



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. Mechanical and Automation  
Engineering  
W.E.F. 2025-26

## Department of Mechanical Engineering

### 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.

### Mission

- **M1:** To impart quality Mechanical Engineering education in accordance with the needs of the society.
- **M2:** To produce globally competent Mechanical Engineers through research, industry institute interaction.
- **M3:** To help Mechanical Engineering graduates to implement their acquired engineering knowledge for society and community development.



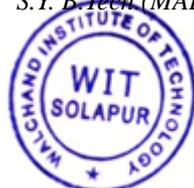
# Mechanical and Automation Engineering

## Program Educational Objectives (PEOs)

- Graduate will excel in professional career in the field of Mechanical and Automation Engineering.
- Graduate will exhibit strong fundamentals required to pursue higher education and continue professional development in emerging technology in Mechanical and Automation Engineering.
- 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.

## Knowledge and Attitude Profile (WK)

WK1	A systematic, theory-based understanding of the natural sciences applicable to the discipline and awareness of relevant social sciences.
WK2	Conceptually-based mathematics, numerical analysis, data analysis, statistics and formal aspects of computer and information science to support detailed analysis and modelling applicable to the discipline.
WK3	A systematic, theory-based formulation of engineering fundamentals required in the engineering discipline.
WK4	Engineering specialist knowledge that provides theoretical frameworks and bodies of knowledge for the accepted practice areas in the engineering discipline; much is at the forefront of the discipline.
WK5	Knowledge, including efficient resource use, environmental impacts, whole-life cost, re-use of resources, net zero carbon, and similar concepts, that supports engineering design and operations in a practice area.
WK6	Knowledge of engineering practice (technology) in the practice areas in the engineering discipline.
WK7	Knowledge of the role of engineering in society and identified issues in engineering practice in the discipline, such as the professional responsibility of an engineer to public safety and sustainable development.
WK8	Engagement with selected knowledge in the current research literature of the discipline, awareness of the power of critical thinking and creative approaches to evaluate emerging issues.
WK9	Ethics, inclusive behaviour and conduct. Knowledge of professional ethics, responsibilities, and norms of engineering practice. Awareness of the need for diversity by reason of ethnicity, gender, age, physical ability etc. with mutual understanding and respect, and of inclusive attitudes.



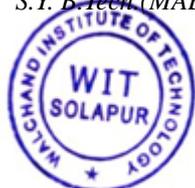
<b>Program Outcomes (POs)</b>	
<b>PO 1</b>	<b>Engineering Knowledge:</b> Apply knowledge of mathematics, natural science, computing, engineering fundamentals and an engineering specialization as specified in WK1 to WK4 respectively to develop to the solution of complex engineering problems.
<b>PO 2</b>	<b>Problem Analysis:</b> Identify, formulate, review research literature and analyze complex engineering problems reaching substantiated conclusions with consideration for sustainable development. (WK1 to WK4)
<b>PO 3</b>	<b>Design/Development of Solutions:</b> Design creative solutions for complex engineering problems and design/develop systems/components/processes to meet identified needs with consideration for the public health and safety, whole-life cost, net zero carbon, culture, society and environment as required. (WK5)
<b>PO 4</b>	<b>Conduct Investigations of Complex Problems:</b> Conduct investigations of complex engineering problems using research-based knowledge including design of experiments, modelling, analysis & interpretation of data to provide valid conclusions. (WK8).
<b>PO 5</b>	<b>Engineering Tool Usage:</b> Create, select and apply appropriate techniques, resources and modern engineering & IT tools, including prediction and modelling recognizing their limitations to solve complex engineering problems. (WK2 and WK6)
<b>PO 6</b>	<b>The Engineer and The World:</b> Analyze and evaluate societal and environmental aspects while solving complex engineering problems for its impact on sustainability with reference to economy, health, safety, legal framework, culture and environment. (WK1, WK5, and WK7).
<b>PO 7</b>	<b>Ethics:</b> Apply ethical principles and commit to professional ethics, human values, diversity and inclusion; adhere to national & international laws. (WK9)
<b>PO 8</b>	<b>Individual and Collaborative Team work:</b> Function effectively as an individual, and as a member or leader in diverse/multi-disciplinary teams.
<b>PO 9</b>	<b>Communication:</b> Communicate effectively and inclusively within the engineering community and society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations considering cultural, language, and learning difference
<b>PO 10</b>	<b>Project Management and Finance:</b> Apply knowledge and understanding of engineering management principles and economic decision-making and apply these to one's own work, as a member and leader in a team, and to manage projects and in multidisciplinary environments.
<b>PO 11</b>	<b>Life-long Learning:</b> Recognize the need for, and have the preparation and ability for i) independent and life-long learning ii) adaptability to new and emerging technologies and iii) critical thinking in the broadest context of technological change. (WK8)
<b>Program Specific Outcomes (PSOs)</b>	
<ol style="list-style-type: none"> <li>1. Design high quality mechanical and automation engineering equipments for the modern industry and society.</li> <li>2. Implement manufacturing processes for mechanical and automation engineering equipment.</li> </ol>	



## Department of Mechanical Engineering

### 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



# Mechanical and Automation Engineering

## Course Code Format

2	4	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	Theory, L-Lab session P- Programming		

## Program Code

MA	Mechanical and Automation Engineering
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## Course Type

BS	Basic Science
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ES	Engineering Science
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HU	Humanities & Social Science
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MC	Mandatory Course
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CC	Core Compulsory Course
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SN*	Self-Learning <i>N* indicates the serial number of electives offered in the respective category</i>
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EN*	Core Elective <i>N* indicates the serial number of electives offered in the respective category</i>
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ON*	Open Elective <i>N* indicates the serial number of electives offered in the respective category</i>
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SK	Skill Based Course
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SM	Seminar
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MP	Mini project
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PR	Project
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IN	Internship
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## Sample Course Code

24MAU3CC1T	Mechanics of Materials
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# Mechanical and Automation Engineering

## B. Tech. Semester III

Course Code	Name of Course	Engagement Hours			Credits	SA		FA		Total
		L	T	P		Theory	OE/POE	ISE	ICA	
24MAU3CC1T	Mechanics of Materials	2			2	60		40		100
24MAU3CC2T	Manufacturing Processes & Technology	2			2	60		40		100
24MAU3CC3T	Applied Thermodynamics	2			2	60		40		100
24##U3ON*4T	Open Elective I	2			2	60		40		100
24##U3ON*4A	Open Elective I (Tutorial)		1		1				25	25
24CMU3EM5T	Entrepreneurship Development	1	1		2				50	50
24##U3MD6T	Multidisciplinary Minor I	2			2	60		40		100
24CMU3VE7T	Universal Human Values	2			2	50*				50
	<b>Subtotal</b>	13	2		15	350		200	75	625
<b>Laboratory Courses</b>										
24MAU3CC1L	Mechanics of Materials Lab			2	1				25	25
24MAU3CC2L	Manufacturing Processes & Technology Lab			2	1				25	25
24MAU3CC3L	Applied Thermodynamics Lab			2	1		25		25	50
24MAU3CC8P	Programming in C++	1		2	2		50	25	25	100
24MAU3FP9L	Community Engagement Project (CEP)/ Field Project (FP)			4	2				50	50
	<b>Subtotal</b>	1		12	7		75	25	150	250
	<b>Grand Total</b>	14	2	12	22	350	75	225	225	875

# Mechanical and Automation Engineering

## B. Tech. Semester IV

Course Code	Name of Course	Engagement Hours			Credits	SA		FA		Total
		L	T	P		Theory	OE/ POE	ISE	ICA	
24MAU4CC1T	Kinematics & Dynamics of Machinery	2			2	60		40		100
24MAU4CC2T	Fluid Mechanics & Fluid Machines	2			2	60		40		100
24MAU4CC3T	Mechatronics	2			2	60		40		100
24MAU4CC4T	Project Management	2			2	60		40		100
24##U4ON*5T	Open Elective II	2			2	60		40		100
24##U4ON*5A	Open Elective II (Tutorial)		1		1				25	25
24##U4MD6T	Multidisciplinary Minor II	1			1			50		50
24CMU4AE7T	General Proficiency	1	1		2				50	50
24CMU4VE8T	Professional Ethics	2			2			50		50
	<b>Subtotal</b>	14	2		16	300		300	75	675
<b>Laboratory Courses</b>										
24MAU4CC1L	Kinematics & Dynamics of Machinery Lab			2	1		25		25	50
24MAU4CC2L	Fluid Mechanics & Fluid Machines Lab			2	1				25	25
24MAU4CC3L	Mechatronics Lab			2	1				25	25
24##U4MD6L	Multidisciplinary Minor II Lab			2	1				25	25
24MAU4CC9D	Computer Aided Machine Drawing	1		2	2		50		25	75
24MAU4VS10L	Electrical Technology	1		2	2				50	50
	<b>Subtotal</b>	2		12	8				175	250
	<b>Grand Total</b>	<b>16</b>	<b>2</b>	<b>12</b>	<b>24</b>	<b>300</b>	<b>75</b>	<b>300</b>	<b>250</b>	<b>925</b>

**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	Name of Course	Engagement Hours			Credits	FA		SA		Total
		L	T	P		Theory	OE/ POE	ISE	ICA	
24CMU4MC2T	Environmental Studies	-	-	-	-	50	-	-	-	50

**Note:**

- \*Examination will be MCQ based
- N\* indicates the serial number of electives offered in the respective category
- ## indicates program code of offering Programme
- Internal Continuous Assessment (ICA): ICA shall be a continuous process based on the performance of the student in assignments, class tests, quizzes, attendance and interaction during theory and lab sessions, journal writing, report presentation, etc., as applicable.
- Students must pass Environmental Studies course to become eligible for the award of degree.
- **List of Open Electives**  
**Open Electives- I (Semester-III)**

Course Code	Course Name
24CEU3O14T	Managerial Economics
24MAU3O24T	Renewable Energy
24ETU3O34T	Sustainable Development
24CSU3O44T	Management Information Systems
24ECU3O54T	Fundamentals Of Digital Marketing
24ITU3O64T	Cyber Laws

**Open Electives- II (Semester-IV)**

Course Code	Course Name
24GEU4O15T	Higher Engineering Mathematics
24GEU4O25T	Advanced Engineering Mathematics
24GEU4O35T	Applied Mathematics
24GEU4O45T	Statistics and Fuzzy logic
24GEU4O55T	Applied Statistics

- For **Open Elective (OE) III** in Semester V:
  1. Students are required to enroll in one of the courses of a minimum duration of 8 weeks offered on the SWAYAM/NPTEL platform. The list of courses will be finalized and released by Board of Studies each year.
  2. List of MOOC courses will be provided by the department depending on the availability of the courses in that semester under NPTEL / Swayam or Other recognized MOOC Platforms as per suggestions by the BoS.

3. Students may enroll for the course in **Semester III / IV / V**. They must complete all assignments and appear for the certification examination conducted by SWAYAM/NPTEL.
4. Students must pass the examination by the end of Semester V. The marks earned by the student in final assessment of this MOOC course/courses will be appropriately scaled and transferred to **Open Elective (OE) III** in Semester V.

- **Multidisciplinary Minor (MDM) Courses**

Student can choose one of the below mentioned Multidisciplinary Minor Program during the start of Semester III.

Sr. No.	MDM Program	MDM I (Sem III)	MDM II (Sem IV)	MDM III (Sem V)	MDM IV (Sem VI)	MDM V (Sem VII)
1	Computer Science and Engineering	Operating System	UI Technologies	Software Engineering	Big Data Technologies	Software Testing and Quality Assurance
2	Information Technology	Principles of Operating Systems	Web Technology (UI/ UX)	Software Engineering Principles	DevOps	Cyber Security
3	Civil Engineering	Smart Buildings	Geoinformatics	Environmental Impact Assessment	Infrastructural Systems	Disaster Preparedness and planning
4	Electronics and Telecommunication Engineering	Fundamentals of Electronic Circuits	Electronics Design and Prototyping	Introduction to Embedded Systems	Fundamentals of Communication Techniques	Enclosure and Communication Design for IoT
5	Electronics and Computer Engineering	Analog Electronics	Digital Electronics	Microcontrollers and Peripherals	Advanced Controllers and Interfacing	Electronic System Design



**WALCHAND INSTITUTE OF TECHNOLOGY, SOLAPUR**  
(An Autonomous Institute)  
Second Year B.Tech. (Mechanical and Automation Engineering), Semester-III

**24MAU3CC1T: Mechanics of Materials**

Teaching Scheme		Examination Scheme	
Lectures	2 Hours/week	ESE	60 Marks
Practical	2 Hours/week	ISE	40 Marks
Credits	3	ICA	25 Marks

**Introduction:**

This course provides a fundamental understanding of concepts of stress and strain along with elastic properties of materials and the behaviour of structural elements under various types of loading. It covers shear force and bending moment diagrams for different types of beams and the analysis of bending and shear stresses in beams of various cross-sections, principal stresses and strains. Students will also apply principles in the design of shafts, beams, and structural members, making it an essential foundation for mechanical design engineering. The course emphasises on both theoretical understanding and practical numerical application to develop the analytical and design skills essential for solving real-world mechanical engineering problems.

**Course Prerequisite:**

Knowledge of Engineering mechanics.

**Course Objectives:**

1. To understand and analyze internal forces, bending moment, torsion, and axial loads in structural and mechanical elements.
2. To impart the ability to evaluate stresses, strains, and material deformation in beams, shafts, and bars under various loading conditions.
3. To introduce students with analytical methods for calculating bending, shear, torsional stresses, and deflections in structural components for safe mechanical design.
4. To introduce and use method like Mohr's circle and deflection equations for determining principal stresses, slopes, and deflections in beams.

**Course Outcomes:**

After completing the course, students will be able to

1. Compute stress, strain in homogeneous and composite materials under concentrated loads and also principal stresses and maximum shear stresses.
2. Draw shear force and bending moment diagrams for beams under different loading conditions and identify maximum bending moments and points of contraflexure.
3. Analyse bending and shear stresses in beams and sketch their distribution diagram.
4. Apply torsion theory to determine shaft dimensions and torsional stresses, and use suitable method to find beam slope and deflection.



<b>Unit – I</b>	<b>Simple stresses and strains</b>	<b>5 Hours</b>
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, volumetric strain in rectangular bar, principle of super position, thermal stresses in composite bars		
<b>Unit – II</b>	<b>Shear force &amp; bending moment Diagrams</b>	<b>5 Hours</b>
Concept of shear force and bending moment and 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		
<b>Unit – III</b>	<b>Bending and shear stresses in beams</b>	<b>5 Hours</b>
Bending stresses: theory of simple bending, assumptions, derivation of flexural formula, bending stress distribution diagrams for common symmetrical and unsymmetrical sections (circular, rectangular, I-section, 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 circular, rectangular, I-section, T-section		
<b>Unit – IV</b>	<b>Principal stresses and strains</b>	<b>5 Hours</b>
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)		
<b>Unit – V</b>	<b>Slope and deflection in beams</b>	<b>4 Hours</b>
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. (standard cases), moment area method		
<b>Unit – VI</b>	<b>Torsion of circular shafts</b>	<b>4 Hours</b>
Introduction to torsion, basic assumptions, torsion equation, stresses in hollow and solid circular shafts, power transmitted by shaft		
ICA consists of minimum 8 practicals / assignments from the below list		
<ol style="list-style-type: none"> <li>1. Tensile Test on a Ductile Material and Plotting of Stress-Strain Curve</li> <li>2. Numericals on axial deformation in composite bars &amp; elastic constants.</li> <li>3. Plotting Shear Force and Bending Moment Diagrams.</li> <li>4. Analysis of Bending and Shear Stress in various Beam Sections</li> <li>5. Analytical and Graphical Solution (Mohr's Circle) for compound stresses.</li> <li>6. Torsion Test on Circular Shaft</li> <li>7. Torsional Stress Calculation in Circular Shafts</li> <li>8. Slope and Deflection Calculation in Beams</li> <li>9. Graphical solution using suitable software for 2D stress conditions.</li> <li>10. Write a program to compute and plot shear force and bending moment diagrams.</li> <li>11. Develop a program to determine stress, strain and young's modulus using suitable programming language.</li> </ol>		



<b>Text Books</b>
<ol style="list-style-type: none"> <li>1. R. K. Rajput, Strength of materials- S. Chand &amp; Co. Ltd., New Delhi.</li> <li>2. S.S. Bhavikatti, Strength of materials, Vikas Publishing House Pvt Ltd, New Delhi.</li> <li>3. R.K. Bansal, Strength of materials, Laxmi publications (P) Ltd., New Delhi.</li> </ol>
<b>Reference Books</b>
<ol style="list-style-type: none"> <li>1. Beer and Johnson, Strength of materials, Mc-Graw Hill International student series.</li> <li>2. Timoshenko and Young, Strength of materials, CSB Publishers.</li> <li>3. Ramamrutham S., Strength of materials, Dhanpat Rai, Co. (P) Ltd., Delhi.</li> </ol>
<b>e-Resources</b>
<ol style="list-style-type: none"> <li>1. <a href="https://sm-nitk.vlabs.ac.in/List%20of%20experiments.html">https://sm-nitk.vlabs.ac.in/List%20of%20experiments.html</a></li> <li>2. <a href="https://onlinecourses.nptel.ac.in/noc22_ce75/preview">https://onlinecourses.nptel.ac.in/noc22_ce75/preview</a></li> </ol>



**WALCHAND INSTITUTE OF TECHNOLOGY, SOLAPUR****(An Autonomous Institute)****Second Year B.Tech. (Mechanical and Automation Engineering), Semester-III****24MAU3CC2T: Manufacturing Processes and Technology**

Teaching Scheme		Examination Scheme	
Lectures	2 Hours/week	ESE	60 Marks
Practical	2 Hours/week	ISE	40 Marks
Credits	3	ICA	25 Marks

**Introduction:**

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 product 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 are 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 the course, students will be able to

1. Apply appropriate manufacturing processes to meet specific product requirements from a range of available options.
2. Select suitable forming processes, both conventional and unconventional based on material and design specifications.
3. Assess the suitability of various manufacturing technologies, considering factors like cost, efficiency, and material compatibility.
4. Perform CNC part programs for basic machining operations, ensuring accuracy and efficiency.

<b>Unit – I</b>	<b>Casting Processes</b>	<b>4 Hours</b>
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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, moulding materials, and their properties, gating system, types of risers, function of a riser, the method to improve the efficiency of risers, riser design. green sand moulding (hand and machine moulding), shell moulding, investment casting, centrifugal casting, gravity, and pressure die casting processes. fettling process. induction furnace construction and working of melting furnaces such as cupola. casting defects, fettling process



<b>Unit – II</b>	<b>Forming Processes</b>	<b>4 Hours</b>
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		
<b>Unit – III</b>	<b>Advanced Forming Processes</b>	<b>4 Hours</b>
Introduction to advanced forming processes, high energy rate forming process- explosive, magnetic pulse forming. forming with hydrostatic pressure- hydro-forming process		
<b>Unit – IV</b>	<b>Introduction to Traditional Machine Tools</b>	<b>4 Hours</b>
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		
<b>Unit – V</b>	<b>Unconventional Machining</b>	<b>4 Hours</b>
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		
<b>Unit – VI</b>	<b>NC Technology and Part Programming for CNC machines</b>	<b>4 Hours</b>
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, principles of CNC program, word address format (WAF), tool length and cutter diameter compensation, canned cycles, subprogram		
ICA consists of minimum 8 practical/assignments from the below list		
<ol style="list-style-type: none"> <li>1. Design of riser &amp; gating system/patterns</li> <li>2. Demonstration of casting defects</li> <li>3. Testing of casting sand properties</li> <li>4. Demonstration of welding processes</li> <li>5. Demonstration of Lathe Mechanism, attachments and operations</li> <li>6. Demonstration of Gear cutting on milling and indexing</li> <li>7. Demonstration of Flexible Manufacturing System</li> <li>8. CNC Part Programming</li> <li>9. Assignment on unconventional machining methods</li> <li>10. Assignment on advanced forming processes</li> </ol>		
<b>Text Books</b>		
<ol style="list-style-type: none"> <li>1. P.N. Rao, Manufacturing Technology: Foundry, Forming and Welding, Mc Graw Hill Publications</li> <li>2. P. C. Sharma, Production Technology, S. Chand &amp; Co. Ltd.</li> <li>3. Grover M.P, Automation, Production Systems, and Computer Integrated Manufacturing- Prentice Hall of India</li> <li>4. Kundra, Rao, Tiwari, Numerical Control -Computer Aided Manufacturing, Tata McGraw Hill Publication</li> <li>5. B.S. Raghuvanshi, Workshop Technology (Volume II), Dhanpat Rai Publications</li> <li>6. P. N. Rao, Manufacturing Technology, Vol. II., McGraw Hill Publications</li> </ol>		

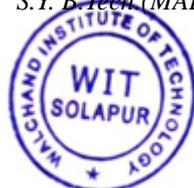


### Reference Books

1. J.S. Campbell, Principles of Manufacturing Material and Processes, Tata Mc Graw Hill Publications
2. S. Kalpakjian, S.R. Scsimid, Manufacturing Engineering and Technology, Pearson Education.
3. D.D. Bedworth, M.R Henderson & P.M. Wolfe, Computer Integrated Design and Manufacturing, Tata McGraw Hill Publication Co.
4. Yoram Koren, Computer control of manufacturing systems, Tata McGraw Hill Publications
5. Asfahl C. R., "Robots and Manufacturing Automation" John Wiley & Sons Publications

### e-Resources

<https://archive.nptel.ac.in/courses/112/107/112107219/>





# WALCHAND INSTITUTE OF TECHNOLOGY, SOLAPUR

(An Autonomous Institute)

Second Year B.Tech. (Mechanical and Automation Engineering), Semester-III

## 24MAU3CC3T: Applied Thermodynamics

Teaching Scheme		Examination Scheme	
Lectures	2 Hours/week	ESE	60 Marks
Practical	2 Hours/week	ISE	40 Marks
Credits	3	ICA	25 Marks
		OE	25 Marks

### Introduction:

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. To understand thermal properties enthalpy, entropy, internal heat etc.
2. To understand thermodynamic laws.
3. To study boiler, boiler accessories. nozzle and compressor.
4. To use thermodynamic relation for design of boiler.

### Course Outcomes:

After completing the course, students will be able to

1. Apply the laws of thermodynamics to applications like thermal systems such as heat engines, refrigerators, and heat pumps
2. Calculate entropy change and enthalpy for ideal gases and phase change processes using appropriate thermodynamic relations and property diagrams
3. Analyze vapour power cycles for the performance of boilers and condensers
4. Examine work input/output, volumetric efficiency, and isothermal efficiency of reciprocating air compressors by computing the effect of multi-staging and intercooling

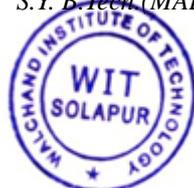
Unit – I	Basic Laws of Thermodynamics	4 Hours
Review of basic concepts, Zeroth first, and second law of thermodynamics, limitation of first law of thermodynamics, Kelvin-Planck and Clausius statements and their equivalence, heat engine, refrigerator and heat pump, reversibility and irreversibility, Carnot cycle, reversed Carnot cycle, enthalpy		



<b>Unit – II</b>	<b>Entropy</b>	<b>3 Hours</b>
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		
<b>Unit – III</b>	<b>Properties of pure substance &amp; steam</b>	<b>4 Hours</b>
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		
<b>Unit – IV</b>	<b>Boilers</b>	<b>3 Hours</b>
Classification, mountings and accessories, salient features of high-pressure boilers, evaporation, equivalent evaporation, boiler efficiency, heat losses in boiler plant & heat balance sheet		
<b>Unit – V</b>	<b>Vapour Power Cycles</b>	<b>4 Hours</b>
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		
<b>Unit – VI</b>	<b>Steam Condensers</b>	<b>3 Hours</b>
Elements of steam condensing plants, types of condensers, thermodynamic analysis of condensers, efficiencies		
<b>Unit – VII</b>	<b>Steam Nozzles</b>	<b>3 Hours</b>
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		
<b>Unit – VIII</b>	<b>Reciprocating Air Compressors</b>	<b>4 Hours</b>
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		
ICA consists of minimum 8 practicals/assignments from the below list 1. Flash and fire point of oil 2. Test on grease penetrometer & dropping point apparatus. 3. Experiment on Redwood viscometer 4. Demonstration of boiler mountings 5. Demonstration of boiler accessories 6. Case study of boiler heat balance sheet 7. Computational fluid dynamic (CFD) in thermodynamics 8. Computer programme to solve thermodynamic problems 9. Demonstration of heat recovery devices 10. Industrial visit to study boilers		
<b>Text Books</b>		
1. S. Domkundwar, Kothandraman, A Course in Thermal Engineering, Dhanpat Rai & Co. Delhi. 2. P.K. Nag, Basic & Applied Thermodynamics, Tata McGraw Hill Publications		



<b>Reference Books</b>
1. Yunus A. Cengel, Michael A. Boles and Mehmet Kanoglu, Thermodynamics: An Engineering Approach, McGraw Hill Publications 2. Michael J. Moran and Howard N. Shapiro, Fundamentals of Engineering Thermodynamics, Wiley Publications
<b>e-Resources</b>
<a href="https://archive.nptel.ac.in/courses/112/106/112106310/">https://archive.nptel.ac.in/courses/112/106/112106310/</a>





# WALCHAND INSTITUTE OF TECHNOLOGY, SOLAPUR

(An Autonomous Institute)

Second Year B.Tech. (Mechanical and Automation Engineering), Semester-III

## 24CMU3EM5T: Entrepreneurship Development

### Teaching Scheme

**Lectures** 1 Hour/week

**Practical** 1 Hour/week

**Credits** 2

### Examination Scheme

**ESE** ----

**ISE** ----

**ICA** 50 Marks

### Introduction:

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 Prerequisite:

This course requires familiarity with basic business terminology, management principles, and economics.

### 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 the course, students will be able to

1. Identify various characteristics of entrepreneurs and also various types of entrepreneurs.
2. Evaluate the challenges and limitations faced by Entrepreneurship Development Programmes (EDPs) in achieving their goals.
3. Generate business ideas and prepare a comprehensive entrepreneurial project report
4. Compare different structures, ownership forms, funding options and interpret the role of government support systems in promoting entrepreneurship.

### Unit – I

### Entrepreneur

3 Hours

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



<b>Unit – II</b>	<b>Entrepreneurship Development</b>	<b>4 Hours</b>
Concept of entrepreneurship, Entrepreneurship Development Programmes (EDPs)- meaning & need of EDPs, course content & curriculum of EDPs, phases of EDPs, problems of EDPs		
<b>Unit – III</b>	<b>Entrepreneurial Project Development</b>	<b>4 Hours</b>
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		
<b>Unit – IV</b>	<b>Small-Medium Enterprises and Support Systems</b>	<b>3 Hours</b>
Meaning and definition of micro, small & medium enterprises, forms of business ownership, funding options available, role of government organization to support business		
ICA consists of the following 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.		
<b>Text Books</b>		
1. Dr. S. S. Khanka, Entrepreneurial Development, S. Chand Publications 2. Vasant Desai, Small-Scale Industries and Entrepreneurship, Himalaya Publishing House 3. Alpana Trehan, Entrepreneurship, Dream Tech Press		
<b>Reference Books</b>		
1. Vasant Desai, Dynamics of Entrepreneurial Development and Management, Himalaya Publishing House 2. Michael Schaper, Thierry Volery, Pauli Weber, Kate Lewis, Entrepreneurship & Small Business, Wiley Publications 3. Robert Hisrich, Michael Peters, Dean Shepherd, Sabyasachi Sinha, Entrepreneurship, McGraw Hill Publications		
<b>e-Resources</b>		
<a href="https://archive.nptel.ac.in/courses/127/105/127105007/">https://archive.nptel.ac.in/courses/127/105/127105007/</a>		





## WALCHAND INSTITUTE OF TECHNOLOGY, SOLAPUR

(An Autonomous Institute)

Second Year B.Tech. (Mechanical and Automation Engineering), Semester-III

### 24CMU3VE7T: Universal Human Values

Teaching Scheme		Examination Scheme	
Lectures	2 Hours/week	ESE	50 Marks
Practical	----	ISE	----
Credits	2	ICA	----

#### Introduction:

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:

This course requires basic communication and comprehension skills, open-mindedness and willingness to reflect, general awareness of social issues.

#### Course Objectives:

1. To help the students appreciate the essential complementarity 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 value-based 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 Outcomes:

After completing the course, students will be able to

1. Distinguish between values and skills; understand the harmony in the self and human being.
2. Analyze the harmony in the family, society, and nature leading to an understanding of the holistic perception of harmony.



	<ol style="list-style-type: none"> <li>Demonstrate understanding of harmonious relationships in the family and society through discussions, case studies, and value-based reflections.</li> <li>Identify human responsibilities toward nature and propose value-based actions that promote environmental harmony.</li> </ol>	
<b>Unit – I</b>	<b>Course Introduction - Need, Basic Guidelines, Content and Process for Value Education</b>	<b>7 Hours</b>
	<ol style="list-style-type: none"> <li>Understanding the need, basic guidelines, content and process for value education</li> <li>Self-exploration–what is it? - its content and process; ‘natural acceptance’ and experiential validation- as the mechanism for self-exploration</li> <li>Continuous happiness and prosperity- a look at basic human aspirations</li> <li>Right understanding, relationship and physical facilities- the basic requirements for fulfillment of aspirations of every human being with their correct priority</li> <li>Understanding happiness and prosperity correctly- a critical appraisal of the current scenario</li> <li>Method to fulfill the above human aspirations understanding and living in harmony at various levels.</li> </ol>	
<b>Unit – II</b>	<b>Understanding Harmony in the Human Being - Harmony in Myself!</b>	<b>7 Hours</b>
	<ol style="list-style-type: none"> <li>Understanding human being as a co-existence of the sentient ‘i’ and the material ‘body’</li> <li>Understanding the needs of self (‘i’) and ‘body’ –sukhand suvidha</li> <li>Understanding the body as an instrument of ‘i’ (i being the doer, seer and enjoyer)</li> <li>Understanding the characteristics and activities of ‘i’ and harmony in ‘i’</li> <li>Understanding the harmony of i with the body: sanyamand swasthya; correct appraisal of physical needs, meaning of prosperity in detail</li> <li>Programs to ensure sanyamand swasthya</li> </ol>	
<b>Unit – III</b>	<b>Understanding Harmony in the Family and Society- Harmony in Human Relationship</b>	<b>8 Hours</b>
	<ol style="list-style-type: none"> <li>Understanding harmony in the family – the basic unit of human interaction</li> <li>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</li> <li>Understanding the meaning of vishwas, difference between intention and competence</li> <li>Understanding the meaning of samman, difference between respect and differentiation; the other salient values in relationship</li> <li>Understanding the harmony in the society (society being an extension of family): samadhan, samridhi, abhay, sah-astitva as comprehensive human goals</li> <li>Visualizing a universal harmonious order in society- undivided society (akhand samaj), universal order (sarvabhaum vyawastha)- from family to world family</li> </ol>	
<b>Unit – IV</b>	<b>Understanding Harmony in the Nature and Existence - Whole existence as Coexistence</b>	<b>8 Hours</b>
	<ol style="list-style-type: none"> <li>Understanding the harmony in the Nature</li> <li>Interconnectedness and mutual fulfillment among the four orders of nature recyclability and self-regulation in nature</li> <li>Understanding Existence as Co-existence (Sah-Astitva) of mutually interacting units in all-pervasive space</li> <li>Holistic perception of harmony at all levels of existence</li> </ol>	



**Text Books**

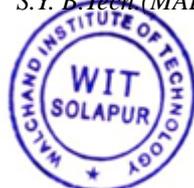
1. R.R Gaur, R Sangal, G P Bagaria, A foundation course in Human Values and professional Ethics, Excel books, New Delhi, 2010, ISBN 978-8-174-46781-2
2. The teacher's manual: R.R Gaur, R Sangal, G P Bagaria, A foundation course in Human Values and professional Ethics – Teachers Manual, Excel books, New 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, 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. Subhas Palekar, 2000, How to practice Natural Farming, Pracheen (Vaidik) Krishi Tantra Shodh, Amravati.
7. A Nagraj, 1998, Jeevan Vidya ek 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.

**e-Resources**

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. <https://drive.google.com/drive/folders/16eOka8AoBpLG1CDajRvk4MXgfXQWzFCB?usp=sharing>





# WALCHAND INSTITUTE OF TECHNOLOGY, SOLAPUR

(An Autonomous Institute)

Second Year B.Tech. (Mechanical and Automation Engineering), Semester-III

## 24MAU3CC8P: Programming in C++

### Teaching Scheme

<b>Lectures</b>	1 Hour/week
<b>Practical</b>	2 Hours/week
<b>Credits</b>	2

### Examination Scheme

<b>ISE</b>	25 Marks
<b>ICA</b>	25 Marks
<b>POE</b>	50 Marks

### Introduction:

This course deals with the study of basic concepts involved in C++ programming, like character sets, tokens, and operators. It includes an overview of the OOP's flow control structure. Emphasis is also given on classes, objects, constructors, etc.

### Course Prerequisite:

Programming for problem-solving using C.

### Course Objectives:

1. Understand the Fundamentals of Object-Oriented Programming (OOP)
2. Gain Proficiency in C++ Programming Basics
3. Learn to apply control flow statements and develop modular code using functions
4. Build a solid foundation in defining and using classes and objects

### Course Outcomes:

After completing the course, students will be able to

1. Develop algorithms for solving problems using object-oriented language.
2. Write, compile, debug & execute C++ programs.
3. Apply programming skills to solve various computing problems in the mechanical engineering field.

<b>Unit – I</b>	<b>Introduction to Object-Oriented Programming</b>	<b>2 Hours</b>
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Basic concepts, benefits, object-oriented languages, applications

<b>Unit – II</b>	<b>C++ Programming Basics</b>	<b>2 Hours</b>
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C character set, tokens, constants, variables, keywords, primitive data types, operator's operator precedence, expressions, type casting, and type conversion

<b>Unit – III</b>	<b>Control Structures</b>	<b>2 Hours</b>
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Control statement: if, if-else, nested if-else, else if ladder loops: while, do-while, for, nesting of loops, break, continue, switch-case statement



<b>Unit – IV</b>	<b>Functions</b>	<b>4 Hours</b>
Function prototyping, function overloading, and math library functions		
<b>Unit – V</b>	<b>Classes &amp; Objects</b>	<b>2 Hours</b>
Introduction, difference between structures & classes, declaration of class, defining the object of a class, data members, member functions, accessing a member of a class		
<b>Unit – VI</b>	<b>Constructor and Destructor</b>	<b>3 Hours</b>
Default constructor, parameterized constructor, constructor with default parameter, copy constructor, destructor		
ICA consists of minimum 8 practical/assignments from the below list		
<ol style="list-style-type: none"> <li>1. Create a basic C++ class structure to model a mechanical system</li> <li>2. Write a program that takes material properties and calculates specific stiffness or strength.</li> <li>3. Use if-else or switch-case to determine failure criteria based on stress values</li> <li>4. Develop a function to compute linear thermal expansion for different materials based on input temperature and coefficients.</li> <li>5. Solve motion equations using overloaded functions for different variable sets.</li> <li>6. Design a gear class to store number of teeth, module, and calculate pitch circle diameter.</li> <li>7. Create a pipe flow class with constructors to calculate Reynolds number, flow rate, etc.</li> <li>8. Write a loop-based program to simulate projectile motion with time steps and output position at each interval.</li> <li>9. Create a truss member class with functions to compute axial force and classify tension/compression.</li> <li>10. Build a heat engine class to calculate thermal efficiency, work done, and create a menu-driven program for multiple engine types.</li> </ol>		
<b>Text Books</b>		
1. Yashwant Kanitkar, Let us C++, B P B Publication		
<b>Reference Books</b>		
<ol style="list-style-type: none"> <li>1. E. Bal Guruswami-Object Oriented Programming, TataMc Grawhill Publications</li> <li>2. Rajesh Shukla-Object oriented programming in C++, Wiley India Publications</li> </ol>		
<b>e-Resources</b>		
<a href="https://archive.nptel.ac.in/courses/106/105/106105151/">https://archive.nptel.ac.in/courses/106/105/106105151/</a>		





## WALCHAND INSTITUTE OF TECHNOLOGY, SOLAPUR

(An Autonomous Institute)

Second Year B.Tech. (Mechanical and Automation Engineering), Semester-III

### 24MAU3FP9L: Community Engagement Project/ Field Project

Teaching Scheme		Examination Scheme	
Lectures	----	ESE	----
Practical	4 Hours/week	ISE	----
Credits	2	ICA	50 Marks

#### Introduction:

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 Prerequisite:

This course requires basic communication and interpersonal skills, understanding of social and environmental issues, teamwork and collaboration skills, report writing and documentation skills.

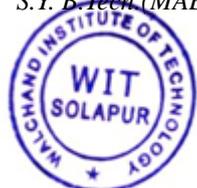
#### Course Objectives:

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

#### Course Outcomes:

After completing the course, students will 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



**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.**

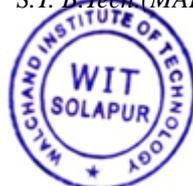
- Introduction
- Primary Data obtained through survey/ field visit
- Analysis of collected data
- Proposed Solution

**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

(An Autonomous Institute)

Second Year B.Tech. (Mechanical and Automation Engineering), Semester- IV

### 24CMU4SL11T: Environmental Studies

Teaching Scheme		Examination Scheme	
Lectures	----	ESE	50 Marks
Practical	----	ISE	----
Credits	----	ICA	----

#### Introduction:

The need of sustainable development is a key to the future mankind. Continuing the problems of all types of pollutions, loss of forest, solid waste disposal, degradation of environment, issues like economic productivity and national security, global warming, ozone layer depletion and loss of biodiversity have made everyone aware of environmental issues. No citizen of the earth affords to be ignorant of environmental issues. Environmental management has captured the attention of health care managers. Managing environmental hazard has becomes very important. It is now more critical than ever before for mankind as a whole to have clear understanding of environmental concerns and to follow sustainable development practices. Destructions of habitats, over-use of energy resources and environmental pollution have been found to be responsible for the loss of a large number of life-forms. It is feared that a large proportion of life are which may get wiped out in the near future.

#### Course Prerequisite:

This course requires basic understanding of science subjects from their higher secondary education, particularly in areas such as biology, chemistry, mathematics, physics, and geography. Familiarity with fundamental ecological concepts and general awareness about current environmental issues will be beneficial. Basic communication and analytical skills are also expected.

#### Course Objectives:

1. Recognize & understand major concepts in Environmental studies & demonstrate in depth understanding of environment.
2. Understand the interdisciplinary approach to complex Environmental problems using basic tools of the natural & social sciences including Biology, Chemistry, Physics,
3. Economics, Political sciences, Laws, Electronics etc.
4. Develop analytical skills, ability to critically evaluate the science & policy ramifications of diverse energy portfolios on air, water & food quality climate, forests etc.

#### Course Outcomes:

After completing the course, students will be able to

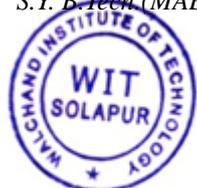
1. Describe the natural environment and its relationships with human activities.
2. Explain the ethical means and technological methods for sustainable management of environmental systems.
3. Explain social, economic and legal policies involved in the resolution of environmental problems.



<b>Unit – I</b>	<b>Nature of Environmental studies</b>	<b>2 Hours</b>
Definition, scope and importance, multidisciplinary nature of environmental studies, need for public awareness		
<b>Unit – II</b>	<b>Natural Resources and Associated Problems.</b>	<b>8 Hours</b>
<p>Forest, resources, use and over-exploration, deforestation, timber extraction, mining, dams and their effects on forests and tribal people</p> <ol style="list-style-type: none"> <li>1. Water resources, use and over-utilization of surface and ground water, floods</li> <li>2. Drought, conflicts over water, dam's benefits and problems</li> <li>3. Mineral resources and usage and exploitation, environmental effects of extracting and using mineral resources.</li> <li>4. Food resources, world food problem, changes caused by agriculture effects of modern agriculture, fertilizer-pesticide problems</li> <li>5. Energy resources, growing energy needs renewable and non-renewable energy sources, use of alternate energy sources</li> <li>6. Land resources, land as a resource, land degradation man induced landslides, soil erosion and desertification</li> <li>7. Role of an individuals in conservation of natural resources</li> <li>8. Equitable use of resources for sustainable lifestyle</li> </ol>		
<b>Unit – III</b>	<b>Ecosystems</b>	<b>8 Hours</b>
<p>Concept of an ecosystem</p> <ol style="list-style-type: none"> <li>1. Structure and function of an ecosystem</li> <li>2. Producers, consumers and decomposers</li> <li>3. Energy flow in the ecosystem</li> <li>4. Ecological succession</li> <li>5. Food chains, food webs and ecological pyramids</li> <li>6. Introduction types, characteristics features, structure and function of the ecosystem:- <ol style="list-style-type: none"> <li>a. Forest ecosystem</li> <li>b. Grassland ecosystem</li> <li>c. Desert ecosystem</li> <li>d. Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)</li> </ol> </li> </ol>		
<b>Unit – IV</b>	<b>Biodiversity and Its Conservations</b>	<b>8 Hours</b>
<p>Introduction-definition, genetic, species and ecosystem diversity</p> <ol style="list-style-type: none"> <li>1. Biogeographically classification of India</li> <li>2. Value of biodiversity consumptive use, productive use, social, ethical aesthetic and option values</li> <li>3. Biodiversity at global, national and local levels</li> <li>4. India as a mega-diversity nation</li> <li>5. Western Ghats as a bio-diversity region</li> <li>6. Hot spot of biodiversity</li> <li>7. Threats of biodiversity, habitat loss, poaching of wildlife, man wildlife conflicts</li> <li>8. Endangered and endemic, species of India</li> <li>9. Conservation of biodiversity, in-situ and Ex-situ conservation of biodiversity</li> </ol>		



<b>Unit – V</b>	<b>Environmental Pollutions</b>	<b>8 Hours</b>
Definitions: - Causes, effects and control measures of 1. Air pollution 2. Water pollution 3. Soil pollution 4. Marine pollution 5. Noise pollution 6. Thermal pollution 7. Near hazards 8. Solid waste Management, causes effects and control measures of urban and Industrial wastes 9. Role of an individual in presentation of pollution 10. Pollution case studies 11. Disaster management: -floods, earthquake, cyclone and landslides, tsunami		
<b>Unit – VI</b>	<b>Social Issues and the Environment</b>	<b>8 Hours</b>
1. From unsustainable to sustainable development 2. Urban problems related to energy 3. Water conservation, rain water harvesting, watershed management 4. Resettlement and rehabilitation of people, its problems and concerns 5. Environmental ethics, issue and possible solutions 6. Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust 7. Consumerism and waste products		
<b>Unit – VII</b>	<b>Environmental Protection</b>	<b>8 Hours</b>
1. Environment protection act 2. Air (prevention and control of pollution act) 3. Water (prevention and control of pollution act) 4. Wildlife protection act 5. Population growth and human health, human rights		
<b>Reference Books</b>		
1. Erach Bharucha (2013): Text book of Environmental Studies for under graduate courses, second Edition. 2. P. S Verna and V.K. Agarwal, 1983. Environmental biology, S. Chand Publications, New Delhi. 3. Dr Prakash Sawant (2009) “Environment studies” Fadake Publisher Kolhapur 4. Dr S. D Kadam (2005) “Human, Environment and Pollution” Fadake Publisher Kolhapur 5. Environment studies- University Press, Solapur University, Solapur 6. Erach Bharucha-“Environmental Studies” UGE Press New Delhi 7. Dr J S Samant (2005)-“Environmental Studies” Shivaji University press 8. Bharucha, E. (2004): Textbook for environmental studies for undergraduate students of all branches of higher education. University Grants Commission (UGC), New Delhi		
<b>e-Resources</b>		
<a href="https://onlinecourses.swyam2.ac.in/cec19_bt03/preview">https://onlinecourses.swyam2.ac.in/cec19_bt03/preview</a>		





**WALCHAND INSTITUTE OF TECHNOLOGY, SOLAPUR**  
(An Autonomous Institute)  
Second Year B.Tech. (Mechanical and Automation Engineering), Semester-IV

**24MAU4CC1T: Kinematics and Dynamics of Machinery**

Teaching Scheme		Examination Scheme	
Lectures	2 Hours/week	ESE	60 Marks
Practical	2 Hours/week	ISE	40 Marks
Credits	3	ICA	25 Marks
		OE	25 Marks

**Introduction:**

This course provides a comprehensive understanding of the basic principles of mechanisms and machinery. It covers key concepts in the design, analysis, and application of mechanical systems, emphasizing their kinematics and dynamics. Students will explore fundamentals such as kinematic links, pairs, and chains, along with the analysis of motion in mechanisms, including velocity, acceleration, and displacement. The course also introduces students to important machine elements such as cams, gears, and gear trains, as well as techniques for balancing rotating and reciprocating masses.

**Course Prerequisite:**

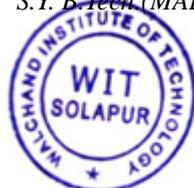
Knowledge of Engineering mechanics (forces, motion).

**Course Objectives:**

1. To build a comprehensive understanding of the fundamental concepts of kinematic links, pairs, chains, and various types of motion in mechanical systems
2. To enable students to analyse the velocity, acceleration, and displacement of mechanisms using both graphical and analytical methods.
3. To impart an understanding of cam profiles, follower motions, and their applications in designing mechanisms
4. To understand the basic of gears and gear trains, apply knowledge in motion and power transmission systems.
5. To introduce methods of static and dynamic balancing of rotating masses and reciprocating parts.

**Course Outcomes:**

- After completing the course, students will be able to
1. Apply the fundamentals of kinematic links, pairs, and chains to determine the degree of freedom, mobility, and inversions in mechanisms.
  2. Determine velocity and acceleration analysis of mechanisms using graphical and analytical methods.
  3. Draw cam profiles for different types of follower motions.
  4. select suitable gears, analyze gear train motion, and use appropriate methods for balancing rotating masses.



<b>Unit – I</b>	<b>Fundamentals of Mechanism</b>	<b>6 Hours</b>
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, condition for correct steering, steering gear mechanisms		
<b>Unit – II</b>	<b>Relative velocity And Acceleration method &amp; Kinematic Analysis of Mechanisms</b>	<b>6 Hours</b>
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, Klein's construction, kinematic analysis of four bar mechanism by analytical method- analytical methods for displacement, velocity and acceleration, analysis of four bar chain		
<b>Unit – III</b>	<b>Cam &amp; Followers</b>	<b>5 Hours</b>
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		
<b>Unit – IV</b>	<b>Gear and Gear trains</b>	<b>6 Hours</b>
Gear: classification spur gear: terminology, law of gearing, involute and cycloidal tooth profile, path of contact, arc of contact, sliding velocity, interference, and undercutting, gear train: types, - simple, compound, reverted and epicyclic gear trains		
<b>Unit – V</b>	<b>Balancing of Rotating and Reciprocating Masses</b>	<b>5 Hours</b>
Static and dynamic balancing of rotary masses, various methods of balancing of rotating masses, forces acting on reciprocating parts of engine neglecting weight of connecting rod, balancing of reciprocating masses- primary and secondary unbalanced forces in reciprocating masses, partial balancing of unbalanced primary forces		
ICA consists of minimum 8 practicals/assignments from below list 1. Demonstration of various types of pairs, quick return mechanism. 2. Verification of Grashof's Law in four bar chain. 3. Generation of involute Gear Teeth profile using Rack & pinion. 4. Experiment of static & dynamic balancing of masses using balancing apparatus. 5. Experiment on study of characteristics of Governor. 6. Demonstration of Steering gear mechanism Ackerman & Davis steering. 7. Experiment on Gyroscope. 8. Sheet based on problems on balancing of rotating masses in different plane. 9. Sheet based on generating cam profile for different followers and follower motions. 10. Sheet based on relative velocity and acceleration diagram & Klein's construction. 11. Balancing of multiple mass in single plane. 12. Numerical on gear trains		
<b>Text Books</b>		
1. S. S. Rattan, Theory of Machines, Third Edition, McGraw Hill Education (India) Pvt Ltd., New Delhi. 11		



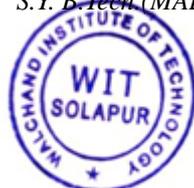
2. Bevan T, Theory of Machines, Third Edition, Longman Publication
3. Ballaney, P., Theory of Machines and Mechanisms, 2005, Khanna Publications

#### 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, Dhanpat Rai and Sons Publications
3. Bevan Thomas, The Theory of Machines, 3rd edition, CBS Publications
4. Shiley J. E. and Uicker J.J. Theory of Machines and Mechanism, McGraw Hill Inc.

#### e-Resources

1. <https://www.vlab.co.in/broad-area-mechanical-engineering>
2. [https://onlinecourses.nptel.ac.in/noc25\\_me46/preview](https://onlinecourses.nptel.ac.in/noc25_me46/preview)





# WALCHAND INSTITUTE OF TECHNOLOGY, SOLAPUR

(An Autonomous Institute)

Second Year B.Tech. (Mechanical and Automation Engineering), Semester-IV

## 24MAU4CC2T: Fluid Mechanics & Fluid Machines

Teaching Scheme		Examination Scheme	
Lectures	2 Hours/week	ESE	60 Marks
Practical	2 Hours/week	ISE	40 Marks
Credits	3	ICA	25 Marks
<b>Introduction:</b>			
The flow of fluids is important in many applications ranging from blood flow in the human body to air flow over the wing of a jet aircraft. This course provides a fundamental understanding of fluid behavior, covering topics like Fluid Statics, Fluid Kinematics & also Fluid Dynamics. The course also deals with water turbines & centrifugal pumps.			
<b>Course Prerequisite:</b>			
Students should have knowledge of fundamentals of Mathematics & Physics			
<b>Course Objectives:</b>			
<ol style="list-style-type: none"> <li>1. To understand the basic principles of fluid mechanics</li> <li>2. To identify various types of flows</li> <li>3. To understand Bernoulli's theorem &amp; its application</li> <li>4. To understand concept of dimensional analysis, drag &amp; lift forces, &amp; similarity principles</li> <li>5. To evaluate the performance of water turbines &amp; centrifugal pumps</li> </ol>			
<b>Course Outcomes:</b>			
After completing the course, students will be able to			
<ol style="list-style-type: none"> <li>1. Solve issues related to fluid statics &amp; kinematics</li> <li>2. Apply Bernoulli's theorem in real world situations</li> <li>3. Perform dimensional analysis, calculate drag &amp; lift forces &amp; apply similarity principles</li> <li>4. Select water turbines &amp; centrifugal pumps</li> </ol>			
<b>Unit – I</b>	<b>Fluid Statics</b>	<b>4 Hours</b>	
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			
<b>Unit – II</b>	<b>Fluid Kinematics</b>	<b>4 Hours</b>	
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			



<b>Unit – III</b>	<b>Fluid Dynamics</b>	<b>3 Hours</b>
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		
<b>Unit – IV</b>	<b>Flow through pipes</b>	<b>3 Hours</b>
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		
<b>Unit – V</b>	<b>Dimensional Analysis, Similitude and Forces on Immersed Bodies</b>	<b>3 Hours</b>
Dimensions of commonly encountered fluid properties, dimensional analysis, Buckingham's $\pi$ theorem, similitude, modeling, drag & lift on immersed bodies		
<b>Unit – VI</b>	<b>Impulse Water Turbines</b>	<b>4 Hours</b>
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		
<b>Unit – VII</b>	<b>Reaction Water Turbines</b>	<b>4 Hours</b>
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		
<b>Unit – VIII</b>	<b>Centrifugal Pumps</b>	<b>3 Hours</b>
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		
ICA consists of minimum 8 practical/assignments from the below list		
<ol style="list-style-type: none"> <li>1. Numerical &amp; theoretical assignments on basics of fluid mechanics (Properties of fluids &amp; related laws)</li> <li>2. Numerical on Piezometer, Simple &amp; inverted U tube manometer</li> <li>3. Any six experiments out of the following.</li> <li>4. Determination of metacentric height of floating body</li> <li>5. Reynold's Experiment</li> <li>6. Verification of Bernoulli's theorem.</li> <li>7. Calibration of Venturi meter</li> <li>8. Determination of minor losses</li> <li>9. Trial on a Pelton wheel.</li> <li>10. Trial on a Francis/ Kaplan turbine.</li> <li>11. Trial on a centrifugal pump.</li> <li>12. Two problems using CFD software</li> </ol>		



<b>Text Books</b>
<ol style="list-style-type: none"> <li>1. Dr. P.N. Modi and Dr. S.M. Seth - Hydraulics and Fluid Mechanics including Hydraulic Machines, Standard Book House</li> <li>2. Dr. R.K. Bansal - Fluid Mechanics and Hydraulic Machines , Laxmi Publication Pvt. Ltd., New Delhi</li> <li>3. Streeter, Wylie, Bedford - Fluid Mechanics, McGraw Hill Publications</li> </ol>
<b>Reference Books</b>
<ol style="list-style-type: none"> <li>1. White - Fluid Mechanics, McGraw Hill Publications</li> <li>2. Irving Shames - Mechanics of Fluid, McGraw Hill Publications</li> <li>3. Murlidhar - Advanced Fluid Engineering, Narosa Publications</li> <li>4. S. K. Som, G. Biswas- Introduction to Fluid Mechanics and Fluid Machines, Tata McGraw Hill Publications</li> </ol>
<b>e-Resources</b>
<ol style="list-style-type: none"> <li>1. <a href="https://archive.nptel.ac.in/courses/112/105/112105269/">https://archive.nptel.ac.in/courses/112/105/112105269/</a></li> <li>2. <a href="https://nptel.ac.in/courses/112104118">https://nptel.ac.in/courses/112104118</a></li> <li>3. <a href="https://archive.nptel.ac.in/courses/112/105/112105206/">https://archive.nptel.ac.in/courses/112/105/112105206/</a></li> <li>4. <a href="https://archive.nptel.ac.in/courses/112/104/112104117/">https://archive.nptel.ac.in/courses/112/104/112104117/</a></li> </ol>





# WALCHAND INSTITUTE OF TECHNOLOGY, SOLAPUR

(An Autonomous Institute)

Second Year B.Tech. (Mechanical and Automation Engineering), Semester-IV

## 24MAU4CC3T: Mechatronics

Teaching Scheme		Examination Scheme	
Lectures	2 Hours/week	ESE	60 Marks
Practical	2 Hours/week	ISE	40 Marks
Credits	3	ICA	25 Marks

### Introduction:

This 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. 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.

### Course Prerequisite:

Basic Electrical & Electronics Engineering

### Course Objectives:

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

### Course Outcomes:

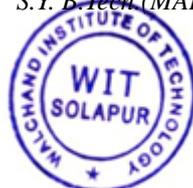
After completing the course, students will be able to

1. Illustrate the key elements of Mechatronic systems and their integration in applications like automobiles, HVAC systems, CNC machines, and domestic appliances.
2. Elaborate the working principles, characteristics, and applications of various sensors and actuators used in Mechatronic systems.
3. Perform number system conversions, binary arithmetic, and design combinational logic circuits using Boolean algebra and Karnaugh Maps.
4. Design basic sequential circuits including flip-flops, latches, counters, and registers, and explain their role in Mechatronic control systems.

Unit – I	Mechatronic Systems and Devices	3 Hours
Basic definition, key elements of mechatronics, historical perspective, mechatronics systems, car engine management system, automatic camera, white goods and domestic appliances, various systems in a modern automobile (ABS, TCS, DAS), modern HVACS, CNC machines and factory automation		



<b>Unit – II</b>	<b>Sensors</b>	<b>3 Hours</b>
Sensors: classification, principle of operation & characteristics, linear and rotational sensors, acceleration sensors, force sensors, torque sensors, flow sensors, temperature sensors, distance sensors, optical sensors		
<b>Unit – III</b>	<b>Number Systems, Operations, and Codes</b>	<b>3 Hours</b>
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		
<b>Unit – IV</b>	<b>Boolean Algebra and Logic Simplification</b>	<b>6 Hours</b>
The inverter, and gate, or gate, NAND gate, NOR gate, XOR and XNOR gates, programmable logic, Boolean operations and expressions, laws and rules of Boolean algebra, De 'Morgan'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		
<b>Unit – V</b>	<b>Combinational Logic Analysis</b>	<b>3 Hours</b>
Basic combinational logic circuits, implementing combinational logic, the universal property of NAND and NOR gates, combinational logic using NAND and NOR gates		
<b>Unit – VI</b>	<b>Functions of Combinational Logic</b>	<b>3 Hours</b>
Half and full adders, decoders, encoders, multiplexers (data selectors), demultiplexers		
<b>Unit – VII</b>	<b>Sequential Logic Circuits</b>	<b>3 Hours</b>
Latches, SR latch, D latch, flip flops, state table and state diagrams, registers, counters		
<b>Unit – VIII</b>	<b>Signals and Signal Conditioning</b>	<b>4 Hours</b>
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		
ICA consists of minimum 8 practical/assignments from the below list		
<ol style="list-style-type: none"> <li>1. Demonstration of logic gates using transistors and LED</li> <li>2. Assignment on Boolean algebra and K-map</li> <li>3. Interfacing of IR sensor module with Arduino UNO R3</li> <li>4. Interfacing of sound sensor module with Arduino UNO R3</li> <li>5. Interfacing of flame sensor module with Arduino UNO R3</li> <li>6. Assignment on ABS and Cruise control</li> <li>7. Speed control of DC motor using Arduino UNO R3</li> <li>8. Assignment on ABS and Cruise control</li> <li>9. Interfacing of servo motor with Arduino UNO R3</li> <li>10. Interfacing of ultrasonic sensor module with Arduino UNO R3</li> </ol>		



<b>Text Books</b>
<ol style="list-style-type: none"> <li>1. W. Bolton, Mechatronics, Pearson Publications</li> <li>2. Shetty &amp; Kolk, Mechatronics System Design, Cengage Learning Publications</li> <li>3. Morris Mano, Digital Logic Fundamentals, Pearson Publications</li> <li>4. R. P. Jain, Modern Digital Electronics, Tata McGraw Hill Publications</li> <li>5. B. P. Lathi, Principles of linear systems and Signal, Oxford university press</li> </ol>
<b>Reference Books</b>
<ol style="list-style-type: none"> <li>1. Bishop et.al, Handbook of Mechatronics, CRC Press</li> <li>2. Shetty &amp; Kolk, Mechatronics System Design, Cengage Learning Publications</li> <li>3. J. Millman and A. Grabel, Microelectronics, Tata McGraw Hill Publications</li> <li>4. Alan V. Oppenheim, Alan S. Willsky, and S. Hamid Nawab, Signals and Systems, Prentice Hall of India Publications</li> </ol>
<b>e-Resources</b>
<a href="https://archive.nptel.ac.in/courses/112/107/112107298/">https://archive.nptel.ac.in/courses/112/107/112107298/</a>



**WALCHAND INSTITUTE OF TECHNOLOGY, SOLAPUR****(An Autonomous Institute)****Second Year B.Tech. (Mechanical & Automation Engineering), Semester-IV****24MAU4CC4T: Project Management**

Teaching Scheme		Examination Scheme	
Lectures	2 Hours/week	ESE	60 Marks
Practical	--	ISE	40 Marks
Credits	2	ICA	--

**Introduction:**

This course provides a comprehensive understanding of the fundamental principles and techniques involved in managing engineering projects effectively. Students will learn how to plan, execute, monitor, and control projects while applying modern tools and software to ensure successful project completion.

**Course Prerequisite:**

Students should have a basic understanding of engineering economics, fundamentals of management, and familiarity with spreadsheet software such as MS Excel.

**Course Objectives:**

1. To introduce the fundamental principles and practices of project management.
2. To enable students to evaluate project feasibility using financial and risk analysis tools.
3. To develop skills for effective project planning, scheduling, monitoring, and controlling.
4. To familiarize students with modern project management software and digital tools.

**Course Outcomes:**

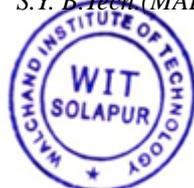
After completing the course, students will be able to

1. Interpret the fundamental concepts, life cycle phases, and responsibilities involved in project management.
2. Evaluate project feasibility using financial and risk analysis tools such as ROI, NPV, and scoring models.
3. Develop project plans and schedules using Work Breakdown Structure (WBS), CPM, and PERT techniques.
4. Apply project management software and information systems for effective monitoring and control of project activities.

Unit – I	Fundamentals of Project Management	4 Hours
Definition and key characteristics of a project, types and classification of projects, overview of project management, its importance and benefits, project life cycle phases, roles and responsibilities of a project manager, skills and competencies required for successful project execution		
Unit – II	Tools and Techniques for Project Feasibility	5 Hours
Introduction to feasibility studies and decision-making models, financial analysis tools: payback period, Return on Investment (ROI), Net Present Value (NPV), Internal Rate of Return (IRR),		



qualitative methods: scoring models, Break-even analysis for project viability assessment		
<b>Unit – III</b>	<b>Risk and Cost Management</b>	<b>5 Hours</b>
Fundamentals of risk management and its significance, risk identification, analysis, and mitigation strategies, estimating terminology and methods, jobbing, factoring, inflation adjustment, economies of scale, unit rate and day work, analogous, parametric, bottom-up, and three-point estimating, project budgeting and resource allocation		
<b>Unit – IV</b>	<b>Project Planning and Scheduling</b>	<b>5 Hours</b>
Importance of project planning and its phases, Work Breakdown Structure (WBS) development, roles and responsibilities in project teams, scheduling techniques, network diagrams, time estimation, Critical Path Method (CPM), Program Evaluation and Review Technique (PERT)		
<b>Unit – V</b>	<b>Monitoring, Control, and Performance Evaluation</b>	<b>4 Hours</b>
Project execution and control processes, techniques for performance monitoring, Key Performance Indicators (KPIS), productivity metrics, Earned Value Analysis (EVA), challenges in project control, evaluation methods to ensure goal achievement		
<b>Unit – VI</b>	<b>Project Management Systems and Software Tools</b>	<b>5 Hours</b>
Introduction to Project Management Information Systems (PMIS), planning and design of PMIS, hands-on overview of MS project, task creation, Gantt charts, dependencies, WBS integration, calendar setup, resource planning, resource leveling, baseline management, use of excel for project tracking, cost estimation, and risk management		
<b>Text Books</b>		
<ol style="list-style-type: none"> <li>1. S. Choudhury – Project Management, Tata McGraw-Hill Publications</li> <li>2. Narendra Singh – Project Management &amp; Control, Himalaya Publishing House</li> <li>3. Nitin Shrotri – How to be an Effective Project Manager (Self-published)</li> </ol>		
<b>Reference Books</b>		
<ol style="list-style-type: none"> <li>1. Harold Kerzner, Project Management: A Systems Approach to Planning, Scheduling and Controlling, Wiley Publications</li> <li>2. Project Management Institute, PMBOK Guide, 5th Edition</li> <li>3. Maylor, Project Management, Pearson Education Publications</li> </ol>		
<b>e-Resources</b>		
<ol style="list-style-type: none"> <li>1. <a href="https://nptel.ac.in/courses/110104073">https://nptel.ac.in/courses/110104073</a></li> <li>2. <a href="https://nptel.ac.in/courses/110105039">https://nptel.ac.in/courses/110105039</a></li> <li>3. <a href="https://swayam.gov.in">https://swayam.gov.in</a></li> <li>4. <a href="https://www.pmi.org/learning">https://www.pmi.org/learning</a></li> <li>5. <a href="https://spoken-tutorial.org">https://spoken-tutorial.org</a></li> <li>6. <a href="https://support.microsoft.com/en-us/project">https://support.microsoft.com/en-us/project</a></li> </ol>		





## WALCHAND INSTITUTE OF TECHNOLOGY, SOLAPUR

(An Autonomous Institute)

Second Year B.Tech. (Mechanical and Automation Engineering), Semester- IV

### 24CMU4AE7T: General Proficiency

Teaching Scheme		Examination Scheme	
Lectures	1 Hour/week	ESE	----
Practical	1 Hour/week	ISE	----
Credits	2	ICA	50 Marks

#### Introduction:

In today's global and competitive professional environment, engineers need more than just technical knowledge to succeed—they must also demonstrate strong communication, problem-solving, interpersonal, and leadership skills. The General Proficiency course has been carefully designed to help students transition smoothly from academia to industry by nurturing holistic development. Through a series of structured, experiential modules, this course sharpens students' employability skills, fosters responsible citizenship, and encourages physical and emotional well-being. It focuses on essential areas such as professional communication, aptitude training, soft skills, and social engagement ensuring students are better prepared for placements and life beyond college.

#### Course Prerequisite:

This course requires basic knowledge of communication language- oral and writing skill.

#### Course Objectives:

1. Teach students to create ATS-friendly, job-specific resumes and write professional emails using standard formats.
2. Help students participate effectively in group discussions by using clear communication, good body language, and time management.
3. Prepare students for interviews by improving self-introductions, nonverbal cues, and strategies for answering questions confidently.
4. Show students how to format and write clear notices, agendas, and meeting minutes with the right tone and language.
5. Raise students' awareness of different personality types and the importance of grooming, body language, time management, and professional etiquette.

#### Course Outcomes:

After completing the course, students will be able to

1. Create job-specific, ATS-friendly resumes and write professional emails.
2. Contribute to group discussions using effective communication techniques.
3. Face an interview with confidence by applying personal interview techniques.
4. Write clear and well-structured notices and meeting of minutes following professional standards.
5. Identify personality types, maintain proper grooming & body language and manage time well.



<b>Unit – I</b>	<b>Professional Communication</b>	<b>4 Hours</b>
<p>ATS friendly resume preparation, resume according to job description, tips to make an effective resume, Do's and Don'ts of professional email writing</p>		
<b>Unit – II</b>	<b>Group Discussion (GD) Skills</b>	<b>4 Hours</b>
<p>Role of group discussion in selection process, tips for effective GD participation, Do's and Don'ts of effective group participation. body language and time management in group discussion</p>		
<b>Unit – III</b>	<b>Personal Interview Techniques</b>	<b>2 Hours</b>
<p>Self-introduction, non-verbal communication: posture, power dressing, eye contact, tone, common interview questions and strategies for answering them, handling difficult or unexpected questions</p>		
<b>Unit – IV</b>	<b>Notices, Agendas, and Minutes of Meeting</b>	<b>2 Hours</b>
<p>Writing notices, format and layout, language and tone, sample notices for meetings, events, seminars, etc. guidelines for effective 'minutes of meeting' writing, Do's and Don'ts of minutes of meeting</p>		
<b>Unit – V</b>	<b>Personality Development for Engineering Students</b>	<b>2 Hours</b>
<p>Types of personalities and dealing with them, personality traits, personal grooming &amp; body language for success, personality depiction, time management &amp; discipline, professional etiquettes</p>		
<p>ICA consists of minimum 10 assignments from the below list</p> <ol style="list-style-type: none"> <li>1. Resume Creation: Students will prepare a one-page ATS friendly resume tailored to their Job description</li> <li>2. Email and Letter Writing: Each student will draft a formal email and a cover letter intended for a job application</li> <li>3. Notice, Agenda and Minutes of Meeting Writing: Write the Notice, agenda and Minutes of Meeting in a business setting</li> <li>4. Public Speaking: Just a Minute &amp; Elevator pitch activities.</li> <li>5. Self-Grooming Journal: Students will maintain a grooming and time-management journal for three consecutive days, documenting habits, self-discipline practices, and areas of improvement.</li> <li>6. SWOT Analysis of Personality: Each student will perform a personal SWOT analysis to identify their strengths, weaknesses, opportunities, and threats in the context of personality development and employability.</li> <li>7. Mock Group Discussion: Students will participate in mock GDs on current topics and after GD, performance of participants will be reviewed by peer assessment method</li> <li>8. Mock Personal Interviews: Students will undergo mock HR, simulations in front of peers and instructors, followed by personalized feedback on performance and body language.</li> <li>9. Body Language: Record the responses of students during the interview and instructor will analyse their body language and provide personalised feedback</li> <li>10. Grooming and Etiquette Demonstration: In this session, students will observe and demonstrate proper grooming standards, professional dress code, and social etiquettes suitable for interviews and corporate environments.</li> <li>11. Time Management Activity: Students. will be preparing Vision Board activity where they have to set their long-term goal chronologically</li> <li>12. Leadership and Teamwork Exercise: Solving and discussing Self and Business Case studies</li> </ol>		



<b>Text Books</b>
<ol style="list-style-type: none"> <li>1. Soft Skills: An Integrated Approach to Maximize Personality – Gajendra Singh Chauhan &amp; Sangeeta Sharma, Wiley India Pvt. Ltd.</li> <li>2. Communication Skills for Professionals – Nira Konar, PHI Learning, 3rd Edition, 2022.</li> <li>3. On Writing Well – William Zinsser, Harper Resource Book, 2001.</li> <li>4. Technical English – Dr. M. Hemamalini, Wiley India Pvt. Ltd.</li> <li>5. Professional Speaking Skills – Aruna Koneru, January 2018.</li> <li>6. Group Discussion and Interview Skills – Priyadarshi Patnaik, Cambridge University Press India, 2nd Edition, 2015.</li> </ol>
<b>Reference Books</b>
<ol style="list-style-type: none"> <li>1. Soft Skills – K. Alex, S. Chand Publications.</li> <li>2. Soft Skills: A Textbook for Undergraduates – Ajay R. Tengse, Orient Black Swan.</li> <li>3. Communication Skills – Sanjay Kumar &amp; Pushpa Lata, Oxford University Press.</li> <li>4. Managing Soft Skills for Personality Development – B. N. Ghosh, McGraw Hill.</li> <li>5. Soft Skills for Everyone – Jeff Butterfield, Cengage Learning.</li> <li>6. Soft Skills for Managers – Dr. T. Kalyana Chakravarthi &amp; Dr. T. Latha Chakravarthi, Biztantra Publication.</li> </ol>
<b>e-Resources</b>





# WALCHAND INSTITUTE OF TECHNOLOGY, SOLAPUR

(An Autonomous Institute)

Second Year B.Tech. (Mechanical and Automation Engineering), Semester- IV

## 24CMU4VE8T: Professional Ethics

### Teaching Scheme

**Lectures** 2 Hours/week

**Practical** ----

**Credits** 2

### Examination Scheme

**ESE** ----

**ISE** 50 Marks

**ICA** ----

### Introduction:

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 behaviour in building trust, maintaining credibility, and fostering a positive professional environment.

### Course Prerequisite:

This course requires basic communication and comprehension skills, general awareness of engineering practice, basic understanding of laws and regulations, reflective mindset and willingness to discuss real-world ethical scenarios.

### Course Objectives:

1. To make student aware of Professional Ethics in engineering
2. To make student aware of various theories in Professional Ethics
3. To make student learn about safety, risk and responsibilities of an engineer
4. To make student learn about the global issues in Professional Ethics

### Course Outcomes:

After completing the course, students will be able to

1. Follow Professional Ethics in his/her life.
2. Describe various theories in Professional Ethics.
3. Identify safety, risk and responsibilities of an engineer.
4. Behave consciously to global issues in Professional Ethics.

<b>Unit – I</b>	<b>Introduction to Professional Ethics</b>	<b>3 Hours</b>
Introduction, engineering and professionalism, two models of professionalism, three types of morality, preventive ethics, aspirational ethics		
<b>Unit – II</b>	<b>Engineering Ethics</b>	<b>4 Hours</b>
Senses of engineering ethics, variety of moral issues, types of inquiry, recent developments towards ethics in engineering, moral dilemmas-steps to solve moral dilemmas		
<b>Unit – III</b>	<b>Theories in Engineering Ethics</b>	<b>4 Hours</b>

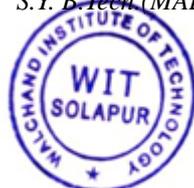


Kohlberg's theory, Gilligan's theory, consensus and controversy, models of professional roles, theories about right action, self-interest, customs and religion, uses of ethical theories		
<b>Unit – IV</b>	<b>Engineering as Social Experimentation</b>	<b>3 Hours</b>
Engineering projects vs standard projects, engineers as responsible experimenters, code of ethics, industrial standards		
<b>Unit – V</b>	<b>Safety and Risk</b>	<b>4 Hours</b>
Concept of safety, engineers and safety, risk- types of accidents, risk benefit analysis, reducing risk, risk management		
<b>Unit – VI</b>	<b>Responsibilities of an Engineer</b>	<b>3 Hours</b>
Collegiality, loyalty, respect of authority, collective bargaining, confidentiality, conflict of interest		
<b>Unit – VII</b>	<b>Rights of an Engineer</b>	<b>3 Hours</b>
Professional rights, employee rights, whistle blowing, intellectual property rights, discrimination, preferential treatment		
<b>Unit – VIII</b>	<b>Global Issues</b>	<b>4 Hours</b>
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		
<b>Text Books</b>		
1. R.S. Naagarazan, A Text Book of Professional Ethics & Human Values, New Age International Publications 2. Professional Ethics: R. Subramanian, Oxford University Press 3. Dr. N. Venkateswaran, Professional Ethics in Engineering, Sree Kamalamani Publications		
<b>Reference Books</b>		
1. Charles E. Harris Jr., Michael S. Pritchard and Michael J. Rabins, Engineering Ethics: Concepts and Cases, 4th Edition, Cengage Publications		
<b>e-Resources</b>		
<a href="https://onlinecourses.nptel.ac.in/noc22_mg54/preview">https://onlinecourses.nptel.ac.in/noc22_mg54/preview</a>		



**WALCHAND INSTITUTE OF TECHNOLOGY, SOLAPUR****(An Autonomous Institute)****Second Year B. Tech. (Mechanical and Automation Engineering), Semester-IV****24MAU4CC9D: Computer-Aided Machine Drawing**

Teaching Scheme		Examination Scheme	
Lectures	1 Hour/week	ESE	----
Practical	2 Hours/week	ISE	----
Credits	2	ICA	25 Marks
		POE	50 Marks
<b>Introduction:</b>			
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.			
<b>Course Prerequisite:</b>			
Basics of isometric & orthographic drawings			
<b>Course Objectives:</b>			
<ol style="list-style-type: none"> <li>1. To introduce students to BIS standards and conventions essential for technical and production drawings.</li> <li>2. To develop the skill of free-hand sketching and interpretation of mechanical components for visualization and communication.</li> <li>3. To impart knowledge of production drawing elements like limits, fits, tolerances, and surface finishes in compliance with industrial practices.</li> <li>4. To train students in 2D and 3D computer-aided drafting techniques using modern CAD tools.</li> </ol>			
<b>Course Outcomes:</b>			
After completing the course, students will be able to			
<ol style="list-style-type: none"> <li>1. Use BIS conventions to create accurate 2D mechanical drawings using standard symbols and annotations.</li> <li>2. Sketch and model mechanical components and assemblies through free-hand and CAD tools based on technical requirements.</li> <li>3. Apply suitable geometric and dimensional tolerances in production drawings.</li> <li>4. Create detailed assembly and exploded views using CAD software for engineering communication and manufacturing.</li> </ol>			
<b>Unit – I</b>	<b>Study of B.I.S. (Bureau of Indian Standards) Conventions</b>		<b>1 Hours</b>
BIS conventions- various shafts, screws, bearing, springs, gears, welds, materials. significance and use in drawings			



<b>Unit – II</b>	<b>Free Hand Sketching of machine component</b>	<b>2 Hours</b>
Importance of sketching, sketching/drafting of various machine elements like various nuts, couplings, cotter joint, knuckle joint, bends		
<b>Unit – III</b>	<b>Production Drawing: Limits, Fits, &amp; Tolerances</b>	<b>2 Hours</b>
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		
<b>Unit – IV</b>	<b>Details and Assembly Drawing</b>	<b>2 Hours</b>
Assembly drawing from given detail drawing and vice versa with tolerances and fits		
<b>Unit – V</b>	<b>Isometric Drafting</b>	<b>1 Hours</b>
Isometric drawing: isometric scale, isometric projection, isometric drawing, circles in isometric view, isometric views of simple object from given orthographic views		
<b>Unit – VI</b>	<b>Computer aided drawing (2D)</b>	<b>2 Hours</b>
The treatment on 2D drawing with- basic commands to draw 2D 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		
<b>Unit – VII</b>	<b>Computer aided drawing (3D)</b>	<b>3 Hours</b>
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		
ICA consists of minimum 6 practicals/assignments from the below list		
<ol style="list-style-type: none"> <li>1. Sheet on BIS Conventions</li> <li>2. Sheet on free hand sketches of machine components.</li> <li>3. Sheet on production drawing</li> <li>4. 2-D sketching with geometrical and dimensional constraints using CAD software (2</li> <li>5. 3D CAD modeling using CAD software</li> <li>6. Sheet on details to assembly using CAD software</li> <li>7. Sheet on assembly to details using CAD software</li> </ol>		
<b>Text Books</b>		
<ol style="list-style-type: none"> <li>1. P. S. Gill, Machine Drawing. S. K. Kataria and Sons, Delhi.</li> <li>2. N. D. Bhatt. Machine Drawing, Charotor Publication House, Bombay.</li> </ol>		



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.

#### **e-Resources**

1. <https://archive.nptel.ac.in/courses/112/102/112102102/>
2. <https://www.me.iitb.ac.in/~ramesh/courses/ME338/ssp1>





## WALCHAND INSTITUTE OF TECHNOLOGY, SOLAPUR

(An Autonomous Institute)

Second Year B.Tech. (Mechanical and Automation Engineering), Semester- IV

### 24MAU4VS10L: Electrical Technology

Teaching Scheme		Examination Scheme	
Lectures	1 Hour/week	ESE	----
Practical	2 Hours/week	ISE	----
Credits	2	ICA	50 Marks

#### Introduction:

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 Prerequisite:

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:

After completing the course, students will be able to

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

<b>Unit – I</b>	<b>DC Motor</b>	<b>4 Hours</b>
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 methods of dc shunt motor- flux and armature control		
<b>Unit – II</b>	<b>AC Motors</b>	<b>3 Hours</b>
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		



<b>Unit – III</b>	<b>Digital Electronics</b>	<b>3 Hours</b>
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		
<b>Unit – IV</b>	<b>Advanced Processors</b>	<b>4 Hours</b>
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		
ICA consists of minimum 8 practical/assignments from the below list		
<ol style="list-style-type: none"> <li>1. Speed control of DC shunt motors by flux control and armature control and armature voltage control method.</li> <li>2. Study of starters used for DC shunt motors.</li> <li>3. Load test on DC Motor.</li> <li>4. Load test on single-phase induction motor.</li> <li>5. Study of starters used for three-phase induction motor.</li> <li>6. Build and test combinational logic &amp; sequential logic circuits in the simulator and on a breadboard.</li> <li>7. Basic programming on 8051 trainer/simulator as a basic introduction to microcontroller.</li> <li>8. Interface IR sensor, sound sensor, and range sensor with Arduino Uno microcontroller board.</li> <li>9. Interface and control DC servo Motor using Arduino Uno board.</li> <li>10. Build a small circuit that will demonstrate interfacing both sensors and actuators with the Arduino UNO board</li> </ol>		
<b>Text Books</b>		
<ol style="list-style-type: none"> <li>1. Vedam Subramaniam, Electric Drives, McGraw Hill Publications</li> <li>2. Massimo Banzi &amp; Michael Shiloh, Make: Getting Started With Arduino, Shroff Maker Media.</li> </ol>		
<b>Reference Books</b>		
<ol style="list-style-type: none"> <li>1. A Fitzgerald, Charles Kingsley, Stephan Umans, Electric Machinery, McGraw Hill Publications</li> <li>2. Ned Mohan, Electric Machines and Drives: A First Course, Wiley India Publications</li> <li>3. Morris Mano, Digital Logic &amp; Computer Design, Pearson India Publications</li> <li>4. M Mazidi, 8051 and Embedded systems, Pearson India Publications</li> <li>5. W Bolton, Mechatronics, Pearson India Publications</li> </ol>		
<b>e-Resources</b>		
<a href="https://nptel.ac.in/courses/108108076">https://nptel.ac.in/courses/108108076</a>		

