DR. BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY

CIRCULAR NO. ACAD/SU/Engg./B.Tech./Syllabi/96/2014

It is hereby informed to all concerned that, the syllabus prepared by the Boards of Studies, Ad-hoc Board, Committees and recommended by the Faculty of Engineering and Technology, the Academic Council at its meeting held on 08-07-2014 has accepted the following **"Revised Syllabi in all Branches of B.TECH."** as appended herewith :-

Sr. No.	Revised Syllabi
[1]	B.Tech. Civil Engineering,
[2]	B.Tech. Mechanical Engineering,
[3]	B.Tech. Electronics & Telecommunication Engineering,
[4]	B.Tech. Computer Science & Engineering,
[5]	B.Tech. Agricultural Engineering,
[6]	B.Tech. Plastics & Polymer Engineering,
[7]	B.Tech. Instrumentation & Control Engineering,
[8]	B.Tech. Production Engineering.

This is effective from the Academic Year 2014-2015 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. ACAD/ SU/ B.TECH./
SYLLABI / 2014/
A.C.S.A. I.No.446[02].

Date:- 13-08-2014.

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Director,
Board of College and
University Development.

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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 the above all syllabi on University Website.**

Copy to :-

1] The Controller of Examinations,

2] The Superintendent, | Engineering Unit |,

3] The Programmer [Computer Unit-1] Examinations,

4] The Programmer [Computer Unit-2] Examinations,

5] The Superintendent, | Eligibility Unit | ,

6] The Director, [E-Suvidha Kendra], in-front of Registrar's Quarter,
Dr. Babasaheb Ambedkar Marathwada University,

7] The Record Keeper,
Dr. Babasaheb Ambedkar Marathwada University.

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DR. BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY, AURANGABAD.

Revised Syllabus of

B.TECH.

MECHANICAL ENGINEERING

[Effective from 2014-15 & onwards]

Dr. Babasaheb Ambedkar Marathwada University, Aurangabad
FACULTY OF ENGINEERING AND TECHNOLOGY
Revised Structure w.e.f. 2014-2015
Final Year B. Tech (Mechanical Engineering)

Sub Code	SEMESTER-VII	Contact Hrs / Week				Examination Scheme						
	Subject	L	T	P	Total	CT	TH	TW	P	Total	Credits	Duration of Theory Exam
MED401	Refrigeration & Air Conditioning	3	1	-	4	20	80	-	-	100	4	3 Hours
MED402	Automatic Control System	3	1	-	4	20	80	-	-	100	4	3 Hours
MED403	Heat Transfer	4	-	-	4	20	80	-	-	100	4	3 Hours
MED404	Tool Design	4	-	-	4	20	80	-	-	100	4	4 Hours
MED441-445	Elective-II	4	-	-	4	20	80	-	-	100	4	3 Hours
MED421	Laboratory-I Refrigeration & Air Conditioning	-	-	2	2	-	-	50	-	50	1	NA
MED422	Laboratory-II Automatic Control System	-	-	2	2	-	-	50	-	50	1	NA
MED423	Laboratory-III Heat Transfer	-	-	2	2	-	-	50	50	100	1	NA
MED424	Laboratory-IV Tool Design	-	-	2	2	-	-	50	50	100	1	NA
MED425	Project-II	-	-	6	6	-	-	100	100	200	3	NA
	Total of semester-VII	**18**	**02**	**14**	**34**	**100**	**400**	**300**	**200**	**1000**	**27**	-

Sub Code	SEMESTER-VIII	Contact Hrs /Week				Examination Scheme						
	Subject	L	T	P	Total	CT	TH	TW	P	Total	Credits	Duration of Theory Exam
MED471	Inplant Training (IPT)*	-	-	-	-	-	-	300	300	600	27	NA
	Total of semester-VIII	-	-	-	-	-	-	300	300	600	27	-
	Grand Total of VII & VIII	**18**	**02**	**14**	**34**	**100**	**400**	**600**	**500**	**1600**	**54**	-

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 NA: Not Applicable

Elective-II
MED441. Project Management and Operation Research
MED442. Product Design
MED443. Composites Materials and Technology
MED444. Finite Element Analysis
MED445. Open Elective

***After every two weeks of In-Plant Training (IPT) student shall apprise the progress of training to the internal guide and get the required inputs.**

Dr.Babasaheb Ambedkar Marathwada University, Aurangabad
(Faculty of Engineering & Technology)

Syllabus: B. Tech. (Mech.)	**Semester-VII**
Code No.: MED401	**Title: Refrigeration & Air Conditioning**
Teaching Scheme	**Class Test (Marks): 20**
Theory: 03 Hrs/week	**Theory Examination (Duration): 3Hrs**
Tutorial: 01 Hrs/week	**Theory Examination (Marks): 80**
Credits: 04	

Course Objectives	:	• To provide insights of thermodynamic principles applied for refrigeration and air conditioning • To understand refrigeration system working on vapour compression cycle using single and multi-compressors. • To study different types of non-conventional refrigeration systems in existence. • To study the psychrometric processes and to understand the different air conditioning systems.
I	:	**Introduction:** (11 Hrs.) Introduction, Recapitulation of Thermodynamics, Thermodynamics process pertaining to refrigeration and air conditioning. First and Second law applied to refrigerating machines, Carnot principles, Unit of refrigeration, COP EER **Air refrigeration:** Air refrigeration cycle. Reverse Carnot cycle, Bell-Coleman cycle Numerical on above. Air Refrigeration Systems: Thermodynamic processes, priority criteria and suitability of air refrigeration system. Types of Air refrigeration system, Simple, Boot Strap, Regeneration, Reduced Ambient. Evaporative System. Comparison of these cycles based on DART rating. Numerical on above.
II	:	**Simple Vapor Compression Cycle:** (08 Hrs.) Necessity of modification of Carnot Cycle, Thermodynamic processes in VCC. Simple vapor compression system: Various conditions of vapor refrigerant in the system, Improvement in simple system. Flash Chamber, Flash Intercooler. Numerical on above syllabus. Refrigerants: Desirable properties of refrigerant, R-12, R-22, R-717, R-134, Butane, Recent substitute for refrigerants.
III	:	**Compound Vapor Compression Cycle:** (11 Hrs.) Compound vapor Compression System: Need of compound compression Two stage compression, and various arrangements for improvement in C O P with mathematical analysis. Numericals. Three Stage Compressions: Various arrangements for improvement in C. P. Numericals. Multiple Evaporator System, Requirement for multiple Evaporator, Various arrangements for improvement in C O P. Mathematical analysis. Numericals on multiple evaporator.
IV	:	**Introduction to Cryogenics and Non-Conventional Heat Operated Systems:** (10 Hrs.) Cascade Refrigeration: Thermodynamically analysis of Cascade systems Various arrangements. Methods of Producing and maintaining low temperature such as simple Linde, Claude, Kapitea, Heylandt cycle, Philips, Stirlingmachine, Thermodynamic analysis of above cycle to find yield and exegetic efficiency. Numericals. Vapor absorption system: System components, Representation of system on various charts, Steam ejector system, Representation on T-s and P-V plane, Applications and Limitations, C O P. Numericals on above systems.

V	:	**Psychrometry:** (14Hrs.) Introduction to Psychrometry: Need of Air Conditioning, principle of psychrometry, psychometric properties such as DBT, WBT relative humidity, specific humidity, dew point temperature, Enthalpy, Thermodynamic wet bulb temperature, Numericals. Applied Psychrometry: Representation of various psychometric processes on psychometric chart and their analysis, Adiabatic mixing of streams, By pass factor, sensible heat factor, RSHF, ESHF, GSHF, ADP, Ventilation and infiltration Use of psychometric charts and numericals on above.
VI	:	**Human Comfort and Air Conditioning:** (06 Hrs.) Requirements of temperature, Humidity and concept of effective temperature, comfort charts. Air Conditioners: Air conditioning systems and their types, selection of system, Components and controls of air distribution, Window air conditioners, split air conditioners, Central air conditioners, Human comfort parameters, Load Estimation, Infiltration, Internal heat gains
Text Books & Reference Books	:	1. Arora C P, Refrigeration and Air Conditioning, Tata McGraw Hill, 3rd edition. 2. Domkundwar and Domkundwar, Refrigeration and Air Conditioning, DhanpatRai Publications, 1st. 3. Manohar Prasad, Refrigeration and Air Conditioning, New Age International Publishers, 2nd edition. 4. Ballany P L, Refrigeration and Air Conditioning, Khanna Publications, 2nd edition. 5. Dossat R J, Principles of Refrigeration, Prentice Hall, 5th edition. 6. William C Whitman, William Johnson, Refrigeration and Air Conditioning Technology, Thomson Delmar Learning, 5th edition.

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

Pattern of Question Paper

The six 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. Set ten questions in all, 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 and should be set for ten marks each. The Question no.1 and 6 should be of objective nature.
4. Two questions of 15 marks each from remaining questions from each section A and B be asked to solve.

Dr.Babasaheb Ambedkar Marathwada University, Aurangabad
(Faculty of Engineering & Technology)

Syllabus: B. Tech. (Mech.)	**Semester-VII**
Code No.: MED402	**Title: Automatic Control System**
Teaching Scheme	**Class Test (Marks): 20**
Theory: 03 Hrs/week	**Theory Examination (Duration): 3Hrs**
Tutorial: 01 Hrs/week	**Theory Examination (Marks): 80**
Credits: 04	

Course Objectives	:	• To study the fundamental concepts of control systems and mathematical modeling of the system. • To study the concept of time response and frequency response of the system. • To study the basics of stability analysis of the system. • To study the various control actions & controllers of a control system.
I	:	**Representation of Control System Components :** (12 Hrs.) Introduction, 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.
II	:	**Block Diagram Algebra:** (08 Hrs.) 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
III	:	**Hydraulic Systems&Pneumatic Systems:** (10 Hrs.) 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 etc
IV	:	**Electrical Systems & Modes of Control:** (12 Hrs.) 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.
V	:	**Response Characteristics:** (08 Hrs.) 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
VI	:	**Analysis of Frequency Response:** (10 Hrs.)

		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
Text Books & Reference Books	:	1. Nagrath Gopal, Automatic Control Systems, New Age International, 4th edition. 2. K. Ogata, Modern Control Engg., PHI, 3rd edition. 3. Hasan Saeed, Automatic Control Systems, Katson Publication, 6th edition. 4. Francis Raven, Automatic Control Systems, TMH, 5th edition. 5. S. K .Bhattacharya, Control Systems Engineering, Pearson Education, 3rd edition. 6. Benjamin C. Kuo., Automatic Control System, PHI, 7th edition.

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

Pattern of Question Paper

The six 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. Set ten questions in all, 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 and should be set for ten marks each. The Question no.1 and 6 should be of objective nature.
4. Two questions of 15 marks each from remaining questions from each section A and B be asked to solve.

Dr.Babasaheb Ambedkar Marathwada University, Aurangabad
(Faculty of Engineering & Technology)

Syllabus: B. Tech. (Mech.)	**Semester-VII**
Code No.: MED403	**Title: Heat Transfer**
Teaching Scheme	**Class Test (Marks): 20**
Theory: 04 Hrs/week	**Theory Examination (Duration): 3Hrs**
Credits: 04	**Theory Examination (Marks): 80**

Course Objectives	:	• The student should able to understand physical principles associated with the subject. • The student should be able to define any process or system involving heat transfer. • The student should be able to use requisite inputs for computing heat transfer rates and / or system involving heat transfer.
I	:	**Introduction:** (14 Hrs) Applications of heat transfer in various field from everyday life to space craft. Various modes of heat transfer, , mechanisms of different modes of heat transfer **Conduction Heat Transfer:** Fourier's law of heat conduction, conductivity, dependence of conductivity on different factors. Three dimensional heat conduction in rectangular, cylindrical and spherical co-ordinates and simplification of the same. Electrical analogy, concept of thermal resistance. Introduction to Newton's law of cooling, Unidirectional heat conduction through material with variable conductivity and heat generation, heat conduction with convective environment, Concept of critical radius of insulation, log mean area and shape factor in conduction..
II	:	**Extended Surfaces(Fins):** (08 Hrs.) Methods to improve/ reduce rate of heat transfer, Theory of simple pin-fin under steady state conduction without heat generation with different end conditions, Efficiency and effectiveness of fin, Use of fin Theory for rectangular and circumferential fin, application of fin theory for error estimation in temperature measurement.
III	:	**Unsteady State Conduction Heat Transfer:** (08 Hrs) Single lumped heat capacity method, development of unsteady state heat transfer equation for objects with negligible internal resistance, Biot and Fourier number. Applications of the theory.
IV	:	**Convection:** (12 Hrs.) Concept of boundary layer, hydrodynamic and thermal boundary layer, Development of empirical relation using dimensional analysis for forced and natural convection. Condensation heat transfer, Nusselt theory, film wise and drop wise condensation, heat transfer in pool boiling phenomenon.
V	:	**Radiation Heat Transfer:** (10 Hrs.) Laws of radiation : Stefen Boltzman's law Planck's distribution law, definitions of various terms used in radiation heat transfer , Concept of solid angle and intensity of radiation, shape factor, radio city irradiation, Use of electrical analogy, Response of thermocouple.
VI	:	**Heat Exchanger:** (08 Hrs.) Various heat exchangers, Classification, development of LMTD Equation for parallel and counter flow, correlation for other heat exchanger, effect of fouling on performance of heat exchanger, Effectiveness of heat exchanger, designing of heat exchanger including NTU method. Applications of the theory.
Text Books & Reference	:	1. J. P. Holman, Heat Transfer, Tata McGraw Hill, 3rd edition. 2. P.K. Nag, Heat transfer, Tata McGraw Hill, 2nd edition. 3. John H. Lienhard, A Heat Transfer Textbook Engineering, Phlogiston

Books		Press Cambridge, Massachusetts, 3rd edition. 4. R. K. Rajput, Heat and mass transfer, S. Chand Publication, 5th edition. 5. Robert W. Searth, Process heat transfer, Elsevier Science & Technology Books, ISBN: 0123735882, 5th edition. 6. Yunua Cengel and A. J. Gajar, Heat and Mass Transfer, Tata McGraw Hill, 6th edition. 7. K. Sadik and L. Honhton, Heat Exchangers, Selection, Rating and thermal design, CRC Press, 2nd edition.

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

Pattern of Question Paper
The six 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. Set ten questions in all, 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 and should be set for ten marks each. The Question no.1 and 6 should be of objective nature.
4. Two questions of 15 marks each from remaining questions from each section A and B be asked to solve.

Dr.Babasaheb Ambedkar Marathwada University, Aurangabad
(Faculty of Engineering & Technology)

Syllabus: B. Tech. (Mech.)	**Semester-VII**
Code No.: MED404	**Title: Tool Design**
Teaching Scheme	**Class Test (Marks): 20**
Theory: 04Hrs/week	**Theory Examination (Duration): 4Hrs**
Credits: 04	**Theory Examination (Marks): 80**

Course Objectives	:	• To have knowledge and competency in the field of tool engineering • To pursue higher education in the field of tool engineering • To design a cutting tool suit the given operation • To select tool material • To analyze tool wear and tool life • To design a jig or fixture for given operation • To design blanking and piercing die
Unit		**Contents**
I	:	**Introduction:** (02 Hrs.) Tooling-Definition, classification, AISI tool materials and their properties
II	:	**Elements of Machining Process:** (12 Hrs.) 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, Numericals **Progresses in Cutting Tools:** (02 Hrs.) Review of recent progresses in rake angles, tool life, carbide inserts cutting tools to improve machining performance
III	:	**Multipoint Cutting Tools:** (06 Hrs.) 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 nomenclature. Machining volume, time and forces for drilling and milling operations **Limits, Fits and Gauges:** (08 Hrs.) Tolerances, functional and non-functional dimensions, ways of expressing tolerances, specifying tolerances tolerance accumulation and 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-Taylors Principle, Numericals
IV	:	**Jigs and Fixtures:** (12 Hrs.) 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, tennon, 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
V	:	**Design of Dies:** (10 Hrs.) 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.
VI	:	**Drawing Dies:** (08 Hrs.) 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
Text Books & Reference Books	:	1. P. H. Joshi, Jig & Fixtures, TMH Publication, 2nd edition. 2. M H A Kempster, Introduction to Jig and Tool Design, Butterworth-Heinemann Ltd., 3rd edition. 3. Herman W. Pollack, Tool Design, Reston Publishing Company, INC., 2nd edition. 4. Ghosh & Mallik, Manufacturing Science, East West Press., 2nd edition. 5. Amitabh Bhattacharya, Metal Cutting Theory and Practice, New Central Book Agency (P) Ltd. 6. Fundamentals of Tool Design, ASTME. 7. Cyril Donaldson *et al*, Tool design, TMH Publication, 3rd edition. 8. Erik K Henriksen, Jigs and fixture design manual, IP. 9. PSG, Design Data Book, PSG College of Technology 10. Hindustan Machine Tools, Production Technology, Tata McGraw Hill.

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

Pattern of Question Paper

The six 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. Set ten questions in all, 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 and should be set for ten marks each. The Question no.1 and 6 should be of objective nature.
4. Two questions of 15 marks each from remaining questions from each section A and B be asked to solve.

Dr.Babasaheb Ambedkar Marathwada University, Aurangabad
(Faculty of Engineering & Technology)

Syllabus: B. Tech. (Mech.)	**Semester-VII**
Code No.: MED441	**Title: EL-II (Project Management & Operations Research)**
Teaching Scheme	**Class Test (Marks): 20**
Theory: 04 Hrs./week	**Theory Examination (Duration): 3Hrs**
Credits: 04	**Theory Examination (Marks): 80**

Course Objectives	:	• Aims to introduce students to use quantitative methods and techniques for effective decisions-making; model formulation and applications that are used in solving business decision problems. • To apply different OR techniques in problem formulation and solving Linear Programming, Transportation, Assignment, Sequencing problems • To understand use of PERT /CPM in Project Management • To understand concept of Advanced Linear programming.
I	:	**Introduction:** (03 Hrs.) Origin of OR and its role in solving industrial problems, General approach for solving OR problems, Classification of mathematical models, various decision making environments
II	:	**Linear Programming:** (14 Hrs.) Assumption of LPP, Formulation of LP problem, Two variable Graphical methods, Types of solutions, Simplex algorithm (maximization and minimization), Big M method and two phase method, Degeneracy in simplex method, Duality in LP, Introduction to sensitivity analysis. **Advanced Linear Programming:** Introduction to dynamic programming, Application in practical use
III	:	**Transportation model:** (13 Hrs.) Assumption in the transportation model, Initial Basic Feasible solution and optimal solution, Variants in transportation problems(degeneracy, unbalanced problems) **Assignment model:** Definition of Assignment model, Hungarian method for solution of the Assignment Problems, Variations of the Assignment problem(non-square and maximization, Travelling Salesman problem(Application in crew Assignment)
IV	:	**Game Theory:** (14 Hrs.) Characteristics of Games, Game models, Definitions, Rules for Game theory, Mixed strategies(2X2 Game) **Queuing Model:** Queuing systems and structures, Notation, single server and multi server models, Poisson input-exponential service, constant rate service, infinite population.
V	:	**Sequencing Model:** (06 Hrs.) Assumptions in Sequencing Problem. Processing n jobs through one, two, three and m machines Processing of two jobs through m machines using graphical method
VI	:	**Network Analysis:** (10 Hrs.) Role of Network Techniques in Project Management, Numbering the events (Fulkerson's Rule), Probability calculations and Float calculations, Critical Path Method, crashing cost and crashing Network.
Text Books & Reference Books	:	1. P. K. Gupta, D.S. Hira, Operations Research, S. Chand and Co., 4th edition. 2. S. D. Sharma and H.D. Sharma, Operations Research, Kedar Nath Ram Nath, 15th edition. 3. F. Hillier and G. Lieberman, Introduction to Operations Research, Mc-Graw Hill Companies, 7th edition. 4. Wayne L. Winston, Operations Research: Applications and Algorithms, Thomson Learning, 4th edition. 5. Kanti Swarup, Gupta P. K. and M. M. Singh, Operations Research, Sultan

		Chand & Sons, 12th edition. 6. H A Taha, Operations Research:An Introduction, Pearson Prentice Hall, 9th edition. 7. Ravindran, Phillips, Solberg, Operations Research: Principles and Practice, Wiley India Pvt. Ltd, 2nd edition. 8. B.C. Punmia & K.K. Khandelwal, Project Planning and Control with PERT & CPM, Firewall Media, 4th edition. 9. Srinath L. S., PERT and CPM Principles and Application, East West Press, 3rd edition.

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

Pattern of Question Paper

The six 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. Set ten questions in all, 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 and should be set for ten marks each. The Question no.1 and 6 should be of objective nature.
4. Two questions of 15 marks each from remaining questions from each section A and B be asked to solve.

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(Faculty of Engineering & Technology)

Syllabus: B. Tech. (Mech.)	**Semester-VII**
Code No.: MED442	**Title: EL-II (Product Design)**
Teaching Scheme	**Class Test (Marks): 20**
Theory: 04 Hrs./week	**Theory Examination (Duration): 3Hrs**
Credits: 04	**Theory Examination (Marks): 80**

Course Objectives	:	• Develop an ability to apply knowledge of mathematics, science, and engineering. • Understand the basic Engineering Design Methods. • To develop product concepts and understand the product design procedure. • To create Creativity in problem solving techniques. • To understand the concept and history of Industrial design. • To develop product presentation skills. • To understand the concept of CAD, Rapid prototyping and design for production.
I	:	**Introduction to Basic Engineering Design Methods:** (08 Hrs.) Difference between Prescriptive and Descriptive Design Models of. Different models of Design Process such as Cross, Archer. French, Pahl and Beitzs, Roozenberg&Eakels, and French model of design.
II	:	**Product Design Procedure:** (08 Hrs.) Market research, planning and positioning of product, understanding of problem areas and limitations, User group and their background. Analysis of ideas from various angles of design – methodologies to fit it to the user.
III	:	**Role of Creativity in Problem Solving:** (14 Hrs.) Vertical and lateral thinking, Brainstorming, Synectic technique, Gorden technique, and Morphological techniques of creativity **Industrial Design:** Concept and history of ID. Design and Sketching. Project planning and project management, working in teams; role, responsibility and leadership. Project planning and administration.
IV	:	**Product Presentation:** (10 Hrs.) Visual communication skills related to products and service. Typeface, layouts, sketches for leaflets and instruction. Exploded view for product and service manuals. 2D & 3D presentation, Concept drawings, renderings, sketches, computer generated images.
V	:	**Computer Aided Designs (CAD):** (12 Hrs.) Modern CAD techniques , parametric design etc. digital assembly techniques and data management in team environments. Role of computers for Industrial Design. **Rapid Prototyping :** Principles, Types of prototyping, methodologies, tools and materials, their applications
VI	:	**Design for Production:** (08 Hrs.) Process consideration in design – design for easy assembly – manufacturing – maintenance – convenience – operation and safety.

Text Books & Reference Books	:	1. Product Design and Manufacture: John R. Linbeck, P.H.I. Publications. 1995. USA 2. Product Design and Development: Karl T. Ulrich and Steven Eppinger, Tata McGraw -Hill Publishing Company Ltd, 2003.New Delhi. 3. Product Design and Manufacture and Assembly: Geoffrey Boothroyd, Peter Dewhurst and Winston Knight, Marcel Dekker, Inc.1994. New York 4. Engineering Design Methods: Nigel Cross, John Wiley and Sons 1994. England. 5. Engineering Design, A Systematic Approach, G Pahl and W Beitz, the Design Council, Springer Verlag,1993,London. 6. CAD/CAM, Computer Aided Design and Manufacturing: Mikell P. Groover and Emory W. Zimmers, Jr., P.H.I., 1998, New Delhi. 7. Product Design: Fundamentals of Methods: N.F.M. Roozenberg and Eakels. John Wiley and Sons 1995. England. 8. Industrial Design: Van Doran Herold. McGraw-Hill Boo Company, 1968, London. 9. Product Design: A practical guide to systematic methods of new product development, by Mike Baxter. Chapman and Hall, 1995. London. 10. Design for Excellence : James G. Bralla, McGraw-Hill Inc,1996,USA 11. CAD/CAM/CIM : P.Radhakrishnan, S. Subramanyan, Wiley Eastern Ltd., 1994.New Delhi 12. Product Design and Development by Dr. G.S. Dangayach ,AshishDutt Sharma, ParitoshVardhan Jain, College Book Centre,2003,Jaipur,India

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

Pattern of Question Paper

The six 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. Set ten questions in all, 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 and should be set for ten marks each. The Question no.1 and 6 should be of objective nature.
4. Two questions of 15 marks each from remaining questions from each section A and B be asked to solve.

Dr. Babasaheb Ambedkar Marathwada University, Aurangabad
(Faculty of Engineering & Technology)

Syllabus: B. Tech. (Mech.) Code No.: MED443	Semester-VII Title: EL-II (Composite Materials & Technology)
Teaching Scheme Theory: 04 Hrs./week Credits: 04	Class Test (Marks): 20 Theory Examination (Duration): 3Hrs Theory Examination (Marks): 80

Course Objective	:	This subject introduces to the students the different types of composite materials, their properties and applications.
I	:	**Introduction to composites:** (08 Hrs.) Fundamentals of composites - need for composites – Enhancement of properties - classification of composites – Matrix-Polymer matrix composites (PMC), Metal matrix composites (MMC), Ceramic matrix composites (CMC) – Reinforcement – Particle reinforced composites, Fibre reinforced composites. Applications of various types of composites.
II	:	**Polymer matrix composites:** (15 Hrs.) Polymer matrix resins – Thermosetting resins, thermoplastic resins – Reinforcement fibres – Rovings – Woven fabrics – Non woven random mats – various types of fibres. PMC processes - Hand layup processes – Spray up processes – Compression moulding – Reinforced reaction injection moulding - Resin transfer moulding – Pultrusion – Filament winding – Injection moulding. Fibre reinforced plastics (FRP), Glass fibre reinforced plastics (GRP).
III	:	**Metal matrix composites:** (12 Hrs.) Characteristics of MMC, Various types of Metal matrix composites Alloy vs. MMC, Advantages of MMC, Limitations of MMC, Metal Matrix, Reinforcements – particles – fibres. Effect of reinforcement - Volume fraction – Rule of mixtures. Processing of MMC – Powder metallurgy process - diffusion bonding – stir casting – squeeze casting.
IV	:	**Ceramic matrix composites:** (10 Hrs.) Engineering ceramic materials – properties – advantages – limitations – Monolithic ceramics - Need for CMC – Ceramic matrix - Various types of Ceramic Matrix composites- oxide ceramics – non oxide ceramics – aluminium oxide – silicon nitride – reinforcements – particles- fibres- whiskers. Sintering - Hot pressing – Cold isostatic pressing (CIPing) – Hot isostatic pressing (HIPing).
V	:	**Advances in composites:** (10 Hrs.) Carbon / carbon composites – Advantages of carbon matrix – limitations of carbon matrix Carbon fibre – chemical vapour deposition of carbon on carbon fibre perform. Sol gel technique. Composites for aerospace applications.
VI	:	**Composite product design:** (05 Hrs.) Design Cycle, Numerical Analysis and modeling of composite materials
Text Books & Reference Books	:	1. Mathews F.L. and Rawlings R.D., Composite materials: Engineering and Science, Chapman and Hall, London, England, 1st edition, 1994. 2. Chawla K.K., Composite materials, Springer – Verlag, 1987. 3. Clyne T.W. and Withers P.J., Introduction to Metal Matrix Composites, Cambridge University Press, 1993. 4. Strong A.B., Fundamentals of Composite Manufacturing, SME, 1989. 5. Sharma S.C., Composite materials, Narosa Publications, 2000. 6. Short Term Course on Advances in Composite Materials, Composite Technology Centre, Department of Metallurgy, IIT- Madras, December

		2001.

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

Pattern of Question Paper
The six 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. Set ten questions in all, 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 and should be set for ten marks each. The Question no.1 and 6 should be of objective nature.
4. Two questions of 15 marks each from remaining questions from each section A and B be asked to solve.

Dr. Babasaheb Ambedkar Marathwada University, Aurangabad
(Faculty of Engineering & Technology)

Syllabus: B. Tech. (Mech.)
Code No.: MED444
Teaching Scheme
Theory: 04 Hrs./week
Credits: 04

Semester-VII
Title: EL-II (Finite Element Analysis)
Class Test (Marks): 20
Theory Examination (Duration): 3Hrs
Theory Examination (Marks): 80

Course Objectives	:	• To understand the basic concept of FEA. • Enable the students to formulate the design problems into FEA. • To understand the application of FEA in different fields. • To understand the use FEA software's.
I	:	**Introduction:** (08 Hrs.) Equilibrium equations in elasticity subjected to body force, traction forces, stress strain relations for plane stress and plane strain, Boundary conditions, Initial conditions, Euler's Lagrange's equations of bar, beams, Principal of a minimum potential energy, principle of virtual work, Rayleigh-Ritz method, Galerkins method., Guass elimination Numerical integration.
II	:	**Basic Procedure:** (12 Hrs.) General description of Finite Element Method, Engineering applications of finite element method, Discretization process; types of elements 1D, 2D and 3D elements, size of the elements, location of nodes, node numbering scheme, half Bandwidth, Stiffness matrix of bar element by direct method, Properties of stiffness matrix, Preprocessing, post processing
III	:	**Interpolation Models:** (10 Hrs.) Polynomial form of interpolation functions- linear, quadratic and cubic, Simplex, Complex, Multiplex elements, Selection of the order of the interpolation polynomial, Convergence requirements, 2D Pascal triangle, Linear interpolation polynomials in terms of global coordinates of bar, triangular (2D simplex) elements, Linear interpolation polynomials in terms of local coordinates of bar, triangular (2D simplex) elements, CST element.
IV	:	**Higher Order And Isoparametric Elements:** (08 Hrs.) Lagrangian interpolation, Higher order one dimensional elements- quadratic, Cubic element and their shape functions, properties of shape functions, Truss element, Shape functions of 2D quadratic triangular element in natural coordinates, 2D quadrilateral element shape functions – linear, quadratic, Biquadric rectangular element (Noded quadrilateral element), Shape function of beam element. Hermit shape functions of beam element.
V	:	**Derivation Of Element Stiffness Matrices And Load Vectors:** (08 Hrs.) Direct method for bar element under axial loading, trusses, beam element with concentrated and distributed loads, matrices, Jacobian, Jacobian of 2D triangular element, quadrilateral, Consistent load vector, Numerical integration.
VI	:	**Heat Transfer Problems:** (14 Hrs.) Steady state heat transfer, 1D heat conduction governing equation, boundary conditions, One dimensional element, Functional approach for heat conduction, Galerkin approach for heat conduction, heat flux boundary condition, 1D heat transfer in thin fins. **Applications I:** Solution of bars, stepped bars, plane trusses by direct stiffness method. Solution for displacements, reactions and stresses by using elimination approach, penalty approach. **Applications II:** Solution of beam problems, heat transfer 1D problems with conduction and convection. Introduction to software used in FEA(like ANSYS, NASTRAN)
Text Books & Reference	:	1. C.S.Krishnamurthy, Finite element analysis, Tata McGraw Hill, 1st edition. 2. J. N. Reddy, An introduction to finite element method, Tata McGraw Hill, 2nd

Books		edition. 3. Chandrupatla and Belegundu, Introduction to finite element in engineering, Prentice Hall of India. 4. O. C. Zienkiewicz& R. L. Taylor, The finite element method, Tata McGraw Hill, 1st edition. 5. R.D. Cook, Concept and Application of Finite element analysis, John wiley, 1st edition. 6. Bathe, Finite element procedures in engineering analysis, Prentice Hall of India, 1st edition. 7. Daryl L. logan, A first course in the finite element method, Thomson, 3rd edition. 8. Hutton, Fundamentals of Finite element method, Tata McGraw Hill, 1st edition. 9. George R. Buchanan, Finite element analysis, Schaum, 2nd edition. 10. S.S.Rao, Finite element method in engineering, Elsevier, 4th edition.
Digital References		1. Wikipedia/ 2. www.ansys.com 3. www.mscsoftware.com/

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

Pattern of Question Paper
The six 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. Set ten questions in all, 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 and should be set for ten marks each. The Question no.1 and 6 should be of objective nature.
4. Two questions of 15 marks each from remaining questions from each section A and B be asked to solve.

Dr.Babasaheb Ambedkar Marathwada University, Aurangabad
(Faculty of Engineering & Technology)

Syllabus of B. Tech. (Mechanical) | **Semester-VII**
Code No.: MED421 | **Title: Laboratory-I Refrigeration and Air Conditioning**

Teaching Scheme:
Practical: 02 Hrs. / week | **Term Work (Marks): 50**
Credits: 01

Course objective	After successful completion of course students shall be able to understand working of Refrigeration and Air Conditioning systems and the use of different RAC tools.

Practical	
	Name of Experiment
List of Practicals (Not Less than ten)	1. To study working of domestic Refrigerator along with wiring diagram.
	2. Study of RAC tools and their applications in refrigeration workshop And Lab.
	3. Study of different types of Compressors.
	4. To study the procedure of leak detection, evacuation and charging of refrigerant.
	5. To study Vapour Absorption refrigeration system.
	6. Trial on Window Air Conditioner test rig.
	7. Trial refrigeration test rig.
	8. Trial on Air Conditioner test rig.
	9. Report on different international protocols to regulate global warming.
	10. Report on visit to refrigeration establishments.

Term Work assessment shall be done on the basis of

- Performing the experiments in the laboratory
- Continuous assessment

Practical Examination, if applicable, shall be conducted on the syllabus and term work mentioned above

Dr.BabasahebAmbedkarMarathwada University, Aurangabad
(Faculty of Engineering & Technology)

Syllabus of B. Tech. (Mechanical)
Code No.: MED422

Semester-VII
Title: Laboratory-II Automatic Control System
Term Work (Marks): 50

Teaching Scheme:
Practical: 02 Hrs./week
Credits: 01

Course objective	After successful completion of course students shall be able to understand working of Hydraulic systems, Pneumatic systems and many Control Actions.

Practical		
List of practicals (Any ten of the following should be completed)	Sr.No.	Name of Experiment
	1.	Study of various types of measuring instruments & transducers (at least ONE of each type)
	2.	Study of control system components (At least TEN components)
	3.	Study of any ONE of Hydraulic system using hydraulic servomechanism
	4.	Experiment on speed control of DC Motor
	5.	Experiment on speed control of AC Motor
	6.	Experiment on speed control of Stepper Motor
	7.	Circuit Preparation by using Hydraulic Trainer Kit
	8.	Circuit Preparation by using Pneumatic Trainer Kit
	9.	Study of Circuits for M/C Tools.
	10.	Experiment on Level Control System
	11.	Experiment on Temperature Control System
	12.	Experiment on Position Control using Synchros
	13.	Study of Design of Automatic Control System with i) Plant layout. ii) Block diagram. iii) Steady state Analysis iv) Design of controller. For various control systems like Temp. flow etc.

Term Work assessment shall be done on the basis of

- Performing the experiments in the laboratory
- Continuous assessment

Practical Examination, if applicable, shall be conducted on the syllabus and term work mentioned above

Assignments on unit 1, 2, 5 & 6.

Dr. Babasaheb Ambedkar Marathwada University, Aurangabad
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Syllabus: B. Tech. (Mech.)
Code No.: MED423
Teaching Scheme:
Practical : 02 Hrs./week
Credits: 01

Semester-VII
Title: Laboratory-III Heat Transfer
Term Work (Marks): 50
Practical (Marks): 50

Course objective	To find thermal conductivity and/or convection coefficient in different set of experiments and compare the result with theoretical values in heat transfer data book.

Practical		
List of practicals (Not less than ten)	1	Experiment on heat conduction in Metal rod.
	2	Experiment on heat conduction in Composite structure.
	3	Experiment on heat conduction in insulating material
	4	Experiment on heat conduction in Pin fin.
	5	Experiment on natural convection
	6	Experiment on forced convection
	7	Determination of emissivity of a surface.
	8	Experimental verification of Steffen Bolts man's constant.
	9 / 10	Experiment on heat exchangers (parallel and counter flow).

Term Work assessment shall be done on the basis of

- Performing the experiments in the laboratory
- Continuous assessment

Practical Examination, if applicable, shall be conducted on the syllabus and term work mentioned above

Dr.Babasaheb Ambedkar Marathwada University, Aurangabad
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Syllabus: B. Tech. (Mech.)
Code No.: MED424
Teaching Scheme:
Practical: 2 Hrs. / week
Credits: 01

Semester-VII
Title: Laboratory-IV Tool Design
Term work (Marks): 50
Practical Examination (Marks): 50

Course objective	• The students shall understand nomenclature related to single point cutting tool. • The students shall understand the importance of drafting after design of tooling. • Students shall understand nomenclature of all multi point cutting tools.

Practical		
List of practicals (Not less than ten)	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.
	3.	One A1 size drawing sheet on locating devices.
	4.	One A1 size drawing sheet on clamping devices
	5.	One A1 size drawing sheet on Jig design by referring design data book
	6.	One A1 size drawing sheet on Fixture design by referring design data book.
	7.	One A1 size drawing sheet on multipoint cutting tools.
	8.	One A1 size drawing sheet on die design.
	9.	Numericals based on measurements of cutting time, forces, cutting power.
	10.	Study of guidelines /brochure of cutting tool/ inserts of an industrial cutting tool manufacturer.
	11.	Brief report on recent progresses / research in cutting tools

Term Work assessment shall be done on the basis of

- Performing the experiments in the laboratory
- Continuous assessment

Practical Examination, if applicable, shall be conducted on the syllabus and term work mentioned above

Dr.Babasaheb Ambedkar Marathwada University, Aurangabad
(Faculty of Engineering & Technology)

Syllabus: B. Tech. (Mech.)	**Semester-VII**
Code No.: MED425	**Title: Project-II**
Teaching Scheme	**Term Work (Marks): 100**
Practical: 6 Hrs./week	**Practical Examination (Marks): 100**
Credits: 03	

Course Objectives	:	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. 2. To motivate students for creativity. 3. To create awareness regarding latest technology 4. To have common platform for interaction about emerging technology. 5. To inculcate qualities of team work. 6. To explore related information using books, research papers, journals & websites. 7. To improve presentation and communication skills.
		Guidelines For Students And Faculty: 1. Students shall complete the Project-II in continuation of the work planned in third year under the course Project-I 2. Each student/group is required to- a. Submit a report with latest status of the project work. 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. c. Submit a report on the project topic with a list of required hardware, software or other equipment for executing the project in the third week of their academic semester. d. Start working on the project and submit initial development and CPM/PERT planning drawing in the fourth week of their academic semester. 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. f. Overall assembling, wiring, code writing, testing, commissioning along with performance analysis, should be completed within next two weeks. g. In the last week, student/group will submit final project report to the guide. 3. Every assigned faculty/s should maintain record of progress of each student or group. The format and other guidelines for the purpose of the Project Submission in hard bound copies should be as follows, **REPORT STRUCTURE** Index/Contents/Intent List of Figures List of Tables List of Symbols / Abbreviations 1. Introduction 2. Literature survey 3. System development 4. Performance analysis

		5. Conclusions References Appendices Acknowledgement
		1. INTRODUCTION 1.1 Introduction 1.2 Necessity 1.3 Objectives 1.4 Theme 1.5 Organization 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 5. CONCLUSIONS 5.1 Conclusions 5.2 Future Scope 5.3 Applications Contributions (if any,) The innovative work/invention/new ideas generated from the analysis of the work which can be taken from the conclusions **REFERENCES** • Author, "Title", Name of Journal/Transactions/ Book, Edition/Volume, Publisher, Year of Publication, page to page (pp.__). 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 List of references should be as per use in the text of the report **APPENDICES** Related data or specifications or referred charts, details computer code/program, *etc.* **ACKNOWLEDGEMENTS** Expression of gratitude and thankfulness for helping in completion of the said task

		with name & signed by the candidate
		• General Guidelines Text should be printed on front and correct side of the watermark on quality bond paper Paper size- A4, 75 to 85 gsm paper Left Margin-1.5" Right Margin-3/4" Top Margin-1" Bottom Margin-1" • Pagination First page of every chapter need not be printed but counted, second page onwards page number to printed at bottom center place. All Greek words must be italic Report Heading -ALL CAPITAL—16 Font Chapter heading -ALL CAPITAL—14 Font Subchapter –Title Case-12 Font Sub-Subchapter –First Alphabet Capital case-12 Font Page numbers for Index/Contents/Intent should be in roman All text should be in times new roman Cover page should have complete symbol of institute Suitable flap (bookmark) with name of the candidate, Department and Institute name and symbol can be used with nylon strip.
		For more information and sample of hard copy please contact the respective Head of the Department.

Dr. Babasaheb Ambedkar Marathwada University, Aurangabad
(Faculty of Engineering & Technology)

Syllabus: B. Tech. (Mech.)	**Semester-VIII**
Code No.: MED471	**Title: Inplant Training (IPT)**
Examination Scheme:	**Term work (Marks): 300**
Credits: 27	**Practical Examination (Marks): 300**

(a)	**Rationale:** 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)	**Objectives:** 1) The students of B.Tech course shall get an opportunity to work on live problems of the industry. 2) He/She shall apply his leaving concepts in the real work situation. 3) He/She shall get an exposure to the industrial environment and thereby enable himself/herself to appreciate the other related aspects of industry vis, human, economic, commercial and regulatory. 4) He/She shall identify career paths taking into account their individual strengths and aptitude. 5) He/She shall contribute for the achievement of economic goals and aspirations of the industry and our country as a whole.
(c)	The curriculum for B.Tech students of Final Year Course of Part-II shall consist of; 1) Inplant 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. 2) A project on live problems of the industry shall be undertaken by the student/group of students undergoing training in the same establishment. 3) The term work shall consist of the inplant 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. 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.
(d)	**General Provisions, Rules and Regulation of Inplant Training** 1. **Definition** • In-plant training (IPT) means a course of training in any industry or establishment undergone in pursuance of memorandum of understanding between industry and institute and under the prescribed terms and conditions of Dr. Babasaheb Ambedkar Marathwada University, Aurangabad. • Institute means an academic Institution of higher learning associated and admitted under the privileges of university, i.e. Maharashtra Institute of Technology, Aurangabad affiliated to Dr. Babasaheb Ambedkar Marathwada University, Aurangabad.

- Industry means any industry or business in which any trade, occupation or subject field in engineering or technology may be specified as a designated trade.
- Establishment includes research organizations (like IITs, NITs, National Laboratories or research organization as recognized by Central Govt. / State Govt. / University)
- University means any of the universities mentioned in the schedule of Maharashtra University Act, 1994 i.e. Dr. Babasaheb Ambedkar Marathwada University, Aurangabad.
- Collaboration means collaborative academic activity of the Institute with industry.
- Student means a B Tech Course student.

2. **Memorandum of understanding:**
Maharashtra Institute of Technology, Aurangabad will enter into an agreement with the industry through 'Memorandum of Understanding' for creating facilities of inplant 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.

3. **Admission to inplant training:**
No student will be deputed for inplant training unless he/she produces testimonial of having kept one term for the subject under B.Tech. of final year course satisfactorily in Maharashtra Institute of Technology, Aurangabad.

4. **Period of inplant training:**
The period of Inplant 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.

5. **Contract of Inplant Training :**
- The student of Maharashtra Institute of Technology shall enter into a contract of inplant training with the employing industry.
- The inplant training shall be deemed to have commenced on the date, on which the contract of inplant training has been entered into.
- Every contract of inplant training will contain the Terms and Conditions to be agreed by both the parties.
- Every contract of inplant training shall be registered with the Maharashtra Institute of Technology within 15 days from entering into the contract.

6. **Violation of contract:**
Where an employer, with whom a contract for inplant training has been entered into, is for any reason, unable to fulfill his obligation under the contract, the contract end 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 "inplant trainee" under the other employer till the expiry period of the inplant training. The agreement on registration with Maharashtra Institute of Technology shall be deemed to be the contract of inplant training between the student and other employer, and from the date of such registration, the contract of inplant 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.

7. Termination of Contract:

The contract of inplant training shall terminate on the expiry of the period of inplant training.

Either party to the contract of inplant training make an application to Maharashtra Institute of Technology, Aurangabad for the termination of the contract.

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.

Provided that where a contract is terminated-

- For the failure on the part of the Employer, Maharashtra Institute of Technology will depute students to another Employer for providing facilities of inplant training to the remaining period of training.
- For the failure on the part of the student, the student will not be allowed to continue his/her inplant training in that term. The student shall be deputed for inplant training in the next coming term.

8. Expectation from the Employer / Industry / Establishment:

The following expectations are derived for effective inplant training.

- To provide legitimate facilities for the training and learning of all the processes.
- To guide the student for understanding a project of immense importance to industry and to help him/her for his/her career advancement.

9. Obligation of Students:

- Student must maintain a minimum attendance of 90% of total working days for the period of Inplant Training.
- To learn his/her subject field in Engineering or Technology consciously and diligently at his place of training.
- To carry out all orders of his/her Employer and the Superior in the establishment.
- To abide by the Rules and Regulations of the Industry/Establishment in all matters of conduct and discipline.
- To carry out the obligation under the contract of inplant training.
- The student shall maintain a report of his work during the period of his inplant training in a proforma (form no: 2) made available in Annexure.
- 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 inplant 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 inplant 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 inplant training.

10. Maintenance of Record:

Every student of B.Tech. course shall maintain a daily record of the work done by him/her relating to the inplant training in the proforma (Annexure).

11. Industry Sponsored Student Projects:

The scheme envisages working out suitable programme for B.Tech. students. They are required to complete their inplant 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 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-

- Cost reduction
- Enhancing productivity
- Development/Improvement/ Effective use of Soft wares/ Systems
- Energy conservation measures
- Process Improvement technique
- Application Development
- Plastic and Polymer working
- Hardware/ Software
- Agro engineering and so on.

12. **What will form a good project?**

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.

13. **Time Schedule for the Project:**

The following time schedule should be planned by each student or groups of students, who undertake the project.

- Proposal to be received before specified date.
- Project acceptance before.
- Commencement of the project.
- Completion of the project.

14. **Commitment on the part of the Institute:**

- Providing a faculty member to supervise the project.
- Providing the Institute facilities to complete the project.
- Coordinator from industry will be invited to participate in the stage wise assessment of the students performance.

15. **Assistance for completion of the Project:**

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.

16. **Monitoring of Inplant Training:**

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 Institute of Technology, Aurangabad will monitor the progress of inplant training in association with industry authority.

	17. Conduct and Discipline: 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.
	18. B.Tech. Students are Trainees and not Workers: • Every B.Tech. student undergoing an inplant training in the respective branch of Engineering & Technology in any Establishment shall be treated as a trainee and not a worker and- • The provision of any law with respect to labour will not apply to such a trainee.
	19. Settlement of Disputes: Any disagreement or dispute between an industry and a B.Tech. student trainee arising out of the contract of inplant 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.
	20. Holding of Test and Grant of Certificate: The progress in inplant training of every student shall be assessed by the industry and Maharashtra Institute of Technology faculty from time to time. Every B.Tech. student undergoing an inplant training shall be issued a certificate of Proficiency on completion of his/her training to the satisfaction of the industry.
	21. Offer of Stipend / Other Welfare Activities and Employment: 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 inplant training. However, if the industry desirous to do so 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.
(e)	**PRACTICAL EXAMINATION** The Practical examination will be conducted after successful completion of the inplant 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 1. Seminar Performance 2. An oral on the project work done. 3. Assessment of the term work / report.