WALCHAND INSTITUTE OF TECHNOLOGY, SOLAPUR
(AN AUTONOMOUS INSTITUTE)

Affiliated to
Punyashlok Ahilyadevi Holkar Solapur University,
Solapur

CHOICE BASED CREDIT SYSTEM (CBCS)

Structure and Syllabus
for
S.Y.B. Tech. in Mechanical & Automation Engineering
as per NEP -2020
(With Effect from 2023-24)
Scheme - 2023

(Dr. S. B. Tuljapure)
Chairman
Board of Studies in Mechanical Engineering

Mechanical Engineering Department

Department Vision

To produce world class globally competent distinguished graduates/ post graduates/ doctoral, Mechanical Engineers on the basis of their capabilities, dedication and work ethic and continuously strive towards societal development.

Department Mission

- To impart quality Mechanical Engineering education in accordance with the needs of the society.
- To produce globally competent Mechanical Engineers through research,industry institute interaction.
- To help Mechanical Engineering graduates to implement their acquired engineering knowledge for society and community development.

Mechanical and Automation Engineering

Under Graduate Program

Program Educational Objectives (PEOs)

1. Graduate will excel in professional career in the field of Mechanical and Automation Engineering.
2. Graduate will exhibit strong fundamentals required to pursue higher education and continue professional development in emergingtechnology in Mechanical and Automation Engineering.
3. Graduate will adhere to ethics; develop team spirit and effective communication skills to be successful leaders with a holistic approach to societal and environmental issues with professional conduct.

Program Outcomes (POs)

The program outcomes of B. Tech. Mechanical and Automation Engineering Program are summarized as following:

1. **Engineering Knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem Analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences.
3. **Design/Development of Solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

4. **Conduct Investigations of Complex Problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. **The Engineer and Society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities, relevant to the professional engineering practice.
7. **Environment and Sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and Team Work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. **Project Management and Finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one‟s own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

12. **Life-long Learning:** Recognize the need for, and have the preparation and ability to engage in independent and lifelong learning in the broadest context of technological change.

Program Specific Outcomes (PSOs)

1. Design high quality mechanical and automation engineering equipment for the modern industry and society.
2. Implement manufacturing processes for mechanical and automation engineering equipment.

Legends used–

L	Lecture Hours / week
T	Tutorial Hours / week
P	Practical Hours / week
FA	Formative Assessment
SA	Summative Assessment
ESE	End Semester Examination
ISE	In Semester Evaluation
ICA	Internal Continuous Assessment
POE	Practical and Oral Exam
OE	Oral Exam
MOOC	Massive Open Online Course
HSS	Humanity and Social Science
NPTEL	National Programme on Technology Enhanced Learning
F.Y.	First Year
S.Y.	Second Year
T.Y.	Third Year
B.Tech.	Bachelor of Technology

Course Code Format:

2	**1**	**M**	**A**	**U/P**	**2**	**C**	**C**	**1**	**T / L**
Year of Syllabus revision		Program Code		U-Under Graduate, P-Post Graduate	Semester No. / Year 1/2/3/…8	Course Type		Course Serial No. 1-9	T-Theory, L-Lab session

Program Code MA	Mechanical and Automation Engineering
Course Type	
BS	Basic Science
ES	Engineering Science
HU	Humanities & Social Science
MC	Mandatory Course

CC	Core Compulsory Course
SN*	Self-Learning **N*** *indicates the serial number of electives offered in therespective category*
EN*	Core Elective **N*** *indicates the serial number of electives offered in therespective category*
SK	kill Based Course
SM	Seminar
MP	Mini project
PR	Project
IN	Internship

Sample Course Code:

21MAU1BS1T	Engineering Physics (Group A)

Walchand Institute of Technology, Solapur

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

Semester-III

Course Code	Name of Course	Engagement Hours			Credits	FA		SA		Total
		L	T	P		ESE	OE/ POE	ISE	ICA	
MAPCC02	Mechanics of Materials	2		2	3	60		40	25	125
MAPCC03	Manufacturing Processes & Technology	2		2	3	60		40	25	125
MAPCC04	Applied Thermodynamics	2		2	3	60	25	40	25	150
MAPCC05	Programming in C++	1		2	2		50	25	25	100
MACEPFP	Community Engagement Project (CEP)/ Field Project (FP)			4	2				50	50
OE01	Open Elective I	2	1		3	60		40	25	125
EEM01	Entrepreneurship Development	1	1		2				50	50
VEC01	Universal Human Values	2			2	50*				50
MDM01	Multidisciplinary Minor I	2			2	60		40		100
	Total	**14**	**2**	**12**	**22**	**350**	**75**	**225**	**225**	**875**

Semester -IV

Course Code	Name of Course	Engagement Hours			Credits	FA		SA		Total
		L	T	P		ESE	OE/ POE	ISE	ICA	
MAPCC06	Kinematics & Dynamics of Machinery	2		2	3	60	25	40	25	150
MAPCC07	Fluid Mechanics & Fluid Machines	2		2	3	60		40	25	125
MAPCC08	Mechatronics	2		2	3	60		40	25	125
MAPCC09	Computer Aided Machine Drawing	1		2	2		50		25	75
MAVSEC03	Electrical Technology	1		2	2				50	50
MAEEM02	Project Management	2			2	60		40		100
OE02	Open Elective II	2	1	-	3	60		40	25	125
AEC02	General Proficiency	1	1		2				50	50
VEC02	Professional Ethics	2			2			50		50
MDM02	Multidisciplinary Minor II	1		2	2			50	25	75
	Total	**16**	**2**	**12**	**24**	**300**	**75**	**300**	**250**	**925**
MASL01	Environmental Science					50*				
										975

*Examination will be MCQ based.

Walchand Institute of Technology, Solapur

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

MAPCC02 MECHANICS OF MATERIALS

Teaching Scheme	**Examination Scheme**
Lectures– 2 Hours/week, 2 Credits	**ESE** - 60 Marks
Practical – 2 Hours/week, 1 Credit	**ISE** - 40 Marks
	ICA - 25 Marks

The course provides a fundamental study on stresses and strains on deformable solids. It focuses on the analysis of members subjected to axial, bending, and torsional loads. The course discusses in detail, the shear force and bending moments on beams. It introduces the concept of principal stresses in the analysis of structural members. In a nutshell, the course aims at developing the skill to solve design problems on analysis of Mechanical Elements which is basic need of mechanical engineering.

Course Prerequisite:

1. Knowledge of Basic Mechanical Engineering
2. Knowledge of Engineering mechanics.

Course Objectives:

1. To develop understanding of the basic concepts related to different types of stresses in engineering components and basic knowledge of principal stresses and strains.
2. To make students understand concept of shear force and bending moment also slope and deflection beams.
3. To make the students learn and draw bending stresses and shear stresses in of various cross sections.
4. To make student learn basic principles of torsion in shafts

Course Outcomes:

After completing this course, student shall be able to -

1. Demonstrate fundamental knowledge of different types of stresses induced for given applications and compute principal stresses, position of principal planes.
2. Draw & interpret SFD, BMD for various beams and mark salient points.
3. Formulate the bending and shear stresses equations and draw bending and shear stress diagrams.
4. Determine torsional strength in shafts and slope and deflection in beams

Unit 1 – Shear force & bending moment Diagrams No of lectures – 06

Concept of shear force and bending moment and its sign conventions, determinate beams (Simply supported, cantilever and overhanging) due to concentrated load, UDL, UVL and Couple. Maximum bending moment and position of points of contra flexure

Unit 2 – Simple stresses and strains No of lectures – 05

Concepts of Stress, strain, Hooke's law, Poisson's ratio, Elastic constants & interrelation between elastic constants, factor of safety. Stresses and strains in homogeneous and composite bars under concentrated loads, principle of super position.

Unit 3 – Bending and shear stresses in beams No of lectures – 05

Bending stresses: Theory of simple bending, assumptions, derivation of flexural formula, second moment of area of common cross sections (circular, rectangular, I, T section etc.) moment of resistance and section modulus.

Shear stresses: Concept, derivation of shear stress distribution formula, shear stress distribution diagrams for common symmetrical and unsymmetrical sections such as rectangular, circular, I and T etc. (Only numerical)

Unit 4 – Torsion of circular shafts No of lectures – 03

Introduction to Torsion, Basic assumptions, Torsion equation, Stresses in hollow and solid circular shafts, power transmitted by shaft.

Unit 5 – Principal stresses and strains No of lectures – 05

Concept of principal stress and principal planes, expression for principal stresses and maximum shear stress, position of principal planes and planes of maximum shear, Graphical solution using Mohr's circle of stresses. (2-D stress System)

Unit 6 – Slope and deflection in beams No of lectures – 04

Bending into a circular arc – slope, deflection and radius of curvature Double integration – Determination of slope and deflection for cantilever & simply supported beam subjected to point load, U.D.L.

- **Internal Continuous Assessment (ICA):**

  ICA consists of minimum 8 practical / assignments based on curriculum.

  Recommended practicals/assignments:

  1. Solving numerical on simple & stress and strains
  2. Analytical and Graphical Solution (Mohr's Circle) for compound stresses.
  3. Drawing SFD and BMD for standard beam and loading conditions.
  4. Determine & draw bending stresses and shear stresses distribution diagram in the beam.
  5. Solving the numerical on solid and hollow shafts.
  6. Experiment of Tensile testing on mild steel specimen.
  7. Determination of slope and deflection by using double integration method.
  8. Determination and Graphical representation using suitable FEA tool. (Any One)
     a) Determine Principal Stresses, Maximum shear stresses and their locations.
     b) Plot SFD and BMD for a given beam.
     c) Find Bending/Shear Stresses and Bending/Shear Stress distribution.

- **Textbooks**

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

- **Reference Books**

1. Beer and Johnson, Strength of materials, Mc-Graw Hill International student series.
2. Timoshenko & Young, Strength of materials, CSB Publishers.
3. Ramamrutham S., Strength of materials, Dhanpat Rai & Co. (P) Ltd., Delhi.

Walchand Institute of Technology, Solapur

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

MAPCC03 MANUFACTURING PROCESSES AND TECHNOLOGY

Teaching Scheme	**Examination Scheme**
Lectures– 2 Hours/week, 2 Credits	**ESE** - 60 Marks
Practical – 2 Hours/week, 1 Credit	**ISE** - 40 Marks
	ICA - 25 Marks

This course covers all primary manufacturing processes like casting, forging, rolling, extrusion and Drawing along with Fabrication. These processes are basics of Mechanical Engineering Programme. The basics of this processes along with their applications and equipment and machinery required for the processes is covered in brief. Further machining is another method of manufacturing products with the use of machine tools which are also discussed in brief.

Course Prerequisite:

Fundamentals of mechanics, force, power and mechanical properties of materials, thermal properties of materials is required to be known.

Course Objectives:

1. To introduce to the students the casting technique and its significance in manufacturing.
2. To introduce to the students with various plastic deformation processes and their application.
3. To study the conventional machining processes such as drilling, milling, shaping, planning carried out on typical machine tools for different applications.
4. To study unconventional machining processes such as EDM, ECM, AWJM and USM carried out on special purpose machine tools for typical applications

Course Outcomes:

After completing this course, student shall be able to -

5. Select the suitable manufacturing processes as per the requirement from available processes.
6. Select the suitable forming process as per the requirement from available conventional and unconventional forming processes.
7. Select the suitable manufacturing technology as per the requirement from available conventional and unconventional technology.
8. Demonstrate proficiency in writing the CNC part program for the basic machining operations.

Unit 1 - Casting Processes No of lectures – 04

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 – 04

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

Unit 3 –Forming Processes No of lectures – 04

Classification of forming processes, forging, types of forging, numerical on upset forging. Extrusion and its types, Wire drawing process and its types, Rolling process and its types, numerical on rolling. Advanced forming processes and types.

Unit 4 – Advanced Forming Processes No of lectures – 04

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

Unit 5 – Introduction to Traditional Machine Tools No of lectures – 04

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.
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.

Unit 6 - Unconventional Machining No of lectures – 04

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

Unit 7 – NC-CNC- DNC Technology and Tooling No of lectures – 04

Elements of NC Manufacturing System, concept of work zero and machine zero, Steps in NC Manufacturing.

Classification of CNC machine tools, CNC controllers, Adaptive Control, Direct Numerical Control and its types, Tool magazines, Automatic tool changers,

Unit 8 - CNC Part Programming No of lectures – 04

Principles of CNC Program, Word Address Format (WAF), Tool Length and Cutter Diameter Compensation, Canned Cycles, Subprogram.

- **Internal Continuous Assessment (ICA) :**
  ICA consists of minimum 8 practical based on curriculum.
  Recommended practicals:

1. Study of patterns and layouts.
2. Study of casting defects.
3. Testing of casting sand properties
4. Study of welding processes.
5. Lathe Mechanism, attachments and operations.
6. Gear cutting on milling and indexing.
7. Study of Flexible Manufacturing System.
8. Introduction to CNC/VMC machines.
9. Assignment on unconventional machining methods
10. Assignment on advanced forming processes.

- **Textbooks**
    1. Generation of electrical energy – B.R.Gupta, S.Chand & co. ltd.
    2. A course in Power Plant Engineering – Arora Domkundwar ,Dhanpat Rai & co.
    3. Solar Energy – S. P. Sukhatme, Tata McGraw hill co.
    4. Solar Energy – G. D. Rai, Khanna Publisher.
    5. Energy Technology – S.Rao & Dr.B.B.Purulekar, Khanna publishers.
    6. Power Plant Engineering – P.K.Nag, Tata McGraw hill publishing co.
    7. Power Plant Engineering – R. K. Rajput
- **Reference Books**
    1. Power Plant Technology – M. M. El Wakil.
    2. Berau of Energy efficiency Manual
    3. Non-conventional Energy Sources- G.D.Rai, Khanna Publisher.

Walchand Institute of Technology, Solapur

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

MAPCC04 APPLIED THERMODYNAMICS

Teaching Scheme	**Examination Scheme**
Lectures– 2 Hours/week, 2 Credits	**ESE** - 60 Marks
Practical – 2 Hours/week, 1 Credit	**ISE** - 40 Marks
	ICA - 25 Marks
	OE - 25 Marks

Applied Thermodynamics" is a topic of core Mechanical Engineering. This course provides pre-requisites for steam and gas power cycle, refrigeration cycle, psychometric principles, internal combustion engine and gas turbine engine cycles. The syllabus covers basic properties of fluids, design of boiler, condenser, turbine, nozzle, and compressor. It helps students to understand and address industrial applications.

Course Prerequisite:

Basic knowledge of Physics, Chemistry, Mathematics.

Course Objectives:

1. Understand thermal properties like pressure, temperature, enthalpy, entropy, internal heat etc.
2. Understand thermodynamic laws.
3. Analyse boiler, boiler accessories. nozzle and compressor.
4. Apply thermodynamic relation for design of boiler.

Course Outcomes:

After completing this course, student shall be able to:

1. Apply knowledge of mathematics and science to solve real thermodynamics problems.
2. Evaluate performance of mechanical devices like boiler, compressor, steam turbine, etc.
3. Apply knowledge of basic thermodynamic concepts for analysis of vapour power cycles
4. Apply knowledge of thermodynamics concepts for analysis of flow of steam nozzles and steam condensers.

Unit 1- Basic Laws of Thermodynamics No. of Lectures-04

Review of basic concepts, Zeroth, First, and Second Law of Thermodynamics, Limitation of first law of thermodynamics, Kelvin-Planck, and Clausius statements and their equivalence. heat engine, refrigerator and heat pump, Reversibility and Irreversibility, Carnot cycle. Reversed Carnot cycle, Enthalpy,

Unit 2- Entropy No. of Lectures-03

Entropy definition, Principle of entropy increase Calculation of entropy change for: i) Phase change of pure substance ii) Change of state of an ideal gas.

Unit 3- Properties of pure substance & steam No. of Lectures-04

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 4- Performance of Boilers No. of Lectures-03

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

Unit 5- Vapour Power Cycles No. of Lectures-04

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

Unit 6- Steam Condensers No. of Lectures-03

Elements of steam condensing plants, types of condensers, thermodynamic analysis of condensers, efficiencies.

Unit 7- Steam Nozzles No. of Lectures-03

Types of nozzles, flow of steam through nozzles, condition for maximum discharge, expansion of steam considering friction, Supersaturated flow through nozzles, Mach. No., Types of flows.

Unit 8- Reciprocating Air Compressors No. of Lectures-04

Uses of compressed air, classification of compressor, 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)**

ICA consists of minimum 8 practical based on curriculum.

Recommended practicals:

1. Flash and fire point of oil.
2. Test on grease penetrometer & dropping point apparatus.
3. Experiment on Redwood viscometer.
4. Study of boiler mountings.
5. Study of boiler accessories.
6. Case study of boiler heat balance sheet.
7. Application of Computational fluid dynamic (CFD) in thermodynamics.
8. Computer programme to solve thermodynamic problems.
9. Industrial visit to study boilers.

- **Text Books**

1. A Course in Thermal Engineering -S. Domukundwar, Kothandraman ,Dhanpat Rai & Co. Delhi.
2. Basic & Applied Thermodynamics -P.K. Nag Tata McGraw Hill Publication

- **Reference Books**

1. Thermodynamics: An Engineering Approach, by Yunus A. Cengel, Michael A. Boles and Mehmet Kanoglu, McGraw Hill publication.
2. Fundamentals of engineering thermodynamics, by Michael J. Moran and Howard N. Shapiro, Wiley publication.

Walchand Institute of Technology, Solapur

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

MAPCC05 PROGRAMMING IN C++

Teaching Scheme	**Examination Scheme**
Theory- 1 Hour./Week, 1 Credit	**ISE** - 25 marks
Practical- 2 Hours./Week, 1 Credit	**ICA** - 25 marks
	POE- 50 marks

This course deals with the study of basic concepts involved in programming, like character sets, tokens, and operators. Section I includes an overview of the OOP's flow control structure, and in Section II, with the emphasis given on classes, objects, constructors, etc., After completion of this course, the students will be able to develop a program on problems related to the mechanical engineering field.

Course Prerequisite:

Programming for problem-solving using C.

Course Objectives:

The objectives of the course are to have students identify and practice object-oriented programming concepts and techniques, and practice the use of C++ classes and class libraries, arrays, vectors, inheritance, and file I/O stream concepts.

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++ programs by applying knowledge of various features like class, object, etc.
3. Apply knowledge and programming skills to solve various computing problems in the mechanical engineering field.
4. Develop the programmes using coding conventions that followed in software industries

Unit 1: Introduction to Object-Oriented Programming No. of Lectures-02

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

Unit 2: C++ Programming Basics No. of Lectures-02

C character set, tokens, constants, variables, keywords, primitive data types, operator's operator precedence, expressions, type casting, and type conversion.

Unit 3: Control Structures No. of Lectures-02

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

Unit 4: Functions No. of Lectures-02

Function Prototyping, Function Overloading, and Math Library Functions.

Unit 5: Classes & Objects No. of Lectures-02

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: Principles of OOP's No. of Lectures-03

Abstraction, Inheritance, Polymorphism, Encapsulation.

Unit 7: Constructor No. of Lectures-02

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

Unit 8: Coding Conventions No. of Lectures-01

- **Internal Continuous Assessment (ICA)**

  ICA consists of minimum 8 practical / assignments based on curriculum.
  Recommended practicals/assignments:

1. Implementation of control statements in basic mathematical operations.
2. Implementation of control statements in basic mechanical design fields.
3. Implementation of functions in geometrical data findings.
4. Develop a code to find properties in Thermal fields.
5. Develop class for 2D shapes used for beams.
6. Execute a code on encapsulation.
7. Execute a code for polymorphism.
8. Execute a code for abstraction.
9. SOLID code convention.
10. development of code on any mechanism.

- **Text Books:**

1. Yashwant Kanitkar, Let us C++, BPB Publication

- **Reference Books:**

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

Walchand Institute of Technology, Solapur

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

MACEPFP COMMUNITY ENGAGEMENT PROJECT/ FIELD PROJECT

Teaching Scheme **Examination Scheme**

Practical – 4 Hours/week, 2 Credits **ICA -** 50 Marks

Community Engagement Project/ Field Project is an experiential learning strategy that integrates meaningful community engagement with instruction, participation, learning and community development. It applies the experience to personal and academic development. It is meant to link the community with the institutes for mutual benefit. The community will be benefited with the focused contribution of the students for the village/ local development. The institute finds an opportunity to develop social sensibility and responsibility among students and also emerge as a socially responsible institution.

Course Objectives:

1. To sensitize the students to the living conditions of the people who are around them
2. To help students to realize the harsh realities of the society
3. To bring about an attitudinal change in the students and help them to develop societal consciousness, sensibility, responsibility and accountability
4. To make students aware of their inner strength and help them to find new /out of box solutions to the social problems
5. To make students socially responsible citizens who are sensitive to the needs of the disadvantaged sections
6. To help students to initiate developmental activities in the community in coordination with public and government authorities

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Course Outcomes:

After completing this course, student shall be able to -

1. Apply the knowledge to solve the real world problems
2. Demonstrate complexity of understanding, problem analysis, problem-solving, critical thinking, and cognitive development
3. Develop interpersonal skills, particularly the ability to work well with others, and build leadership and communication skills
4. Improve social responsibility and citizenship skills
5. Develop connections with professionals and community members for learning and career opportunities

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Procedure:

- Form a group of not more than 5 students.
- A mentor/guide will be allotted for each group.
- Students should finalize a particular habitation or village or municipal ward, as far as possible, in the near vicinity of their place of stay.
- Students may work in close association with Non-Governmental Organizations like Lions Club, Rotary Club, etc. or with any NGO actively working in that habitation.
- Then, they should conduct a preliminary survey including the socio-economic conditions of the allotted habitation, in terms of their own domain or subject area. Or it can even be a general survey, incorporating all the different areas.

- If required, a survey form based on the type of habitation (rural, urban etc.) should be prepared before visiting the habitation.
- The Governmental agencies, like revenue administration, corporation and municipal authorities and village secretariats may be aligned for the survey.
- Analysis of the collected data should be done.
- A solution should be proposed to the problem identified.

Students should prepare a report which should include following points.

- Introduction
- Primary Data obtained through survey/ field visit
- Analysis of collected data
- Proposed Solution

Students may take help from different government departments like –

- Agriculture
- Health
- Marketing and Cooperation
- Animal Husbandry
- Horticulture
- Fisheries
- Sericulture
- Revenue and Survey
- Natural Disaster Management
- Irrigation
- Law & Order
- Excise and Prohibition
- Mines and Geology
- Energy

Examples of community engagement / field projects are as below:

- Study of per capita domestic water consumption in the selected colonies in the ward
- Study and characterization of domestic waste generation in the ward
- Analysis of depot level operations data
- Study of depot level maintenance processes
- Study and mapping of open drains in the ward
- Study of availability and access of public toilets in the ward
- Study and mapping of community spaces in the ward

Walchand Institute of Technology, Solapur

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

EEM01 ENTERPRENEURSHIP DEVELOPMENT

Scheme **Examination Scheme**

Lectures– 1 Hour/week, 1 Credit **ICA** - 50 Marks

Tutorial – 1 Hour/week, 1 Credit

Entrepreneurship education in India has gained relevance in today's context. Education in the area of entrepreneurship helps students to develop skills and knowledge, which could benefit them for starting, organizing and managing their own enterprises. Entrepreneurship education encourages innovation, fosters job creation, and improves global competitiveness. This course will focus on key attributes of Entrepreneurship: Qualities of a successful entrepreneur, Entrepreneurship Development Programmes, Ideation Techniques, Business Plan Formulation, and Different Support Systems. To sum up, the course will make students to have an understanding of the complete entrepreneurial ecosystem.

Course Objectives:

1. To familiarize with entrepreneurship and its significance in national development
2. To develop skills required to establish and run a successful enterprise
3. To acquaint with the options available with new entrepreneurs
4. To formulate business plan/project report for a startup
5. To acquaint with support system associated with entrepreneurial development

Course Outcomes:

After completing this course, student shall be able to -

1. Identify the qualities required to become a successful entrepreneur
2. Select the proper type of Entrepreneurship Development Programmes
3. Identify the business opportunities that fit the individual or the group & prepare a business plan
4. Select a proper funding option for establishing new enterprise.

Unit-1: Entrepreneur No. of lectures-3

Concept, meaning and definitions of entrepreneur, need of entrepreneur, intrapreneur, social entrepreneur, qualities of entrepreneurs, types of entrepreneurs.

Unit-2: Entrepreneurship Development No. of lectures- 4

Concept of entrepreneurship, Entrepreneurship Development Programmes (EDPs)- meaning & need of EDPs, course content & curriculum of EDPs, phases of EDPs, problems of EDPs

Unit-3: Entrepreneurial Project Development No. of lectures- 4

Idea generation–sources and methods, preparation of a project report/ business plan including: market plan, financial plan, operational plan, HR plan, working capital management, break even analysis etc.

Unit-4: Small-Medium Enterprises and Support Systems No. of lectures- 3

Meaning and definition of Micro, Small & Medium Enterprises, forms of business ownership, Funding options available, role of government organization to support business.

- **Internal Continuous Assessment (ICA) :**

Students of a batch should be divided into groups (consisting of maximum five members) to carry out the following tasks:

1. Two case studies on successful entrepreneurs
2. Two case studies on failure of businesses
3. Idea generation & selection of an idea for business

4. Preparation of project report / business plan for starting a small unit and presentation on the same.

- **Textbooks**

1. Entrepreneurial Development, Dr. S. S. Khanka, S. Chand Publications
2. Small-Scale Industries and Entrepreneurship - Vasant Desai, Himalaya Publishing House
3. Entrepreneurship, Alpana Trehan, Dreamtech Press

- **Reference Books**

1. Dynamics of Entrepreneurial Development and Management - Vasant Desai, Himalaya Publishing House
2. Entrepreneurship & Small Business, Michael Schaper, Thierry Volery, Pauli Weber, Kate Lewis, Wiley Publicatiion
3. Entrepreneurship, Robert Hisrich, Michael Peters, Dean Shepherd, Sabyasachi Sinha, McGraw Hill Publication

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Walchand Institute of Technology, Solapur

S. Y. B. Tech. All Branches of Engineering - Semester-III

VEC01 UNIVERSAL HUMAN VALUES

Teaching Scheme:	**Examination Scheme:**
Lectures: 2 hours per week, 2 Credits	**ESE** - 50 marks

The salient features of this course are:

1. It presents a universal approach to value education by developing the right understanding of reality (i.e. a worldview of the reality "as it is") through the process of self-exploration.
2. The whole course is presented in the form of a dialogue whereby a set of proposals about various aspects of the reality are presented and the students are encouraged to self-explore the proposals by verifying them on the basis of their natural acceptance within oneself and validate experientially in living.
3. The prime focus throughout the course is toward affecting a qualitative transformation in the life of the student rather than just a transfer of information.
4. While introducing the holistic worldview and its implications, a critical appraisal of the prevailing notions is also made to enable the students discern the difference on their own right.

Course Prerequisite:

None. UHV-I Universal Human Values – Introduction (desirable)

Course Objectives:

This introductory course input is intended:

1. To help the students appreciate the essential complementarily between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity which are the core aspirations of all human beings.

2. To facilitate the development of a Holistic perspective among students towards life and profession as well as towards happiness and prosperity based on a correct understanding of the Human reality and the rest of existence. Such a holistic perspective forms the basis of Universal Human Values and movement towards valuebased living in a natural way. Holistic, Value-Based Education for Realising the Aspirations articulated in NEP2020

3. To highlight plausible implications of such a Holistic understanding in terms of ethical human conduct, trustful and mutually fulfilling human behavior and mutually enriching interaction with Nature.

Thus, this course is intended to provide a much-needed orientational input in value education to the young enquiring minds.

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

1.Become more aware of themselves, and their surroundings (family, society, nature)

2.Would become more responsible in life, and in handling problems with sustainable solutions, while keeping human relationships and human nature in mind.

3.Have better critical ability.

4. Become sensitive to their commitment towards what they have understood (human values, human relationship and human society)

5. Apply what they have learnt to their own self in different day-to-day settings in real life, at least a beginning would be made in this direction.

Unit 1: Course Introduction - Need, Basic Guidelines, Content and Process for Value Education:

[No of Lectures-07]

1. Understanding the need, basic guidelines, content and process for Value Education

2. Self-Exploration–what is it? - its 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 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, meaning of Prosperity in detail.

6. Programs to ensure Sanyam and Swasthya

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

1. Understanding Harmony in the family – the basic unit of human interaction

2. Understanding values in human-human relationship; 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, Difference between respect and differentiation; the other

salient values in relationship

5. Understanding the harmony in the society (society being an extension of 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 Coexistence

[No of Lectures-08]

1. Understanding the harmony in the Nature

2. Interconnectedness and mutual fulfillment among the four orders of naturerecyclability 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. Reprinted2008.

2. PL Dhar, RR Gaur, 1990, Science and Humanism, Common wealth Purblishers.

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, Universe Books.

6. SubhasPalekar, 2000, How to practice Natural Farming, Pracheen (Vaidik) Krishi Tantra Shodh, Amravati.

7. A Nagraj, 1998, Jeevan Vidyaek Parichay, 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

1. Value Education websites, http://uhv.ac.in,http://www.uptu.ac.in
2. Story of Stuff, http://www.storyofstuff.com
3. Al Gore, An Inconvenient Truth, Paramount Classics, USA
4. Charlie Chaplin, Modern Times, United Artists, USA
5. IIT Delhi, Modern Technology – the Untold Story
6. Gandhi A., Right Here Right Now, Cyclewala Productions
7. AICTE On-line Workshop on Universal Human Values Refresher Course-I Handouts
8. UHV-I handouts

https://drive.google.com/drive/folders/16eOka8AoBpLGlCDajRvk4MXgfXQWzFCB?usp=sharing

9. UHV-II handouts

https://drive.google.com/drive/folders/15eHkMVguzRBDrb65GFi7jMN6UEP5JEk1?usp=sharing

Walchand Institute of Technology, Solapur

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

MAPCC06 KINEMATICS AND DYNAMICS OF MACHINERY

Teaching Scheme	**Examination Scheme**
Lectures– 2 Hours/week, 2 Credits	**ESE** - 60 Marks
Practical – 2 Hours/week, 1 Credit	**ISE** - 40 Marks
	ICA - 25 Marks
	OE - 25 Marks

Kinematics & Dynamics of Machinery is a fundamental course for Mechanical engineers to understand the working principals of any machine. This course is essential to understand the motion, transmission of the motion and the forces responsible for the motion. It deals with kinematic analysis of mechanisms and machines. The course is expected to help students in their basic understanding and use of kinematic analysis.

Course Prerequisite:

1. Engineering Mechanics
2. Applied Physics

Course Objectives:

1. To make the students conversant with basic concepts of machine and mechanisms applied to real life.
2. To develop the competency to analyze the velocity and acceleration in mechanisms.
3. To develop the competency to understand & apply the principles of gear theory to design various applications.
4. To develop the competency to design a cam profile for various follower motions.
5. To make student learn about the balancing, unbalancing of rotating masses and their effects.

Course Outcomes:

After completing this course, student shall be able to -

1. Identify the nature of kinematic pair, chains and Mechanism.
2. APPLY fundamentals of gear theory as a prerequisite for gear design
3. CONSTRUCT & ANALYZE velocity and acceleration in mechanisms and cam profile for given follower motion.
4. To understand the importance of balancing and implications of computed results in dynamics.

Unit 1 - Fundamentals of Mechanism No of lectures – 05

Kinematic link, Types of links, Kinematic pair, Types of constrained motions, Types of Kinematic pairs, Kinematic chain, Types of joints, Mechanism, Machine, Degree of freedom, Mobility of Mechanism, Inversion, Grashoff's law, Four-Bar Chain and its Inversions, Slider crank Chain, Double slider crank Chain and its Inversions.

Unit 2 – Relative velocity And Acceleration method & Kinematic Analysis of Mechanisms

No of Lectures-06

Basics of Velocity and acceleration in mechanisms, Velocity analysis in mechanisms by following graphical methods- Relative velocity & acceleration method, (problems up to six links) Concept of Corioli's Component of Acceleration.

Kinematic analysis of four bar Mechanism by analytical method- Analytical methods for displacement, velocity and acceleration, analysis of four bar chain.

Unit 3 – Cams & Followers No of lectures – 05

Classification of Followers and Cams, Terminology of Cam Displacement diagram for the Motion of follower as Uniform velocity, Simple Harmonic Motion (SHM), Uniform Acceleration and Retardation Motion (UARM), Cycloid motion, Cam Profile construction for Knife-edge Follower and Roller Follower, Cam jump Phenomenon

Unit 4 –Gears No of lectures – 04

Gear: Classification

Spur Gear: Terminology, law of gearing, Involute and cycloidal tooth profile, path of contact, arc of contact, sliding velocity, Interference and undercutting.

Unit 5 -Gear Trains No of lectures – 04

Gear Train: Types, - simple, compound, reverted and Epicyclic gear Trains.

Unit 6 – Balancing of Rotating and reciprocating Masses No of lectures – 04

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 (theoretical treatment)

- **Internal Continuous Assessment (ICA) :**

  ICA consists of minimum 8 practical based on curriculum.

  Recommended practicals:

  1. Study & Demonstration of various types of pairs, quick return mechanism.
  2. Study & Demonstration of Grashof's Law
  3. Sheet based on generating cam profile for different followers and follower motions (minimum 2 problems)
  4. Generation of involute Gear Teeth profile using Rack & pinion.
  5. Study of static & dynamic balancing of masses using balancing apparatus.
  6. Assignment problems on gear trains (minimum four).
  7. Sheet based on problems on balancing of rotating masses in different plane (minimum two problems on A2 size drawing sheet)
  8. Estimate important kinematic data related to following (any two) mechanisms to sketch them.1. Bicycle free wheel sprocket mechanism 2. Geneva Mechanism 3. Foot operated pump.
  9. To do computer programming for Kinematic Analysis of four bar chain mechanism using Analytical Method by using software/programming language.
  10. Study of characteristics of Governor
  11. Experiment on Gyroscope.
  12. Study of friction and its applications.
  13. Study of Steering gear – Ackerman & Davis steering.

- **Textbooks**

1. S. S. Rattan, "Theory of Machines", Third Edition, McGraw Hill Education (India) Pvt. Ltd., New Delhi. 11.
2. Bevan T, "Theory of Machines", Third Edition, Longman Publication 12.

3. Ballaney, P., “Theory if Machines and Mechanisms”, 2005, ISBN 9788174091222 / 817409122X Khanna Publications.

- **Reference Books**

1. R. L. Norton, “Kinematics and Dynamics of Machinery”, First Edition, McGraw Hill Education (India) P Ltd. New Delhi
2. Dr. V. P. Singh, “Theory of Machine”, Dhanpatrai and Sons.
3. Bevan Thomas, “The Theory of Machines”, 3rd edition, CBS publication.
4. Shiley J. E. and Uicker J.J. „Theory of Machines and Mechanism“, McGraw Hill Inc

Walchand Institute of Technology, Solapur

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

MAPCC07 FLUID MECHANICS & FLUID MACHINES

Teaching Scheme	**Examination Scheme**
Lectures– 2 Hours/week, 2 Credits	**ESE** - 60 Marks
Practical – 2 Hours/week, 1 Credit	**ISE** - 40 Marks
	ICA - 25 Marks

Fluid Mechanics & Fluid Machines course has a wide scope and is of prime importance in several fields of engineering and science. The Fluid Mechanics part emphasizes on the fundamentals, underlying the principles of fluid mechanics and application of those principles to solve real life problems. Fluid Machines part covers the effect the fluid properties & flow parameters on parts of the machines. It explains the different types of energy conversions occurring in fluid machines. It also deals with the design of fluid machines- water turbines & centrifugal pumps considering the various types of efficiencies.

Course Objectives:

1. To understand the basic principles of fluid mechanics
2. To identify various types of flows
3. To understand Bernoulli's theorem & its application
4. To understand concept of dimensional analysis, drag & lift forces, & similarity principles
5. To evaluate the performance of water turbines & centrifugal pumps

Course Outcomes:

At the end of course, students will be able to

1. Solve issues related to fluid statics & kinematics
2. Apply Bernoulli's theorem in real world situations
3. Perform dimensional analysis, calculate drag & lift forces & apply similarity principles
4. Select or design water turbines & centrifugal pumps

Unit 1 – Fluid Statics No of lectures – 04

Center of pressure, Total pressure on immersed surfaces – horizontal, vertical & inclined The principle of buoyancy, Archimedes' principle, conditions of equilibrium for submerged & floating bodies, discussions on stability, Meta-center & metacentric height.

Unit 2 – Fluid Kinematics No of lectures – 04

Lagrangian & Eulerian method of description of fluid flow, Types of flow with examples, Streamlines, path lines & streak lines, velocity components, local & convective acceleration, velocity potential function, equi-potential lines, Laplace equation governing potential flow, stream function, continuity equation in Cartesian co-ordinates.

Unit 3 –Fluid Dynamics No of lectures – 03

Euler's equation along a stream line & Bernoulli's equation, applications of Bernoulli's Theorem: Venturi meter, Orifice meter & Pitot tube, Flow through sharp edged small circular orifices, Determination of hydraulic coefficients of an orifice.

Unit 4 – Flow through pipes No of lectures – 03

Major & minor Energy losses, Darcy-Weisbach equation, loss of head in pipe connections & fittings, equivalent pipe, Hydraulic Gradient Line (HGL) & Total Energy Line (TEL), Siphon, flow through pipes in series & parallel, efficiency of power transmission, maximum

transmission of fluid power through a given pipe

Unit 5 – Dimensional Analysis, Similitude and Forces on Immersed Bodies

No of lectures – 03

Dimensions of Commonly Encountered Fluid Properties, Dimensional Analysis, Buckingham's Π theorem, similitude, modeling, Drag & Lift on immersed bodies

Unit 6 – Impulse Water Turbines No of lectures – 04

Euler's equation for rotodynamic machines, Classification of water turbines, Pelton wheel, Work done and efficiencies of Pelton wheel, working proportions of Pelton wheel, Design of Pelton Turbine runner, governing of Pelton turbine.

Unit 7 – Reaction Water Turbines No of lectures – 04

Construction and Working of Francis, Kaplan turbine. Work done and efficiencies of Francis & Kaplan turbine, Working Proportions of Francis & Kaplan turbine, Draft tube, Types and function, governing of reaction turbines.

Unit 8 – Centrifugal Pumps No of lectures – 03

Working principle, construction, types, various Heads, multistage pumps, Velocity triangles, Minimum starting speed, Maximum Suction Height & Net Positive Suction Head, Methods of priming, Calculations of efficiencies, Discharge, blade angles, Heads, Power required, impeller dimensions, specific speed of pumps, Performance characteristics of pumps.

- **Internal Continuous Assessment (ICA) :**

  ICA consists of minimum 8 practical based on curriculum.

  Recommended practicals

  1. Numerical & theoretical assignments on basics of fluid mechanics (Properties of fluids & related laws)
  2. Numericals on Piezometer, Simple & inverted U tube manometer

  Any six experiments out of the following.

  1. Determination of metacentric height of floating body
  2. Reynold's Experiment
  3. Verification of Bernoulli's theorem.
  4. Calibration of Venturimeter
  5. Determination of minor losses
  6. Trial on a Pelton wheel.
  7. Trial on a Francis/ Kaplan turbine.
  8. Trial on a centrifugal pump.
  9. Two problems using CFD software

- **Textbooks**

  1. Dr. P.N. Modi and Dr. S.M. Seth - Hydraulics and Fluid Mechanics including Hydraulic Machines, Standard Book House.
  2. Dr. R.K. Bansal - Fluid Mechanics and Hydraulic Machines , Laxmi Publication Pvt. Ltd., New Delhi.
  3. Streeter, Wylie, Bedford - Fluid Mechanics, McGraw Hill Publication.

- **Reference Books**

  1. White - Fluid Mechanics, McGraw Hill Publication
  2. Irving Shames - Mechanics of Fluid, McGraw Hill Publication.
  3. Murlidhar - Advanced Fluid Engineering, Narosa Publication.
  4. S. K. Som, G. Biswas- Introduction to Fluid Mechanics and Fluid Machines, Tata McGraw Hill publications

Walchand Institute of Technology, Solapur

Second Year. B. Tech (Mechanical and Automation Engineering)

Semester-IV

MAPCC08 MECHATRONICS

Teaching Scheme	**Examination Scheme**
Lectures– 2 Hours/week, 2 Credits	**ESE** - 60 Marks
Practical – 2 Hours/week, 1 Credit	**ISE** - 40 Marks
	ICA - 25 Marks

The course is an introductory course aimed at designing mechatronic systems, which require integration of the mechanical, electrical, electronic, and computing engineering disciplines within a unified framework. Contents covered in this course include mechatronic systems, sensors and actuators and digital logic.

Digital technology pervades almost everything in our daily lives. For example, cell phones and other types of wireless communications, television, radio, process controls, automotive electronics, consumer electronics, aircraft navigation— to name only a few applications—depend heavily on digital electronics. A strong grounding in the fundamentals of digital technology is going to prepare the student for the highly skilled jobs of the future.

In addition, programmable logic is important in many applications and that topic is introduced in this course and example programs are given as a part of laboratory experiments.

Course Prerequisite:

Basic Electrical & Electronics Engineering

Course Objectives:

1. To teach fundamental principles of digital circuit design
2. To impart the knowledge of programmable devices

Course Outcomes:

After completing this course, student shall 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

Unit-1: Mechatronic Systems and Devices No. of lectures - 03

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

Unit-2: Sensors and Actuators No. of lectures - 03

Sensors: Classification, Principle of Operation & Characteristics, Linear and rotational sensors, acceleration sensors, Force sensors, Torque Sensors, Flow Sensors, Temperature Sensors, Distance Sensors, Optical Sensors

Actuators: Classification of Actuators, Hydraulic and Pneumatic Actuators

Unit-3: Number Systems, Operations, and Codes No. of Lectures- 03

Decimal Numbers, Binary Numbers, Decimal-to-Binary Conversion, Binary Arithmetic Complements of Binary Numbers, Signed Numbers, Arithmetic Operations with Signed Numbers, Hexadecimal Numbers, Octal Numbers, Binary Coded Decimal (BCD), Digital Codes, Error Codes

Unit-4: Boolean Algebra and Logic Simplification No. of Lectures -06

The Inverter, AND Gate, OR Gate, NAND Gate, NOR Gate, Exclusive-OR and Exclusive-NOR Gates, Programmable Logic, Boolean Operations and Expressions, Laws and Rules of Boolean algebra, DeMorgan's theorems, Boolean Analysis of Logic Circuits, Logic Simplification Using Boolean Algebra, Standard Forms of Boolean Expressions, Boolean Expressions and Truth Tables , The Karnaugh Map, Karnaugh Map SOP Minimization

Unit-5: Combinational Logic Analysis No. of Lectures -03

Basic Combinational Logic Circuits, Implementing Combinational Logic, The Universal Property of NAND and NOR gates, Combinational Logic Using NAND and NOR Gates

Unit-6: Functions of Combinational Logic No. of Lectures -03

Half and Full Adders , Decoders, Encoders , Multiplexers (Data Selectors), Demultiplexers

Unit-7: Sequential Logic Circuits No. of Lectures- 03

Latches, SR latch, D latch, flip flops, state table and state diagrams, registers, counters

Unit-8: Signals and Signal Conditioning No. of lectures - 04

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, ADC/DAC, OPAMPs

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- **Internal Continuous Assessment (ICA) :**

  ICA consists of minimum 8 practical based on curriculum.

  Recommended practicals:

  1. Demonstration of logic gates using transistors and LED
  2. Assignment on Boolean algebra and K-map
  3. Interfacing of IR sensor module with Arduino UNO R3
  4. Interfacing of sound sensor module with Arduino UNO R3
  5. Interfacing of flame sensor module with Arduino UNO R3
  6. Assignment on ABS and Cruise control
  7. Speed control of DC motor using Arduino UNO R3
  8. Assignment on ABS and Cruise control
  9. Interfacing of servo motor with Arduino UNO R3
  10. Interfacing of ultrasonic sensor module with Arduino UNO R3

- **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 pres

- **Reference Books**

1. Bishop et.al, Handbook of Mechatronics, CRC Press
2. 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 & Automation Engineering) Semester-IV

MAPCC09 COMPUTER-AIDED MACHINE DRAWING

Teaching Scheme	**Examination Scheme**
Lectures – 1 Hours/week, 1 Credits	**ICA** - 25 Marks
Practical – 2 Hours/week, 1 Credit	**POE** - 50 Marks

This course contains different BIS conventions free hand sketching, production drawings, assembly and detail drawings. It also includes 2D & 3D drawings using drafting software. It also includes geometric dimensioning & tolerances used for production drawing.

Course Prerequisite: Basics of mechanical drawing, isometric & orthographic drawings.

Course Objectives:

1. To use various BIS conventions.
2. To understand geometric dimensions, tolerances & symbols.
3. To draw parts and assembly drawing.
4. To operate drafting and modelling software.

Course Outcomes:

After completing this course, student shall be able to -

1. Apply the BIS conventions in component drawings & assembly drawings.
2. Use geometrical dimensions, tolerances, and symbols in part-assembly drawings
3. Draw part and assembly drawing of mechanical components
4. Prepare 2D and 3D drawing pf machine components using drafting software.

Unit 1: Study of B.I.S. (Bureau of Indian Standards) Conventions No. of Lectures: 01

BIS Conventions-Significance and importance and use in drawings.

Unit 2: Free Hand Sketching of machine component No. of Lectures: 02

Importance of sketching. Sketching/drafting of various machine elements.

Unit 3: Production Drawing: Limits, Fits, & Tolerances- No. of Lectures: 02

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: 02

Assembly drawing from given detail drawing and vice versa with tolerances and fits.

Unit 5: Isometric Drafting No. of Lectures: 01

Isometric Drawing: Isometric scale, Isometric projection, Isometric drawing, Circles in

isometric view, Isometric views of simple object from given orthographic views

Unit 6: Computer aided drafting (2D) No. of Lectures: 02

The treatment on 2D Drawing with- Basic commands to draw 2-D objects like line, circle, arc, ellipse, polygon etc. Edit & Modify commands: Erase, extension, break, fillet, chamfer, trim, scale, hatching etc. Dimensioning & text commands, Viewing and other: Zoom, pan, block etc. Computer aided drafting for Isometric Drawing

Unit 7: Computer aided drafting (3D) No. of Lectures: 03

Introduction to Computer aided drafting (3D), Introduction to modeling: Wireframe, Solid, Surface Modeling, 3-dimensional drawing: UCS & 3-dimensional co-ordinates, Solid modeling commands: primitive solids, extrude, revolve, sweep, loft, press pull, etc, Solid editing commands: 3D-rotate, 3D-Move. 3D-Scale, Boolean operations, Slice, Sections, etc.

- **Internal Continuous Assessment (ICA):**

  ICA consists of minimum 8 practical based on curriculum.

  Recommended practicals

  1. Sheet on BIS Conventions
  2. Sheet on free hand sketches
  3. Sheet on production drawing
  4. 2-D sketching with geometrical and dimensional constraints using CAD software-I
  5. 2-D sketching with geometrical and dimensional constraints using CAD software -II
  6. 3D CAD modeling of the parts-I
  7. 3D CAD modeling of the parts-II
  8. Sheet on details to assembly
  9. Sheet on assembly to details

- **Textbooks**
  1. P.S. Gill, Machine Drawing. S.K. Kataria and Sons , Delhi.
  2. N. D. Bhatt. Machine Drawing, Charotor Publication House, Bombay.
  3. N. Sidheshwar. P. Kannaiah 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-IV

MAVSEC03 ELECTRICAL TECHNOLOGY

Teaching Scheme
Theory – 1Hour/Week, 1 Credit
Practical- 2Hours/Week, 1 Credit

Examination Scheme
ICA-50 marks

The subject Electrical Technology is integration of electrical and electronic engineering. The course deals with fundamental working principles and analysis of DC motors and induction motors. The course gives introduction to Arduino an open-source electronics platform . It aims to learn concepts of programming and interfacing of different devices with Arduino.

Course Prerequisites

Basic Electrical Engineering , Basic Electronics Engineering and Systems in Mechanical Engineering.

Course Objectives

1.To study principle of operation of DC motors and its speed control techniques.
2.To know about three phase induction motor working and its applications.
3.To understand Arduino IDE; an open source platform and its basic programming features.
4.To interface Arduino board with different devices and sensor.

Course Outcomes

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

1. Identify and select a suitable DC motor and its speed control method for a given industrial application.
2. Identify and select a suitable induction motor and its application.
3. Use Boolean expressions to realize combinational logic circuits
4. Apply programming concepts to understand role of microcontroller and Arduino in embedded Systems.

Unit 1- DC Motor No. of Lectures: 04

Generating and motoring action, Constructional features of a DC machine, and its significance in motor. Types of DC Motors- Shunt and Series. Starters for DC Motors. Characteristics of DC shunt motor, Speed control methodsof DC shunt motor- Flux and Armature Control.

Unit 2- AC Motors No. of Lectures: 03

Constructional features, working principle of single phase and three phase induction motor, types, torque equation, torque-slip characteristics, effect of rotor resistance on characteristics. Starters (DOL starter and Star Delta starter), Methods of speed control- voltage and frequency control, variable frequency drive, applications.

Unit 3- Digital Electronics No. of Lectures: 03

Logic Gates- Symbol, output equation, truth table, the realization of basic gates using universal gates.

Combinational Logic Circuits - Half and Full Adder, Half and Full Subtractor.

Unit 4- Advance Processors No. of Lectures: 04

Introduction to microcontroller and microprocessors, role of embedded systems, open source embedded platforms. Arduino-Introduction, IDE- features, IDE overview, Programming concepts: variables, functions and conditional statements. Concept of GPIO in Atmega328 based Arduino board, digital input and output. Arduino Interfacing - LED, IR Sensor, DC servo motor.

- **Internal Continuous Assessment (ICA) :**

  ICA consists of minimum 8 practical based on curriculum.

  Recommended practicals:

1. Speed control of DC shunt motors by flux control and armature control and armature voltage control method.
2. Study of starters used for DC shunt motors.
3. Load test on DC Motor.
4. Load test on single-phase induction motor.
5. Study of starters used for three-phase induction motor.
6. Build and test combinational logic & sequential logic circuits in the simulator and on a breadboard.
7. Basic programming on 8051 trainer/simulator as a basic introduction to microcontroller.
8. Interface IR sensor, sound sensor, and range sensor with Arduino Uno microcontroller board.
9. Interface and control DC servo Motor using Arduino Uno board.
10. 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

MAEEM02 PROJECT MANAGEMENT

Teaching Scheme	**Examination Scheme**
Theory- 2 Hours/week, 2 Credits	**ESE-** 60 Marks
	ISE- 40 Marks

Project management is the application of knowledge, skills, tools, and techniques to project activities to meet the project requirements. It is broken into five different categories like planning, scheduling, monitoring and controlling. Some software might be used to help or manage various projects, with each project having unique requirements.

Course Prerequisite: Basic maths like exponents, graphs, knowledge of spreadsheets

Course Objectives:

The course aims to:

1. To understand the concepts of Project Management for planning to execution ofprojects.
2. To carry out the feasibility analysis in Project Management using analysis tools forrisk, cost estimation.
3. To enable for the use of planning, scheduling, monitoring and controlling methods in
4. Project Management
5. To make them capable to analyse, apply and appreciate contemporary projectmanagement software available in market.

Course Outcomes:

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

1. Describe concept, importance & Professional responsibilities of project management, project management process, it's tools and techniques.
2. Implement various techniques used to analyze risks in the projects and various techniques used for cost estimation of a project.
3. Use methods for planning and scheduling of a project and methods for monitoring and control of a project.
4. Understanding PMIS and use of computer Applications at various stages of a project.

Unit 1-Introduction to Project Management No. of lectures- 03

Definition & Characteristics of Project, Classification of Projects, Project Management, Benefits, Project Management Process, Role of Project Manager. Project Lifecycle.

Unit 2- Project Management Process Tools and Techniques No. of lectures- 04

Feasibility Studies, Numerical Models (Payback Period, Return on Investment, Net Present Value, Internal rate of Return), Scoring Models, Break Even Analysis.

Unit 3-Project Risk Management No. of lectures- 03

Introduction of Risk Management, Role of Risk Management in Overall Project Management, Steps in Risk Management, Risk Identification, Risk Analysis, Reducing Risks.

Unit 4-Project Cost Estimating No. of lectures- 04

Estimating terminology, Project Costs, Estimating Methods (Jobbing, Factoring, Inflation, Economies of Sales, Unit Rates, Day Work), Analogous Estimating, Parametric Estimating, Bottom-Up Estimating, Three-Point Estimates, Project Budgeting,Resource Allocation

Unit 5-Project Planning and Scheduling No. of lectures-04

Project Planning: Introduction, Need of Project Planning, Project Life Cycle, Roles, Responsibility and Team Work, Project Planning Process, Work Breakdown Structure (WBS)
Scheduling: Introduction, Development of Project Network, Time Estimation, Determinationof the Critical Path, PERT Model

Unit 6- Project Monitoring and Control No. of lectures-03

Project Execution and Control: Introduction, Project Execution, Project Control Process, Purpose of Project Execution and Control.
Project Performance Measurement and Evaluation: Introduction, Performance Measurement, Productivity, Project Performance Evaluation, Benefits and Challenges of Performance Measurement and Evaluation, Controlling the Projects

Unit 7- Project Management Information System: No. of lectures-03

Introduction, Project Management InformationSystem (PMIS), Planning of PMIS, Design of PMIS.

Unit 8- Computer Applications in Project Management No. of lectures-04

Introduction to MS Projects – Understanding the MS Project screen & different views, Defining the project, working with calendar, Outline the project, Create dependenciesbetween tasks, Creating WBS, Format task list and Gantt chart, Resource planning, levelling and preparing resource graph, working with baseline, tracking the project. Use of excel andMS project for feasibility studies, risk management, project cost estimating, project planning and scheduling etc.

- **Text Books:**

1. S. Choudary, Project Management, Tata McGraw Hill.
2. Narendra Singh, Project Management & Control, Himalaya Publishing House.
3. Nitin Shrotri, How to be an Effective Project Manager, Self Published

- **Reference Books**

1. Maylor, Project Management, Pearson Education.
2. Project Management Institute; "A Guide to the Project Management Body of Knowledge(PMBOK Guide)", 5th Revised edition.
3. Harold Kerzner, Project Management: A Systems Approach to Planning, Scheduling andControlling Paperback, Wiley, tenth edition.

Walchand Institute of Technology, Solapur

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

AEC02 GENERAL PROFICIENCY

Teaching Scheme	**Examination Scheme**
Lectures– 1 Hours/week, 1 Credits	**ICA** - 50 Marks
Tutorial – 1 Hours/week, 1 Credit	

This course includes a cluster of personal qualities, habits, attitudes that have the potential to make someone a good student and compatible with the requirements of academia. Put simply, they are the ways in which you talk, you move around, listen and present yourself. Students who possess such skills are more adept and academic savvy. They are able to gain a further understanding of tasks and successfully engage with them, enabling them to gain more control over their learning. Along with playing an important role in the development of students' overall personality and performance, this course also amount to good skills in communication; presenting information in a clear and concise manner; team-building ability; leadership; time management; group discussions; and interviews and interpersonal skills. All of which are important for students' academic development and growth.

Course Prerequisite:

The students need to have basic knowledge of communication language- oral and writing skill.

Course Objectives:

1. To nurture student's effective presentation skills
2. To make students communicate effectively in writing for a variety of purposes.
3. To develop the skills in interpersonal communication and in expressing the views in a clear and succinct manner.
4. To inculcate soft skills in students for personal and professional success

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. Draft resumes, letters, emails, and reports professionally with appropriate content and context.
4. Exhibit various soft skills like email writing, task management, elevator pitch, SWOT analysis etc.

Unit 1– Presentation Skills	No of lectures-04
Unit 2– Letter/Resume Writing Skills	No of lectures-02
Unit 3– Interview and Group Discussion Skills	No of lectures-04
Unit 4– Email writing Skills	No of lectures-02
Unit 5– Report writing Skills	No of lectures-02

- **Internal Continuous Assessment (ICA) :**
  ICA consists of minimum 8 tutorials based on curriculum.
  Recommended tutorials:
  1. Write a resume for various purposes.
  2. Prepare a power point presentation (slides) on a given topic

3. Self-analysis (SWOT)
4. Letter writing (Leave application, Job application, and Enquiry letter)
5. Write a review article (Book Review/ Research paper review)
6. Write a summary/abstract of the given article
7. Group Discussion
8. Personal interview (Mock)
9. Email writing
10. Poster Presentation

- **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

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Walchand Institute of Technology, Solapur

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

VEC 02 PROFESSIONAL ETHICS

Teaching Scheme	**Examination Scheme**
Lectures– 2 Hours/week, 2 Credits	**ISE** - 50 Marks

This course is designed to explore the principles and standards of moral and ethical conduct in professional settings. This course aims to equip students with the necessary tools to navigate complex ethical dilemmas and make informed decisions that uphold the integrity and ethical standards of their profession. It emphasizes the importance of ethical behavior in building trust, maintaining credibility, and fostering a positive professional environment.

Course Objectives:

5. To make student aware of Professional Ethics in engineering
6. To make student aware of various theories in Professional Ethics
7. To make student learn about safety, risk and responsibilities of an engineer
8. To make student learn about the global issues in Professional Ethics

Course Outcomes:

After completing this course, student will be able to

9. Follow Professional Ethics in his life.
10. Describe various theories in Professional Ethics.
11. Identify safety, risk and responsibilities of an engineer.
12. Behave consciously to global issues in Professional Ethics.

Unit 1 - Introduction to Professional Ethics No of lectures – 03

Introduction, Engineering and Professionalism, Two models of Professionalism, Three types of morality, Preventive Ethics, Aspirational Ethics

Unit 2 – Engineering Ethics No of lectures – 04

Senses of engineering ethics, Variety of Moral Issues, Types of Inquiry, Recent developments towards ethics in engineering, Moral Dilemmas-steps to solve moral dilemmas.

Unit 3 –Theories in Engineering Ethics No of lectures – 04

Kohlberg's Theory, Gilligan's Theory, Consensus and Controversy, Models of Professional Roles, Theories about Right Action, Self interest, Customs and Religion, Uses of Ethical theories.

Unit 4 – Engineering as Social Experimentation No of lectures – 03

Engineering projects vs Standard projects, Engineers as responsible experimenters, code of ethics, Industrial standards.

Unit 5 – Safety and Risk No of lectures – 04

Concept of safety, Engineers and safety, Risk- Types of accidents, Risk Benefit analysis, Reducing risk, Risk Management.

Unit 6 – Responsibilities of an Engineer No of lectures – 03

Collegiality, Loyalty, Respect of Authority, Collective Bargaining, Confidentiality, Conflict of Interest.

Unit 7 – Rights of an Engineer No of lectures – 03

Professional Rights, Employee Rights, Whistle Blowing, Intellectual Property Rights, Discrimination, Preferential Treatment.

Unit 8 – Global Issues No of lectures – 04

Multinational Corporation, Ways of promoting morally just measures, Environmental Ethics, Computer Ethics, Weapons Development, Engineers as Managers, Expert Witnesses and Advisors, Moral Leadership, Corporate Social Responsibility.

- **Textbooks**

4. R.S. Naagarazan, A Text Book of Professional Ethics & Human Values, New Age International, 2006.
5. Professional Ethics: R. Subramanian, Oxford University Press, 2015.
6. Dr. N. Venkateswaran, Professional Ethics in Engineering, Sree Kamalamani Publications.

- **Reference Books**

5. Charles E. Harris Jr., Michael S. Pritchard and Michael J. Rabins, Engineering Ethics: Concepts and Cases, 4th Edition.
