

WALCHAND INSTITUTE OF TECHNOLOGY, SOLAPUR

*Structure of S.Y. B. Tech. Mechanical and Automation Engineering
(W.E.F. 2022-23)*

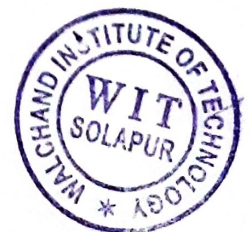
Semester III

Course Code	Name of the Course	Engagement Hours			Credits	FA		SA		Total
		L	T	P		ESE	ISE	ICA		
21MAU3CC1T	Applied Thermodynamics	3	-	-	3	60	40	-	100	
21MAU3CC2T	Mechanics of Materials	3	-	-	3	60	40	-	100	
21MAU3CC3T	Manufacturing Processes	3	-	-	3	60	40	-	100	
21MAU3ES4D	Computer Aided Machine Drawing	2	-	-	2	-	25	-	25	
21MAU3ES5P	Programming in C++	2	-	-	2	-	25	-	25	
21CEU3HU6T	Universal Human Values	3	-	-	3	60	40	-	100	
Sub Total		16	-	-	16	240	210		450	
Course code	Name of Laboratory / Tutorial Course	Engagement Hours			Credits	FA		SA		Total
		L	T	P		ESE		ISE	ICA	
						POE	OE			
21MAU3CC1L	Applied Thermodynamics	-	-	2	1	-	-	-	25	25
21MAU3CC2L	Mechanics of Materials	-	-	2	1				25	25
21MAU3CC3L	Manufacturing Processes	-	-	2	1	-	25	-	25	50
21MAU3ES4D	Computer-Aided Machine Drawing	-	-	2	1	50		-	25	75
21MAU3ES5P	Programming in C++	-	-	2	1	50	-	-	25	75
21MAU3HU7L	General Proficiency			2	1				25	25
21MAU3IN8L	Internship-I	-	-	-	-	-	-	-	-	-
Sub Total		-	-	-	6	125			150	275
Grand Total		16		12	22	365		210	150	725

- Internship of four weeks shall be completed by students in the first & /or second year of the programme latest before commencement of third year & will be assessed at T. Y. Sem-I. Students can complete two separate internships of two weeks each or one internship of four weeks. The internship can be done in the form of an Industrial Internship / MOOC course / Certification course / Workshop any other relevant activity as specified by the department.

SBI
Chairman

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WALCHAND INSTITUTE OF TECHNOLOGY, SOLAPUR

Structure of S.Y. B. Tech. Mechanical and Automation Engineering

(W.E.F. 2022-23)

Semester IV

Course Code	Name of the Course	Engagement			Credits	FA		SA		Total
		Hours				ESE	ISE	ICA		
		L	T	P						
21MAU4CC1T	Mechatronics-I	3	-	-	3	60	40	-	100	
21MAU4CC2T	Industrial Hydraulics and Pneumatics	3	-	-	3	60	40	-	100	
21MAU4BS3T	Engineering Mathematics-III	3	-	-	3	60	40	-	100	
21MAU4CC4T	Kinematics & Theory of Machines	3	-	-	3	60	40	-	100	
21MAU4CC5T	Advanced Manufacturing Technology	3	-	-	3	60	40	-	100	
21MAU4ES6P	Programming using Python	2	-	-	2	50	25	-	75	
Sub Total		17	-	-	17	350	225	-	575	
Course code	Name of Laboratory / Tutorial Course	Engagement			Credits	FA		SA		Total
		Hours				ESE		ISE	ICA	
		L	T	P		POE	OE			
21MAU4CC1L	Mechatronics-I	-	-	2	1	-	-	-	25	25
21MAU4CC2L	Industrial Hydraulics and Pneumatics	-	-	2	1	-	25	-	25	50
21MAU4CC4L	Kinematics & Theory of Machines	-	-	2	1	-	25	-	25	50
21MAU4CC5L	Advanced Manufacturing Technology	-	-	2	1	-	-	-	25	25
21MAU4ES6L	Programming using Python	-	-	2	1	-	-	-	25	25
21MAU4ES7L	Electrical Technology			2	1				25	25
Sub Total		-	-	12	08	50	-	150	200	
Grand Total		17		12	25	400	225	150	775	

Mandatory Course: Environmental Studies course will be taught in both Semester III and IV whereas the assessment will be in semester IV as End Semester Examination.

Course Code	Theory Course Name	Engagement			Credits	FA		SA		Total
		L	T	P		ESE	ISE	ICA		
21GEU4MC2T	Environmental Studies	1	-	-	-	50	-	-	50	



Walchand Institute of Technology, Solapur
S. Y. B. Tech. (Mechanical and Automation Engineering), Semester-III
21MAU3CC1T: Applied Thermodynamics

Teaching Scheme

Theory-3 Hrs/Week
Practical- 2 Hrs/Week

Examination Scheme

ESE - 60 marks
ISE - 40 marks
ICA - 25 marks

Course Outcomes:

At the end of this course, the students will be able to

1. Apply knowledge to solve real life problems related to basic laws of thermodynamics & properties of pure substances & steam.
2. Evaluate the performance of mechanical devices like boilers, compressors, steam turbines, etc.
3. Apply knowledge of basic thermodynamic concepts for the analysis of vapour power cycles
4. Apply knowledge of thermodynamics concepts for the analysis of the flow of steam through nozzles and steam condensers.

SECTION I

Unit 1: Basic Laws of Thermodynamics

No. of Lectures-07

Review of basic concepts, Zeroth, First, and Second Law of Thermodynamics, Limitation of the first law of thermodynamics, Kelvin- Plank, and Clausius statements and their equivalence. Heat engine, refrigerator and heat pump, Reversibility and Irreversibility, Carnot cycle. Entropy, Principle of entropy increase, Calculation of entropy change for: i) Phase change of pure substance ii) Change of state of an ideal gas.

Unit 2: Properties of pure substance & steam

No. of Lectures-07

Properties of pure Substance-Property diagram for phase-change processes, Steam properties (wet, saturated, superheated, degree of superheat and dryness fraction); Temperature-entropy and temperature-enthalpy diagrams, Mollier diagram.

Unit 3: Performance of Boilers

No. of Lectures-06

Classification, mountings and accessories, salient features of high-pressure boilers, Evaporation, equivalent evaporation, Boiler efficiency, heat losses in boiler plant & heat balance sheet.

SECTION II

Unit 4: Vapour Power Cycles

No. of Lectures-06

Classification of cycles, vapour power cycles, Carnot vapour power cycle, simple Rankine cycle, actual Rankine cycle, Effect of operating conditions on Rankine cycle efficiency.

Unit 5: Steam Nozzles

No. of Lectures-06

Types of Nozzles, flow of steam through nozzles, condition for maximum discharge, expansion of steam considering friction, Super-saturated flow through nozzles, Mach. No., Types of flows.

Unit 6: Reciprocating Air Compressors

No. of Lectures-08

Uses of compressed air, classification of compressors, constructional detail of single & multistage compressor, computation of work, isothermal work done, isothermal efficiency, effect of clearance,

volumetric efficiency, FAD, theoretical & actual indicator diagram, need of multistage, work done, volumetric efficiency, condition for maximum efficiency, inter cooling.

Internal Continuous Assessment (ICA)

Minimum 8 Assignments/experiments based on the above syllabus.

Text Books:

1. S. Domkundwar, Kothandraman, A Course in Thermal Engineering ,Dhanpat Rai & Co. Delhi.
2. R. K. Rajput, Thermal Engineering, Laxmi Publication, New Delhi
3. P.K. Nag, Basic & Applied Thermodynamics, Tata McGraw Hill Publication

Reference Books:

1. C.P. Arora, Thermodynamics, McGraw Hill, New Delhi.
2. R. Yadav, Thermodynamics & Heat Engine Vol. 1 &Vol. 2, Central Book Depot.
3. Cengel Boles, Thermodynamics, McGraw Hill, New Delhi.
4. R. Yadav, Steam & Gas Turbines-, CPH, Allahabad



Walchand Institute of Technology, Solapur
S. Y. B. Tech. (Mechanical and Automation Engineering), Semester-III
21MAU3CC2T: Mechanics of Materials

Teaching Scheme

Theory-3 Hrs/Week
Practical-2 Hrs/Week

Examination Scheme

ESE - 60 marks
ISE - 40 marks
ICA - 25 marks

Course Outcomes:

At the end of this course, students will be able to

1. Demonstrate fundamental knowledge about different types of stresses induced for given applications & compute principal stresses & position of principal planes.
2. Draw & interpret shear force and bending moment diagrams for various beams under different loading conditions & analyse the bending & shear stresses in various sections.
3. Compute slope and deflection for beams subjected to various loads by different methods.
4. Determine the torsional strength of solid & hollow circular shafts.

SECTION-I

Unit 1: Simple Stress and Strain

No. of Lectures-06

Stress, strain, Hooke's law, Poisson's ratio, Modulus of Elasticity, Modulus of Rigidity, and Bulk Modulus. Interrelation between elastic constants, Stress-strain diagram, factor of safety. Stresses and strains, homogeneous and composite bars under concentrated loads. Temperature stresses in simple members.

Unit 2: Principal stresses and strains

No of Lectures-07

Normal and shear stresses on any oblique plane. Concept of principal planes, derivation of expression for principal stresses and maximum shear stress, the position of principal planes, and planes of maximum shear. (2-D stress system) Graphical solution using Mohr's circle of stresses.

Unit 3: Shear Force and Bending Moment Diagrams

No. of Lectures-07

Shear force and bending moment diagrams for statically determinate beam due to concentrated load, uniformly distributed load, uniformly varying load, and couple, (Cantilever, simply supported, overhang beam) Relationship between the rate of loading, shear force, and bending moment. Maximum bending moment and position of points of contra flexure.

SECTION-II

Unit 4: Bending and Shear Stresses in Beams

No. of Lectures-08

Bending stresses: Theory of simple bending, assumptions, derivation of flexural formula, second moment of area of common cross sections (circular, rectangular, I, T, C section) with respect to centroidal and parallel axes, bending stress distribution diagrams, moment of resistance and section modulus.

Shear stresses: Concept, derivation of shear stress distribution formula, shear stress distribution diagrams for common symmetrical sections, maximum and average shears stresses, shear connection between flange and web.

Unit 5: Slope and Deflection of Beams.

No. of Lectures-08

Bending into a circular arc – slope, deflection, and radius of curvature –Double integration and Macaulay's methods – Determination of slope and deflection for cantilever and simply supported beams subjected to point loads, - U.D.L. Mohr's theorems – Moment area method – application to simple standard cases

Unit 6:Torsion of circular shafts

No. of Lectures-04

Introduction, pure torsion, assumptions, derivation of torsional equations, polar modulus, torsional rigidity/stiffness of shafts, power transmitted by solid and hollow circular shafts.

Internal Continuous Assessment (ICA)

Minimum 8 Assignments/experiments based on the above syllabus.

Text Books:

1. R. K. Rajput, Strength of materials, S. Chand & Co. Ltd., New Delhi.
2. R.K. Bansal, Strength of materials, Laxmi publications (P) Ltd., New Delhi.
3. S.S. Bhavikatti, “Strength of Materials”, Vikas Publishing House Pvt Ltd, New Delhi.

Reference Books:

1. Basu A. R., Strength of materials, Dhanpat Rai & Co. (P) Ltd., Delhi.
2. Khurmi R. S. & Gupta J. K., Strength of materials, S. Chand & Co.Ltd., New Delhi.
3. Ramamrutham S., Strength of materials, Dhanpat Rai & Co. (P) Ltd., Delhi.
4. Beer and Johnson, Strength of materials, Mc-Graw Hill International student series.
5. Timoshenko & Young, Strength of materials, CSB Publishers



Walchand Institute of Technology, Solapur
S. Y. B. Tech. (Mechanical and Automation Engineering), Semester-III
21MAU3CC3T: Manufacturing Processes

Teaching Scheme

Theory: 3Hrs/week

Practical: 2Hrs/week

Examination Scheme

ESE : 60Marks

ISE : 40 Marks

ICA : 25 Marks

POE : 25 Marks

Course Outcomes

At the end of this course, the students will be able to

1. Select the appropriate manufacturing process for a given component.
2. Understand the performance of each process.
3. Prepare a process plan for the given component.

SECTION-I

Unit 1: Casting Processes

No. of Lectures-06

Definition of casting, Basic steps in casting processes, Advantages, limitations, and applications of the casting process, General introduction to patterns, Types of patterns, materials used, Allowances, types of cores and core boxes, molding materials, and their properties, Gating system, types of risers, Function of a riser, the method to improve the efficiency of risers, Riser design

Unit 2: Molding processes

No. of Lectures-09

Green sand molding (hand and machine molding), Shell molding, Investment casting, centrifugal casting, gravity, and pressure die casting processes.

Induction furnace construction and working of melting furnaces such as Cupola, Arc furnaces, induction furnaces, Crucible, oil, and gas-fired furnaces.

Unit 3: Fettling, Cleaning, and Inspection of Castings

No. of Lectures-05

Need for fettling, stages in fettling, equipment used in fettling and cleaning of castings, Common important defects in castings. Inspection procedure, Computer applications in foundry processes, foundry, Mechanization.

SECTION-II

Unit 4: Conventional Forming Processes:

No. of Lectures-07

Introduction to forming process, Classification of forming processes, forging, types of forging, numerical on upset forging. Extrusion, Types – direct extrusion, indirect extrusion, impact extrusion, hydrostatic extrusion, Wire drawing process, Methods of tube drawing, hot rolling, cold rolling of sheets, classification of Rolling mills, theory of rolling, numerical on rolling.

Unit 5: Advanced Forming Processes:**No. of Lectures-05**

Introduction to advanced forming processes, High energy rate forming process- explosive, electro-hydraulic, magnetic pulse forming. Forming with hydrostatic pressure- hydro-mechanical and hydro-forming process.

Unit 6: Joining processes**No. of Lectures-08**

Welding processes, classification of the welding process, arc welding, welding rod selection, TIG welding & MIG welding, submerged arc welding, gas welding, resistance welding, Brazing, and soldering.

Internal Continuous Assessment (ICA)

Minimum 8 Assignments/experiments based on the above syllabus.

Text Books:

1. N.D. Titov, Foundry Practice.
2. P. L . Jain, Principles of Foundry Technology. TaTA McGraw Hill
3. P.N. Rao, Manufacturing Technology: Foundry, Forming and Welding.
4. P. C . Sharma, Production Technology, S. Chand & Co. Ltd.

Reference books:

1. J.S. Campbell, Principles of Manufacturing Material and Processes, Tata McGrawHill.
2. S. Kalpakjian, S.R. Scsimid, Manufacturing Engineering and Technology, Pearson Education.



Walchand Institute of Technology, Solapur
S. Y. B. Tech. (Mechanical and Automation Engineering), Semester-III
21MAU3ES4D: Computer-Aided Machine Drawing

Teaching Scheme

Theory-2 Hrs/Week
Practical-2 Hrs/Week

Examination Scheme

ISE-25 marks
ICA-25 marks
POE-50 marks

Course Outcomes:

At the end of this course, the student will be

1. Apply the BIS conventions in component drawings & assembly drawings.
2. Draw part and assembly drawing of mechanical components
3. Use geometrical dimensions, tolerances, and symbols in part-assembly drawings

Unit 1: Study of B.I.S. (Bureau of Indian Standards) Conventions: **No. of Lectures 07**
BIS Conventions-Significance and importance and use in drawings.

Unit 2: Sketching of machine components **No. of Lectures 08**
Importance of sketching. Sketching/drafting of various machine elements.

Unit 3: Production Drawing: Limits, Fits, & Tolerances- **No. of Lectures 07**
Dimensional Tolerances: Introduction to the system of limits and fits. Basic concepts. Terminology, Tolerances, various types. Necessity of Limit system, Unilateral, and Bilateral Tolerances, Selection of tolerances based on fits.
Geometrical Tolerances: -Need of Geometrical Tolerances, Terminology, and Tolerances for Single Features such as Straightness, Flatness, Circularity, and Cylindricity. Tolerances for Related Features such as Parallelism, Perpendicularity, Angularity, Concentricity, Tolerance Symbol, and Value, Indicating Geometrical Tolerances on drawings.
Surface Finish: -Surface Texture, Surface Roughness Number, Roughness Symbols, and Range of Roughness obtainable with different manufacturing processes.

Unit 4: Details and Assembly Drawing **No. of Lectures 08**
Assembly drawing from given detail drawing and vice versa with tolerances and fits.

Internal Continuous Assessment (ICA)

Internal assessment will include a minimum of 8 assignments on 3D modeling and drafting on the above topics.

Text Books:

1. P.S. Gill, Machine Drawing. S.K. Kataria and Sons , Delhi.
2. N. D. Bhatt. Machine Drawing. Charotar Publication House, Bombay.
3. N. Sidheshwar. P. Kanniah and V.V. S. Sastry. Machine Drawing, Tata McGraw Hill, New Delhi.
4. George Omura, Mastering Auto CAD, BPB Publications.
5. K.L.Narayana, P.Kanniah, & K.V. Reddy, "Machine Drawing" SciTech Publications (India Pvt. Ltd.) Chennai

Reference Books:

1. IS: SP46- Engineering drawing practice for schools and colleges, B.I.S. Publications.
2. IS: 696- Code of practice for general engineering drawings B.I.S. Publications.
3. IS : 2709-Guide for selection of fits, B.I.S. Publications.
4. IS:919-Recommendation for limits and fits for Engineering, B.I.S. Publications
5. IS: 8000- Part I, II. III. IV, Geometrical tolerancing of technical drawings -- B.I.S. Publications.



Walchand Institute of Technology, Solapur
S. Y. B. Tech.(Mechanical and Automation Engineering), Semester-III
21MAU3ES5P: Programming in C++

Teaching Scheme

Theory- 2 Hrs/Week
Practical- 2 Hrs/Week

Examination Scheme

ISE - 25 marks
ICA - 25 marks
POE- 50 marks

Course Outcomes:

At the end of this course, the students will be able to

1. Develop algorithms for solving problems using object-oriented language.
2. Write, compile, debug & execute C++ program by applying knowledge of various features like class, object, etc.
3. Apply knowledge and programming skills to solve various computing problems in the field of mechanical engineering.

SECTION I

Unit 1: Introduction to Object Oriented Programming

No. of Lectures-04

Basic concepts, Benefits, object-oriented languages, Applications.

Unit 2: C++ Programming basics

No. of Lectures-04

C character set, tokens, constants, variables, keywords, primitive data types, operators (arithmetic, unary, binary, ternary, logical, assignment, relational, increment, decrement, conditional), operator precedence, expressions, type casting, and type conversion.

Unit 3: Control Structures

No. of Lectures-07

Control Statement: if, if-else, nested if –else, else if ladder Loops: while, do-while, for, nesting of loops, break, continue, switch-case statement.

SECTION II

Unit 4: Functions

No. of

Lectures-08

Function Prototyping, Call by Reference, return by reference, inline function, Default arguments, Function with default arguments, const arguments, Function Overloading, and Math Library Functions.

Unit 5: Classes & Objects

No. of Lectures-04

Introduction, Difference between structures & classes, Declaration of class, defining the object of a class, Data members, Member functions, accessing a member of a class.

Unit 6: Constructor and Destructors

No. of Lectures-03

Default constructor, Parameterized constructor, a constructor with a default parameter, Copy constructor, and Destructor.

Internal Continuous Assessment (ICA)

Minimum 6 programs based on the above syllabus. Preferably covering topics such as bending moment, shear force calculations, the centre of gravity, moment of inertia, etc.

Text Books:

Yashwant Kanitkar, Let us C++ , BPB Publication

Reference Books:

1. E. Balguruswami-Object Oriented Programming, Tata McGraw hill Publication
2. Rajesh Shukla-Object oriented programming in C++, Wiley India Publications



Walchand Institute of Technology, Solapur

S. Y. B. Tech. (Mechanical and Automation Engineering), Semester-III

21CEU3HU6T : Universal Human Values

Teaching Scheme

Theory- 3 Hrs/week

Examination Scheme

ESE - 60 marks

ISE - 40 marks

Course Outcomes:

At the end of this course, students will be able to

1. Appreciate the essential complementarity between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity, which are the core aspirations of all human beings.
2. Develop a holistic perspective towards life and profession as well as towards happiness and prosperity based on a correct understanding of Human reality and the rest of Existence.
3. Appreciate the Universal Human Values and movement towards value-based living in a natural way.
4. Highlight ethical human conduct, trustful and mutually fulfilling human behavior, and mutually enriching interaction with Nature.

Unit 1: Course Introduction - Need, Basic Guidelines, Content and Process for Value Education No. of Lectures-08

1. Understanding the need, basic guidelines, content, and process for Value Education
2. Self-Exploration–what is it? - It's content and process; 'Natural Acceptance' and Experiential Validation- as the mechanism for self-exploration
3. Continuous Happiness and Prosperity- A look at basic Human Aspirations.
4. Right understanding, Relationship, and Physical Facilities- the basic requirements for the fulfillment of aspirations of every human being with their correct priority.
5. Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario
6. Method to fulfill the above human aspirations understanding and living in harmony at various levels.

Unit 2: Understanding Harmony in the Human Being - Harmony in Myself!

No. of Lectures-07

1. Understanding human being as a co-existence of the sentient 'I' and the material 'Body'
2. Understanding the needs of Self ('I') and 'Body' –Sukh and Suvidha
3. Understanding the Body as an instrument of 'I' (I being the doer, seer, and enjoyer)
4. Understanding the characteristics and activities of 'I' and harmony in 'I'
5. Understanding the harmony of I with the Body: Sanyam and Swasthya; correct appraisal of Physical needs, the meaning of Prosperity in detail.
6. Programs to ensure Sanyam and Swasthya

Unit 3: Understanding Harmony in the Family and Society- Harmony in Human- Human Relationship No. of Lectures-08

1. Understanding Harmony in the family – the basic unit of human interaction
2. Understanding values in a human-human relationship; the meaning of Nyaya and program for its fulfillment to ensure Ubhay-tripti; Trust (Vishwas) and Respect (Samman) as the foundational values of relationship
3. Understanding the meaning of Vishwas; Difference between intention and competence

4. Understanding the meaning of Samman, the Difference between respect and differentiation; the other salient values in the relationship
5. Understanding the harmony in the society (society being an extension of the family): Samadhan, Samridhi, Abhay, Sah-astitva as comprehensive Human Goals
6. Visualizing a universal harmonious order in society- Undivided Society (Akhand Samaj), Universal Order (Sarvabhaum Vyawastha)- from family to world family!

Unit 4: Understanding Harmony in the Nature and Existence - Whole existence as Co-existence No. of Lectures-08

1. Understanding the harmony in the Nature
2. Interconnectedness and mutual fulfillment among the four orders of nature- recyclability, and self-regulation in nature
3. Understanding Existence as Co-existence (Sah-astitva) of mutually interacting units in all pervasive space
4. Holistic perception of harmony at all levels of existence

Text Books

1. R.R Gaur, R Sangal, G P Bagaria, A foundation course in Human Values and Professional Ethics, Excel books, New Delhi, 2010, ISBN 978-8-174-46781-2
2. The teacher's manual: R.R Gaur, R Sangal, G P Bagaria, A foundation course in Human Values and Professional Ethics – Teachers Manual, Excel books, New Delhi, 2010

Reference Books

1. B L Bajpai, 2004, Indian Ethos and Modern Management, New Royal Book Co., Lucknow. Reprinted 2008.
2. PL Dhar, RR Gaur, 1990, Science and Humanism, Commonwealth Publishers.
3. Sussan George, 1976, How the Other Half Dies, Penguin Press. Reprinted 1986, 1991
4. Ivan Illich, 1974, Energy & Equity, The Trinity Press, Worcester, and HarperCollins, USA
5. Donella H. Meadows, Dennis L. Meadows, Jorgen Randers, William W. Behrens III, 1972, limits to Growth, Club of Rome's Report, and Universe Books.
6. Subhas Palekar, 2000, How to practice Natural Farming, Pracheen(Vaidik) Krishi Tantra Shodh, Amravati.
7. A Nagraj, 1998, Jeevan VidyaekParichay, Divya Path Sansthan, Amarkantak.
8. E.F. Schumacher, 1973, Small is Beautiful: a study of economics as if people mattered, Blond & Briggs, Britain.
9. A.N. Tripathy, 2003, Human Values, New Age International Publishers

Relevant websites, movies, and documentaries

2. Value Education websites, <http://uhv.ac.in>, <http://www.uptu.ac.in>
3. Story of Stuff, <http://www.storyofstuff.com>
4. Al Gore, An Inconvenient Truth, Paramount Classics, USA
5. Charlie Chaplin, Modern Times, United Artists, USA
6. IIT Delhi, Modern Technology – the Untold Story
7. Gandhi A., Right Here Right Now, Cyclewala Productions
8. AICTE On-line Workshop on Universal Human Values Refresher Course-I Handouts
9. UHV-I handouts
<https://drive.google.com/drive/folders/16eOka8AoBpLGICDajRvk4MXgfXQWzFCB?usp=sharing>
10. UHV-II handouts
<https://drive.google.com/drive/folders/15eHkMVguzRBDrb65GFj7jMN6UEP5JEk1?usp=sharing>



Walchand Institute of Technology, Solapur
S. Y. B. Tech. (Mechanical and Automation Engineering), Semester-III
21MAU3HU7L: General Proficiency

Teaching Scheme

Lab-2 hrs/week

Examination Scheme

ICA-25 marks

Course Outcomes:

At the end of this course, the student will be able to

1. Prepare good quality presentations and deliver them effectively.
2. Perform effectively in group discussions and personal interviews.
3. The draft resumes, letters, emails, and reports professionally with appropriate content and context.

Course Content:

1. Self-Introduction
2. Resume writing
3. Presentation skills
4. Letter writing
5. Email writing
6. Group discussion
7. Interview skills
8. Report writing

Internal Continuous Assessment (ICA)

Case Studies on above mentioned topics

Text Books:

1. Gajendra Singh Chauhan & Sangeeta Sharma, Soft Skills: An Integrated Approach to Maximize Personality, Willy India Pvt. Ltd.
2. William Zinsser, On Writing Well, Harper Resource Book.
3. Dr. M. Hemamalini, Technical English. Willy India Pvt. Ltd
4. Aruna Koneru, Professional Speaking Skills. Oxford University Press

References Books:

1. K. Alex, Soft Skills, S. Chand Publications
2. Ajay R Tengse, Soft Skills – A Textbook for Undergraduates, Orient Black Swan
3. Sanjay Kumar, Pushpa Lata, Communication Skills, Oxford University Press
4. B N Ghosh, Managing Soft Skills for Personality Development, McGraw Hill Publication



Walchand Institute of Technology, Solapur

S. Y. B. Tech. (Mechanical and Automation Engineering), Semester-IV

21MAU4CC1T: Mechatronics-I

Teaching Scheme

Theory-3 Hrs/Week

Practical- 2 Hrs/Week

Examination Scheme

ISE- 40 marks

ICA- 25 marks

ESE- 60 marks

Course Outcomes:

At the end of this course, students will be able to:

1. Illustrate the principle and applications of sensors and actuators in mechatronic systems
2. Demonstrate fundamental knowledge about various ADC, DAC, and op-amp
3. Perform binary arithmetic operations
4. Simplify Boolean expressions using algebra and K Maps
5. Build and run simple combinational and sequential circuits in a simulator and using a breadboard.

Unit 1: Mechatronic Systems and Devices

No. of lectures –04

Basic Definition, Key elements of Mechatronics, Historical Perspective, Examples of Mechatronics Systems: Car Engine Management, various systems in a modern automobile (ABS, TCS, DAS), Modern HVACs, CNC machines, and factory automation.

Unit 2: Sensors and Actuators

No. of lectures - 08

Sensors: Classification, Principle of Operation & Characteristics, Linear and rotational sensors, acceleration sensors, Force sensors, Torque Sensors, Flow Sensors, Temperature Sensors, Distance Sensors, Optical Sensors, Ultrasonic Sensors, microsensors, and Selection criteria. Actuators: Classification of Actuators, Hydraulic and Pneumatic Actuators, DC Motors, AC motors, Stepper Motors, Switches, Solenoids, Piezoelectric Actuators, VFDs, micro-actuators

Unit 3: Signals and Signal Conditioning

No. of lectures –08

Examples of signals & systems as seen in everyday life, Continuous-time signals: elementary signals, exponential, sine, step, impulse, ramp, rectangular, triangular, and operations on signals, Classification of signals: Continuous and discrete time, deterministic and non-deterministic, periodic and aperiodic, symmetric (even) and asymmetric (odd) Signal Conditioning, Signal Processing, Filtering, relays, optocouplers, ADC/DAC, OPAMPs, DAQ, loggers, Multiplexer

SECTION II

Unit 4 Fundamentals of Digital Systems

No. of Lectures- 06

Number systems, binary, hexadecimal and octal numbers, binary arithmetic, conversion to other number bases, Gray codes, Alphanumeric codes, parity bits, Binary logic, and gates.

Unit 5 Combination Logic Circuits

No. of Lectures -08

Boolean Algebra, algebraic manipulation, standard forms, max terms and min terms, Karnaugh maps for 3, 4, 5 6 variables, prime implicants, don't care conditions, encoders, decoders, and arithmetic circuits.

Unit 6 Sequential Logic Circuits

No. of Lectures- 06

Latches, SR latch, D latch, flip flops, state table and state diagrams, registers, counters, memory basics, clocking, and timing

Internal Continuous Assessment (ICA)

Minimum 8 Assignments/experiments based on the above syllabus.

Text Books:

1. W. Bolton, Mechatronics, Pearson Publishing
2. Shetty & Kolk, Mechatronics System Design, Cengage Learning
3. Morris Mano, Digital Logic Fundamentals, Pearson Publishing
4. R. P. Jain, "Modern Digital Electronics," Tata McGraw Hill
5. B. P. Lathi, Principles of linear systems and Signal, Oxford university press

Reference Books

1. Bishop et.al, Handbook of Mechatronics, CRC Press
2. 5. Shetty & Kolk, Mechatronics System Design, Cengage Learning
3. J. Millman and A. Grabel, "Microelectronics", Tata McGraw Hill
4. Alan V. Oppenheim, Alan S. Willsky, and S. Hamid Nawab, Signals and Systems, Prentice Hall of India



Walchand Institute of Technology, Solapur

S. Y. B. Tech. (Mechanical and Automation Engineering), Semester-IV

21MAU4CC2T: Industrial Hydraulics and Pneumatics

Teaching Scheme

Theory-3 Hrs/Week

Practical-2 Hrs/Week

Examination Scheme

ESE - 60 marks

ISE - 40 marks

ICA - 25 marks

OE - 25 marks

Course Outcomes:

At the end of this course, students will be able to

1. Draw diagrams & symbols of various hydraulic, and pneumatic components & devices
2. Describe the construction & working of various hydraulic, and pneumatic components & devices
3. Select proper hydraulic, and pneumatic components & devices for different applications
4. Prepare hydraulic, and pneumatic circuits for various applications

SECTION -I

Unit 1: Introduction to Hydraulic system & Hydraulic actuators

No. of Lectures-06

Introduction to Fluid power system, hydraulic system Advantages, limitations & applications of hydraulic system, Hydraulic Actuators - Linear & Rotary, Types, Working, Construction of linear & rotary actuators, Cushioning effects, Seals & Packing- Types, materials, Applications

Unit 2: Pumps, Accumulators, Intensifiers & Valves

No. of Lectures-08

Pumps- Types, working, Characteristics, Applications, Calculation of force & velocity of piston, System components: Accumulators, Intensifiers, their types, working, applications, Symbols used in hydraulic circuits, Hydraulic Pressure control valves- Direct acting type, pilot operated, sequence, counterbalancing, unloading, pressure reducing, Construction & Working, Direction control valves- Types, construction & working, Spool actuation methods, spool center positions, Flow control valves- Compensated & Non-Compensated, Construction & Working, One-way valve

Unit 3: Hydraulic circuits

No. of Lectures-06

Simple circuit, Speed control circuits: Meter in, Meter out & bleed off circuits, Regenerative circuit, Sequencing circuit, Counterbalancing & Synchronizing circuits, Circuits with accumulator & intensifier, Hydraulic clamping circuit, hydraulic braking system

SECTION II

Unit 4: Introduction to Pneumatic system & Actuators

No. of Lectures-06

Pneumatic system: Advantages, limitations & applications of pneumatic system, Comparison of hydraulic & pneumatic system, IS symbols used in pneumatic circuits, pneumatic cylinders and air motors, construction and working, types

Unit 5: Pneumatic System Elements & Valves

No. of Lectures-08

Piping, materials and pressure ratings, piping layout, air compressors, types, working, selection criteria, FRL unit, construction and working of Direction control valves, Flow control valves and pressure control valves – types and working, Quick Exhaust valve, Time delay valve

Unit VI– Pneumatic circuits**No. of Lectures-06**

Simple Pneumatic circuits, Pneumatic clamping systems, Pneumatic braking systems, Pneumatic power tools, Time delay circuits

Internal Continuous Assessment (ICA)

Minimum 8 Assignments/**experiments** based on the above syllabus & allied visits.

Text Books:

1. S. R. Majumdar, Oil Hydraulics- Principle & Maintenance, Tata McGraw Hill Publication
2. S. R. Majumdar, Pneumatics- Principle & Maintenance, S. R. Majumdar, Tata McGraw Hill Publication
3. H. L. Stewart, Hydraulics and Pneumatics”, Industrial Press

Reference Books:

1. Eaton-Vickers Industrial Hydraulics Manual
2. Festo’s Manual on Pneumatic Principle, Applications
3. Jagadeesha T, Hydraulics and Pneumatics, Dreamtech Press



Walchand Institute of Technology, Solapur
S. Y. B. Tech. (Mechanical and Automation Engineering), Semester-IV
21MAU4BS3T: Engineering Mathematics –III

Teaching Scheme
Theory-3 Hrs/Week

Examination Scheme
ESE - 60 marks
ISE - 40 marks

Course Outcomes:

1. Solve partial differential equation of first order
2. Write a function in terms of sine and cosine components to model simple periodic functions.
3. Use numerical methods for evaluating definite integrals and solving linear and non-linear equations.
4. Draw various probability distribution functions.

SECTION I

Unit 1: First Order Partial Differential equations

No. of Lectures-07

Non-linear partial differential Equations of *Type I* $f(p, q)=0$, *Type II* $f(p, q, z) = 0$, *Type III* $f1(p, x) = f2(q, y)$, Linear partial differential equations – Lagrange’s method, Solution of partial differential equation by method of separation of variables.

Unit 2: Fourier series:

No. of Lectures-06

Introduction, Definition, Euler's formula, Fourier series of periodic functions with period 2π and $2L$, Dirichlet's theorem (only statement), even and odd functions, half range sine, and cosine series.

Unit 3: Numerical Integration:

No. of Lectures-07

Newton Cotes Integration Formula: Trapezoidal rule, Simpson’s Rule (1/3rd and 3/8th), Double integration, Integration of Equation: Gauss Quadrature 2 point and 3-point method.

SECTION II

Unit 4: Solution of Algebraic and Transcendental Equations:

No. of Lectures-08

Introduction, Basic properties of equations. Bisection Method, False Position Method, Newton-Raphson Method, Multiple Roots, Newton's iterative formula for obtaining square root, and Muller's Method. System of non-linear equations by Newton Raphson Method.

Unit 5: Statistics – I (Probability):

No. of Lectures-08

Random variable, discrete and continuous random variable, Probability density function, Binomial, Poisson, and Normal distributions.

Unit 6: Statistics – II

No. of Lectures-04

Coefficient of correlation and lines of Regression of bivariate data.

Internal Continuous Assessment (ICA)

Minimum 8 Assignments based on the above syllabus.

Text Books:

1. J. N. and P. N. Wartikar, A Text of Applied Mathematics Vol. I and Vol. II, Vidyarthi Grah Prakashan, Pune.
2. B. S. Grewal, Higher Engineering Mathematics, Khanna Publication, Delhi.
3. Jaggi and Mathur, Advanced Engineering Mathematics, Dhanpatrai and Sons, Bhopal.
4. N. P. Bali, Ashok Saxena, and N. Ch. S. N. Iyengar, A Text of Applied Mathematics, Laxmi Publication, Delhi.

Reference Books:

1. Kreyzig, Advanced Engineering Mathematics, John Wiley & Sons, New York.
2. Peter O Neil, Engineering Mathematics, CRC Press.
3. S. G. Gupta, Fundamental of statistics, Himalaya Publishing House.



Walchand Institute of Technology, Solapur
S. Y. B. Tech. (Mechanical and Automation Engineering), Semester-IV
21MAU4CC4T: Kinematics & Theory of Machines

Teaching Scheme

Theory- 3 Hrs/Week
Practical- 2 Hrs/Week

Examination Scheme

ESE - 60 marks
ISE - 40 marks
ICA - 25 marks
OE - 25 marks

Course outcomes:

At the end of the course, students will be able to

1. Identify the nature of kinematic pairs, chains, and Mechanisms.
2. Construct and analyze velocity and acceleration polygon for various mechanisms by graphical method.
3. Analyze the motion transmission by using gear drives.
4. Compute the forces and couples in members for application in the design of machine members.
5. Understand and evaluate the torque transmitted by various friction devices by Uniform pressure & wear theory.
6. Draw a cam profile for specific follower motions

SECTION-I

Unit 1: Fundamentals and Types of Mechanisms

No. of Lectures-06

Kinematic Link, types of links, kinematic pair, types of constrained motion, types of kinematic Chains, types of joints, mechanism, machine, degree of freedom, Kutzbach criterion, Grubler's criterion, Grashoff's law, four bar chain and its inversion, Slider crank and its inversion, double slider crank and its inversion, Condition for correct steering, Davis and Ackermann Steering Gear Mechanism.

Unit 2: Velocity & Acceleration in Mechanisms

No. of Lectures-07

Velocity and acceleration in mechanisms, Velocity analysis in mechanisms by following graphical methods. 1) Relative velocity & acceleration, Corioli's Component of Acceleration 2) Klein's Construction.

Unit 3: Gear & Gear trains

No. of Lectures-07

Gears: Classification of gears, Nomenclature, Law of gear tooth action, Cycloidal and involute tooth profiles. Expressions for the velocity of sliding between teeth, path of contact, arc of contact, and contact ratio. Interference of involute gears, Gear Trains: Simple, Compound, Reverted, and Epicyclic Gear Trains.

SECTION-II

Unit 4: Balancing of Rotating Masses

No. of Lectures-06

Static and Dynamic balancing of rotary masses, Various Methods of balancing of rotating masses, Balancing of reciprocating masses- Primary and secondary unbalanced forces in reciprocating masses, partial balancing of unbalanced primary forces (No Numerical treatment on balancing of reciprocating masses)

Unit 5: Friction**No. of Lectures-07**

Types of friction, laws of friction, friction between screw and nut, screw jack with square and V - treads, torque required to lift or lower the load, efficiency of screw jack, Overhauling & self-locking screws, Uniform Pressure & wear theory, Friction in pivot & collar bearings, friction circle. Friction clutches & brakes, design considerations of clutch.

Unit 6: Cams**No. of Lectures-07**

Types of cams and followers, cam nomenclature, Follower motions, displacement, velocity and acceleration diagrams for following motions of the follower 1) Uniform velocity 2) Simple harmonic motion 3) Uniform acceleration & retardation. 4) Cycloidal motion 5) Oscillatory follower, Construction of cam profile for radial cams with different types of followers.

Internal Continuous Assessment (ICA)

Minimum 8 Assignments/Experiments based on the above syllabus.

Text Books:

1. Ballaney P. L., Theory of Machines, Khanna Publications, New Delhi.
2. Khurmi R. S. & Gupta J. K., Theory of Machines, S. Chand Publications, New Delhi.
3. Bansal R. K., Theory of Machines, Laxmi Publications, New Delhi.
4. V.P. Singh, Theory of Machines, Dhanpat Rai & Sons Co. Pvt. Ltd., Delhi.

Reference Books:

1. Rattan S. S., Theory of Machines, Tata McGraw Hill Publication, New Delhi.
2. Shigley J., Theory of Machines & Mechanisms, McGraw Hill International students' edition.
3. Thomas Bevan, Theory of Machines, CBS Publication, New Delhi



Walchand Institute of Technology, Solapur

S.Y. B.Tech (Mechanical and Automation Engineering) Semester- IV

21MAU4CC5T: Advanced Manufacturing Technology

Teaching Scheme

Lectures–3 Hrs/Week

Practical –2 Hrs/Week

Examination Scheme

ESE – 60Marks

ISE - 40Marks

ICA –25Marks

Course Outcomes: After completion of the course the students will be able to: -

1. Explain the working of manufacturing machine tools like lathe, drilling, milling, etc.
2. Explain the concept of unconventional machine tools like EDM, ECM, AWJM, and USM in mechanical industries.
3. Describe the components of automation in different manufacturing systems
4. Solve Computer Aided Manufacturing related problems and develop CNC part programs.

SECTION -I

Unit 1: Introduction to Traditional Machine Tools

No. of lectures-07

Centre Lathe- Parts and functions, specifications, accessories, and attachments. Lathe operations. Drilling Machine: Classification, construction, and working of Pillar type and radial drilling machines, Job & Tool holding devices and accessories, various operations.

Unit 2: Milling & Gear manufacturing

No. of lectures-07

Classification of Milling Machines, construction and working of column and knee type milling Machines, Milling methods – Up milling and down milling, milling operations, Gear cutting on milling machines, Gear Hobbing

Unit 3: Unconventional Machining

No. of lectures-06

Introduction, classification, the significance of Unconventional machining, Electrical discharge machining (EDM), Electrochemical Machining (ECM), Ultrasonic machining (USM), Abrasive Water Jet Machining (AWJM), Principle, working, applications, advantages, limitations

SECTION -II

Unit 4: Fundamentals of NC system

No. of Lectures: 06

Evolution of NC system, Elements of NC Manufacturing System, concept of work zero and machine zero, Types of NC systems, Steps in NC Manufacturing, Flexible Manufacturing System (FMS) and its types, Elements of FMS, Applications of FMS.

Unit 5: CNC- DNC Technology and Tooling**No. of Lectures: 06**

Classification of CNC machine tools, CNC controllers, Features of CNC, Adaptive Control, Direct Numerical Control, Types of Direct Numerical Control, Tool magazines, Automatic tool changers, Pallets,

Unit 6: CNC Part Programming**No. of Lectures: 08**

Principles of CNC Program, Word Address Format (WAF), Tool Length and Cutter Diameter Compensation, Canned Cycles for Lathe, Milling and Drilling, Introductory treatment of Subprogram.

Internal Continuous Assessment (ICA)

Minimum 8 Assignments/experiments based on the above syllabus.

Text books:

1. Grover M.P, Automation, Production Systems, and Computer Integrated Manufacturing,- Prentice Hall of India
2. Kundra, Rao, Tiwari, Numerical Control -Computer Aided Manufacturing, T. M. Hill Pub. Co.
3. B.S. Raghuvanshi, Workshop Technology (Volume II), Dhanpat Rai Publication
4. P. N. Rao, Manufacturing Technology, Vol. II., McGraw Hill

Reference Books:

1. D.D. Bedworth, M.R Henderson & P.M. Wolfe, Computer Integrated Design and Manufacturing, Tata McGraw Hill Pub. Co.
2. Yoram Koren, Computer control of manufacturing systems, Tata McGraw Hill
3. Asfahl C. R., "Robots and Manufacturing Automation" John Wiley & Sons.



Walchand Institute of Technology, Solapur

S. Y. B. Tech. (Mechanical and Automation Engineering), Semester-IV
21MAU4ES6P: Programming using Python

Teaching Scheme

Theory - 2 Hrs/Week
Practical - 2 Hrs/Week

Examination Scheme

ISE -25 marks
ICA -25 marks
POE - 50 marks

Course Outcome:

At the end of this course, students will be able to

1. Write and compile Python scripts by appropriately selecting decision and loop control structures.
2. Write and compile Python scripts using functions.
3. Write and compile Python scripts using various sequence datatypes such as tuple, dictionary, and string.

SECTION I

Unit 1: Introduction to Python and Computer Programming **No. of Lectures 03**
Python basics, Features of Python, A basic program in python

Unit 2: Data Types, Variables, Basic Input-Output Operations, Basic Operators **No. of Lectures 04**

Sample python program, Python literals, Operators - data manipulation tools, Variables - data-shaped boxes, Input and Output Statements

Unit 3: Boolean Values, Conditional Execution, Loops, Lists and List Processing, Logical and Bitwise Operations **No. of Lectures-08**

Making decisions in Python, Python's loops, Logic and bit operations in Python, Lists - collections of data, sorting simple lists - the bubble sort algorithm, Lists - some more details, Lists in advanced applications

SECTION II

Unit 4: Functions **No. of Lectures-06**

Writing functions in Python, how functions communicate with their environment, returning a result from a function, Types of arguments in Python, Scope of Variables in Python, recursive functions, map function, and filter function.

Unit 5: Tuples, Dictionaries, and Data Processing **No. of Lectures-05**

Tuple Creation, Accessing Elements of tuple, Functions in tuple, dictionary Creation, accessing data from the dictionary, Updating Dictionary, Functions of dictionary

Unit 6: Modules, String, and Exceptions **No. of Lectures-04**

Using modules, some useful modules, Errors, The anatomy of exception, some of the most useful exceptions, Python's nature of strings, String methods, Strings in action, programs on module strings & exception.

Internal Continuous Assessment (ICA)

1. Any two-computer programs on data types, variables, basic input-output operations, and basic operators.
2. Any two-computer programs on Boolean Values and Conditional Execution,
3. Any two-computer programs Loops, Lists, and List Processing, Logical and Bitwise Operations
4. Any two-computer programs on Functions.
5. Any two-computer programs on Tuples, Dictionaries, and Data Processing
6. Any two-computer programs on Modules, String, and Exception Handling.
7. Case Study

Note: Use suitable Python IDE.

Text Books

1. e-Resource: Python 2.7.16 documentation <https://docs.python.org/2/>
2. e-Resource: Python 3.7.3 documentation <https://docs.python.org/3/>
3. Mark Summerfield-Programming in Python 3(Addison-Wesley Professional)

Reference Books

1. Beazley and Brian K. Jones-Python Cookbook, O'Reilly Media, Inc.
2. Mark Lutz - Learning Python, O'Reilly Media, Inc.
3. Mark Lutz - Programming Python, O'Reilly Media, Inc.
4. David Sale - Testing Python, John Wiley & Sons Inc.



Walchand Institute of Technology, Solapur
S. Y. B. Tech. (Mechanical and Automation Engineering), Semester-IV
21MAU4ES7L: Electrical Technology

Teaching Scheme
Practical- 2 Hrs/Week

Examination Scheme
ICA-25 marks

Course Outcomes

On completion of this course, the student will be able to

1. Identify and select a suitable DC motor/induction motor / special purpose motor and its speed control method for a given industrial application.
2. Program Arduino IDE using conditional statements
3. Interfacing sensors with Arduino IDE

SECTION -I

1. Speed control of DC shunt motors by flux control and armature control.
2. Speed control of DC shunt motors by armature voltage control method.
3. Study of starters used for DC shunt motors.
4. Load test on DC Motor
5. Load test on a three-phase induction motor.
6. Load test on single-phase induction motor.
7. Study of starters used for three-phase induction motor.
8. Study characteristics and applications of different types of AC and DC motors.

SECTION -II

1. Build and test combinational logic & sequential logic circuits in the simulator and on a breadboard.
2. Basic programming on 8085 trainer/simulator as an introduction to microprocessor and assembly programming.
3. Basic programming on 8051 trainer/simulator as a basic introduction to microcontroller.
4. Interface IR sensor, sound sensor, and range sensor with Arduino Uno microcontroller board.
5. Interface and control stepper motor with Arduino Uno board.
6. Interface and control DC motor using PWM with Arduino Uno board.
7. Interface and control DC servo Motor using Arduino Uno board.
8. Build a small circuit that will demonstrate interfacing both sensors and actuators with the Arduino UNO board

Textbooks:

- 1) Vedam Subramaniam, Electric Drives, McGraw Hill
- 2) Massimo Banzi & Michael Shiloh, Make: Getting Started With Arduino, Shroff Maker Media.

Reference Books:

- 1) A Fitzgerald, Charles Kingsley, Stephan Umans, Electric Machinery, McGraw Hill
- 2) Ned Mohan, Electric Machines and Drives: A First Course, Wiley India.
- 3) Morris Mano, Digital Logic & Computer Design, Pearson India.
- 4) M Mazidi, 8051 and embedded systems, Pearson India.
- 5) W Bolton, Mechatronics, Pearson India.



Walchand Institute of Technology, Solapur
S. Y. B. Tech. (Mechanical and Automation Engineering), Semester-IV
21GEU4MC2T: Environmental Studies

Teaching Scheme
Theory -1Hr/Week

Examination Scheme
ESE - 50 marks

Course Outcomes:

At the end of this course, the students will be able to

- 1 Recognize and understand the major concepts in Environmental studies & demonstrate in depth understanding of the Environment.
2. Understand inter disciplinary approach.
3. Evaluate the critical analytical skills concerning to energy portfolios & other.

Unit 1: Nature of Environmental studies **(2 Hrs.)**

Definition, scope and importance

Multidisciplinary nature of environmental studies, Need for public awareness

Unit 2: Natural resources and associated problems. **(5 Hrs.)**

- a) Forest, resources, use and over-exploration, deforestation, timber extraction, mining, dams and their effects on forests and tribal people.
- b) Water resources, Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dam's benefits and problems
- c) Mineral resources. And usage and exploitation, environmental effects of extracting and using mineral resources.
- d) Food resources, world food problem, changes caused by agriculture effects of modern agriculture, fertilizer-pesticide problems
- e) Energy resources, growing energy needs renewable and non-renewable energy sources, use of alternate energy sources
- f) Land resources, land as a resource, land degradation man induced landslides, soil erosion and desertification
- g) Role of an individuals in conservation of natural resources
- h) Equitable use of resources for sustainable lifestyle

Unit 3: Ecosystems **(5 Hrs.)**

- a) Concept of an ecosystem
- b) Structure and function of an ecosystem
- c) Producers, consumers and decomposers
- d) Energy flow in the ecosystem
- e) Ecological succession
- f) Food chains, food webs and ecological pyramids

Introduction types, Characteristics features, structure and function of the ecosystem:-

- I. Forest ecosystem
- II. Grassland ecosystem
- III. Desert ecosystem

IV. Aquatic ecosystems (ponds, streams, lakes, rivers ,oceans, estuaries)

Unit 4: Biodiversity and its conservations

(5 Hrs.)

- a) Introduction-Definition, genetic, species and ecosystem diversity
- b) Biogeographically classification of India
- c) Value of biodiversity consumptive use, productive use, social, ethical aesthetic and option values
- d) Biodiversity at global, national and local levels
- e) India as a mega-diversity nation
- f) Western Ghats as a bio-diversity region
- g) Hot -spot of biodiversity
- h) Threats of biodiversity, habitat loss, poaching of wildlife, man wildlife conflicts
- i) Endangered and endemic, species of India
- j) Conservation of biodiversity, in-situ and Ex-situ conservation of biodiversity

Unit 5: Environmental Pollutions

(5 Hrs.)

Definitions:- Causes, effects and control measures of

- a) Air Pollution
- b) Water pollution
- c) Soil Pollution
- d) Marine pollution
- e) Noise pollution
- f) Thermal pollution
- g) Near hazards
- h) Solid waste Management, causes effects and control measures of urban and Industrial wastes
- i) Role of an individual in presentation of pollution
- j) Pollution case studies
- k) Disaster management:-Floods, earthquake, cyclone and landslides, Tsunami

Unit 6: Social issues and the Environment

(4 Hrs.)

- a) From Unsustainable to Sustainable development
- b) Urban problems related to energy
- c) Water conservation, rain water harvesting, watershed management
- d) Resettlement and rehabilitation of people, its problems and concerns
- e) Environmental ethics, issue and possible solutions
- f) Climate change, Global warming, acid rain, Ozone layer depletion, nuclear accidents and holocaust.
- g) Consumerism and waste products

Unit 7: Environmental Protection

(4 Hrs.)

- a) Environment Protection act
- b) Air (prevention and control of Pollution act)
- c) Water (prevention and control of Pollution act)
- d) Wildlife Protection act
- e) Population growth and human health, human rights



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