

**CIRCULAR NO.SU/B.Sc./CBC&GS /67/2023**

It is hereby inform to all concerned that, the syllabi prepared by the Board of Studies, Ad-hoc Boards and recommended by the Dean, Faculty of Science & Technology, the Hon'ble Vice-Chancellor has accepted the **following syllabi of Bachelor of Science with Practical Pattern of Question Paper under the scheme of Choice Based Credit & Grading System** in his emergency powers under section 12(7) of the Maharashtra Public Universities Act, 2016 on behalf of the Academic Council as appended herewith.

Sr.No.	Courses	Semester
1.	B.Sc. Biotechnology (Degree)	IIIrd & IVth semester
2.	B.Sc. Automobile Technology (Degree)	IIIrd & IVth semester
3.	B.Sc. Workshop Technology (Degree)	IIIrd & IVth semester
4.	B.Sc. Refrigeration and Air Conditioning (Degree)	IIIrd & IVth semester
5.	B.Sc. Physics (Optional)	IIIrd & IVth semester
6.	B.Sc. Chemistry (Optional)	IIIrd & IVth semester
7.	B.Sc. Analytical Chemistry (Optional)	IIIrd & IVth semester
8.	B.Sc. Statistics (Optional)	IIIrd & IVth semester

This is effective from the Academic Year 2023-24 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/2023/670-77
Date:- 03.06.2023.

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*Deputy Registrar,
Academic Section*

Copy forwarded with compliments to :-

- 1] **The Principal of all 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, Dr.BAMU,A'bad.**
- 2] The Section Officer,[B.Sc.Unit] Examination Branch,Dr.BAMU,A'bad.
- 3] The Programmer [Computer Unit-1] Examinations, Dr.BAMU,A'bad.
- 4] The Programmer [Computer Unit-2] Examinations, Dr.BAMU,A'bad.
- 5] The In-charge,[E-Suvidha Kendra], Rajarshi Shahu Maharaj Pariksha Bhavan, Dr.BAMU,A'bad.
- 6] The Public Relation Officer, Dr.BAMU,A'bad.
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**Dr. Babasaheb Ambedkar Marathwada University
Aurangabad – 431004 (MS) India**



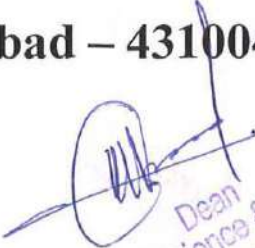
**Undergraduate Bachelor Degree Program
in
Science & Technology
Workshop Technology**

**Course Structure and Curriculum
(Outcome Based Curriculum)**

**Choice Based Credit System
(Effective from Academic Year 2023-24)**

**Dr. Babasaheb Ambedkar Marathwada University
Aurangabad – 431004 (MS) India**


Dr. Prashant Ambekar


Dean
Faculty of Science & Technology
Dr. Babasaheb Ambedkar Marathwada
University, Aurangabad

Dr. Babasaheb Ambedkar Marathwada University, Aurangabad

Choice Based Credit System (CBCS) Curriculum

For

Faculty of Science & Technology

Course Structure and Scheme of Examination

B.Sc. Workshop Technology Undergraduate Degree Program

Semester III

	Course Code	Course Title	Teaching Time / Week	Credits	Scheme of Examination			
					Max Marks	CIA	UA	Min Marks
(DSC-1C) Core Courses	WT-311	Production Management	2 hours	2	50	10	40	20
	WT-312	Manufacturing Process I	2 hours	2	50	10	40	20
	WT-321	Lab Course Based on WT-311	3 hours	1.5	50	10	40	20
	WT-322	Lab Course Based on WT-312	3 hours	1.5	50	10	40	20
(DSC-2C) Core Courses	WT-313	Applied Thermodynamics	2 hours	2	50	10	40	20
	WT-314	Strength of Material I	2 hours	2	50	10	40	20
	WT-323	Lab Course Based on WT-313	3 hours	1.5	50	10	40	20
	WT-324	Lab Course Based on WT-314	3 hours	1.5	50	10	40	20
(DSC-3C) Core Courses	WT-315	Machine Drawing I	2 hours	2	50	10	40	20
	WT-316	Mechanical Measurement I	2 hours	2	50	10	40	20
	WT-325	Lab Course Based on WT-315	3 hours	1.5	50	10	40	20
	WT-326	Lab Course Based on WT-316	3 hours	1.5	50	10	40	20
Skill Enhancement Course (SEC I)	WT-317	Any one Skill to be chosen out of two SEC (A) : Aptitude and Reasoning I SEC (B) : Mathematics I	2 Hours	2	50	10	40	20
Ability Enhancement Compulsory Courses (AECC-3)	WT-331	Communication Skills in English III	3 hours	3	50	10	40	20
	WT-332	Marathi/Hindi A student can opt any one of these subject (SL-3)	3 hours	3	50	10	40	20
Additional Credits		Computer Ability	2 Hours	2*	50	10	40	20
			38 Hours	29	750	150	600	
Total Credits for Semester III : 29(Theory : 20 ; Practical : 9)								


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Course Structure and Scheme of Examination
B.Sc. Workshop Technology Undergraduate Degree Program

Semester IV

	Course Code	Course Title	Teaching Time / Week	Credits	Scheme of Examination			
					Max Marks	CIA	UA	Min Marks
(DSC-1D) Core Courses	WT-411	Industrial Organisation	2 hours	2	50	10	40	20
	WT-412	Manufacturing Process II	2 hours	2	50	10	40	20
	WT-421	Lab Course Based on WT-411	3 hours	1.5	50	10	40	20
	WT-422	Lab Course Based on WT-412	3 hours	1.5	50	10	40	20
(DSC-2D) Core Courses	WT-413	Heat Transfer	2 hours	2	50	10	40	20
	WT-414	Strength of Material II	2 hours	2	50	10	40	20
	WT-423	Lab Course Based on WT-413	3 hours	1.5	50	10	40	20
	WT-424	Lab Course Based on WT-414	3 hours	1.5	50	10	40	20
(DSC-33) Core Courses	WT-415	Machine Drawing II	2 hours	2	50	10	40	20
	WT-416	Mechanical Measurement II	2 hours	2	50	10	40	20
	WT-425	Lab Course Based on WT-415	3 hours	1.5	50	10	40	20
	WT-426	Lab Course Based on WT-416	3 hours	1.5	50	10	40	20
Skill Enhancement Course (SEC II)	WT-417	Any one Skill to be chosen out of two SEC (A) : Aptitude and Reasoning II SEC (B) : Mathematics II	2 Hours	2	50	10	40	20
Ability Enhancement Compulsory Courses (AECC-4)	WT-431	Communication Skills in English IV	3 hours	3	50	10	40	20
	WT-432	Marathi/Hindi A student can opt any one of these subject (SL-4)	3 hours	3	50	10	40	20
Additional Credits		Computer Ability Environmental studies	2 Hours	2*	50	10	40	20
			38 Hours	29	750	150	600	
Total Credits for Semester IV : 29(Theory : 20 ; Practical : 9)								


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Dean
Faculty of Science & Technology
Dr. Babasaheb Ambedkar Marathwada University, Aurangabad

WT-311: Production Management

Total Credits : 2	Teaching Time / Week : (2 /Week)
Marks: 50 (10 CA + 40 UA)	

Learning Objective

1. The main objective of this course is to make students familiar with the system of production system and basic techniques.
2. Student study the different importance of plant location, different layouts and material handling equipments,

Unit I : Introduction

- Concept of production,
- Types of production,
- Input and Output Model
- Functions of production planning and control
- Productivity & it's types
- Simplification & Standardization & Its Effects

Unit II: Plant Location & Layout

- Concept
- Location Economics
- Rural Vs Urban Plant Sites
- Plant Layout & Its Types
- Flow Pattern
- Methods of Plant and factory Layouts

Unit III: Material Handling

- Introduction and Definition
- Function and principle of Material Handling
- Engineering and Economics factors of Material Handling
- Selection of Material Handling Equipments.
- Types of Material Handling Equipment And Working

Unit IV: Material Management

- Material Management Concept,
- Purchasing or procurement
- Purchase organization,

- Buying technique,
- Quality and Quality standards,
- Purchasing procedure & accounting,
- stores and material control receipts and issue of materials, store records.

Learning Outcomes

The student will know what he/she learns about the course

- Recognizes the concept of production management.
- Recognizes the effects of globalization to the production management.
- Assesses the primary problems of production management.

Reference Text Books

- Industrial Engineering and Industrial management by O.P. Khanna
- Industrial Organization and Management by S.K. Basu

WT-312: Manufacturing Process I

Total Credits : 2	Teaching Time / Week : (2 /Week)
Marks: 50 (10 CA + 40 UA)	

Learning Objectives

- To understand basic manufacturing processes like casting and metal working
- Acquire Knowledge about types of pattern, casting, and moulding.
- Acquire knowledge about various forming technologies.
- To have a broad knowledge to design a casting process for a product and design of welded joints

Unit I: Introduction

- Classification of Manufacturing process
- Various kinds of production
- Computers in manufacturing
- Selection of Manufacturing process
- General Material property & definitions

Unit II: The Casting Process

- General, Sand-Molding
- Patterns, Molding Materials
- Cores, Gates & risers
- Design of casting
- Miscellaneous casting process
- Cleaning & Finishing of Casting, Inspection and Testing Casting
- Repairing & Salvaging defective casting
- Comparison of casting process
- Cupola
- Foundry furnaces
- Pouring & handling equipments

Unit III: The Mechanical Working of Metals

- General,
- Rolling, Forging
- Extrusion, Pipe & Tube Manufacturing
- Hot Drawing & cupping
- Drawing of wire, rod & tube

- Sheet Metal working
- Hobbing, Riveting and stacking
- Shot Peening
- Characteristics of metal forming process

Learning Outcomes

Expected student outcomes: Upon successful completion of the course, the students will be able to:

- Distinguish between different types of casting and differentiate between their output product characteristics.
- Characterize the major machining operations of turning, milling, and drilling via description of cutting tools used and basic components of the machine tools.
- Learned various forming technologies

Reference Text Books

- Production Technology by Dr. P.C. Sharma
- Production Technology by Er. R. K. Jain

WT-321: Lab Course Based on WT-311 (Production Management)

Total Credits : 1.5	Teaching Time / Week : (3 /Week)
Marks: 50 (10 CA + 40 UA)	

Lab Study practical

- To study Functions of production planning and control
- To study different Plant Layouts
- To study production flow pattern in different industries
- To study types of Material Handling Equipment
- To study Purchasing of material as per industrial requirement
- To study the procedure of buying technique of required material in plants
- To study the Quality and Quality standards of material & equipment

WT-322: Lab Course Based on WT-312 (Manufacturing Process I)

Total Credits : 1.5	Teaching Time / Week : (3 /Week)
Marks: 50 (10 CA + 40 UA)	

Lab practical

- To produce a carting from sand mould.
- To study and prepare a pattern for given object for lost form casting / to prepare a Green sand mold from the prepared pattern / to melt and pour Aluminum metal into the mold.
- To study the Cupola Furnace in details
- To study Pouring & handling equipments
- To prepare a sheet metal product (Funnel) & Report the various parameters for the various passes during the rolling of the given metal piece.
- To carry out the hot rolling process
- To carry out the Extrusion process

WT-313: Applied Thermodynamics

Total Credits : 2	Teaching Time / Week : (2 /Week)
Marks: 50 (10 CA + 40 UA)	

Course Objectives:

course will enable students;

This course deals with the fundamentals of Thermodynamics including thermodynamic systems and properties, relationships among the thermos-physical properties, the laws of thermodynamics and applications of these basic laws in thermodynamic systems. This course will provide the essential tools required to study thermodynamic systems in Applied Thermodynamics.

Unit:-I Introduction-07

- Simple Steam Power Plant
- Internal Combustion (I.C.) Engines, Domestic Refrigerator, Room Air Conditioner
- Fuel Cells
- Macroscopic Versus Microscopic Viewpoint
- Thermodynamic System and Control Volume, Thermodynamic Properties, Processes and Cycles
- Homogeneous and Heterogeneous Systems
- Thermodynamic Equilibrium
- Quasi-Static Process
- Pure Substance
- Concept of Continuum
- Thermostatic
- Units and Dimensions

Unit:-II First Law of Thermodynamics 07

- First Law for a Closed System Undergoing a Cycle
- First Law for a Closed System Undergoing a Change of State
- Energy A Property of the System
- Different Forms of Stored Energy
- Specific Heat at Constant Volume
- Enthalpy
- Specific Heat at Constant Pressure
- Energy of An Isolated System
- Perpetual Motion Machine of the First Kind

Unit:-III Second Law of Thermodynamics-08

- Qualitative Difference between Heat and Work
- Cyclic Heat Engine
- Energy Reservoirs
- Kelvin-Planck Statement of Second Law, Clausius' Statement of the Second Law
- Refrigerator and Heat Pump
- Equivalence of Kelvin-Planck and Clausius Statements
- Reversibility and Irreversibility, Causes of Irreversibility, Conditions for Reversibility
- Carnot Cycle
- Reversed Heat Engine
- Carnot's Theorem
- Corollary of Carnot's Theorem
- Absolute Thermodynamic Temperature Scale
- Efficiency of the Reversible Heat Engine
- Equality of Ideal Gas Temperature and Kelvin Temperature
- Types of Irreversibility

Unit:-IV Entropy-04

- Introduction
- Two Reversible Adiabatic Paths Cannot Intersect Each Other
- Clausius' Theorem
- The Property of Entropy
- Entropy Change in an Irreversible Process
- Entropy Principle
- Applications of Entropy
- First and Second Laws Combined

Reference Text Books

- 1) Engineering Thermodynamics by P.K. NAG Tata McGRAW Hill
- 2) Thermodynamics an engineering approach by Yunus A. Cengel and Michael A. Boles
- 3) Applied Thermodynamics by R.K. Rajput

Course Outcome:

Students who successfully complete this course will have demonstrated an ability to:

1. Use thermodynamic terminology correctly.

2. Explain fundamental thermodynamic properties.
3. Derive and discuss the first and second laws of thermodynamics.
4. Solve problems using the properties and relationships of thermodynamic fluids.
5. Analyse basic thermodynamic cycles.
6. Students must have understanding of thermodynamic fundamentals before studying their application in applied thermodynamics.
7. The understanding of thermodynamic properties and processes will assist students in other related coursework

WT-314: Strength of Material I

Total Credits : 2	Teaching Time / Week : (2 /Week)
Marks: 50 (10 CA + 40 UA)	

Course Objectives: course will enable students;

1. To understand the basic concepts of the stresses and strains for different materials and strength of structural elements.
2. To know the development of internal forces and resistance mechanism for one dimensional and two dimensional structural elements.
3. To analyse and understand different internal forces and stresses induced due to representative loads on structural elements.
4. To analyse and understand principal stresses due to the combination of two dimensional stresses on an element and failure mechanisms in materials.
5. To evaluate the behavior of torsional members, columns and struts.

Unit:-I Simple Stresses and Strains-08

- Classification of loads, Stress, Simple stress, Strain, Tensile strain, Compressive strain, Shear strain, Volumetric strain
- Stress and Elongation Produced in a bar due to its self-weight
- Tie Bar of Uniform Strength, Stress in a Bar due to Rotation
- Elongation in Case of a Taper Rod, Elongation of a Conical Bar due to its Self-weight
- Poisson's Ratio, Relation between E and C, Relation between E and K
- Stresses Induced in Compound Ties or Struts
- Thermal Stress and Strain, Hoop Stress

Unit:-II Principal Stresses and Strains 09

- Stresses in a Tensile Member, Stresses due to Pure Shearing
- Two Mutually Perpendicular Direct Stresses
- Principal Planes and Principal Stresses
- Two-dimensional Stress System (General)
- Graphical Methods, Mohr's circle, Mohr's circle construction for like stresses, Mohr's circle construction for unlike stresses, Mohr's circle construction for two perpendicular direct stresses as the state of simple shear, Mohr's circle construction for principal stresses
- Ellipse of stress
- Combined Bending and Torsion

- Analysis of Strain, Direct strain on oblique plane due to a direct pull on a plane, Direct strain on a oblique plane due to shear stress, Direct strain on an oblique plane due to two normal pulls and a shear force
- Strain on an inclined section due to two perpendicular normal strains
- Ellipse of strains, Mohr's circle of strains
- Principal strains and strain energy due to principal stresses. Principal strains due to principal stresses, Strain energy due to principal stresses

Unit:-III Bending Moments and Shearing Forces 09

- Introduction, Some Basic Definitions, Classification of Beams, Shear Force (S.F.) and Bending Moment (B.M.)
 - Sign conventions
 - Cantilever with an End Load, Cantilever with Uniformly Distributed Load
 - Cantilever with Uniformly Distributed load and a Concentrated Load at the Free End
 - Cantilever Carrying Uniformly Distributed Load for a Part of its Length from the Free End
 - Cantilever Carrying Load Whose Intensity Varies Uniformly from Zero at the Free End to the Per unit Run at the Fixed End
 - Cantilever Carrying load Whose Intensity varies Uniformly from Zero at the Fixed Point End to w Per Unit Run at the Free End
-
- Simply Supported Beam Carrying Concentrated Load at the Mid Span, Simply Supported Beam Carrying Concentrated Load not at Mid Span, Simply Supported Beam Carrying a Uniformly Distributed Load of w Per unit Run over the Whole Span
 - General Relation between the Load, the Shearing Force and the Bending Moment
 - Simply Supported Beam Carrying a Load whose Intensity varies
-
- Uniformly from Zero at each End to w per Unit Run at the Mid Span
 - Simply Supported Beam carrying a Load whose Intensity varies Uniformly from Zero at one end to w per unit Run at the other End
 - Simply Supported Beam with Equal Overhangs and carrying a Uniformly Distributed Load of per w Unit Run over the Whole Length, The Points of Contraflexure
 - Loading and B.M. diagrams from S.F. Diagrams

Reference Text Books

- 1) Strength of Materials by R.K. Rajput -S. Chand Technical
- 2) Strength of Materials by S. Ramamrutham & R. Narayanan -Dhanpat rai Publishing Company

Course Outcome:

Students who successfully complete this course will have demonstrated an ability to:

1. Understand the concepts of stress and strain at a point as well as the stress-strain relationships for homogenous, isotropic materials.
2. Calculate the stresses and strains in axially-loaded members, circular torsion members, and members subject to flexural loadings.
3. Determine the stresses and strains in members subjected to combined loading and apply the theories of failure for static loading.
4. Determine and illustrate principal stresses, maximum shearing stress, and the stresses acting on a structural member.

WT-323: Lab Course Based on WT-313 (Applied Thermodynamics)

Total Credits : 1.5	Teaching Time / Week : (3 /Week)
Marks: 50 (10 CA + 40 UA)	

Lab practical

1. Practical based on **Working of Domestic Refrigerator**
2. To study the Thermodynamic Properties in details
3. To study conservation of energy relates to the first law of thermodynamics.
4. Joule experiment
5. To observe changes in enthalpy in chemical processes
6. To study the Second law of thermodynamics using practical example

WT-324: Lab Course Based on WT-314 (Strength of Material I)

Total Credits : 1.5	Teaching Time / Week : (3 /Week)
Marks: 50 (10 CA + 40 UA)	

Lab practical

1. Tension test
2. Deflection test on Cantilever beam
3. Deflection test on simply supported beam
4. Torsion test
5. Hardness test
6. Spring test

WT-315: Machine Drawing I

Total Credits : 2	Teaching Time / Week : (2 /Week)
Marks: 50 (10 CA + 40 UA)	

Learning Objective

1. The student will acquire knowledge of threads, fastening arrangements, different styles of attachment for shaft.
2. To understand and apply national and international standards while drawing machine component.

Unit I: Screw Threads

- Introduction, Definitions (various Parts of Screw threads),
- Forms of screw threads,
- Triangular or V Threads and Square Threads (With Types)
- Conventional representation of thread (All Methods)
- Multiple Starts threads
- Right and Left hand Threads

Unit II: Screw Fastenings

- Introduction,
- Types of Nuts: Hexagonal & Square Nut, Types of nuts of special purpose
- Bolts & Forms of Bolts (All Types)
- Set Screw, Washer
- Locking Arrangement of Nuts
- Foundation Bolts
- Conventional representation of Nuts and Bolts

Unit III: Key, Cotter and Pin Joints

- Introduction,
- Keys Joint, Taper keys and its types, Parallel or feather keys, Spline shaft, Woodruff Key, Cone Key
- Cotter and Cotter joints (All Types)
- Pin Joint or Knuckle joints

Unit IV: Shaft Couplings

- Introduction
- Fast and Rigid Coupling
- Box or muff Coupling, Half lap Coupling, Split muff Coupling
- Flanged, Protected flanged & Solid flanged Coupling

- Flexible Coupling
- Universal Coupling
- Oldham Coupling

Learning Outcomes

1. Students will get good interpretation of machine components
2. Students will understand standardization of drawings.
3. Student will understand the Indian and International standard components.
4. Student will able create drawings to industrial standard.
5. Learn what tolerance and fits and assembly

WT-316: Mechanical Measurement I

Total Credits : 2	Teaching Time / Week : (2 /Week)
Marks: 50 (10 CA + 40 UA)	

Learning Objectives

1. The main objective of this course is to make students familiar with the mechanical measuring systems, and the standard measurement methods.
2. It further aims to make them to understand the basic measurement systems in the real time engineering applications.

Unit I: Measurements and Measurement Systems

- Introduction, Significance of Measurements
- Methods of Measurement: Direct Methods, Indirect Methods, Primary, Secondary and Tertiary Measurements
- Primary Measurements, Secondary Measurements, Tertiary Measurements
- Mechanical, Electrical and Electronic Instruments
- Classification of Instruments : Absolute Instruments, Secondary Instruments
- Functions & Applications of Instruments and Measurement Systems
- Elements of a Generalized Measurement System

Unit II Static Characteristics of Instruments and Measurement Systems

- Static Characteristics, True Value, Static Error, Static Correction, Scale Range and Scale Span, Error Calibration Curve, Scale Readability, Repeatability and Reproducibility, Drift
- Signal to Noise Ratio (S/N), Noise, Accuracy and Precision, Range of Doubt, Discrepancy
- Static Sensitivity, Linearity, Hysteresis, Threshold, Dead Time , Dead Zone

Unit III Errors in Measurements

- Errors in Measurements, Limiting Errors (Guarantee Errors), Relative (Fractional) Limiting Error
- Combination of Quantities with Limiting Errors, Known Errors
- Types of Errors: Gross Errors, Systematic Errors, Instrumental Errors, Environmental Errors, Observational Errors, Random (Residual) Errors

Unit IV Pressure Measurements

- Introduction, Types of Pressure Measurement
- Manometers, Types of Manometers
- Bourdon Tube, Bellows, Diaphragms

- Electromechanical Pressure Transducers, Potentiometric Transducers, Strain Gauges, Inductive Transducers
- Linear Variable Differential Transducers LVDT, Capacitive Transducers, Piezoelectric Transducers
- Photoelectric Transducers, McLeod Gauge, Knudsen Gauge, Thermal Conductivity Gauges
- Thermocouple Gauge Pirani Gauge

Learning Outcomes

1. Selecting suitable mechanical measuring instruments for basic and special requirement in the industries.
2. Analyzing the characteristics of measuring instruments.
3. Designing the fits and tolerances to improve the existing performance.
4. Determine error and analyzing uncertainty in the measurements.
5. Work in quality control and quality assurances divisions in industries.

WT-325: Lab Course Based on WT-315 (Machine Drawing I)

Total Credits : 1.5	Teaching Time / Week : (3 /Week)
Marks: 50 (10 CA + 40 UA)	

Lab Practical

- Draw Triangular or V Threads
- Draw and Square Threads
- Draw and Hexagonal Nuts
- Draw and Square Nuts
- Draw Foundation Bolts
- Draw Cotter and Cotter joints (All Types)
- Draw Pin Joint or Knuckle joints
- Draw any three types of coupling

WT-326: Lab Course Based on WT-316 (Mechanical Measurement I)

Total Credits : 1.5	Teaching Time / Week : (3 /Week)
Marks: 50 (10 CA + 40 UA)	

Lab Practical

- To Study Elements of a Generalized Measurement System
- To Study Static & Dynamic Characteristics of instrument
- To study types of errors using measurement instrument
- Calibration of LVDT
- To study bourdon tube pressure gauge
- Calibration of Pressure Gauge
- To study Thermal Conductivity Gauges
- To study Manometers

Total Credits : 2	Teaching Time / Week : (2 /Week)
Marks: 50 (10 CA + 40 UA)	

Learning Objectives

1. This course is designed to suit the need of the outgoing students and to acquaint them with frequently asked patterns in quantitative aptitude and logical reasoning during various examinations and campus interviews.

Unit -I: Quantitative Ability (Basic Mathematics)

- Number Systems
- LCM and HCF
- Decimal Fractions
- Simplification
- Square Roots and Cube Roots
- Average

Unit -II: Arithmetic Ability I

- Problems on Ages
- Surds & Indices
- Percentages
- Problems on Numbers
- Permutation and Combinations
- Probability

Unit -III: Logical Reasoning

- Analogy
- Blood Relation
- Directional Sense
- Number and Letter Series
- Coding – Decoding
- Calendars
- Clocks
- Venn Diagrams
- Seating Arrangement

Learning Outcomes

1. Understand the basic concepts of quantitative ability
2. Understand the basic concepts of logical reasoning Skills
3. Acquire satisfactory competency in use of reasoning
4. Solve campus placements aptitude papers covering Quantitative Ability, Logical Reasoning Ability
5. Compete in various competitive exams

Skill Enhancement Course (SEC I) SEC B

WT-317: Mathematics I

Total Credits : 2	Teaching Time / Week : (2 /Week)
Marks: 50 (10 CA + 40 UA)	

Unit – I Algebra I

- Logarithm: Concept and laws of logarithm
Determinant and matrices
- Value of determinant of order 3×3
- Solutions of simultaneous equations in three unknowns by Cramer's rule.

Unit– II Trigonometry

- Trigonometric ratios of Compound, allied, multiple and sub-multiple angles (without proofs)
- Factorization and de-factorization formulae (without proofs)
- Inverse trigonometric ratios and related problem.
- Principle values and relation between trigonometric and inverse trigonometric ratio.

Unit– III Coordinate Geometry

- Straight line and slope of straight line a. Angle between two lines. b. Condition of parallel and perpendicular lines
- Various forms of straight lines.

a. Slope point form, two point form. b. Two points intercept form. c. General form. d. Perpendicular distance from a point on the line. e. Perpendicular distance between two parallel lines.

Dr. Babasaheb Ambedkar Marathwada University, Aurangabad

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	WT-425	Lab Course Based on WT-415	3 hours	1.5	50	10	40	20
	WT-426	Lab Course Based on WT-416	3 hours	1.5	50	10	40	20
Skill Enhancement Course (SEC II)	WT-417	Any one Skill to be chosen out of two SEC (A) : Aptitude and Reasoning II SEC (B) : Mathematics II	2 Hours	2	50	10	40	20
Ability Enhancement	WT-431	Communication Skills in English IV	3 hours	3	50	10	40	20
Compulsory Courses (AECC-4)	WT-432	Marathi/Hindi A student can opt any one of these subject (SL-4)	3 hours	3	50	10	40	20
Additional Credits		Computer Ability	2 Hours	2*	50	10	40	20
			38 Hours	29	750	150	600	
Total Credits for Semester IV : 29(Theory : 20 ; Practical : 9)								

WT-411: Industrial Organisation

Total Credits : 2	Teaching Time / Week : (2 /Week)
Marks: 50 (10 CA + 40 UA)	

Learning Objectives

Industrial organization provides a foundation for the study of many other fields that rely on an understanding of interactions among firms in the economy, including business strategy, corporate finance, marketing, international trade, banking, and the economics of organizations.

Unit I: Ownership

- Introduction
- Types of Ownership : Individual, Partnership, joint stock companies, co-operative, public sectors and government undertakings
- Differences between the ownerships
- Advantages & Disadvantages of ownerships
- Scale of Industry – small, medium and large,
- Registration and other formalities, Excise and relevant taxation. Procurement of power Water and other facilities.

Unit II: Finance

- Sources,
- Raising Of Finances, Banks, Financial Institutions Leasing Institution, Shares Debentures, Loans, Credits, Convertible Bonds.
- Cost Account And Control, Prime Cost, Elements Of Cost,
- Break Even Chart,
- Budget And Budgetary Control,
- Profit And Loss Account,
- Balance Sheet.

Unit III: Finance

- Procuring Or Buying,
- Inspections,
- Storing Production Material Handling,
- Packing And Forwarding,
- Marketing
- Supervision

- There Advantages And Disadvantages

Learning Outcomes

- Explain how firms acquire market power and how they use this market power once acquired;
- Analyze how competing firms interact strategically;
- To master the concepts developed in the course material in such a way that independent research can be carried out.
- Describe the current state of knowledge in the field of industrial organization.

Reference Text Books

- Industrial Engineering and Industrial management by O.P. Khanna
- Industrial Organization and Management by S.K. Basu

WT-412: Manufacturing Process II

Total Credits : 2	Teaching Time / Week : (2 /Week)
Marks: 50 (10 CA + 40 UA)	

Learning Objectives

- To understand basic machining processes
- Acquire Knowledge about types of tools, chip formation, effects of processes
- Acquire knowledge about various cutting tools materials & cutting fluids

Unit I: The Welding Process

- General
 - Types of Welding
 - Gas Welding, Electric Arc Welding, Resistance Welding
 - Miscellaneous welding process
 - Liquid Solid State welding
 - Weldability
 - Testing & Inspection of welding joints
 - Welding Cost
 - Design Aspects
 - Hard facing of metal
-
- Characteristics of welding process

Unit II: The Machining Process

- General
- The mechanics of chip formation
- Single point cutting tool
- Method of machining
- Types of chips
- Principle element of metal machining
- Thermal aspect of chip formation
- Tool Wear & Tool Life
- Machineability

Unit III: Cutting Tool Material & Cutting Fluid

- General
- Cutting Tool Material: Plane Carbon, Alloy, High Speed, Non Ferros,

- Cemented carbides , Laminated and Coated carbide
- CBN tool
- Cutting Fluids:
- Necessity of Lubrication
- Types of cutting fluids
- Application of cutting fluids

Learning Outcomes

Expected student outcomes: Upon successful completion of the course, the students will be able to:

- Distinguish between different types of welding process & its characteristics.
- Characterize the major machining process
- Learned various cutting tools & fluids used in the industry

Reference Text Books

- Production Technology by Dr. P.C. Sharma
- Production Technology by Er. R. K. Jain

WT-421: Lab Course Based on WT-411 (Industrial Organisation)

Total Credits : 1.5	Teaching Time / Week : (3 /Week)
Marks: 50 (10 CA + 40 UA)	

Lab Study practical

- To study the different types of ownerships
- To study Break Even Chart with practical example
- To study balance sheet of any on industry
- To study the inspection process of two /three / four wheeler industry
- To study the supervision process and shift control process of industry

WT-422: Lab Course Based on WT-412 (Manufacturing Process II)

Total Credits : 1.5	Teaching Time / Week : (3 /Week)
Marks: 50 (10 CA + 40 UA)	

Lab practical

1. To study and observe the Arc welding demonstration and practice
2. To study and observe the Gas welding demonstration and practice
3. To study and observe the Brazing process demonstration and practice
4. Study of various conventional machining processes
5. Study of Tool Geometry
6. Study of chips and determination of chip reduction co-efficient in turning mild steel by HSS tool with different depth of cut.
7. To perform shaping operation of given mild steel rod.

WT-413: Heat Transfer

Total Credits : 2	Teaching Time / Week : (2 /Week)
Marks: 50 (10 CA + 40 UA)	

Course Objectives: course will enable students;

- 1) To understand the mechanisms of heat transfer under steady and transient conditions.
- 2) To understand the concepts of heat transfer through extended surfaces.
- 3) To learn the thermal analysis and sizing of heat exchangers and to understand the basic concepts of mass transfer.

Unit:-I BASIC CONCEPTS -07

- Transfer-General Aspects, Heat, Importance of heat transfer,
 - Thermodynamics, Definition, Thermodynamic systems
 - Macroscopic and microscopic points
 - Pure substance
 - Thermodynamic equilibrium
 - Properties of systems, State, Process, Cycle, Point function, Path function, Temperature, Pressure, Energy. Work, Heat, Comparison of work and heat
 - Differences between thermodynamics and heat transfer, Basic laws governing heat transfer, Modes of heat transfer
-
- Heat Transfer by Conduction, Fourier's law of heat conduction
 - Thermal conductivity of materials
 - Thermal resistance (R)
 - Heat Transfer by Convection, Heat Transfer by Radiation

Unit:-II BOILING AND CONDENSATION -07

- Introduction, Boiling Heat Transfer
- General aspects, Boiling regimes, Bubble shape and size consideration, Bubble growth and collapse
- Critical diameter of bubble
- Factors affecting nucleate boiling
- Boiling correlations
- Nucleate pool boiling
- Critical heat flux for nucleate pool
- Boiling, Film pool boiling
- Condensation Heat Transfer, General aspects

- Laminar film condensation on a vertical plate
- Turbulent film condensation, Film condensation on horizontal tubes, Film condensation inside horizontal tubes
- Influence of the presence of non-condensable gases

Unit:-III HEAT EXCHANGERS -07

- Introduction, Types of Heat Exchangers
- Heat Exchanger Analysis
- Logarithmic Mean Temperature Difference (LMTD), LMTD for parallel-flow, LMTD for counter-flow
- Overall Heat Transfer Coefficient
- Correction Factors for Multi-pass Arrangements
- Heat Exchanger Effectiveness and Number of Transfer Units (NTU)
- Pressure Drop and Pumping Power
- Evaporators, Introduction, Classification of evaporators,

Unit:-IV MASS TRANSFER-05

- Introduction, Modes of Mass Transfer
- Concentrations, Velocities and Fluxes, Concentrations
- Velocities, Fluxes, Fick's Law
- Mass Transfer Co-efficient, Convective Mass Transfer

Reference Text Books

- 1) Heat and Mass Transfer SI UNIT by R.K. Rajput S. Chand Technical
- 2) Heat and Mass Transfer SI UNIT by P.K. NAG

Course Outcome: Upon completion of the course, the student will be able to

- 1) Understand the basic modes of heat and mass transfer.
- 2) Apply principles of heat and mass transfer to predict transfer coefficients
- 3) Analyze working of various heat transfer equipment
- 4) Design heat and mass transfer equipment.

WT-414: Strength of Material II

Total Credits : 2	Teaching Time / Week : (2 /Week)
Marks: 50 (10 CA + 40 UA)	

Course Objectives:

course will enable students;

1. To understand the basic concepts of the stresses and strains for different materials and strength of structural elements.
2. To know the development of internal forces and resistance mechanism for one dimensional and two dimensional structural elements.
3. To analyze and understand different internal forces and stresses induced due to representative loads on structural elements.
4. To analyze and understand principal stresses due to the combination of two dimensional stresses on an element and failure mechanisms in materials.
5. To evaluate the behavior of torsional members, columns and struts.

Unit:-I Bending Stresses in Beams-07

- Theory of Simple Bending
- Position of Neutral Axis
- Section Modulus
- Practical Application of Bending Equation
- Beam of Heterogeneous Materials (Flitched beam)
- Beams of Uniform Strength
- Bimetallic Strip
- Reinforced Cement Concrete (R.C.C.)

Unit:-II Combined Direct and Bending Stresses-07

- Introduction
- Load acting Eccentrically to One Axis
- Condition for No Tension in the Section
- Wind Pressure on Chimneys
- Earth Pressure on retaining Walls
- Angle of repose
- Earth pressure

Unit:-III Shearing Stresses-04

- Introduction
- Shearing Stress Variation
- Variation of Shear Stress in Beam Cross-section
- Shear Stress Distribution for Typical Sections

Unit:-IV Centroid and Moment of Inertia -08

- Centre of Gravity of a Body

- Determination of Centre of Gravity
- Centroid
- Positions of Centroids of Plane Geometrical Figures
- Positions of Centre of Gravity of Regular Solids
- Centroids of Composite Areas
- Centre of Gravity of Simple Solids Areas and Volumes - Centroid Method
- Centre of Gravity in a Few Simple Cases Moment of Inertia (M.O.I)- Introduction
- Moment of Inertia (Second Moment of an Area)
- Theorem of Parallel Axes (or Transfer Formula)
- Theorem of Perpendicular Axes
- Radius of Gyration (Radius of Inertia)
- Product of Inertia
- Moment of Inertia of Laminae of Different Shapes
- Parallel Axes Theorem for Product of Inertia
- Principal Axes and Principal Moments of Inertia
- Determination of principal moments of inertia and directions of principal axes
- Mohr's circle for principal moments of inertia

Reference Text Books

- 4) Strength of Materials by R.K. Rajput S. Chand Technical
- 5) Strength of Materials by S. Ramamrutham & R. Narayanan Dhanpat rai Publishing Company

Course Outcome:

Students who successfully complete this course will have demonstrated an ability to:

1. Understand the concepts of stress and strain at a point as well as the stress-strain relationships for homogenous, isotropic materials.
2. Calculate the stresses and strains in axially-loaded members, circular torsion members, and members subject to flexural loadings.
3. Determine the stresses and strains in members subjected to combined loading and apply the theories of failure for static loading.
4. Determine and illustrate principal stresses, maximum shearing stress, and the stresses acting on a structural member.

WT-423: Lab Course Based on WT-413 (Heat Transfer)

Total Credits : 1.5	Teaching Time / Week : (3 /Week)
Marks: 50 (10 CA + 40 UA)	

Lab Practical (Any 8)

1. Determination of Thermal Conductivity of Metal Rod.
2. Determination of Thermal Conductivity of Liquid
3. Determination of Thermal Conductivity of Insulating Material
4. Determination of Overall Heat Transfer Coefficient of a Composite wall.
5. Determination of Effectiveness on a Metallic fin.
6. Determination of Heat Transfer Coefficient in a free Convection on a vertical tube.
7. Determination of Heat Transfer Coefficient in a Forced Convection Flow through a Pipe.
8. Determination of Critical Heat Flux.
9. Determination of Emissivity of a Surface.
10. Determination of Stefan Boltzman Constant.
11. Determination of LMDT and Effectiveness in a Parallel Flow and Counter Flow Heat Exchangers.

WT-424: Lab Course Based on WT-414 (Strength of Material II)

Total Credits : 1.5	Teaching Time / Week : (3 /Week)
Marks: 50 (10 CA + 40 UA)	

1. Compression test on wood or concrete,
2. Impact test
3. Shear test
4. Verification of Maxwell's reciprocal theorem on beams
5. Use of electrical resistance strain gauge
6. Deflection test on Continuous beam

WT-415: Machine Drawing II

Total Credits : 2	Teaching Time / Week : (2 /Week)
Marks: 50 (10 CA + 40 UA)	

Learning Objective

1. The student will acquire knowledge of fastening arrangements such as welding, riveting.
2. The student also is enabled to prepare the assembly of various machine or engine components and miscellaneous machine components.

Unit I: Pulley

- Introduction, Types of Pulleys : C.I. Belt Pulley, Fast and loose Pulley,
- Stepped Pulley
- Split Pulley, Rope Pulley,
- V-Belt Pulley & Details of V-Groove

Unit II: Spur Gearing

- Introduction, Definitions (various Parts of Spur Gear),
- Pitch Definitions, Relationship between pitches
- Tooth Proportions
- Involute Spur Gears
- Construction of base circle and Approximate Construction of Teeth Profile
- Rack and Pinion

Unit III: Riveted and Welded Joints

- Introduction of Riveting,
- Caulking and fullering
- Forms and Proportions of Rivet heads
- Failure of Riveted Joints
- Types of Riveted Joints : Lap & butt Joint
- Introduction of Welding,
- Types of Welded & Welds Joints
- Representation of Welded Joints

Unit IV: Assembly Drawing

- Introduction & Types of Assembly Drawing
- Accepted norms to be observed for Assembly Drawing

- Sequence of preparing the assembly drawing
- Problems : Tool Post Assembly, Crane hook Assembly, Stuffing box Assembly, Eccentric Drawing

Learning Outcomes

1. Students will get good interpretation of machine components
2. Students will understand standardization of drawings.
3. Student will able create drawings to industrial standard.
4. Learn what tolerance and fits and assembly

WT-416: Mechanical Measurement II

Total Credits : 2	Teaching Time / Week : (2 /Week)
Marks: 50 (10 CA + 40 UA)	

Learning Objectives

1. The main objective of this course is to make students familiar with the mechanical measuring systems, and the standard measurement methods.
2. It further aims to make them to understand the basic measurement systems in the real time engineering applications.

Unit I: Metrology

- Introduction, Dimensional Measurements
- Length Standards, Line and End Standards, Line Standard Instruments : Vernier Caliper, Micrometer
- Gauge Blocks, Use of Gauge Blocks
- Dial Gauges, Comparators, Types of Comparators
- Measurement of Angle, Angle Comparators

Unit II: Strain Gauges and Measurement Of Strain

- Introduction, Ballast Circuit, Wheatstone Bridges, Gauge Sensitivity
- Strain Gauges Connected in Series
- Stress Strain Relationships
- Rosettes

Unit III: Force and Torque Measurements

- Force, Basic Methods of Measurement of Force
- Multiple Lever Systems, Pendulum Scale, Accelerometers
- Hydraulic and Pneumatic Load Cells
- Measurement of Torque, Measurement of Torque of Rotating Shafts, Torque Measuring methods using Strain Sensors

Unit IV Temperature Measurements

- Introduction, Classification of Temperature Measuring Devices
- Liquid in Glass Thermometers, Pressure Gauge Thermometers
- Bimetallic Thermometers
- Electrical Resistance Thermometers
- Semi-conductor Thermometers, Thermister

- Thermocouples

Learning Outcomes

1. Selecting suitable mechanical measuring instruments for basic and special requirement in the industries.
2. Analyzing the characteristics of measuring instruments.
3. Designing the fits and tolerances to improve the existing performance.
4. Determine error and analyzing uncertainty in the measurements.
5. Work in quality control and quality assurances divisions in industries.

WT-425: Lab Course Based on WT-415 (Machine Drawing II)

Total Credits : 1.5	Teaching Time / Week : (3 /Week)
Marks: 50 (10 CA + 40 UA)	

Lab Practical

- Draw Fast and loose Pulley, Stepped Pulley
- Draw Construction of base circle and Approximate Construction of Teeth Profile
- Draw Forms and Proportions of Rivet heads
- Draw Welded & Welds Joints
- Draw any Tool Post assembly
- Draw Crane hook Assembly

WT-426: Lab Course Based on WT-416 (Mechanical Measurement II)

Total Credits : 1.5	Teaching Time / Week : (3 /Week)
Marks: 50 (10 CA + 40 UA)	

Lab Practical

- To determine the length, height and diameter of the given work piece using vernier caliper, vernier height gauge
- To determine the length, height and diameter of the given work piece using micrometer.
- To study Wheatstone Bridges using strain gauge
- Calibration of Thermocouple
- Calibration of Load Cell
- To study Hydraulic and Pneumatic Load Cells
- To Study Electrical Resistance Thermometers
- Determination of modulus of elasticity of a mild steel specimen using strain gauges.

Skill Enhancement Course (SEC II) SEC A

WT-417: Aptitude and Reasoning II

Total Credits : 2	Teaching Time / Week : (2 /Week)
Marks: 50 (10 CA + 40 UA)	

Learning Objectives

1. This course is designed to suit the need of the outgoing students and to acquaint them with frequently asked patterns in quantitative aptitude and logical reasoning during various examinations and campus interviews.

Unit -I: Arithmetic Ability II

- Logarithm
- Profit and Loss
- Simple and Compound Interest
- Time, Speed and Distance
- Time & Work
- Ratio and Proportion
- Area
- Mixtures and Allegation

Unit II : Arithmetic Ability III

- Pipes and Cistern
- Boats and Stream
- Volume and Surface Areas
- True Discounts
- Bankers Discounts
- Heights and Distance
- Old Man Out and Serise

Unit -III: Data Interpretation

- Tabulation
- Bar graphs
- Pie Charts
- Line Graphs

Learning Outcomes

1. Understand the basic concepts of quantitative ability

2. Understand the basic concepts of logical reasoning Skills
3. Acquire satisfactory competency in use of reasoning
4. Solve campus placements aptitude papers covering Quantitative Ability, Logical Reasoning Ability
5. Compete in various competitive exams


Dr. Prashant Ambad

Skill Enhancement Course (SEC II) SEC B

WT-417: Mathematics II

Total Credits : 2	Teaching Time / Week : (2 /Week)
Marks: 50 (10 CA + 40 UA)	

Unit – I Algebra II

- Matrices, algebra of matrices,
- Transpose adjoint and inverse of matrices.
- Solution of simultaneous equations by matrix inversion method.
- Types of partial fraction based on nature of factors and related problems.

Unit-II Mensuration

- Area of regular closed figures, Area of triangle, square, Area of triangle, square, and circle.
- Volume of cuboids, cone, cylinders and sphere.

Unit –III Statistics

- Range, coefficient of range of discrete and grouped data.
- Mean deviation and standard deviation from mean of grouped and ungrouped data, weighted means
- Variance and coefficient of variance.
- Comparison of two sets of observation.