, G. Sujatha Sri Krishna Hitech publications.

List of COs	PO no. and keyword	Competency Indicator	Performance Indicator
CO:1	PO1:Apply the knowledge of Basic science	1.2	1.2.1
CO:2	PO1:Apply the knowledge of Basic science	1.2	1.2.1
CO:3	PO1:Apply the knowledge of Basic science	1.2	1.2.1
CO:4	PO1:Apply the knowledge of Basic science	1.2	1.2.1
CO:5	PO1:Apply the knowledge of Basic science	1.2	1.2.1