

**DR. BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY**  
**CIRCULAR NO.SU/Engg./B.Tech./02/2019**



It is hereby informed to all concerned that, the syllabi prepared by the Board of Studies & recommended by the Dean, Faculty of Science & Technology the **has accepted the following syllabi in accordance with Choice Based Credits & Grading System for all Branches of B.Tech. Final Year** in his emergency powers under section 12(7) of the Maharashtra Public Universities Act, 2016 on behalf of the Academic Council and Management Council as enclosed herewith:-

Sr.No.	Syllabi as per CBC & GS
[1]	Final Year B.Tech.[Civil Engineering],
[2]	Final Year B.Tech. [Mechanical Engineering],
[3]	Final Year B.Tech. [Agricultural Engineering],
[4]	Final Year B.Tech.[Electrical Engineering],
[5]	Final Year B.Tech. [Plastic & Polymer Engineering],
[6]	Final Year B.Tech [Electronics & Telecommunication Engg.],
[7]	Final Year B.Tech. [Computer Science Engineering].

This is effective from the Academic Year 2019-2020 and onwards.

All concerned are requested to note the contents of this circular and bring the notice to the students, teachers and staff for their information and necessary action.

University Campus,  
Aurangabad-431 004.  
REF.NO.SU/2019/ 820-30  
Date:- 24-07-2019.

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**Deputy Registrar,**  
**Syllabus Section**

**Copy forwarded with compliments to :-**

- 1] **The Principals, affiliated concerned Colleges, Dr. Babasaheb Ambedkar Marathwada University.**
- 2] **The Director, University Network & Information Centre, UNIC, with a request to upload this Circular on University Website.**

**Copy to :-**

- 1] The Director, Board of Examinations & Evaluation,
- 2] **The Section Officer, [ Engineering Unit ] Examination Branch,**
- 3] The Section officer, [Eligibility Unit],
- 4] **The Programmer [Computer Unit-1] Examinations,**
- 5] **The Programmer [Computer Unit-2] Examinations,**
- 6] The In-charge, [E-Suvidha Kendra],
- 7] The Public Relation Officer,
- 8] The Record Keeper,

**DR. BABASAHEB AMBEDKAR  
MARATHWADA UNIVERSITY,  
AURANGABAD.**



**Curriculum of  
Final Year B.Tech  
Mechanical Engineering  
Under Choice Based Credit & Grading System**

**UNDER THE FACULTY OF SCIENCE & TECHNOLOGY.**

**[ Effective from 2019-20 & onwards ]**

**DR. BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY,  
AURANGABAD**

**[FACULTY OF SCIENCE AND TECHNOLOGY]**



**REVISED SYLLABUS  
Of  
Final Year B. Tech. (Mechanical Engineering)  
(w.e.f. academic year 2019-2020)**

**FACULTY OF SCIENCE AND TECHNOLOGY**  
**Revised Structure w.e.f. 2019-2020**  
 Final Year. B.Tech. (Mechanical Engineering)

Course Code	SEMESTER-VII	Contact Hrs / Week				Examination Scheme						
	Course	L	T	P	Total	CT	TH	TW	PE	Total	Credits	Duration of Theory Exam
MED401	Tool Design	4	-	-	4	20	80	-	-	100	4	4 Hrs
MED402	Automatic Control Systems	4	-	-	4	20	80	-	-	100	4	3 Hrs
MED403	Refrigeration and Cryogenics	4	-	-	4	20	80	-	-	100	4	3 Hrs
*	Open Elective II	4	-	-	4	20	80	-	-	100	4	3 Hrs
MED441- MED443	Elective III	4	-	-	4	20	80	-	-	100	4	3 Hrs
MED444- MED446	Elective IV	2	-	-	2	10	40	-	-	50	2	2 Hrs
MED421	Lab: Tool Design	-	-	2	2	-	-	25	25	50	1	
MED422	Lab: Automatic Control Systems	-	-	2	2	-	-	50	-	50	1	
MED423	Lab: Refrigeration and Cryogenics	-	-	2	2	-	-	25	25	50	1	
MED424	Lab: Hydraulic Machines	-	-	2	2	-	-	50	50	100	1	
MED425	Project II:	-	-	4	4	-	-	100	100	200	4	
	<b>Total of semester-VII</b>	<b>22</b>	<b>-</b>	<b>12</b>	<b>34</b>	<b>110</b>	<b>440</b>	<b>250</b>	<b>200</b>	<b>1000</b>	<b>30</b>	
Course Code	SEMESTER-VIII	Contact Hrs / Week				Examination Scheme						
	Course	L	T	P	Total	CT	TH	TW	PE	Total	Credits	Duration of Theory Exam
MED471	IPT	-	-	-	-	-	-	300	300	600	24	NA
	<b>Total of semester-VIII</b>							<b>300</b>	<b>300</b>	<b>600</b>	<b>24</b>	
	<b>Grand Total of VII &amp; VIII</b>	<b>22</b>	<b>-</b>	<b>12</b>	<b>34</b>	<b>110</b>	<b>440</b>	<b>550</b>	<b>500</b>	<b>1600</b>	<b>54</b>	

L: Lecture hours per week      T: Tutorial hours per week      P: Practical hours per week  
 CT: Class Test                      TH: University Theory Examination      TW: Term Work  
 P: Practical/Oral Examination  
 IPT: In Plant Training

### Elective III

	<b>Thermal</b>	<b>Design</b>	<b>Manufacturing</b>
<b>Course Code</b>	MED441	MED442	MED443
<b>Course</b>	Automobile Engineering	Vibration and Noise Control	Composite Materials and Manufacturing

### Elective IV

<b>Elective</b>	<b>Thermal</b>	<b>Design</b>	<b>Manufacturing</b>
<b>Course Code</b>	MED444	MED445	MED446
<b>Course</b>	HVAC (Heating Ventilation and Air Conditioning)	Tribology	Industry 4.0

### Open Elective-II Course

<b>Sr. No.</b>	<b>Name of course</b>	<b>Department</b>	<b>Course code</b>
1.	Fundamentals of Bioenergy	AED	AED431
2.	Big DataAnalytics	CSED	CSE431
3.	Solid Waste Management	CED	CED431
4.	Energy Planning and Conservation	EED	EED431
5.	Data Science	ETC	ETC431
6.	Operations Research	MED	MED431
7.	Polymer Recycling and Waste Management	PPED	PPE431

<b>Dr. Babasaheb Ambedkar Marathwada University, Aurangabad</b> (Faculty of Science & Technology) <b>Syllabus of Final Year B. Tech. (Mechanical Engineering) Semester-VII</b>	
<b>Course Code: MED401</b> <b>Teaching Scheme:</b> <b>Theory: 04 Hrs/week</b> <b>Credits: 04</b>	<b>Course: Tool Design</b> <b>Class Test: 20 marks</b> <b>Theory Examination Duration: 04 Hrs</b> <b>Theory Examination Marks: 80</b>
<b>Prerequisite</b>	: 1.Fundamental knowledge of manufacturing sciences and manufacturing processes along with engineering and machine drawing.  2.Basic knowledge of machine design and familiar with design data book.
<b>Objectives</b>	: 1. To study and understand elements of Tooling. 2. Analyses and applications of Tooling. 3. Design of Jigs, Fixtures and Dies for a given component.
<b>Unit-I</b>	: <b>Introduction:</b> Tooling-Definition, classification, AISI tool materials and their properties  <div style="text-align: right;"><b>02 Hrs</b></div>
<b>Unit-II</b>	: <b>Elements of Machining Process:</b> Basic requirements of machining process, single point cutting tool-Geometry and tool signature, mechanics of chip formation, types of chips, effect of tool geometry and cutting condition on machining process, tool wear-types and mechanism, tool life, forces on cutting tool, merchants force circle, power requirements, design and construction details of single point cutting tool for turning, boring and shaping operations, economics based on cutting tool, cutting fluids-types, properties, Numerical  <b>Progresses in Cutting Tools:</b> Review of recent progresses in rake angles, tool life, carbide inserts cutting tools to improve machining performance.  <div style="text-align: right;"><b>10Hrs</b></div>
<b>Unit-III</b>	: <b>Multipoint Cutting Tools:</b> Drills-classification and nomenclature, drill point geometry, selection of drills for various operation. Reamers-classification and nomenclature. Milling cutters-classification and nomenclature of end mill, plain milling cutter. Taps-classification and nomenclature  Broaches- classification and nomenclature. Hobs- classification and

	<p>nomenclature. Machining volume, time and forces for drilling and milling operations.</p> <p><b>Limits, fits and Gauges</b></p> <p>Tolerances, functional and nonfunctional dimensions, way of expressing tolerances , specifying tolerances and tolerances accumulation, compounding interchangeability, selective assembly, Indian standards BIS-919-1963, nominal and basic size , limits and fits ,plain gauge, snap gauge, contour and profile gauges, gauge design, Taylor’s principle, numerical.</p> <p style="text-align: right;"><b>12Hrs</b></p>			
<b>Unit-IV</b>	<p><b>: Jigs and Fixtures:</b></p> <p>Principle of location, degree of freedom, 3-2-1 method of location, 4-2-1 method of location, locating devices, Drill jig-types of jig bushes, types of drill jigs, design and development procedure of jig for different components. Fixtures-setting block, tenon, clamping of fixtures, types of fixtures, design and development of milling / turning fixture for different components. Tolerances, method of dimensions and manufacturing of jigs and fixtures</p> <p style="text-align: right;"><b>08 Hrs</b></p>			
<b>Unit-V</b>	<p><b>: Design of Dies:</b></p> <p>Power presses types and construction details, die cutting operation, cutting action in die and punch, center of pressure, clearances and significance, cutting forces, methods of reducing cutting forces, method of punch support, strippers, stock stops, guide pilots, knockouts, design of blanking and piercing dies.</p> <p style="text-align: right;"><b>10 Hrs</b></p>			
<b>Unit-VI</b>	<p><b>: Drawing Dies:</b></p> <p>Metal flow and factors affecting drawing, blank size calculations, drawing force, single and double acting dies, design and development of drawing dies for different components.</p> <p style="text-align: right;"><b>06 Hrs</b></p>			
<b>Reference Books, e- books, e- Journals</b>	<b>Sr. No</b>	<b>Title</b>	<b>Author</b>	<b>Publication</b>
	1	Fundamentals of Tool Design	ASTME	ASTME
	2	Tool design	Cyril Donaldson	TMH Publication, New Delhi.
	3	Jig & Fixtures	P. H. Joshi,	TMH Publication, Second Edition

	4	Introduction to Jig and Tool Design	M H A Kempster	Cengage Learning
	5	Jigs and fixture design manual	Erik K Henriksen	Industrial Press Inc.,
	6	Manufacturing Science	Ghosh / Mallik	East West Press
	7	Design Data Book	Kalaikathir Achchagam	Data book of engineers by PSG college-Coimbatore
	8	Metal Cutting Theory and Practice	A. Bhattacharya	CRC Press
<b>Additional References</b> :	:	1. nptel.iitm.ac.in 2. ocw.mit.edu 3. see.stanford.edu		

**Section:A** Units I, II and III; **Section: B** Units IV, V, and VI

**Pattern of Question paper:**

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**For 80 Marks Paper:**

1. Ten questions.
2. Five questions in each section.
3. Question no 1 from section A and Question no 6 from section B be made compulsory and should cover complete syllabus of the respective section for 10 marks each.
4. Remaining questions will be of 15 marks each.
5. Any two questions of 15 marks from remaining questions in each section are to be solved.



<b>Dr. Babasaheb Ambedkar Marathwada University, Aurangabad</b> (Faculty of Science & Technology) <b>Syllabus of Final Year B. Tech. (Mechanical Engineering) Semester-VII</b>	
<b>Course Code: MED402</b> <b>Course: Automatic Control Systems</b> <b>Teaching Scheme:</b> <b>Class Test: 20 marks</b> <b>Theory: 04 Hrs/week</b> <b>Theory Examination Duration: 03 Hrs</b> <b>Credits: 04</b> <b>Theory Examination Marks: 80</b>	
<b>Prerequisites</b>	: 1. Basic knowledge of engineering mathematics, physics. 2. Basic understanding of electrical, mechanical systems.
<b>Objectives</b>	: 1. To study the fundamental concepts of control systems and mathematical modeling of the system. 2. To study the concept of time response and frequency response of the system. 3. To study the basics of stability analysis of the system. 4. To study the various control actions & controllers of a control system.
<b>Unit-I</b>	<b>Representation of Control System Components</b> <b>Introduction:</b> - Review of various types of measuring instruments and transducers, Basic concepts of control systems, Classification of control systems, Open loop and Closed loop control system, Transfer Function & Its significance. Introduction, Study of Mechanical, Electrical & Electronics components employed in construction of control systems and Mathematical equations for the same, Study of Mechanical, Electrical, Thermal & Fluid systems and mathematical equations for the same, Analogies (Direct and Indirect) for Mechanical, Electrical, Thermal & Fluid systems <div style="text-align: right;"><b>10 Hrs</b></div>
<b>Unit-II</b>	<b>Block Diagram Algebra:</b> Introduction, Basic rules for solving block diagrams, Representing & reducing block diagram for actual control systems like Liquid level systems, Speed control systems, Temperature control systems, Position control systems <div style="text-align: right;"><b>08 Hrs</b></div>

<b>Unit-III</b>	: <b>Hydraulic Systems &amp; Pneumatic Systems:</b> Study of Hydraulic components used in Hydraulic Systems Viz. Pumps (Gear, Reciprocating, Vane Pump etc.); Hydraulic Actuators (Hydraulic Cylinder, Hydraulic servo motors etc); Valves (2 way, 3 way, 4way, Directional, Pressure Control Valves). Study of components used in Pneumatic systems viz. pneumatic cylinders, Bellows, Various types of Pressure Control Relays, Flapper nozzle system <b>06 Hrs</b>		
<b>Unit-IV</b>	: <b>Electrical Systems &amp; Modes of Control:</b> Study of electrical motors viz. A.C., D.C., Stepper, Servomotors; Speed control of these electrical motors by armature control, field control etc. and their circuit diagrams; Study of electrical servomechanism for position control, speed control of stepper motor. Study of a) On Off Control, b) Proportional (P) Control, c) Integral (I) Control, d) Derivative (D) Control, e) P + I, f) P + D, g) P + I + D (including mathematical representation of the same); Study of these control actions with examples of Mechanical, Hydraulic, Pneumatic systems. <b>08 Hrs</b>		
<b>Unit-V</b>	: <b>Response Characteristics:</b> Introduction of various types of standard input signals, Transient & Steady state response, Transient & Steady state response characteristics of First order and Second order systems when subjected to standard input signals. <b>08 Hrs</b>		
<b>Unit-VI</b>	: <b>Analysis of Frequency Response:</b> Introduction, Characteristics of Frequency Response of different functions (up to Second order systems only) Graphical Method of analyzing frequency response, Bode Plot, Nyquist Plot (Polar Plot), Concept of Stability, Routh's stability criteria. <b>08 Hrs</b>		
<b>Reference Books:</b>	<b>Sl. No</b>	<b>Title</b>	<b>Author</b>
	1	Automatic Control Systems	Francis Raven
	2	Modern Control Engineering	K. Ogata,
			<b>Publication</b>
			TMH, 5 <sup>th</sup> edition.
			PHI, 3 edition.

3	Automatic Control Systems	Hasan Saeed	Katson Publication, 6th edition
4	Automatic Control Systems,	Nagrath Gopal,	New Age International, 4th edition
5	Control Systems Engineering	S. K. Bhattacharya	Pearson Education, 3 <sup>rd</sup> edition.
6	Automatic Control Systems,	Benjamin C. Kuo	PHI, 7th edition.

**Section A:** Units I, II, and III; **Section B:** Units IV, V, and VI.

**Pattern of Question paper:**

The 6 units in the syllabus shall be divided in two equal parts i.e. 3 units respectively. Question paper shall be set having two sections A and B. section A questions shall be set on first part and Section B questions on second part. Question paper should cover the entire syllabus.

**For 80 Marks Paper:**

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2. Five questions in each section.
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<b>Dr. Babasaheb Ambedkar Marathwada University, Aurangabad</b> (Faculty of Science & Technology) <b>Syllabus of Final Year B. Tech. (Mechanical Engineering) Semester-VII</b>	
<b>Course Code: MED403</b> <b>Course: Refrigeration and Cryogenics</b> <b>Teaching Scheme:</b> <b>Class Test: 20 marks</b> <b>Theory: 04 Hrs/week</b> <b>Theory Examination Duration: 04 Hrs</b> <b>Credits: 04</b> <b>Theory Examination Marks: 80</b>	
<b>Prerequisite</b>	1. Basic knowledge and understanding of thermodynamics, heat transfer and fluid mechanics.
<b>Objectives</b>	<b>:</b> 1. To understand fundamentals of refrigeration and cryogenic systems 2. To apply knowledge for various applications of refrigeration and cryogenics 3. To design refrigeration and cryogenic systems. 4. To analyze various refrigeration systems for thermal performance.
<b>Unit-I</b>	<b>:</b> <b>Introduction:</b> Various fundamental methods of refrigeration, Commercial unit, Energy Efficiency Ratio (EER), BEE star rating, Refrigerator and heat pump relationship, Reversed Carnot cycle and its limitations <b>Simple Vapour Compression Cycle :</b> Classical development of vapour compression refrigeration system, Use of phase change (evaporator and condenser), Standard VCRS, Actual VCR cycle, Representation on p-h and T-s diagram, Effect of condenser and evaporator pressure, Effect of suction vapour superheat, Effect of liquid sub cooling. Methods of improvement in simple system. (descriptive and numerical treatment)

		<b>10Hrs</b>
<b>Unit-II</b>	: <b>Multi Pressure system:</b> Limitations of simple VCRs and need of compound VCRs. Multi-evaporator, Multi-compressor, Individual and multiple expansion valves, Flash intercooling, Removal of flash gas, Need of multi pressure system.(descriptive and numerical treatment)	<b>08 Hrs</b>
<b>Unit-III</b>	: <b>Non-Conventional Refrigeration System</b> <b>Vapor Absorption System</b> Need of compression VCRs, Properties of absorbent pair, Ammonia-water system, Water-lithium Bromide absorption system and functioning of each component (descriptive treatment) <b>Steam Jet Refrigeration system</b> Schematic component diagram and its working, Sample calculations, Use and limitations (descriptive treatment) <b>Magnetic Refrigeration System</b> Introduction, working, scope and limitations (descriptive treatment) <b>Refrigerants</b> Classification and ASHRAE nomenclature of refrigerants, Desirable properties of refrigerants, Comparison among commonly used refrigerants and its properties, Effect on Ozone depletion and global warming, Alternative refrigerants, Environmental protection protocol and India's commitment (descriptive)	<b>06 Hrs</b>
<b>Unit-IV</b>	: <b>Air Refrigeration System:</b> Air cycle refrigeration system, Carnot cycle, Bell-Coleman cycle, Thermodynamic process and priority and suitability of air refrigeration system , Types of air refrigeration systems, Simple, Boot strap, Regeneration, Reduced ambient, Evaporative system, Comparison of these cycles based on DART rating(descriptive and numerical treatment)	<b>08Hrs</b>
<b>Unit-V</b>	: <b>Low Temperature Refrigeration (Cryogenics)</b> Introduction, Limitations of VCRs for low temperature production, Cascade staging, Direct staging verses cascade staging, Solid carbon dioxide or dry ice, Production of low temperatures, Cryogenic system, Joules- Thomson coefficient, Liquefaction of gases, Linde and Claude system of liquefaction of	

		gases and its analysis, liquefaction of Hydrogen, liquefaction of Helium.(descriptive and numerical treatment)		
		<b>10 Hrs</b>		
<b>Unit-VI</b>	:	<b>Application of Refrigeration and cryogenic Systems:</b> Introduction, Food preservation, Factors contributing to food spoilage, Methods of food preservation, Method of food freezing, Food processing/preservation by refrigeration, Cold storage, Refrigeration methods for transport, Domestic refrigerators, Water coolers  <b>Cryogenic Systems:</b> Medical applications, Space applications, Production engineering applications, superconductivity, Magnetic levitation(descriptive treatment)		
		<b>06 Hrs</b>		
<b>Text Book</b>	<b>Sr. No</b>	<b>Title</b>	<b>Author</b>	<b>Publication</b>
	1	Refrigeration and Air Conditioning	C.P. Arora	Tata McGraw Hill, 3 <sup>rd</sup> Edition, 2010
	2	Refrigeration and Air Conditioning	Manohar Prasad	Prentice-Hall India
	3	Refrigeration and Air Conditioning	P.L.Ballaney	Khanna Publisher
	4	Refrigeration and Air-conditioning	S.C. Arora and S. Domkundwar	Dhanpat Rai and Co.(P) ltd., New Delhi-
	5	Fundamentals of Cryogenic Engineering	Manta Mukhopadhyay	PHB learning Private limited
<b>References</b>	1	ASHRAE Handbook, Fundamentals,2013	ASHRAE	ASHRAE
	2	Principles of Refrigeration	Roy J.Dossat	Wiley Eastern Limited, New Delhi
	3.	Basic Refrigeration and Air conditioning	P.N. Ananthanarayan	McGraw Hill Publishing Company Ltd., New Delhi, 3 <sup>rd</sup> edition
	4	Industrial Refrigeration Handbook	W.F. Stoecker	McGraw Hill Publishing Company Ltd., New Delhi,
	5	Cryogenic Systems	Randall F. Baron	Oxford University Press, New York, Clarendon Press, Oxford (1985)
<b>Useful links</b>	:	1. <a href="http://nptel.ac.in/courses/112105128/">http://nptel.ac.in/courses/112105128/</a> 2. <a href="http://nptel.ac.in/downloads/112105129/">http://nptel.ac.in/downloads/112105129/</a> 3. <a href="http://www.beestarlabel.com/">http://www.beestarlabel.com/</a>		

	<p>4. <a href="http://www.emersonclimate.com/ProductDocument/Copelandliterature/SGE127-Emerson-General-Product-Catalogue-2017-EN_e.Pdf">http://www.emersonclimate.com/ProductDocument/Copelandliterature/SGE127-Emerson-General-Product-Catalogue-2017-EN_e.Pdf</a></p> <p>5. <a href="http://www.emersonclimate.com/en-S/Brands/vilter/Pages/brochure.aspx">http://www.emersonclimate.com/en-S/Brands/vilter/Pages/brochure.aspx</a></p>
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**Section A:** Units I, II, and III; **Section B:** Units IV, V, and VI.

**Pattern of Question paper:**

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<b>Dr. Babasaheb Ambedkar Marathwada University, Aurangabad</b> (Faculty of Science & Technology) <b>Syllabus of Final Year B. Tech. (All) Semester-VII</b>	
<b>Course Code: AED431</b> <b>Course: OE-II (Fundamentals of Bioenergy)</b> <b>Teaching Scheme:</b> <b>Class Test: 20 marks</b> <b>Theory: 04 Hrs/week</b> <b>Theory Examination Duration: 03 Hrs</b> <b>Credits: 04</b> <b>Theory Examination Marks: 80</b>	
<b>Objectives</b>	: 1. Understand bioenergy technologies, processes, reactions and energy conversion rates for Anaerobic Digestion, gasification, pyrolysis (fast, intermediate and slow) and combustion to study the wells, bore wells and well development. 2. Know what constitutes a suitable feedstock for bioenergy applications
<b>Unit-I</b>	: <b>Introduction to bioenergy-</b> Introduction, Unit of Energy and Introduction of Bioenergy, How Biomass Formed on the Earth, Road Map of Bioenergy, Basic Biomass Technology (Resources and Production) Exploration of Photosynthesis Process, In Photosynthesis Oxygen Comes from Water Molecule. <div style="text-align: right;"><b>08 Hrs</b></div>
<b>Unit-II</b>	: <b>Bioethanol-</b> Basic concept of Cellulosic Bioethanol Process, Pretreatment and Enzyme treatment of Cellulosic Bioethanol Process, Fermentation and Distillation in Cellulosic Bioethanol Production, Basic concept of Plant Design, Pilot Plant and Scale-up <div style="text-align: right;"><b>08 Hrs</b></div>
<b>Unit-III</b>	: <b>Biogas-</b> Basic concept in anaerobic digestion and bio gasification, Biochemical methane



	potential assay and calculations for bio gasification feasibility analysis, Design and operation of bio gasification systems, Biogas utilization, Biomass production System and their Categorization, Important Parameters for Selecting Biomass Crops, Factors Determining the Conversion Process - I <b>08 Hrs</b>			
<b>Unit-IV</b>	: <b>Biodiesel</b> Biodiesel production processes, Biodiesel characterization, Biodiesel feed stocks, Environmental permitting and safety considerations for biodiesel production <b>08 Hrs</b>			
<b>Unit-V</b>	: <b>Thermo Chemical Processes:</b> Basic concepts in gasification and pyrolysis, Gasification and pyrolysis systems, Spark Ignition Engine, Compression Ignition Engine, Gasification Types - Up Drift Gasifier <b>08 Hrs</b>			
<b>Unit-VI</b>	: <b>Bioenergy distribution and end use for a sustainable future -</b> Down Draft and cross flow gasifier, operation and performance of gasifier , fluidized bed gasification, its operation and performance, Biological root of gasification <b>08 Hrs</b>			
<b>Reference Books, e- books, e- Journals</b>	Sr. No.	Title	Author	Publication
	1	Introduction to Bioenergy (Energy and the Environment)	Vaughn C. Nelson, Kenneth L. Starcher	CRC Press; 1 edition (31 May 2016)
	2	Bioenergy: Biomass to Biofuels	Anju Dahiya	Academic Press; 1 edition (12 November 2014)
	3	Bioenergy: Principles and Applications	Yebo Li and Samir Kumar Khanal	Wiley-Blackwell; 1 edition (October 10, 2016)

**Section: A** Units I, II and III; **Section: B** Units IV, V, and VI

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<b>Dr. Babasaheb Ambedkar Marathwada University, Aurangabad</b> (Faculty of Science & Technology) <b>Syllabus of Final Year B. Tech. (All) Semester-VII</b>	
<b>Course Code: CSE431</b> <b>Course: OE-II (Big Data Analytics)</b> <b>Teaching Scheme:</b> <b>Class Test: 20 marks</b> <b>Theory: 04 Hrs/week</b> <b>Theory Examination Duration: 03 Hrs</b> <b>Credits: 04</b> <b>Theory Examination Marks: 80</b>	
<b>Prerequisite</b>	Knowledge of Programming Language (Java preferably), SQL
<b>Objectives</b>	: <ol style="list-style-type: none"> <li>1. To understand the Big Data Platform and its Use cases</li> <li>2. To understand the basics of Apache Hadoop and HDFS</li> <li>3. To apply analytics on Structured, Unstructured Data.</li> </ol>
<b>Unit-I</b>	: <b>FUNDAMENTALS OF BIG DATA</b> The Evolution of Data Management, Understanding the Waves of Managing Data, Defining Big Data, Four Vs, Big Data Management Architecture. Big Data Types: Defining Structured Data, Defining Unstructured Data, Big Data Applications. <b>08 Hrs</b>
<b>Unit-II</b>	: <b>BIG DATA TECHNOLOGY LANDSCAPE:</b> Big Data Technology Components: Exploring the Big Data Stack, Virtualization, Understanding the Basics of Virtualization, Managing Virtualization with the Hypervisor, Abstraction and Virtualization, Implementing Virtualization to Work with Big Data. <b>08 Hrs</b>

<b>Unit-III</b>	:	<b>DATA ANALYTICS:</b> Predictive Analytics: Linear Regression, Logistic Regression, Decision Trees, Descriptive Analytics: Association Rules, Sequence Rules, Segmentation, Social Network Analytics: Social Network Definitions, Social Network Metrics, Social Network Learning, Relational Neighbor Classifier, Business Process Analytics, Web Analytics.  <b>08 Hrs</b>		
<b>Unit-IV</b>	:	<b>HADOOP AND MAP REDUCE:</b> History of Hadoop, Analyzing Data with Hadoop, Hadoop Streaming, Hadoop Echo System, Hadoop Storage, Common Hadoop Shell commands, Hadoop Architecture, Hadoop MapReduce Paradigm: Map and Reduce tasks, Job Scheduling, Shuffle and Sort, Task Execution, Map Reduce Types and Formats.  <b>08 Hrs</b>		
<b>Unit-V</b>	:	<b>HDFS (Hadoop Distributed File System)</b> The Design of HDFS, HDFS Concepts, Command Line Interface, Hadoop file system interfaces, Data flow, Data Ingest with Flume and Sqoop and Hadoop archives, Hadoop I/O: Compression, Serialization, Avro and File-Based Data structures.  <b>08 Hrs</b>		
<b>Unit-VI</b>	:	<b>Hadoop Eco System</b> <b>Pig :</b> Introduction to PIG, Execution Modes of Pig, Comparison of Pig with Databases, Grunt, Pig Latin, User Defined Functions, Data Processing operators. <b>Hive :</b> Hive Shell, Hive Services, Hive Metastore, Comparison with Traditional Databases, HiveQL, Tables, Querying Data and User Defined Functions. <b>Hbase :</b> HBasics, Concepts, Clients, Example, Hbase Versus RDBMS.  <b>08 Hrs</b>		
<b>Reference Books, e- books, e- Journals</b>	<b>Sr. No.</b>	<b>Title</b>	<b>Author</b>	<b>Publication</b>
	1	Big Data Analytics	Seema Acharya, SubhasiniChellappan	Wiley 2015.
	2	Hadoop: The Definitive Guide	Tom White,	Third Edit on, O'reily Media,

				2012
	3	Analytics in a Big Data World: The Essential Guide to Data Science and its Applications	Bart Baesens,	Wiley, 2014, ISBN: 978-1-118-89270-1
	4	Intelligent Data Analysis	Michael Berthold, David J. Hand	Springer, 2007
	5	Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics	Bill Franks	John Wiley & sons, 2012.
	6	Making Sense of Data	Glen J. Myat	John Wiley & Sons, 2007
	7	Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses	Michael Mineli, Michele Chambers, Ambiga Dhiraj	Wiley Publications, 2013.
	8	Analytics in a Big Data World: The Essential Guide to Data Science and its Applications	Bart Baesens,	Wiley, 2014, ISBN: 978-1-118-89270-1

**Section: A** Units I, II and III; **Section: B** Units IV, V, and VI

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**For 80 Marks Paper:**

1. Ten questions.
2. Five questions in each section
3. Question no 1 from section A and Question no 6 from section B be made compulsory and should cover complete syllabus of the respective section for 10 marks each.
4. Remaining questions will be of 15 marks each.

5. Any two questions of 15 marks from remaining questions in each section are to be solved.

<b>Dr. Babasaheb Ambedkar Marathwada University, Aurangabad</b> (Faculty of Science & Technology) <b>Syllabus of Final Year B. Tech. (All) Semester-VII</b>	
<b>Course Code: CED431</b> <b>Course: OE-II (Solid Waste Management)</b> <b>Teaching Scheme:</b> <b>Class Test: 20 marks</b> <b>Theory: 04 Hrs/week</b> <b>Theory Examination Duration: 03 Hrs</b> <b>Credits: 04</b> <b>Theory Examination Marks: 80</b>	
<b>Objectives</b>	: To get introduced to the generation, collection and management of the various types of solid waste and different waste management techniques.
<b>Unit-I</b>	: <b>Introduction to Solid Waste Management (SWM):</b> Need and Objectives of SWM, Waste Management Hierarchy, Functional elements, Environmental impact of mismanagement. Solid waste: Sources, types, Composition, Quantities, Physical, chemical and Biological properties. <b>Generation of solid waste:</b> Factors affecting. Storage and collection: General considerations for waste storage at source, Types of collection systems. Collection System, Transfer station: Meaning, Necessity, Transportation of solid waste: Means and Methods, Routing of vehicles. <b>08 Hrs</b>
<b>Unit-II</b>	: <b>Segregation and Material Recovery:</b> Objectives, Stages of segregation, sorting operations, Guidelines for sorting for materials recovery, E waste

	management, Biomedical waste management. <b>08 Hrs</b>			
<b>Unit-III</b>	: <b>Waste processing:</b> processing technologies: Composting, thermal conversion technologies incineration, treatment of biomedical wastes. Energy recovery from solid waste: Parameters affecting energy recovery, Bio-methanation, Fundamentals of thermal processing, Pyrolysis, Incineration, Advantages and disadvantages of various technological options. <b>08 Hrs</b>			
<b>Unit-IV</b>	: <b>Disposal:</b> Landfills and its introduction, Definition, Essential components, Site selection, Land filling methods, Leachate analysis and landfill gas management, treatment & disposal, Determination of capacity of landfill disposal site. <b>08 Hrs</b>			
<b>Unit-V</b>	: <b>Hazardous waste management:</b> Types of hazardous waste (such as nuclear, biomedical and industrial waste,), problems and issues related to hazardous waste management, Need for hazardous waste management, Legislations on management and handling of HW, Hazardous Characteristics, reduction of wastes at source, Recycling and reuse, labeling and handling of hazardous wastes, incineration, solidification and stabilization of hazardous waste. <b>08 Hrs</b>			
<b>Unit-VI</b>	: <b>Introduction to Solid Waste Management (SWM):</b> Need and Objectives of SWM, Waste Management Hierarchy, Functional elements, Environmental impact of mismanagement. Solid waste: Sources, types, Composition, Quantities, Physical, chemical and Biological properties. <b>08 Hrs</b>			
<b>Reference Books, e- books, e- Journals</b>	<b>Sr. No</b>	<b>Title</b>	<b>Author</b>	<b>Publication</b>
	1	Integrated Solid Waste Management,	Hilary Theisen and Samuel A, Vigil, George Tchobanoglous	McGraw- Hill, New York, 1993
	2	Manual on Municipal Solid waste	Central Public Health and Environmental	Government of India, New Delhi, 2000

		management,	Engineering Organization CPHEEO	
	3	Environmental and Resources Management, Hazardous waste Management	Michael D. LaGrega, Philip L Buckingham, Jeffrey C. E vans	Mc-Graw Hill International edition, New York, 2001
	4	Solid waste Engineering	Vesilind P.A., Worrell W and Reinhart	Thomson Learning Inc., Singapore, 2002
	5	Hazardous Waste Management	Charles A. Wentz	Second Edition, Pub: McGraw Hill International Edition, New York, 1995

**Section: A** Units I, II and III; **Section: B** Units IV, V, and VI

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<b>Dr. Babasaheb Ambedkar Marathwada University, Aurangabad</b> (Faculty of Science & Technology) <b>Syllabus of Final Year B. Tech. (All) Semester-VII</b>	
<b>Course Code: EED431</b> <b>Course: OE-II (Energy Planning and Conservation )</b> <b>Teaching Scheme:</b> <b>Class Test: 20 marks</b> <b>Theory: 04 Hrs/week</b> <b>Theory Examination Duration: 03 Hrs</b> <b>Credits: 04</b> <b>Theory Examination Marks: 80</b>	
<b>Prerequisite</b>	Should have knowledge of Electrical/ Mechanical Appliances, various types of energy utilization.
<b>Objectives</b>	: <ol style="list-style-type: none"> <li>1. Identify the demand supply gap of energy in Indian scenario.</li> <li>2. Understanding basics of energy audit.</li> <li>3. Understand various opportunities in in energy saving for industry</li> </ol>
<b>Unit-I</b>	: <b>Energy Policy:</b>  National & State Level Energy Issues, National & State Energy Policy, Industrial Energy Policy, Energy Security, Energy Vision. Energy Pricing & Impact of Global Variations. Energy Productivity (National & Sector wise productivity).  <b>08Hrs</b>
<b>Unit-II</b>	: <b>Energy action planning:</b>  Energy Action Planning: Key elements, Force field analysis, Energy policy



	purpose, perspective, Contents, Formulation, Ratification, Organizing - location of energy management, Top management support, Managerial function, Roles and responsibilities of energy manager, Accountability. Motivating-motivation of employees. <b>08 Hrs</b>			
<b>Unit-III</b>	: <b>Importance of Energy management:</b> Energy Management: Definition, Energy audit- need, Types of energy audit, Energy management (audit) approach-understanding energy costs, Bench marking, Energy performance. <b>08 Hrs</b>			
<b>Unit-IV</b>	: <b>Elements of Energy conservation:</b> General energy problem, , Scope for energy conservation and its benefits, Energy conservation Principle – Maximum energy efficiency, Maximum cost effectiveness, Mandatory provisions of Energy Conservation act 2001, Features of Energy Conservation act-Standards and labeling, designated consumers, Energy Conservation Building Codes (ECBC). <b>08 Hrs</b>			
<b>Unit-V</b>	: <b>Energy Audit and Measuring Instruments</b> Basic measurements – Electrical measurements, Light, Pressure, Temperature and heat flux, Velocity and Flow rate, Vibrations. Instruments Used in Energy systems: Load and power factor measuring equipments, Wattmeter, flue gas analysis, Temperature and thermal loss measurements, air quality analysis etc. <b>08 Hrs</b>			
<b>Unit-VI</b>	: <b>Lighting and Lighting System:</b> Lightings Levels, Fixtures Lighting techniques – Natural, CFL, LED lighting sources and fittings, Day lighting, Timers, Energy Efficient Windows. <b>08 Hrs</b>			
<b>Reference Books, e- books, e- Journals</b>	<b>Sr. No</b>	<b>Title</b>	<b>Author</b>	<b>Publication</b>
	1	Bureau of Energy efficiency hand books No 1& 2	BEE OF INDIA	BEE OF INDIA
	2	Energy Management Handbook	Wayne C. Turner	Tata McGraw Hill
	3	Energy management	Paul O Callaghan	
	4	Bureau of Energy efficiency hand books No 3,	BEE OF INDIA	BEE OF INDIA

<b>Additional References</b>	:	<a href="https://www.beeindia.gov.in/content/energy-auditors">https://www.beeindia.gov.in/content/energy-auditors</a> information as & when available.
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**Section: A** Units I, II and III; **Section: B** Units IV, V, and VI

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<b>Dr. Babasaheb Ambedkar Marathwada University, Aurangabad</b> (Faculty of Science & Technology) <b>Syllabus of final year B. Tech. (All) Semester-VII</b>		
<b>Course Code: ETC431</b> <b>Teaching Scheme</b> <b>Theory: 04Hrs/week</b> <b>Credits: 04</b>		<b>Course: Open Elective - II (Data Science)</b> <b>Class Test: 20 Marks</b> <b>Theory Examination Duration: 03 Hrs</b> <b>Theory Examination: 80 Marks</b>
<b>Prerequisites</b>	:	Programming Concepts, Data Structure, Basic Linear Algebra, Basic Probability and Statistics
<b>Objectives</b>	:	<ol style="list-style-type: none"> <li>1. Describe what Data Science is and the skill sets needed to be a data scientist</li> <li>2. Explain the significance of exploratory data analysis in data science</li> <li>3. Apply basic machine learning algorithm.</li> <li>4. Identify approaches used for feature generation.</li> <li>5. Create effective visualization of given data.</li> </ol>
<b>Unit-I</b>	:	<b>Introduction:</b> Introduction, big data and data science hype, datafication, current landscape of perspective. <p style="text-align: right;"><b>08 Hrs</b></p>

<b>Unit-II</b>	:	<b>Statistical Inference and Exploratory data analysis:</b> Populations and samples, statistical modelling, probability distributions, fitting a model, Introduction to R. Basic Tools (Plots, Graphs and summary statistics) of EDA, philosophy of EDA, the data science process, Case Study. <b>08 Hrs</b>		
<b>Unit-III</b>	:	<b>Machine Learning Algorithm and its Usage:</b> Linear Regression, k-nearest Neighbors(k-NN), k-means. Spam filtering, naïve Bayes and its application for spam filtering, Data Wrangling: Tools and API for scrapping the web. <b>08 Hrs</b>		
<b>Unit-IV</b>	:	<b>Feature Generation and Selection:</b> Feature generations algorithms, feature selection algorithms: filters, wrappers, decision trees, random forest. Algorithmic ingredients of a recommendation engine, dimensionality reduction, singular value decomposition, principal component analysis. <b>08 Hrs</b>		
<b>Unit-V</b>	:	<b>Mining Social Network:</b> Social Networks as graphs, clustering of graphs, direct discoveries of communities in graphs, portioning of graphs, neighborhood properties of graphs. <b>08 Hrs</b>		
<b>Unit-VI</b>	:	<b>Data visualization and ethical issues:</b> Basic principles, ideas and tools for data visualization, creation of visualization for complex data set. Case study. Privacy, security and ethics of data science. <b>08 Hrs</b>		
<b>Text Books, Reference e-books,e-journals</b>		<b>Sr. No.</b>	<b>Title</b>	<b>Authors</b>
		1.	Doing Data Science, Straight Talk From The Frontline	Cathy O’Neil and Rachel Schutt
		2.	Mining of Massive Datasets. v2.1	Jure Leskovek, Anand Rajaraman and Jeffrey Ullman
		3.	Machine Learning: A Probabilistic Perspective	Kevin P. Murphy
		4.	Data Science for Business: What You Need to Know about Data Mining and Data-analytic Thinking.	Foster Provost and Tom Fawcett
				<b>Publication</b>
				O’Reilly
				Cambridge University Press
				Cambridge, Mass: MIT Press
				O’Reilly

**Section: A** Units I, II and III; **Section: B** Units IV, V, and VI

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<b>Dr. Babasaheb Ambedkar Marathwada University, Aurangabad</b> (Faculty of Science & Technology) <b>Syllabus of Final Year B. Tech. (All) Semester-VII</b>	
<b>Course Code: MED431</b>	<b>Course: OE-II (Operations Research)</b>
<b>Teaching Scheme:</b>	<b>Class Test: 20 marks</b>
<b>Theory: 04 Hrs/week</b>	<b>Theory Examination Duration: 03 Hrs</b>
<b>Credits: 04</b>	<b>Theory Examination Marks: 80</b>
<b>Prerequisite</b>	1.Fundamental knowledge and understanding of Engineering mathematics 2.Understanding of concepts of costing and management concepts
<b>Objectives</b>	: 1. To familiarize the students with formal quantitative approach to problem solving 2. To formulate real life engineering problems 3. To solve engineering problems using various Operations Research Techniques

<b>Unit-I</b>	: <b>Introduction to Operations Research:</b> Basics definition, scope, objectives, phases, models, applications and limitations of Operations Research. <b>02 Hrs</b>
<b>Unit-II</b>	: <b>Linear Programming Problem :</b> Formulation of LPP, Graphical solution of LPP, Simplex Method, Artificial variables, Big-M method, two-phase method, degeneracy and unbound solutions. <b>12 Hrs</b>
<b>Unit-III</b>	: <b>Transportation Model :</b> Transportation Problem: Formulation, solution, unbalanced Transportation problem. Finding basic feasible solutions – Northwest corner rule, least cost method and Vogel’s approximation method. Optimality test – the stepping stone method or MODI method. Degeneracy in Transportation Problem. Assignment Problem: Hungarian Method to solve Assignment Problem, Travelling Salesman as an Extension of Assignment Problem. <b>10 Hrs</b>
<b>Unit-IV</b>	: <b>Inventory Control, Replacement Analysis and Theory of Games :</b> Inventory Models: Economic Order Quantity Models, Quantity Discount Models, Stochastic Inventory Models, Multi Product Models, Inventory Control Models in Practice. Replacement Analysis: Replacement of Items that Deteriorate, Replacement of Items that Fail Suddenly. Theory of Games: Introduction, Minimax and Maximin Principle, Solution of Game with Saddle Point, Solution by Dominance. <b>08 Hrs</b>
<b>Unit-V</b>	: <b>Queuing model and Sequencing model :</b> Queuing Systems And Structures, Notation Parameters, Single Server and Multi Server Models, Poisson Input, Exponential Service, Constant Rate Service, Infinite Population Sequencing Model: Introduction, n jobs through two machines, n jobs through three machines, two jobs through m machines and n jobs through m machines. <b>08 Hrs</b>
<b>Unit-VI</b>	: <b>Network Models:</b> Fulkerson ‘s rule, concept and types of floats, float calculations, CPM and PERT, Crashing cost and crashing Network <b>08 Hrs</b>

	<b>Sr. No</b>	<b>Title</b>	<b>Author</b>	<b>Publication</b>
<b>Reference Books, e- books, e- Journals</b>	1	Operations Research	Taha H.A.	Ninth Edition, Prentice Hall Of India.
	2	Introduction to Operations Research	Frederick S. Hillier and Gerald J. Lieberman	Seventh Edition, Tata McGraw-Hill
	3	Operations Research	P.K. Gupta, D.S Hira	Fourth Edition S. Chand & Co.
	4	Operations Research	Man Mohan, P. K. Gupta, Kanti Swarup	12 <sup>th</sup> Edition, S. Chand & Co.
	5	Operations Research Principles and Practice	Ravindran, Phillips and Solberg	Second Edition, Mc. WSE Willey
	6	Operations Research: Applications and Algorithms	Wayne L. Winston, Jeffrey B. Goldberg	Fourth edition, Thomson Brooks
	7	Operations Research: Theory, Methods and Applications	S. D. Sharma, Himanshu Sharma	Kedar Nath Ram Nath
	8	PERT and CPM: Principles and Applications	L. S. Srinath	Third Edition, affiliated East-West Press Private Limited,
	9	Project Planning and Control with PERT & CPM	Dr. B.C. Punmia & K.K. Khandelwal	Fourth Edition, Firewall Media
<b>Additional References :</b>	:	1. nptel.iitm.ac.in 2. ocw.mit.edu 3. <a href="https://www.journals.elsevier.com/journal-of-operations-management">https://www.journals.elsevier.com/journal-of-operations-management</a> 4. <a href="https://pubsonline.informs.org/journal/opre">https://pubsonline.informs.org/journal/opre</a> 5. <a href="https://www.theorsociety.com/">https://www.theorsociety.com/</a>		

**Section: A** Units I, II and III; **Section: B** Units IV, V, and VI

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<b>Dr. Babasaheb Ambedkar Marathwada University, Aurangabad</b> (Faculty of Science & Technology) <b>Syllabus of Final Year B. Tech. (All) Semester-VII</b>	
<b>Course Code: PPE431</b>  <b>Teaching Scheme</b> <b>Theory: 4 Hrs/week</b> <b>Credits: 4</b>	<b>Course: Open Elective-II (Polymer Recycling and Waste Management)</b>  <b>Class Test: 20 Marks</b> <b>Theory Examination Duration: 03 Hrs</b> <b>Theory Examination: 80 Marks</b>
<b>Objectives</b>	: 1. To learn the need for polymer recycling, techniques employed and applications. 2. To learn the need and various methods/techniques involved in polymer waste management.
<b>Unit-I</b>	: <b>Significance of recycling:</b>

		Global plastics production and composition, global plastics waste composition, quantities and disposal, identification codes of plastics for recycling. Recycling process: collection, sorting and segregation of waste, recycling methods: Primary, secondary, tertiary and quaternary recycling, landfilling.	<b>08 Hrs</b>
<b>Unit-II</b>	:	<b>Recycling equipment/machinery:</b> Equipment for primary and secondary recycling: shredder, granulator, pulverizer, cutter, extruder. Classification and types of reactors for tertiary recycling.	<b>09 Hrs</b>
<b>Unit-III</b>	:	<b>Recycling of plastics from urban waste:</b> Rheology, density and mechanical behavior of recycled plastics, hydrolytic treatment of plastics waste containing paper, processing of mixed plastics waste, recycling additives.	<b>07 Hrs</b>
<b>Unit-IV</b>	:	<b>Recycling techniques:</b> Recycling techniques of PE packaging films and woven sacks, PET bottles and films, PP battery cases, PVC products and thermosetting plastics.	<b>08 Hrs</b>
<b>Unit-V</b>	:	<b>Municipal solid waste management and treatment techniques:</b> Collection, storage, transportation and disposal of municipal solid waste, sorting of MSW, types of vehicles and equipment for primary collection, secondary collection and transport. Different treatment techniques: a) Composting: techniques such as windrow, aerated static pile, in vessel, decentralized, bin and vermicomposting. b) Bio-methanation: merits, applicability, process and types of anaerobic digester systems. c) Refuse derived fuel: classification, composition, production process and uses. d) Sanitary landfilling: requirements, layout, leachate management, waste placement and inspection.	<b>11 Hrs</b>
<b>Unit-VI</b>	:	<b>Tools for combating polymer waste:</b> Combating tools for waste management: extended producer responsibility, product stewardship, shared producer responsibility, usage of green products and usage of biodegradable or environmentally degradable polymers for waste reduction.	<b>05 Hrs</b>

<b>Text Books,</b>	:	<b>Sr. No.</b>	<b>Title</b>	<b>Author</b>	<b>Publication</b>
		1	Plastics Fabrication and	Manas Chanda and	CRC Press



<b>Reference Books, e- books, e- Journals</b>		Recycling	Salil K. Roy	
	2	Introduction to Plastics Recycling	Vannessa Goodship	Smithers Rapra
	3	Recycling of Polymers	Raju Francis	Wiley-VCH
	4	Recycling of Plastic Materials	Francesco Paolo La Mantia	Chemtec Publishing
	5	Feedstock Recycling and pyrolysis of waste plastics	John Schiers & W. Kaminsky	John Wiley and Sons
	6	Mixed Plastic Recycling Technology	B. Hegberg, G. Brenniman	Noyes Data Corporation
	7	Plastics Waste: Recovery of Economic value	Jacob Leidner	Marcel Decker Inc.
	8	Management of municipal solid waste	T. V. Ramchandra	TERI Press
	9	Waste Management	Martin F. Lehmann	I. A. Publishers
	10	Environmental Waste Management	Ram Chandra	CRC Press
	11	Plastic Waste	Jacob Leidner	Marcel Decker Inc.

**SectionA:** Unit-I,IIandIII; **SectionB:**Unit-IV, V andVI.

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<b>Dr. Babasaheb Ambedkar Marathwada University, Aurangabad</b> (Faculty of Science & Technology)	
<b>Syllabus of Final Year B. Tech. (Mechanical Engineering) Semester-VII</b>	
<b>Course Code: MED441</b>	<b>Course: Automobile Engineering (EI- III)</b>
<b>Teaching Scheme: 04 Hrs/week</b>	<b>Class Test: 20 marks</b>
<b>Theory: 04 Hrs/week</b>	<b>Theory Examination Duration: 03 Hrs</b>
<b>Credits: 04</b>	<b>Theory Examination Marks: 80</b>

<b>Prerequisite</b>	1.Fundamental knowledge of Thermodynamics and Theory of Machines 2.Basic understanding of IC engines and its components
<b>Objectives</b>	: 1. To study basics of principles of Automobile systems. 2. To study modern trends in Automobiles. 3. To study working of various Automobile systems
<b>Unit-I</b>	: <b>Introduction to Automobiles:</b> Classification of automobiles, sub- systems of automobiles Power Unit : Functions and location of power unit, Engine parts and types, construction and functions, multi cylinder engines, Engine balance and firing order.  <b>06 Hrs</b>
<b>Unit-II</b>	: <b>Fuel feed systems and lubrication:</b> Fuel feed system for petrol engines, Fuel pumps, Basic principles of Multi Point Fuel Injection systems and Common Rail Diesel Ignition systems. Cooling systems: Purpose, types of cooling system, troubles and remedies of cooling systems. <b>Lubrication:-</b> Types of lubricants, functions and properties of lubricants. Methods of lubrication – Splash type, pressure type, dry and wet sump, mist lubrication. Oil filters, Oil pumps, Oil coolers, Types of cooling system, Engine lubrication, radiator, crankcase ventilation.  <b>09 Hrs</b>
<b>Unit-III</b>	: <b>Transmission and Steering systems</b> Transmission, axles, clutches, propeller shafts and differential: Types of gear boxes, automatic transmission, electronic transmission control, functions and types of front and rear axles, types and functions of the clutches, design considerations of Hotchkiss drive torque tube drive, function and parts of differential and traction control.  <b>09 Hrs</b>
<b>Unit-IV</b>	: <b>Steering System and Wheels</b>  Steering System: functions of steering mechanism, Ackermann steering geometry, steering gear box types.  Wheel geometry, Types of wheels, wheel rims, wheel assembly, tyre and their

	specifications.	<b>08 Hrs</b>		
<b>Unit-V</b>	<p><b>: Braking and Suspension systems:</b>            Functions and types of Brakes, Operation and principle of brakes, Mechanical, hydraulic, power, Air, vacuum brakes, fault finding and maintenance of brakes.            Objectives and types of suspension systems, Types of rigid, axle and independent suspension systems, rear axle suspension, electronic control, pneumatic suspension systems.</p>	<b>10 Hrs</b>		
<b>Unit-VI</b>	<p><b>: Chassis Systems</b>            Chassis frame, terminology of chassis frame, automobile frames, function and types of frames, construction, sub frames, materials and defects in frames.</p>	<b>06 Hrs</b>		
<b>Reference Books:</b>	<b>Sl.No</b>	<b>Title</b>	<b>Author</b>	<b>Publication</b>
	1	Automobile Engineering (Vol. I and II)	Kirpal Singh	Standard publishers Distributors, Delhi.
	2	Automobile Engineering (Vol. I and II)	Singh K	Standard publishers Distributors, Delhi.
	3	Automotive Mechanics	Crouse W.H.	Tata McGraw-Hill, Inc.
	4	Automobile Engineering	R.K. Rajput	Laxmi publications
	5	Automotive Mechanics	Joseph Heitner	East west press pvt. Ltd.
	6	Fundamentals of vehicle dynamics	Thomas D. Gillespie	SAE International

**Section A:** Units I, II, and III; **Section B:** Units IV, V, and VI.

**Pattern of Question paper:**

The 6 units in the syllabus shall be divided in two equal parts i.e. 3 units respectively. Question paper shall be set having two sections A and B. section A questions shall be set on first part and Section B questions on second part. Question paper should cover the entire syllabus.

**For 80 Marks Paper:**

1. Ten questions.
2. Five questions in each section
3. Question no 1 from section A and Question no 6 from section B be made compulsory and should cover complete syllabus of the respective section for 10 marks each.
4. Remaining questions will be of 15 marks each.
5. Any two questions of 15 marks from remaining questions in each section are to be solved.

<b>Dr. Babasaheb Ambedkar Marathwada University, Aurangabad</b> (Faculty of Science & Technology) <b>Syllabus of Final Year B. Tech. (MechanicalEngineering) Semester-VII</b>	
<b>Course Code: MED442</b> <b>Teaching Scheme:</b> <b>Theory: 04 Hrs/week</b> <b>Credits: 04</b>	<b>Course: EI-III (Vibrations and Noise Control)</b> <b>Class Test: 20 marks</b> <b>Theory Examination Duration: 03 Hrs</b> <b>Theory Examination Marks: 80</b>
<b>Prerequisite</b>	1. Basic knowledge and understanding of physics and mathematics
<b>Objectives</b>	: 1. To make the student conversant with fundamentals of vibration and noise. 2. To develop analytical competency in solving vibration problems. 3. To understand the various techniques of measurement and control of vibration and noise.
<b>Unit-I</b>	: <b>Introduction to Vibrations:</b> Introduction, cause and effects and terminology <b>(A) Single Degree of freedom system:</b> Undamped free vibrations, Development of differential equation and its solution for different undamped systems. Computation of natural frequency. <b>(B) Damped free vibrations:</b> differential equation of motion, logarithmic decrement damping methods, Damped natural frequency of vibration (analysis of viscous damping only). <b>(C) Forced Vibrations:</b> Vibrations due to harmonic force excitation centric mass excitation, support excitation, Steady state response curves, phase lag angle. <div style="text-align: right;"><b>08Hrs</b></div>
<b>Unit-II</b>	: <b>Systems with two degrees of Freedom:</b> Systems with two degrees of freedom, determination of natural frequencies, principle modes of vibration, node point systems with rectilinear and angular modes, dynamic and centrifugal pendulum vibration absorbers, response of systems to forced vibrations, viscous and coulomb dampers. Lagrange's equations and applications. <div style="text-align: right;"><b>08 Hrs</b></div>
<b>Unit-III</b>	: <b>Measurement and Control of Vibration:</b> Force and Motion transmissibility, Vibration Measuring devices, Accelerometers, Impact hammer, Vibration shaker-Construction, principles of operation and uses, Vibration Analyzer, Analysis of Vibration Spectrum, Standards related to

	<p>measurement of vibration and accepted levels of vibration Introduction to control of vibration, vibration control methods, passive and active vibration control, reduction of excitation at the source, control of natural frequency, Vibration isolators, Tuned Dynamic Vibration Absorbers, Introduction to Torsional Damper.</p> <p style="text-align: right;"><b>08Hrs</b></p>			
<b>Unit-IV</b>	<p><b>: Basics of Noise:</b> Introduction, Amplitude, Frequency, Wavelength and Sound Pressure Level, Addition, Subtraction and Averaging Decibel Levels, Noise Dose Level, Legislation, Measurement and Analysis of Noise, Measurement Environment, Equipment, Frequency Analysis, Tracking Analysis, Sound Quality Analysis.</p> <p style="text-align: right;"><b>08Hrs</b></p>			
<b>Unit-V</b>	<p><b>: Automotive Noise Sources:</b> Noise Characteristics of engines, engine overall noise levels, assessment of combustion noise, assessment of mechanical noise, engine radiated noise, intake and exhaust noise, engine accessory contributed noise, transmission noise, aerodynamic noise, tyre noise, brake noise.</p> <p style="text-align: right;"><b>08 Hrs</b></p>			
<b>Unit-VI</b>	<p><b>: Source of Noise and Control:</b> Methods for control of engine noise, combustion noise, mechanical noise, predictive analysis, palliative treatments and enclosures, automotive noise control principles, sound in enclosures, sound energy absorption, sound transmission through barriers.</p> <p style="text-align: right;"><b>08 Hrs</b></p>			
<b>Reference Books, e- books, e- Journals</b>	<b>Sr. No</b>	<b>Title</b>	<b>Author</b>	<b>Publication</b>
	1	Vibration and Noise for Engineering”	PujaraKewal	Dhanpat Rai & Sons
	2	Mechanical Vibrations	Grover G. K.	Nem Chand & Bros
	3	Mechanical Vibrations	Rao S.S.	Wiley Publishing Co.
	4	Mechanical Vibration	Wiiliam J Palm III	Wiley India Pvt. Ltd, New Delhi
	5	Noise and Vibration Control	M L Munjal	Cambridge University Press India

	6	Industrial Noise Control – Fundamentals and Applications	Bell, L. H. and Bell, D. H.	Marcel Dekker Inc.
	7	Engineering Noise Control - Theory and Practice	Bies, D. and Hansen, C.	Taylor and Francis
<b>Additional References</b>	:	1. ocw.mit.edu		

**Section A: - Unit I, II and II and Section B: - Unit IV, V and VI**

**Pattern of Question paper:**

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2. Five questions in each section
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4. Remaining questions will be of 15 marks each.
5. Any two questions of 15 marks from remaining questions in each section are to be solved.

<b>Dr. Babasaheb Ambedkar Marathwada University, Aurangabad</b> (Faculty of Science & Technology) <b>Syllabus of Final Year B. Tech. (Mechanical Engineering) Semester-VII</b>	
<b>Course Code: MED442</b> <b>Course: EI-III (Composite Materials and Manufacturing)</b> <b>Teaching Scheme:</b> <b>Class Test: 20 marks</b> <b>Theory: 04 Hrs/week</b> <b>Theory Examination Duration: 03 Hrs</b> <b>Credits: 04</b> <b>Theory Examination Marks: 80</b>	
<b>Prerequisite</b>	1. Fundamental knowledge of Material sciences and material properties along with manufacturing processes.
<b>Objectives</b>	: 1. To present the brief knowledge about constituents, properties and types of composite material. 2. To provide the students with the knowledge about different manufacturing techniques for various types of composite. 3. To expose students with the necessary engineering techniques used for analyzing the behavior of composites on different loading condition and, for modelling and simulating the processes of manufacturing of composites.
<b>Unit-I</b>	: <b>Introduction to Composite Materials:</b>  Fundamentals of composites, need for composites, application of composites, enhancement of properties, concept of Impregnation, classification of composites, Fibres-Types of Fibres used in composites, Composite Matrix and Types –Polymer Matrix Composite(PMC), Metal Matrix Composites(MMC), Ceramic Matrix Composites(CMC), Types of Weaving Pattern of fibre, Fibre architecture – general consideration, concept and problem on volume fraction and weight fraction, clustering of fibres and particles, Resin types of resin, Types of scales used in analyzing composites.  <b>10 Hrs</b>
<b>Unit-II</b>	: <b>Impact of Deformation on Composite Structure:</b>  Deformation of Reinforced Composite: Behaviour in tension, shear, compression, and bending – experimental characterization, macroscopic modelling, mesoscopic modelling, and microscopic modelling. Deformation of



	<p>Lamellar Composite: Elastic deformation of anisotropic lamellar composites, off axis elastic constant of laminae, stresses and deformation of laminates. <b>08 Hrs</b></p>
<b>Unit-III</b>	<p><b>: Recycling of Composites:</b></p> <p>An introduction to composite recycling, properties of recycled fibre, Thermal techniques of composite recycling – fluidized bed recycling process and application of fibre recycled with this method, thermal compression process of recycling, Mechanical techniques of composite recycling – Mechanical grinding, Pyrolysis Chemical technique of composite recycling –solvolysis.</p> <p style="text-align: right;"><b>06 Hrs</b></p>
<b>Unit-IV</b>	<p><b>: Introduction of Manufacturing of Composites:</b></p> <p>Manufacturing of PMC: Manual layup Methods–Hand layup processes, Spray up processes, Compression moulding – Reinforced reaction injection moulding, Resin Transfer Moulding, Liquid Resin Infusion, Liquid Resin-Pultrusion – Thermos tamping – Filament winding –Automated Tape Laying– Injection moulding –Autoclave Manufacturing of MMC: Powder metallurgy process, diffusion bonding, stir casting, squeeze casting.; Manufacturing of CMC: Pressing –Cold isostatic pressing (CIPing) – Hot isostatic pressing (HIPing).</p> <p style="text-align: right;"><b>08 Hrs</b></p>
<b>Unit-V</b>	<p><b>: Rapid Prototyping of Composites:</b></p> <p>Selective Laser Sintering (SLS) – Liquid Phase Sintering, Post processing of SLS in furnace,3D Printing(3DP), Laser Engineering Net Shaping(LENS), Laminated Object Manufacturing(LOM) – Laminate Composite manufacturing using LOM, Fibre Reinforced Composite(FRC) manufacturing using LOM, Stereolithography(SL) of FRC, Fused Deposition Modelling(FDM) of FRC, Ultrasonic Consolidation.</p> <p style="text-align: right;"><b>04 Hrs</b></p>
<b>Unit-VI</b>	<p><b>: Modelling of Composite Processing:</b></p> <p>Brief overview of composite processes and related modelling challenges, basic elements of simulation, Fundamental laws: Continuity Equation– application between liquid resin and fibre interaction for saturated, liquid resin, fibre and void for unsaturated medium, Conservation of momentum–Navier’s Stokes</p>

		equation applied for resin flow between the fibres, Darcy's law and concept of permeability, velocity field and volume and phase average, Brickman's Equation for mesoscale model, Frochheimer's equation for viscous resin fluid in processing of composite, Constitutive equation –resin viscosity for Newtonian and non –Newtonian behaviour and resin with fillers, fibre stress, geometry simplification for solving, boundary and initial condition, Case studies on modelling of composite processing.		
		<b>12 Hrs</b>		
<b>Reference Books, e- books, e- Journals</b>	<b>Sr. No</b>	<b>Title</b>	<b>Author</b>	<b>Publication</b>
	1	An Introduction to composite materials	D. Hull and T.W. Clyne	Cambridge University Press
	2	Introduction to Metal Matrix Composites	T.W. Clyne and P.J. Withers	Cambridge University Press
	3	Composite materials	S.C. Sharma	Narosa Publications
	4	Composite materials: Engineering and Science	F.L. Mathews and R.D. Rawlings	Chapman and Hall
	5	Management, Recycling and Reuse of Waste Composites	V. Goodship	Elsevier Science 2010
	6	Process Modeling in Composite Manufacturing	S.G. Advani and E.M. Sozer	CRC Press
	7	Composites by rapid prototyping technology	S. Kumar and J.P. Kruth	Elsevier 2012, Materials and Design, Volume 31, pp 850-856
	8	Hysteresis of tensile load-strain route of knitted fabrics under extension and recovery processes estimated by strain history	M. Matsuo and T. Yamada	Textile Research Journal 2009, pp 275-284
	9	A non-orthogonal constitutive model for characterizing woven composites.	P. Xue, X. Peng, and J. Cao	Elsevier 2003, Composites Part A, Volume 34, Issue 2

	10	Simulating the deformation mechanisms of knitted fabric composites	M. Duhovic and D. Bhattacharyya	Elsevier 2003, Composites Part A, Volume 37, Issue 11
	11	Modelling and simulation of the mechanical behaviour of weft-knitted fabrics for technical applications	M. de Araújo, R. Fanguero, and H. Hong	Autex Research Journal 2003, Part II: 3d model based on the elastical theory, Volume 3, Issue 4
	12	A finite element approach of the behaviour of woven materials at microscopic scale	D. Durville	Springers 2009, Mechanics of Microstructured Solids, pp 39-46
	13	Consistent mesoscopic mechanical behaviour model for woven composite reinforcements in biaxial tension	G. Hivet and P. Boisse	Elsevier 2008, Composites Part B, Volume 39, Issue 2
	14	Discrete models of woven structures. Macroscopic approach	B. Ben Bauker	Elsevier 2007, Composites Part B, Volume 38, Issue 4
	15	Simplified and advanced simulation methods for prediction of fabric draping	A.K. Pikette, G. Creech and P. de luca	European Journal of Computational Mechanics 2005, Volume 14, Issue 6-7
	16	Simulation of the mechanical behaviour of woven fabrics at the scale of fibers	D. Durville	Springers 2010, International Journal of Material forming, Volume 3, Supplement 2, pp 1241–1251
	17	The handle of cloth as a measurable quantity	F. T. Peirce	Journal of the Textile Institute Transactions 1930, Volume 21, Issue 9
	18	The mechanical properties of woven fabric	P. Grossberg and B.J. Park	Textile Research Journal 1966, Part II: The bending of woven fabrics, Volume

				36, pp 205-211
	19	Models of mechanical properties behavior of dry fibrous materials at various scales in shear and transverse compression: a review	E. Syerko, S. Comas-Cordana and C. Binetruy	Elsevier 2012, Composites Part A: Applied Science and Manufacturing Volume 43, Issue 8, Pages 1365-1388
<b>Additional References</b>	:	1. nptel.iitm.ac.in 2. see.stanford.edu		

**Section A: - Unit I, II and III and Section B: - Unit IV, V and VI**

**Pattern of Question paper:**

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2. Five questions in each section
3. Question no 1 from section A and Question no 6 from section B be made compulsory and should cover complete syllabus of the respective section for 10 marks each.
4. Remaining questions will be of 15 marks each.
5. Any two questions of 15 marks from remaining questions in each section are to be solved.

<b>Dr. Babasaheb Ambedkar Marathwada University, Aurangabad</b> (Faculty of Engineering & Technology) <b>Syllabus of Final Year. B. Tech. (Mechanical Engineering) Semester-VII</b>	
<b>Course Code: MED444</b> <b>Course: EI-IV: (Heating Ventilation and Airconditioning)</b> <b>Teaching Scheme:</b> <b>Class Test: 10 marks</b> <b>Theory: 02 Hrs/week</b> <b>Theory Examination Duration: 02 Hrs</b> <b>Credits: 02</b> <b>Theory Examination Marks: 40</b>	
<b>Prerequisite</b>	1.Fundamental knowledge of Thermodynamics, heat transfer and RAC.
<b>Objectives</b>	1. To offer learners an introduction to ‘Heating Ventilation and Air Conditioning’ industry. 2. Learners should create and modify cooling and heating systems.
<b>Unit-I</b>	<b>Introduction to HVAC:</b> Scope, Review of fundamentals of heat transfer and refrigeration, Review of thermodynamics properties like Temperature, Enthalpy Sensible and Latent heat, Introduction to temperature scales, Common HVAC units. <b>04 Hrs</b>
<b>Unit-II</b>	<b>Air Conditioning:</b> Introduction, Heating and Cooling Process, Cooling with Dehumidification ,Heating with Humidification, Adiabatic Mixing of Two Air Streams Evaporative Cooling Heating and Air Conditioning System Cycles. <b>04 Hrs</b>
<b>Unit-III</b>	<b>Moist air properties and conditioning processes</b> Introduction Properties of Air,Dry bulb Temperature, Wet Bulb Temperature, Dew Point Temperature, Relative Humidity Ratio. <b>04 Hrs</b>
<b>Unit-IV</b>	<b>Cooling &amp; heating load estimations:</b> Basics of heat transfer in building, Understanding of outdoor & indoor conditions Sources of heat gain, Heat loss calculations <b>04 Hrs</b>

<b>Unit-V</b>	<b>Design of air distribution and ventilation system:</b> Components of air distributing and ventilation system, Duct designing & Equipment selection ,Study of air distribution and ventilation system used in Public places like Malls, Cinema Hall, Restaurant and kitchen <b>04 Hrs</b>			
<b>Unit-VI</b>	<b>HVAC Installation and Insulation:</b> INSTALLATION: Sequence of Operation, Chiller Installation, AHU Installation, FCU Installation, Duct Installation, Fan Installation, Pipe Installation, Pump Installation.INSULATING Duct Insulation Pipe Insulation <b>04 Hrs</b>			
<b>Section: A Units I, II and III&amp;Section: B Units IV, V, and VI</b>				
<b>Reference Books, e- books, e- Journals</b>	<b>Sr. No.</b>	<b>Title</b>	<b>Author</b>	<b>Publication</b>
	1	Heating, Ventilating, and Air Conditioning Analysis and Design	Faye C. McQuiston, Jerald D. Parker, Jeffrey D. Spitler	John Wiley & Sons, Inc. Sixth Edition
	2	HVAC Equations, Data, and Rules of Thumb,	Arthur Bell	TMH Publication,2nd Ed
	3	Refrigeration and Air Conditioning	Arora C P	Tata McGraw Hill, 3rd edition
	4	Refrigeration and Air Conditioning,	Domkundwar and Domkundwar	DhanpatRai Publications, 1st
	5	Refrigeration and Air Conditioning,	Manohar Prasad	New Age International Publishers, 2nd edition
<b>Additional References:</b>	:	1. nptel.ac.in 2. ocw.mit.edu 3. <a href="http://www.study.co.uk">www.study.co.uk</a>		

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1. Ten questions.

2. Five questions in each section
3. Question no 1 from section A and Question no 6 from section B be made compulsory and should cover complete syllabus of the respective section for 06 marks each.
4. Remaining questions will be of 07 marks each.
5. Any two questions of 07 marks from remaining questions in each section are to be solved.

<b>Dr. Babasaheb Ambedkar Marathwada University, Aurangabad</b> (Faculty of Engineering & Technology) <b>Syllabus of Final Year. B. Tech. (Mechanical Engineering) Semester-VII</b>	
<b>Course Code: MED445      Course: EI-IV: (Tribology)</b> <b>Teaching Scheme:          Class Test: 10 marks</b> <b>Theory: 02 Hrs/week      Theory Examination Duration: 02 Hrs</b> <b>Credits: 02                  Theory Examination Marks: 40</b>	
<b>Prerequisite</b>	1 Knowledge of physics, machine design. 2. Basic knowledge & understanding of concepts of material sciences.
<b>Objectives</b>	<ol style="list-style-type: none"> <li>1. Understand the fundamentals of tribology</li> <li>2. Understand and explain the different laws of friction and topology of surface.</li> <li>3. Understand and explain the modes and mechanism of wear.</li> <li>4. Decide the monitoring techniques based on performance of Tribological components.</li> <li>5. Apply the concept of tribology to industrial machines for better performance.</li> </ol>
<b>Unit-I</b>	<b>Introduction</b> <ul style="list-style-type: none"> <li>• Introduction to Tribology</li> <li>• History of Tribology</li> <li>• Interdisciplinary approach</li> <li>• Economic benefits</li> </ul> <b>Hrs</b> <div style="text-align: right;"><b>04</b></div>
<b>Unit-II</b>	<b>Study of Friction</b> <ul style="list-style-type: none"> <li>• Friction theories</li> <li>• Friction Measurement Methods</li> </ul>

	<ul style="list-style-type: none"> <li>• Friction of Metals and non-metals</li> <li>• Approach to reduce friction</li> <li>• Friction Instability</li> </ul> <p style="text-align: right;"><b>04 Hrs</b></p>			
<b>Unit-III</b>	<p><b>Study of Wear</b></p> <ul style="list-style-type: none"> <li>• Classification of wear</li> <li>• Factors affecting wear</li> <li>• Mechanism of wear</li> <li>• Wear analysis</li> <li>• Approach to reduce wear</li> </ul> <p style="text-align: right;"><b>04 Hrs</b></p>			
<b>Unit-IV</b>	<p><b>Monitoring Surface Roughness</b></p> <ul style="list-style-type: none"> <li>• Surface roughness measurement</li> <li>• Statistical analysis of surface</li> <li>• Tribological characteristics of surface contacts</li> <li>• Tribological behavior of asperities contact</li> </ul> <p style="text-align: right;"><b>04 Hrs</b></p>			
<b>Unit-V</b>	<p><b>Monitoring of Equipment Conditions</b></p> <ul style="list-style-type: none"> <li>• Condition monitoring techniques</li> <li>• Lubricants</li> <li>• Corrosion, temperature and surface roughness monitoring</li> <li>• Nano/Micro and Green tribology</li> </ul> <p style="text-align: right;"><b>04 Hrs</b></p>			
<b>Unit-VI</b>	<p><b>Application of Tribology</b></p> <ul style="list-style-type: none"> <li>• Rolling contact bearings</li> <li>• Gears</li> <li>• Journal Bearings</li> </ul> <p style="text-align: right;"><b>04 Hrs</b></p>			
<b>Section: A Units I, II &amp; Section: B Units III &amp; IV</b>				
<b>Reference Books, e- books, e- Journals</b>	<b>Sr. No</b>	<b>Title</b>	<b>Author</b>	<b>Publication</b>
	1	Fundamentals of Tribology	S. K. Basu, S. N. Sengupta, B. B. Ahuja	PHI Learning Pvt Ltd
	2	Engineering Tribology	Prasanta Basu	Prentice Hall of India
	3	Engineering Tribology	J. Williams	Cambridge University Press



	4	Tribology in Industries	S. K. Shrivastava	S. Chand & Company Ltd
	5	Introduction to Tribology of Bearings	B. C. Majumdar	S. Chand & Company Ltd
<b>Additional References:</b>	:	1. nptel.ac.in 2. ocw.mit.edu 3. www.study.co.uk		

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<b>Dr. Babasaheb Ambedkar Marathwada University, Aurangabad</b> (Faculty of Engineering & Technology) <b>Syllabus of Final Year. B. Tech. (Mechanical Engineering) Semester-VII</b>	
<b>Course Code: MED446</b> <b>Teaching Scheme:</b> <b>Theory: 02 Hrs/week</b> <b>Credits: 02</b>	<b>Course: EI-IV: (Industry 4.0)</b> <b>Class Test: 10 marks</b> <b>Theory Examination Duration: 02 Hrs</b> <b>Theory Examination Marks: 40</b>
<b>Prerequisite</b>	1.Computer fundamentals and understanding of basics of information technology. 2.Understanding of basic concepts of production and manufacturing technology.
<b>Objectives</b>	1. To offer learners an introduction to Industry 4.0 (or the Industrial Internet), its applications in the business world. 2. Learners will gain deep insights into how smartness is being harnessed from data and appreciate what needs to be done in order to overcome some of the challenges.
<b>Unit-I</b>	<b>Introduction to Industry 4.0</b> The origins of Industries 4.0, Industry 4.0 definition – the digital transformation of Industry and the fourth industrial revolution, The Various Industrial Revolutions, The Journey so far: Developments in USA, Europe, China and other countries, Comparison of Industry 4.0 Factory and Today's Factory, Digitalization and the Networked Economy Drivers Enablers, Benefits of Industry 4.0 <p style="text-align: right;"><b>04 Hrs</b></p>
<b>Unit-II</b>	<b>Technology Roadmap for Industry 4.0</b> Internet of Things (IoT) and Industry 4.0 connectivity, Industry 4.0 and Industrial Internet of Things (IIoT) & Internet of Services (IoS) & Internet of Energy (IoE),

	linking IoT and smart services in Industry 4.0, Smart Factories, Smart Manufacturing, Smart Devices and Products, Smart Logistics, Smart Cities, Predictive Analytics for Smart Business Transformation.			
	<b>04 Hrs</b>			
<b>Unit-III</b>	<b>The Building Blocks of Industry 4.0</b> Cyber-physical Systems (CPS) in the Industry 4.0 vision, Cyber-physical systems before Industry 4.0, Robotic Automation and Collaborative Robots, Support System for Industry 4.0, Mobile Computing, Artificial Intelligence, Additive Manufacturing (3D Printing), Augmented reality and virtual reality in Industry 4.0			
	<b>04 Hrs</b>			
<b>Unit-IV</b>	<b>Role of Data, Information, Knowledge and Collaboration in Future Organizations</b> Resource-based view of a firm, Trends of Industrial Big Data, Data Mining, Data Analytics & Data as a new resource for organizations, Harnessing and sharing knowledge in organizations, Cloud Computing and Industry 4.0			
	<b>04 Hrs</b>			
<b>Unit-V</b>	<b>Applications and Case Studies, Opportunities and Challenges of Industry 4.0</b> Industry 4.0 laboratories, IIoT case studies, Changes for Companies, Entrepreneurs, SMEs and start-ups, Sustainability and circular economy, Infrastructure in Developing Countries, Jobs, Skills and Education in Developed and Developing Countries, Ethical Implications of Industry 4.0 technologies.			
	<b>04 Hrs</b>			
<b>Unit-VI</b>	<b>Business Issues in Industry 4.0 and Impacts on Various Sectors</b> Future of Works and Skills for Workers in the Industry 4.0 Era, Impact on Automotive industry, Agriculture 4.0, Retail and Consumer Goods, Healthcare Industry, E-commerce for Manufacturing, Strategies for competing in an Industry 4.0 world.			
	<b>04 Hrs</b>			
	<b>Section: A Units I, II and III &amp; Section: B Units IV, V, and VI</b>			
<b>Reference Books, e-books, e-Journals</b>	<b>Sr. No.</b>	<b>Title</b>	<b>Author</b>	<b>Publication</b>
	1	Industry 4.0_ the Industrial Internet of Things	Alasdair Gilchrist	Apress
	2	Industry 4.0_ Managing The Digital Transformation	Alp Ustundag, Emre Cevikcan	Springer
	3	Industry 4.0_ Opportunities Behind The Challenge	Dr. Mirjana Stankovic, Ravi	UNIDO General Conference 2017

			Gupta and Dr. Juan E. Figueroa	
	4	The concept Industry 4.0	-	Springer
<b>Additional References:</b>	:	1. nptel.ac.in 2. ndl.iitkgp.ac.in 3. www.sciencedirect.com		

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1. Ten questions.
2. Five questions in each section
3. Question no 1 from section A and Question no 6 from section B be made compulsory and should cover complete syllabus of the respective section for 06 marks each.
4. Remaining questions will be of 07 marks each.
5. Any two questions of 07 marks from remaining questions in each section are to be solved.

<b>Dr. Babasaheb Ambedkar Marathwada University, Aurangabad</b> (Faculty of Science & Technology) <b>Syllabus Final Year B. Tech. (Mechanical Engineering) Semester-VII</b>	
<b>Course Code: MED421      Course: Laboratory - Tool Design</b> <b>Teaching Scheme:              Term Work: 25 marks</b> <b>Practical: 02 Hrs / Week      Practical Examination: 25 marks</b> <b>Credits: 01</b>	
<b>Prerequisite</b>	: 1.Fundamental knowledge of manufacturing sciences and manufacturing processes along with engineering and machine drawing.  2.Basic knowledge of machine design and familiar with design data book.
<b>Objectives</b>	: <ol style="list-style-type: none"> <li>1. To design a cutting tool suitable for the given operation</li> <li>2. To select tool material</li> <li>3. To analyze tool wear and tool life</li> <li>4. To design a jig or fixture for given operation</li> <li>5. To design blanking and piercing die</li> </ol>
<b>List of Practical's (Minimum 08)</b>	: <b>Tool design Experiment</b>  1. Prepare a single point cutting point cutting tool in workshop from any soft material.  2. Demonstration of formation of various types of chips at different cutting conditions.

	<p>3. One sheet (A1 size) on locating devices.</p> <p>4. One sheet (A1 size) on clamping devices</p> <p>5. One sheet (A1 size) on Jig design by referring design data book</p> <p>6. One sheet (A1 size) on Fixture design by referring design data book.</p> <p>7. One sheet (A1 size) on multipoint cutting tools.</p> <p>8. One sheet/Numerical on die design.</p> <p>9. Numerical based on measurements of cutting time, forces, cutting power.</p> <p>10. Study of guidelines /brochure of cutting tool/ inserts of an industrial cutting tool manufacturer.</p> <p>11. Brief report on recent progresses / research in cutting tools</p>
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The assessment of term work shall be done based on the following.

- Continuous assessment
- Performing the experiments in the laboratory
- Oral examination conducted on the syllabus and term work mentioned above.

**Dr. Babasaheb Ambedkar Marathwada University, Aurangabad**

(Faculty of Science & Technology)

**Syllabus of Final Year B. Tech. (Mechanical Engineering) Semester-VII**

**Course Code: MED422      Course: Laboratory of Automatic Control Systems**

**Teaching Scheme:              Term Work: 50 marks**

**Practical: 02 Hrs/week**

**Credits: 01**

<b>Prerequisites</b>	:	<ol style="list-style-type: none"><li>1. Basic knowledge of engineering mathematics, physics.</li><li>2. Basic understanding of electrical, mechanical systems.</li></ol>
<b>Objectives</b>	:	<ol style="list-style-type: none"><li>1. After successful completion of course, students shall be able to understand working of Hydraulic systems, Pneumatic systems and many Control Actions.</li></ol>
<b>(Minimum of the following should be completed)</b>	:	<ol style="list-style-type: none"><li>1. Study of various types of measuring instruments &amp; transducers (at least one of Each type)</li><li>2. Study of control system components (At least TEN components)</li><li>3. Study of any ONE of Hydraulic system using hydraulic servomechanism</li><li>4. Experiment on speed control of DC Motor</li><li>5. Experiment on speed control of AC Motor</li><li>6. Experiment on speed control of Stepper Motor</li><li>7. Circuit Preparation by using Hydraulic Trainer Kit</li><li>8. Circuit Preparation by using Pneumatic Trainer Kit</li><li>9. Study of Circuits for M/C Tools.</li></ol>

	<p>10. Experiment on Level Control System</p> <p>11. Experiment on Temperature Control System</p> <p>12. Experiment on Position Control using Synchro's</p> <p>13. Study of Design of Automatic Control System with</p> <p>i) Plant layout.</p> <p>ii) Block diagram.</p> <p>iii) Steady state Analysis</p> <p>iv) Design of controller.</p> <p>For various control systems like Temp. flow etc.</p>
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The assessment of term work shall be done based on the following.

- Continuous assessment
- Performing the experiments in the laboratory
- Oral examination conducted on the syllabus and term work mentioned above.



**Dr. Babasaheb Ambedkar Marathwada University, Aurangabad**

(Faculty of Science & Technology)

**Syllabus of Final Year B. Tech. (Mechanical Engineering) Semester-VII**

**Course Code: MED423      Course: Laboratory of Refrigeration and Cryogenics**

**Teaching Scheme:              Term Work: 25 marks**

**Practical: 02 Hrs/week      Practical Examination: 25 marks**

**Credits: 01**

<b>Prerequisite</b>	1. 1. Basic knowledge and understanding of thermodynamics, heat transfer and fluid mechanics.
<b>Objectives</b>	: 1. To study understand the fundamental working of various component of 'Refrigeration systems' 2. To study and understand the working of various compressors, controllers and tools used in 'Refrigeration systems' 3. To apply basic concept and analyze the performance of 'Refrigeration systems'
<b>List of Practical's (Minimum 08)</b>	: <b>A] To study and demonstrate the of followings (minimum six)</b> 1. To study various tools used in refrigeration and Air-conditioning 2. To study working of domestic refrigerator its wiring diagram and maintenance. 3. To study various compressors used in refrigeration 4. To study various controllers in refrigeration (at least ten ) 5. To study leak detection and charging of refrigeration systems. 6. To study steam jet refrigeration system

	<p>7. To study magnetic refrigeration system</p> <p>8. To study construction, working of water cooler.</p> <p>9. To study vapour absorption refrigeration system</p> <p><b>B ] To conduct trial on following system (minimum three)</b></p> <ol style="list-style-type: none"> <li>1. Trial on refrigeration system</li> <li>2. Trial on ice plant</li> <li>3. Trial on cascade refrigeration system</li> <li>4. Trial on Heat pump</li> <li>5. Trial on window air conditioner /air conditioning system/ water cooler.</li> </ol> <p><b>C] Technical visit to at least one refrigeration establishment and report on the basis of observations.</b></p> <p><b>D] Technical report on current trend (at least one) of refrigeration such as greenhouse effect, global warming, alternative refrigerants etc.</b></p>
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The assessment of term work shall be done based on the following.

- Continuous assessment
- Performing the experiments in the laboratory
- Oral examination conducted on the syllabus and term work mentioned above.

<b>Dr. Babasaheb Ambedkar Marathwada University, Aurangabad</b> (Faculty of Science & Technology) <b>Syllabus Final Year B. Tech. (Mechanical Engineering) Semester-VII</b>	
<b>Course Code: MED424      Course: Laboratory – Hydraulic Machines</b> <b>Teaching Scheme:              Term Work: 50 marks</b> <b>Practical: 02 Hrs / Week      Practical Examination: 50 marks</b> <b>Credits: 01</b>	
<b>Prerequisite</b>	1. Knowledge of fluid mechanics and machineries
<b>Objectives</b>	: 1. To study different hydraulic machines. 2. To perform trials on turbines. 3. To perform trials on pumps.
<b>List of Practical's (Minimum 08)</b>	: 1. Assignment on 'Jet Pump and Submersible Pump'. 2. Assignment on 'Hydraulic torque convertor'. 3. Assignment on 'Hydraulic Accumulator and Hydraulic Intensifier'. 4. Assignment on 'Hydraulic Press and Hydraulic Ram'. 5. Trial on 'Pelton wheel turbine test rig'. 6. Trial on 'Francis wheel turbine test rig'. 7. Trial on 'Kaplan wheel turbine test rig'. 8. Trial on 'Centrifugal pump test rig'. 9. Trial on 'Gear pump test rig'. 10. Visit to hydro-electric power plant.

The assessment of term work shall be done based on the following.

- Continuous assessment
- Performing the experiments in the laboratory
- Oral examination conducted on the syllabus and term work mentioned above.

<b>Dr. Babasaheb Ambedkar Marathwada University, Aurangabad</b> (Faculty of Science & Technology)	
<b>Syllabus Final Year B. Tech. (Mechanical Engineering) Semester-VII</b>	
<b>Course Code: MED425</b> <span style="float: right;"><b>Course: Project-II</b></span> <b>Teaching Scheme</b> <span style="float: right;"><b>Term Work: 100 Marks</b></span> <b>Practical: 04Hrs/week</b> <span style="float: right;"><b>Practical Examination: 100Marks</b></span> <b>Credits: 04</b>	
<b>Objectives</b>	<b>:</b> <ol style="list-style-type: none"> <li>1. The practical implementation of theoretical knowledge gained during the study to till date is important for engineering education. The student should be able implement their ideas/real time industrial problem / current application of their engineering branch which they have studied in curriculum.</li> <li>2. To motivate students for creativity.</li> <li>3. To create awareness regarding latest technology</li> <li>4. To have common platform for interaction about emerging technology.</li> <li>5. To inculcate qualities of team work.</li> <li>6. To explore related information using books, research papers, journals &amp; websites.</li> <li>7. To improve presentation and communication skills.</li> </ol>
<b>List of Practical's</b>	<b>:</b> <b>Guidelines for Students And Faculty:</b> <ol style="list-style-type: none"> <li>1. Students shall complete the Project-II in continuation of the work planned in third year under the course Project-I</li> <li>2. Each student/group is required to- <ol style="list-style-type: none"> <li>a. Submit a report with latest status of the project work.</li> <li>b. Give a 10 minutes presentation through OHP, PC, and Slide projector followed by a 10-minute discussion in the second week of their academic semester.</li> <li>c. Submit a report on the project topic with a list of required</li> </ol> </li> </ol>

	<p>hardware, software or other equipment for executing the project in the third week of their academic semester.</p> <ol style="list-style-type: none"> <li>d. Start working on the project and submit initial development and CPM/PERT planning drawing in the fourth week of their academic semester.</li> <li>e. Preparation of PCB layout, wiring diagram, purchase of components, software demo, flowchart, algorithm, program/code, assembling, testing, etc. should be submitted by student/s within next five/Six weeks and minimum one page report should be there for each major activity.</li> <li>f. Overall assembling, wiring, code writing, testing, commissioning along with performance analysis, should be completed within next two weeks.</li> <li>g. In the last week, student/group will submit final project report to the guide.</li> </ol> <p>3. Every assigned faculty/s should maintain record of progress of each student or group.</p>
	<p>The format and other guidelines for the Project Submission in hard bound copies should be as follows</p> <p><b>REPORT STRUCTURE</b></p> <p>Index/Contents/Intent  List of Figures  List of Tables  List of Symbols / Abbreviations</p> <ol style="list-style-type: none"> <li>1. Introduction</li> <li>2. Literature survey</li> <li>3. System development</li> <li>4. Performance analysis</li> <li>5. Conclusions</li> </ol> <p>References  Appendices  Acknowledgement</p> <p>1. INTRODUCTION</p> <ol style="list-style-type: none"> <li>1.1 Introduction</li> <li>1.2 Necessity</li> <li>1.3 Objectives</li> <li>1.4 Theme</li> <li>1.5 Organization</li> </ol>

2. LITERATURE  
SURVEY            Literature  
Survey

Related information available in standard Books, Journals, Transactions, Internet Websites *etc.* till date (More emphasis on last three to five years)

3. SYSTEM DEVELOPMENT

Model Development

- Mechanical / Fabricated
- Analytical
- Computational
- Experimental
- Mathematical
- Software

(out of above methods at least one method is to be used for the model development) Some mathematical treatment or related information is required to be embodied.

4. PERFORMANCE ANALYSIS

- Analysis of system developed either by at least two methods depending upon depth of standard
- These methods normally used are Analytical /Computational/Statistical/Experimental/ or Mathematical

Results at various stages may be compared with various inputs

- Output at various stages with same waveforms or signals or related information/parameters
- Comparison of above results by at least two methods and justification for the differences or error in with theory or earlier published results

	<p><b>5. CONCLUSIONS</b></p> <p>5.1 Conclusions</p> <p>5.2 Future Scope</p> <p>5.3 Applications</p> <p>Contributions (if any,)</p> <p>The innovative work/invention/new ideas generated from the analysis of the work which can be taken from the conclusions</p> <p><b>REFERENCES</b></p> <ul style="list-style-type: none"> <li>• Author, “Title”, Name of Journal/Transactions/ Book, Edition/Volume, Publisher, Year of Publication, page to page (pp.____).</li> </ul> <p>These references must be reflected in text at appropriate places in square bracket In case of web pages complete web page address with assessing date has to be enlisted</p> <p>List of references should be as per use in the text of the report</p> <p><b>APPENDICES</b></p> <p>Related data or specifications or referred charts, details computer code/program, <i>etc.</i></p> <p><b>ACKNOWLEDGEMENTS</b></p> <p>Expression of gratitude and thankfulness for helping in completion of the said task with name &amp; signed by the candidate</p> <ul style="list-style-type: none"> <li>• General Guidelines</li> </ul> <p>Text should be printed on front and correct side of the watermark on quality bond paper</p> <p>Paper size- A4, 75 to 85 gsm  paper Left Margin-1.5”  Right Margin-</p>
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	<p>3/4" Top Margin-1"</p> <p>Bottom Margin-1"</p> <ul style="list-style-type: none"> <li>• Pagination</li> </ul> <p>First page of every chapter need not be printed but counted, second page onwards page number to printed at bottom center place.</p> <p>All Greek words must be italic</p> <p>Report Heading -ALL CAPITAL—16 Font</p> <p>Chapter heading -ALL CAPITAL—14 Font</p> <p>Subchapter –Title Case-12 Font</p> <p>Sub-Subchapter –First Alphabet Capital case-12 Font</p> <p>Page numbers for Index/Contents/Intent should be in roman All text should be in times new roman</p> <p>Cover page should have complete symbol of institute</p> <p>Suitable flap (bookmark) with name of the candidate, Department and Institute name and symbol can be used with nylon strip.</p> <p>For more information and sample of hard copy please contact the respective Head of the Department.</p>
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**Dr. Babasaheb Ambedkar Marathwada University, Aurangabad**  
(Faculty of Science & Technology)

**Syllabus Final Year B. Tech. (Mechanical Engineering) Semester-VIII**

**Course Code: MED471**

**Course: In-Plant Training**

**Teaching Scheme**

**Term Work: 300 Marks**

**Credits: 24**

**Practical Examination: 300 Marks**

<b>Rationale</b>	(a)	The techniques and processes of production of goods and services do not demand only technical skills, but also a cluster or conglomerate of skills. A significant part of which is related to the total humanistic growth of the man. Such conglomerate skills technical and humanistic cannot obviously be acquired through pure academic learning of concepts in formalized and institutional courses and in isolation of the actual work situation. It, therefore, naturally follows that no technical education will be complete till it has two components, one learning of concepts vis-a vis acquiring conceptual skill and other application of the concepts in real work situation vis-a vis acquiring manipulative or practicing skills. Technical education needs to have a complement of learning of the techniques of applying the concepts within the industry and business.
<b>Course Objectives</b>	(b)	<ol style="list-style-type: none"> <li>1) The students of B.Tech course shall get an opportunity to work on live problem</li> <li>2) He / She shall apply his leaving concepts in the real work situation.</li> <li>3) He / She shall get an exposure to the industrial environment and thereby enable himself / herself to appreciate the other related aspects of industry via, human, economic, commercial and regulatory.</li> <li>4) He / She shall identify career paths considering their individual strengths and aptitude.</li> <li>5) He / She shall contribute for the achievement of economic goals and aspirations of the industry and our country.</li> </ol>
	(c)	<p>The curriculum for B.Tech students of Final Year Course of Part-II shall consist of;</p> <ol style="list-style-type: none"> <li>1) In-plant training for a period of one full term, and the period of the term shall be as prescribed by the university from time to time</li> <li>2) A project on live problems of the industry shall be undertaken by the student/group of students undergoing training in the same establishment.</li> <li>3) The term work shall consist of the In-plant training record-daily diary, work diary, progress report, a record containing the literature survey in the field of appropriate branch of Engineering, a preliminary report related to project work etc.</li> <li>4) Seminars will be arranged after successful completion of period specified in the scheme of semester VIII of B.Tech. The date and times will be decided according to the convenience of guide and student.</li> </ol>

	<p><b>(d) Memorandum of understanding:</b></p> <p>Maharashtra Institute of Technology, Aurangabad will enter into an agreement with the industry through ‘Memorandum of Understanding’ for creating facilities of In-plant training in the appropriate branch of Engineering according to the Course Curriculum and keep this agreement for a period of 10 years to foster a healthy industry-institute interaction for mutual benefits of both.</p>
	<p><b>Admission to In-plant training:</b></p> <p>No student will be deputed for In-plant training unless he produces testimonial of having kept one term for the subject under B Tech Semester –VIII of final year course satisfactorily in Maharashtra Institute of Technology after passing the TY B Tech Examination (in the appropriate branch).</p>
	<p><b>Period of In-plant training:</b></p> <p>The period of In-plant training will be the period of one term for the subject under B Tech course semester-VIII, which will be notified by Dr. Babasaheb Ambedkar Marathwada University, Aurangabad.</p>
	<p><b>Contract of In-plant Training :</b></p> <ul style="list-style-type: none"> <li>• The student of Maharashtra Institute of Technology shall enter into a contract of In-plant training with the employing industry.</li> <li>• The In-plant training shall be deemed to have commenced on the date, on which the contract of In-plant training has been entered.</li> <li>• Every contract of In-plant training will contain the Terms and Conditions to be agreed by both the parties.</li> <li>• Every contract of In-plant training shall be registered with the Maharashtra Institute of Technology within 15 days from entering into the contract.</li> </ul>
	<p><b>Violation of contract:</b></p> <p>Where an employer, with whom a contract for In-plant training has been entered into, is for any reason, unable to fulfil his obligation under the contract, the contract ends with the consent of Maharashtra Institute of Technology. It is agreed between the employer, the student and any other employer that the student shall be engaged as an “In-plant trainee” under the other employer till the expiry period of the In-plant training. The agreement on registration with Maharashtra Institute of Technology shall be deemed to be the contract of In-plant</p>

		training between the student and other employer, and from the date of such registration, the contract of In-plant training with the first employer shall terminate and no obligation under that contract shall be enforceable at the instance of any party to contract against the other party thereto.
		<p><b>Termination of Contract:</b></p> <p>The contract of In-plant training shall terminate on the expiry of the period of In-plant training.</p> <p>Either party to the contract of In-plant training make an application to Maharashtra Institute of Technology, Aurangabad for the termination of the contract.</p> <p>After considering the content of the application, and objection, Maharashtra Institute of Technology by order in writing, will terminate the contract, if it is satisfied that the parties to the contract have/has failed to carry out the Terms and Conditions of the contract.</p> <p>Provided that where a contract is terminated-</p> <ul style="list-style-type: none"> <li>• For the failure on the part of the Employer, Maharashtra Institute of Technology will depute students to another Employer for providing facilities of In-plant training to the remaining period of training.</li> <li>• For the failure on the part of the student, the student will not be allowed to continue his/her In-plant training in that term. The student shall be deputed for In-plant training in next coming term.</li> </ul>
		<p><b>Expectation from the Employer / Industry / Establishment:</b></p> <p>The following expectations are derived for effective In-plant training.</p> <ol style="list-style-type: none"> <li>1. To provide legitimate facilities for the training and learning of all the processes.</li> <li>2. To guide the student for understanding a project of immense importance to industry and to help him/her for his/her career advancement.</li> </ol>
		<p><b>Obligation of Students:</b></p> <ul style="list-style-type: none"> <li>• To learn his/her subject field in Engineering or Technology conscientiously and diligently at his place of training.</li> <li>• To carry out all orders of his Employer and the Superior in the establishment.</li> <li>• To abide by the Rules and Regulations of the Industry/Establishment in all matters of conduct and discipline.</li> </ul>

	<p>To carry out the obligation under the contract of In-plant training.</p> <ul style="list-style-type: none"> <li>The student shall maintain a report of his work during the period of his In-plant training in a pro-forma (form no: 2) made available in Annexure.</li> </ul> <p>Except in case of extreme urgency, the B.Tech student shall submit an application for all other leaves except the medical leave to the Manager/Gen. Manager (Personnel) of the concerned industry, where he is undergoing an In-plant training and obtain sanction before the leave is taken. In case of Medical Leave, he shall submit an application to Maharashtra Institute of Technology, Aurangabad. The shortage in attendance will be subjected to extending the period of In-plant training in which case, the student may not be allowed to appear for the test, project seminar and assessment of term work etc. which will be held immediately after successful completion of the In-plant training.</p>
	<p><b>Maintenance of Record:</b></p> <p>Every student of B.Tech course shall maintain a daily record of the work done by him/her relating to the In-plant training in the pro-forma (Annexure).</p>
	<p><b>Industry Sponsored Student Projects:</b></p> <p>The scheme envisages working out suitable programme for B.Tech students. They are required to complete their In-plant training in a given period. During this period, they shall be familiar with the understanding of the shop process and activities. The students can be asked to solve the mini-shop problem, which will make them think and try out short experiments as an improvement in the process, tools and equipment. The student here is not expected to acquire the skills in operating machines values. He should appreciate the application of theory learnt.</p> <p>The students in a group alone can undertake a project of immense importance for the benefit of the industry and also useful for the students for their advancement of career. Industry staff and Maharashtra Institute of Technology faculty can plan in advance to effectively complete the practical training with the project for preliminary studies on the floor. The projects should aim mainly-</p> <ul style="list-style-type: none"> <li>Cost reduction</li> <li>Reducing cycle time</li> <li>Enhancing productivity</li> </ul>

		<ul style="list-style-type: none"> <li>• Energy conservation measures</li> <li>• Process Improvement technique</li> <li>• Inventory control</li> <li>• Quality control Technique</li> <li>• Improvement in Material handling system • Bottlenecks in material flow system and so on.</li> <li>• Live problems in the industry.</li> <li>• Application development using electrical related knowledge.</li> <li>• EMI/EMC related issues</li> </ul>
		<p><b>What will form a good project?</b></p> <p>Through the project, it is hoped to provide the students an exciting experience in solving line problems under practical constraints. Hence it is desired that the project should be a well-defined problem, which can be completed and implemented within the project period. It may be a problem, evolving analysis, design, fabrication and / or testing.</p>
		<p><b>Time Schedule for the Project:</b></p> <p>The following time schedule should be planned by each student or groups of students, who undertake the project.</p> <ul style="list-style-type: none"> <li>• Proposal to be received before specified date.</li> <li>• Project acceptance before.</li> <li>• Commencement of the project.</li> <li>• Completion of the project.</li> </ul>
		<p><b>Commitment on the part of the Institute:</b></p> <ul style="list-style-type: none"> <li>• Providing a faculty member to supervise the project.</li> <li>• Providing the Institute facilities to complete the project.</li> </ul> <p>Coordinator from industry will be invited to participate in the stage wise assessment of the students performance.</p>
		<p><b>Assistance for completion of the Project:</b></p> <p>All the projects undertaken by the students are time bound. Although, every attempt results may not be achieved within the period available for the student. In such cases, the services of the associated faculty members can be sought for the completion of the same on mutually agreed terms.</p>
		<p><b>Monitoring of In-plant Training:</b></p> <p>The B.Tech students are expected to follow all the rules and discipline of the industry. However, because of other academic requirements and the nature of the project, the student may have to work in other places outside the industry. The faculty and Industry supervisor will work out a suitable arrangement to review the progress of the work from time to time. Maharashtra</p>

		Institute of Technology, Aurangabad will monitor the progress of In-plant training in association with industry authority.
		<p><b>Conduct and Discipline:</b></p> <p>In all matters of the conduct and discipline, B.Tech student shall be governed by the rules and regulations (applicable to employees of the corresponding category) in the Establishment, where he/she is undergoing a training.</p>
		<p><b>B.Tech Students are Trainees and not Workers:</b></p> <ul style="list-style-type: none"> <li>• Every B.Tech student undergoing an In-plant training in the respective branch of Engineering &amp; Technology in any Establishment shall be treated as a trainee and not a worker and-</li> <li>• The provision of any law with respect to labor will not apply to such a trainee.</li> </ul>
		<p><b>Settlement of Disputes:</b></p> <p>Any disagreement or dispute between an industry and a B.Tech student trainee arising out of the contract of In-plant training shall be resolved both by Maharashtra Institute of Technology and the industry with mutual cooperation. The decision of both Maharashtra Institute of Technology and the industry shall be final.</p>
		<p><b>Holding of Test and Grant of Certificate:</b></p> <p>The progress in In-plant training of every student shall be assessed by the industry and Maharashtra Institute of Technology faculty from time to time.</p> <p>Every B.Tech student undergoing an In-plant training shall be issued a certificate of Proficiency on completion of his training to the satisfaction of the industry.</p>
		<p><b>Offer of Stipend / Other Welfare Activities and Employment:</b></p> <p>It shall not be obligatory on the part of the Employer / Industry to offer any stipend and other welfare amenities available, if any, to the students of B.Tech courses undergoing an In-plant training. However, if the industry desirous to do so, it will be a privilege for the students and also for Maharashtra Institute of Technology in view of the bonding of better understanding and cooperation forever.</p>

	<p><b>PRACTICAL EXAMINATION</b></p> <p>The Practical examination will be conducted after successful completion of the In-plant training for which guide will be internal examiner and external examiner will be appointed by the university. The date of practical examination will be same for the students of a branch and will be notified by the university. The assessment of the practical examination shall consist of</p> <ol style="list-style-type: none"><li>1. Seminar Performance</li><li>2. An oral on the project work done.</li><li>3. Assessment of the term work / report.</li></ol>
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