## RTM Nagpur University-Mechanical Engineering
## B.Tech 4th Semester
## Machining Processes (BTME401T)
## Syllabus (Theory)

| Semester | Course Title (Subject) | Hours / Week | | | Credits | Maximum Marks | | | Exam Duration (Hrs.) |
|---|---|---|---|---|---|---|---|---|---|
| | | L | T | P | | Continual Assessment | University Examination | Total | |
| IV | Machining Processes | 03 | - | - | 03 | 30 | 70 | 100 | 03 |

| Sr. No. | Course Objective The objective of this course is— |
|---|---|
| 1 | Understand basic mechanism of metal removal processes. |
| 2 | Working mechanisms of various machine tools and machining principles. |
| 3 | To know surface finishing and allied processes. |
| 4 | Understand the importance of machining processes and be able to apply the suitable machining processes for an engineering product. |

| Course Outcomes | |
|---|---|
| After successful completion of this course the student will be able to: | |
| CO1 | Understand fundamentals of metal cutting |
| CO2 | Understand basic construction and operations of lathe shaping, planning |
| CO3 | Understand basics of milling and milling cutters. slotting |
| CO4 | To know about the surface finishing processes. |
| CO5 | Understand the basic of drilling, boring, reaming and broaching. |

## Machining Processes (Theory) SYLLABUS

| Contents | No of hours |
|---|---|
| **Unit I** <br><br> **Introduction to Machining Parameters**: Introduction to machining, Tool materials, nomenclature and tool geometry of single point cutting tool, tool materials properties, classification, HSS, carbide tool, coated tools, diamond coated tool. <br> Theory of Metal Cutting: Introduction. Orthogonal and Oblique cutting. Mechanics of Metal Cutting. Merchant's circle, Chip formation, cutting force calculations, cutting fluids, cutting speed, feed and depth of cut on power requirement, Estimation of tool life. | 09 |
| **Unit II** <br> Lathe: Introduction, types, construction of simple lathe, mechanism and attachments for various operations, machine specifications, basis for selection of cutting speed, feed and depth of cut, time estimation for turning operations such as facing, step turning, taper turning, threading, knurling. <br> Introduction to Capstan, Turret Lathe and fundamentals of NC. <br> **Shaper:** Introduction, types, specification, description of machines, cutting parameters. Mechanism of shaper: Quick return mechanism, Crank & slotted link mechanism, Table feed mechanism, attachments for shaper, work holding devices, shaper operations. <br> **Planer:** Introduction, specifications, description, types of planner, open side planner, pit planner Mechanism for planner: Driving mechanism, feeding mechanism, planner cutting tools, cutting parameters. | 10 |
| **Unit III** <br> **Milling:** Introduction. Specification, types, column & knee type milling machine, fixed bed type milling machines, production milling machines, special purpose milling machines such as thread milling Machines, profile milling machine, Gear Milling. Hobbing machines. Mechanisms & Attachments for Milling, Cutting parameters, Types of milling operations, Types of milling cutters, Tool geometry & their specifications. Indexing - simple, compound and differential. <br> **Slotter:** Introduction, specifications, description, type of drives for slotter, types of slotting machines -production slotter, puncher slotter, tool room slotter, slotter tools. | 09 |
| **Unit IV** <br> **Grinding**: Operations, grinding wheel, specifications & selection, cylindrical & centreless grinding operation, surface grinding, tool & cutter grinding, time estimation for grinding operations. <br> **Super finishing process:** Honing, Lapping, super finishing, polishing, buffing, 'metal spraying, galvanizing and electroplating. Process parameters and attainable grades of surface finish, surface measurement. | 09 |

| Unit V | |
|---|---|
| **Drilling:** introduction, tools for drilling, classification of drills, twist drills, drill size and specifications, tipped drills, type of drilling machines-portable drilling machine. bench drilling machine, right drilling machine, radial drilling machine, universal drilling machine, multisided drilling machine. Drilling machines operations, time estimation for drilling. <br> **Reaming:** Introduction, description of reamer, type of reaming operations. <br> **Boring:** Introduction, types of boring machine, horizontal boring machine, vertical boring machine, jig machine, micro boring. boring operations. <br> **Broaching:** Introduction, type of broaches, nomenclature of broaches. types of broaching machines. | 09 |

| Sr. No. | List of Tutorials |
|---|---|
| 01 | Based on above syllabus |

**References:**

**Text Books Recommended:**

1. Workshop technology (Vol. II), V. S. Raghuwanshi, Dhanpat Rai & Sons
2. Manufacturing Science, Ghosh & Mallik, East West Press
3. Manufacturing technology (Metal cutting & Machine tools) Vol. II, P. N. Rao, Tata Mc-Graw Hill
4. Workshop technology, H. S. Bawa, Tata Mc-Graw Hill
5. Introduction to Manufacturing Processes, J. A. Schey, Tata Mc-Graw Hill
6. Workshop Technology (Volume II), Hajra Chaudhary, Media Promoters & Publishers

**Reference Books Recommended:**

1. Manufacturing Engineering & Technology, S. Kalpakjian & S.R. Schmid
2. Technology of Machine Tools, Krar & Oswald
3. Manufacturing Processes, M. Begman
4. Processes & Materials of Manufacture, R. Lindberg
5. Production Technology, HMT

**RTM Nagpur University-Mechanical Engineering**
**B.Tech 4th Semester**
**Machining Processes Lab (BTME401P)**
**Syllabus (Practical)**

| Semester | Course Title(Subject) | Hours / Week | | | Credits | Maximum Marks | | |
|---|---|---|---|---|---|---|---|---|
| | | L | T | P | | Continual Assessment | University Examination | Total |
| IV | Machining Processes Lab | - | - | 02 | 01 | 25 | 25 | 50 |

| Course Outcomes | |
|---|---|
| After successful completion of this course the student will be able to: | |
| CO1 | Understand basic cutting tools. |
| CO2 | Working of lathe and turning operation |
| CO3 | Shaping and planning operation |
| CO4 | Milling and drilling operation |
| CO5 | Grinding and surface finishing |

### List of Practical's

Minimum Eight out of following shall be performed:

| Sr. No. | List of Practical's |
|---|---|
| 01 | Study of Single Point Cutting Tool. |
| 02 | Study of Various forces on single point cutting tools. |
| 03 | Study of multiple point cutting tools (milling, drilling) |
| 04 | Study of Lathe Machine. |
| 05 | Study of Shaper mechanisms. |
| 06 | Study of milling machine |
| 07 | One Job on Milling. |
| 08 | One Job on Drilling, Boring |
| 09 | One Job on Thread Cutting, Taper Turning. |
| 10 | One Job on Surface Grinding. |

| Semester | Course Title (Subject) | Hours / Week | | | Credits | Maximum Marks | | | Exam Duration (Hrs.) |
|---|---|---|---|---|---|---|---|---|---|
| | | L | T | P | | Continual Assessment | University Examinatio | Total | |
| IV | Hydraulic Machines | 3 | - | - | 3 | 30 | 70 | 100 | 3 |

| Sr. No. | Course Objective <br> The objective of this course is– |
|---|---|
| 1 | This course includes hydraulic turbines, centrifugal pumps, positive displacement pumps and miscellaneous water lifting devices |
| 2 | At the end of this course, students will understand practical applications of fluid; based on momentum and angular momentum principles involved in hydraulic machines. |
| 3 | Also understand design parameters and performance characteristics of various hydraulic machines & devices. |
| 4 | To learn more about power generation by using water |

| Course Outcomes | |
|---|---|
| After successful completion of this course the student will be able to: | |
| CO1 | Classify turbomachine, components of HEPP, Design of Pelton wheel |
| CO2 | Design of Francis and kaplan Turbine,Governing OF turbine |
| CO3 | Design of centrifugal Pumps |
| CO4 | Design of reciprocating Pumps |
| CO5 | Learn miscellaneous Water Lifting Device |

**Suggested References:**

1. Manufacturing Engineering & Technology, S. Kalpakjian & S.R. Schmid
2. Technology of Machine Tools, Krar & Oswald
3. Manufacturing Processes, M. Begman
4. Processes & Materials of Manufacture, R. Lindberg Production Technology, HMT

## SYLLABUS

| Contents | No of hours |
|---|---|
| **Unit I** Theory of turbo machines and their classification, Elements of hydro-electric power plant, Impulse Turbine:- principle, constructional features, Installation of Pelton Turbine, Velocity Diagram and Analysis, Working proportions, Design parameters, Governing. | 7 |
| **Unit II**<br><br>Reaction or pressure Turbine:- principles of operation, Degree of reaction, comparison over Pelton Turbine, Classification Of Draft tube, Cavitation in Turbine, Francis Turbine, Propeller Turbine, Kaplan Turbine:- Types, Constructional features, Installations, Velocity Diagram and analysis, Working proportions, Design parameters, Governing. | 7 |
| **Unit III**<br><br>Centrifugal pumps:- Principle of operation, Classification, Component of Centrifugal Pump installation, Priming , Fundamental equation, Various heads, Velocity triangles and their analysis, or, Effect of outlet blade angle, Vane shapes, Losses and Efficiencies of pumps, Multi staging of pumps, Design Consideration, Working proportions, N.P.S.H., Cavitations in pumps | 7 |
| **Unit IV**<br><br>Positive Displacement Pumps:- Basic principle, Classification, Reciprocating pump working,Design Main Components, Slip, % slip, negative slip, Work Done, Indicator Diagram, effect of acceration head and friction head on indicator diagram ,Cavitations, Air vessels,Seperation. | 7 |
| **Unit V**<br><br>Miscellaneous Water Lifting Device: - Air lift pumps, Hydraulic Ram, Submersible pump, Regenerative pumps, Gear pump, screw pump, Vane pump | 7 |

**References:**

**Text Books Recommended:**

1. Fluid Mechanics & Fluid Power Engineering – R.K.Rajput, S.Chand Publications

2. Fluid Mechanics & Machines – R. K. Bansal, Laxmi Publications

**Reference Books Recommended:**

1. Fluid Mechanics with Engineering Applications, E. Finnemore & Franzini, Tata Mc-Graw Hill

2. Hydraulic Machines-Theory and Design, V. P. Vasandani, Khanna Publishers

3. Fluid Mechanics, A. K. Jain, Khanna Publishers 4. Hydraulic & Compressible Flow Turbo-machines, A. T. Sayers, Mc-Graw Hill . Mechanics of Fluids, Merle C. Potter, CL-Engineering

6. Fluid Mechanics, John F. Douglas, Pearson

## RTM Nagpur University-Mechanical Engineering
## B.Tech 4th Semester
## FLUID MECHANICS & HYDRAULIC MACHINES Lab (BTME402P)
## Syllabus (Practical)

| Semester | Course Title(Subject) | Hours / Week | | | Credits | Maximum Marks | | |
|---|---|---|---|---|---|---|---|---|
| | | L | T | P | | Continual Assessment | University Examination | Total |
| IV | FLUID MECHANICS & HYDRAULIC MACHINES LAB | - | - | 02 | 01 | 25 | 25 | 50 |

| Course Outcomes | |
|---|---|
| After successful completion of this Practical course the student will be able to | |
| CO1 | Explain what is Stability condition of floating bodies, Law of conservation of Energy. |
| CO2 | Apply Frictional losses and Hydraulic co-efficient in the pipe flow. |
| CO3 | Estimate the Performance characteristics of Pelton Turbine |
| CO4 | Estimate the Performance characteristics of Francis Turbine & Kaplan Turbine. |
| CO5 | Estimate the Performance characteristics of Centrifugal Pump & Reciprocating Pump. |

| Sr. No. | List of Practical's |
|---|---|
| 01 | To determine the metacentric height of given floating vessel. |
| 02 | To verify Bernoulli's theorem. |
| 03 | To find friction losses in pipe. |
| 04 | To find the value of co-efficient of given venture meter fitted in a pipe. |
| 05 | To find the value of co-efficient of Discharge for a given orifice meter. |
| 06 | Performance characteristics of Pelton wheel. |
| 07 | Performance characteristic of Francis Turbine. |
| 08 | Performance characteristic of Kaplan Turbine. |
| 09 | Performance characteristic of Variable Centrifugal speed pump |
| 10 | Performance characteristic of Reciprocating pump. |
| 11 | To find Reynold's Number |

**Suggested References:**

1. Fluid Mechanics, Frank M. White, McGraw Hill Publication
2. Hydraulic Machines-Theory and Design, V. P. Vasandani, Khanna Publishers
3. Fluid Mechanics, John F. Douglas, Pearson
4. Introduction to Fluid Mechanics, James E.A., John and Haberm W.A., Prentice Hall of India

## RTM Nagpur University-Mechanical Engineering
## B.Tech 4th Semester
## MECHANICS OF MATERIAL (BTME403T)
## Syllabus (Theory)

| Semester | Course Title (Subject) | Hours / Week | | | Credits | Maximum Marks | | | Exam Duration (Hrs.) |
|---|---|---|---|---|---|---|---|---|---|
| | | L | T | P | | Continual Assessment | University Examination | Total | |
| IV | MECHANICS OF MATERIAL | 3 | - | - | 3 | 30 | 70 | 100 | 3 |

| Sr. No. | Course Objective<br>The objective of this course is– |
|---|---|
| 1 | To study different types of stresses, strain and deformation induced in the mechanical components due to external loads. |
| 2 | To study Shear force and Bending moment, Stresses in beam under various loading conditions. |
| 3 | To understand phenomena of Deflection of Beam and Strain Energy. |
| 4 | To design and analyse shaft for various loading conditions |
| 5 | To understand design process and failure phenomena of Column & Struts. |

### Course Outcomes

After successful completion of this course the student will be able to:

| | |
|---|---|
| CO1 | Demonstrate fundamental knowledge about various types of loading and stresses induced |
| CO2 | Draw the SFD and BMD for different types of loads and support conditions. |
| CO3 | Estimate the strain energy in mechanical elements. And analyse the deflection in beams. |
| CO4 | Can design shaft for various loading conditions. |
| CO5 | Understand theory of failure and effective designing of column and Struts. |

# MECHANICS OF MATERIAL SYLLABUS (Theory)

| Contents | No of hours |
|---|---|
| **Unit I**<br><br>Concept of simple stresses and strains: Introduction, stress, strain, types of stresses, stress and strain diagram for brittle & ductile material, elastic limit, Hooks law, modulus of elasticity, modulus of rigidity, factor of safety, analysis of tapered rod, analysis of composite section, thermal stress and strain.<br><br>Longitudinal strain & stress, lateral stresses and strains, Poisson's ratio, volumetric stresses and strain with uni-axial, bi-axial & tri-axial loading, bulk modulus, relation between Young's modulus and modulus of rigidity, Poisson's ratio and bulk modulus<br><br>Principal stresses and strains:- Definition of principal planes & principal stresses, analytical method of determining stresses on oblique section when member is subjected to direct stresses in one plane in mutually perpendicular two planes, when member is subjected to shear stress and direct stresses in two mutually perpendicular planes, Mohr's circle for representation of principal stresses | 12 Hrs. |
| **Unit II**<br><br>Shear force and bending moment: - Types of beam (cantilever beam, simply supported beam, overhung beam etc.), Types of loads (Concentrated and UDL), shear force and bending moment diagrams for different types of beams subjected to different types of loads, sign conventions for bending moment and shear force, shear force and bending moment diagrams for beams subjected to<br>couple, Relation between load, shear force and bending moment.<br><br>Stresses in beams: - Pure bending, theory of simple bending with assumptions & expressions for bending stress, derivation of bending equation, bending stresses in symmetrical sections, section modulus for various shapes of beam sections.<br><br>Shear stresses in beams: - Concept, derivation of shear stress distribution formula, shear stress distribution diagram for common symmetrical sections, maximum and average shear stress. | 10Hrs |
| **Unit III**<br><br>Deflection of beams:- Deflection & slope of cantilever, simply supported, overhung beams subjected to concentrated load, UDL, Relation between slope, deflection & radius curvature Macaulay's method to determine deflection of beam.<br><br>Strain energy & impact loading: - Definition of strain energy stored in a body when it is subjected to gradually applied load, suddenly applied loads & impact loads. Strain energy stored in bending & torsion | 12Hrs |

| | | |
|---|---|---|
| **Unit IV** <br> Torsion of circular shafts: - Derivation of torsion equation with the assumptions made in it. Torsion shear stress induced in the shaft, when it is subjected to torque. Strength and rigidity criterion for design of shaft. Torque transmitted by solid & hollow circular shaft. Equivalent twisting and bending moment in shaft when it is subjected to bending moment, torque & axial load. | | 8Hrs |
| **Unit V** <br> Column & Struts: - Failure of long & short column, slenderness ratio, assumptions made in Euler's column theory, end conditions for column. Expression for crippling load for various end conditions of column and derivation on column with both ends hinged. Effective length of column, limitations of Euler's formula, Rankine formula. | | 4Hrs |

| Sr. No. | List of Tutorials |
|---|---|
| 01 | problems on simple and principle stresses |
| 02 | problems on Mohr's circle |
| 03 | problems on Thermal stresses |
| 04 | problems on S.F. & B.M. diagrams |
| 05 | problems on Stresses in beam bending |
| 06 | problems on shear stresses |
| 07 | problems on Macaulay's methods |
| 08 | problems on shafts |
| 09 | problems on columns & struts |

Assignments (Guidelines)

At least one problem on the following topic

1. Stresses in Beams ( A two wheeler chassis design concept)

2. Strain energy and deflection ( Determination of equivalent load due to impact on the component and its design)

3. Torsion , Column and Struts ( Design of frames of solar PV roof top system using software like Stat-Pro)

**Note:** Preferably The assignments shall be based on live problems. Project based learning may be incorporated by judiciously reducing number of Assignments

**References:**

**Text Books Recommended:**

1. Strength of Materials by S. Ramamrutham and R. Narayanan, Dhanpat Rai Publishing Company (P) Ltd, 18th Edition 2017.

2. Strength of Materials by R.K. Bansal, Laxhmi Publications , New Delhi, 6th edition, 2017

3. Strength of Materials by S.S.Rattan, Mcgraw Hill Education, 3rd edition , 2016

Reference Books Recommended:

1. Mechanics of Materials By Beer , Johnston, Dewolf and Mazurek , Tata McGraw- Hill Education , 7th edition , 2015

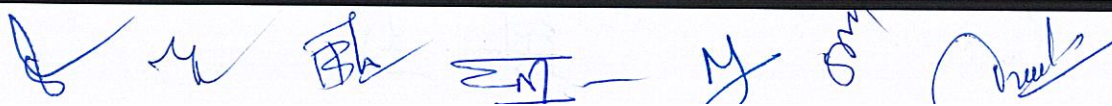2. Elements of Strength of Materials by Timoshenko, S.P. and Young, D.H., East West Press, 5th edition, 2011

| Semester | Course Title(Subject) | Hours / Week | | | Credits | Maximum Marks | | |
| | | L | T | P | | Continual Assessment | University Examination | Total |
|---|---|---|---|---|---|---|---|---|
| IV | Material Testing Lab | - | - | 2 | 1 | 25 | 25 | 50 |

| Sr. No. | Course Objective The objective of this course is– |
|---|---|
| 1 | Create specimen for metallographic examination. |
| 2 | Analyze the microstructure and investigate various properties of ferrous and nonferrous Materials. |
| 3 | Test different Engineering Materials. |
| 4 | Analyze the hardenability microstructure. |
| 5 | Test Cast Iron. |
| 6 | To familiarize material behavior under different loading conditions |
| 7 | To acquaint with surface hardness measurement method |
| 8 | To familiarize with impact test methods for different materials |
| 9 | To study and analyze deflection of beams in various loading conditions. |
| 10 | To study and understand behavior of material under various loading conditions. |

| Course Outcomes | |
|---|---|
| After successful completion of this course the student will be able to: | |
| CO1 | Analyze the Microstructure and investigate various properties of ferrorous and Non ferrous Materials . Analyse the stress strain behaviour of materials |
| CO2 | Analyse the effect of tensile, shearing force and can utilized the gained while tackling real life engineering problems for different types of Materials |
| CO3 | Understand Microstructures and their Applications for various uses |
| CO4 | Measure torsional strength , hardness of material |
| CO5 | Incorporate the various important concepts learnt while designing components |

****NOTE: At least 10 Experiments should be included in the Journal-At least 5 from Serial Number 1 to 7 and at least 5 from serial Number 8 to 14). This Practical load shall be equally shared by subject teachers handling subjects Material Science & Engineering and Mechanics of Materials.
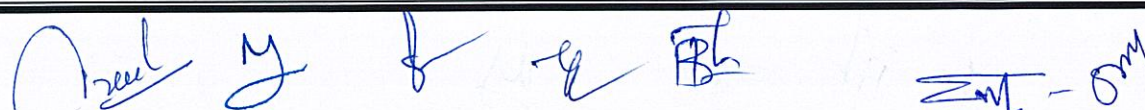
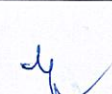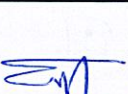| Sr. No. | Material Testing Lab -List of practical's |
|---|---|
| 01 | To study the Metallurgical Microscopes & Preparation of specimen for metallographic examination. |
| 02 | Micro-structural examination of different types of Steels |
| 03 | Micro-structural study of White Cast Iron and Grey Cast Iron |
| 04 | Micro-structural study of Malleable Cast Iron and Nodular Cast Iron |
| 05 | Study of Universal Testing Machine |
| 06 | Determination of tensile properties of ductile material |
| 07 | Determination of properties of brittle material |
| 08 | Compression test on materials |
| 09 | Shear test on metals |
| 10 | Impact test on materials |
| 11 | Torsion test of metal shaft |
| 12 | Determination of bending strength by deflection of beam |
| 13 | Measurement of hardness with the help of Rockwell Hardness Tester |
| 14 | Measurement of hardness with the help of Brinell Hardness Tester |

## RTM Nagpur University-Mechanical Engineering
## B.Tech 4th Semester
## Engineering Thermodynamics (BTME404T)
## Syllabus( Theory)

| Semester | Course Title (Subject) | Hours / Week | | | Credits | Maximum Marks | | | Exam Duration (Hrs.) |
|---|---|---|---|---|---|---|---|---|---|
| | | L | T | P | | Continual Assessment | University Examination | Total | |
| IV | Engineering Thermodynamics | 3 | - | - | 3 | 30 | 70 | 100 | 03 |

| Sr. No. | Course Objective<br>The objective of this course is– |
|---|---|
| 1 | 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 fundamental laws in thermodynamic systems |
| 2 | To present a comprehensive and rigorous treatment of classical thermodynamics while retaining an engineering perspective. |
| 3 | Explain the working principle of various power cycles used in thermal systems. |

| Course Outcomes | |
|---|---|
| After successful completion of this course, the student will be able to: | |
| CO1 | **Explain** thermodynamics concepts, **relate** laws of the ideal gas, **identify** various thermodynamic processes and apply the laws to **determine** the energy transfer in terms of heat and work. |
| CO2 | **Explain** the first law of thermodynamics and **apply** the law to **evaluate** open, closed systems, thermal components and devices. |
| CO3 | **Interpret the** second law of thermodynamics, entropy, and apply the law to evaluate heat engine, heat pump, and refrigerator performance. |
| CO4 | **Relate** various steam properties, and **analyze** the different types of processes using steam as working fluid to **determine** the energy transfer in terms of heat and work. |
| CO5 | **Compare** various power cycles and **analyze** the cycles to **determine** the energy transfer in terms of heat, work and efficiency. |

| Engineering Thermodynamics Syllabus | |
|---|---|
| Contents | No of hours |
| **Unit I** | 10 |
| Basic concepts of Thermodynamics, Systems and their types, Property, State, Process, Phase, Cycles. Comparison of microscopic and macroscopic approaches. Path and point functions. Thermodynamic Equilibrium. Zeroth law of thermodynamics and its significance for temperature measurement Introduction to First law of thermodynamics, Energy transfer, Heat and work transfer. Ideal Gas laws: Boyle"s law, Charle"s law, Gay-Lussac"s law, Avagadro"s law, Equation of state, General gas equation, Specific Heat, Universal gas constant. Thermodynamic Processes: Constant pressure, Constant volume, Isothermal, Isentropic and Polytropic process, representation on P-V and T-s Diagram, Calculation of Heat transfer, Work done, Change in Internal Energy and Enthalpy for these processes. | |
| **Unit II** | 9 |
| The first law of Thermodynamics for Closed System undergoing a process and cycle (Control Mass System) and Open System (Control Volume System) Steady Flow process applies to Compressor, Pump, Turbine, Boiler, Steam Nozzle, Throttling Device, Heat Exchanger, Fan and blower. (Analytical treatment on First law applied to thermodynamic processes and cycles and Steady low energy equation applied to various flow devices is expected). , | |
| **Unit III** | 9 |
| Second Law of Thermodynamics:- Heat Reservoir, source and sink. Heat Engine, Refrigerator, Heat Pump, Kelvin-Plank and Clausius Statements, Perpetual Motion Machine I and II, Carnot Cycle, Thermodynamic Temperature scale. Entropy:- Clausius Inequality, Entropy, Principle of Increase of Entropy, Change in Entropy for different thermodynamics processes with T-S Diagram, Reversible and Irreversible Processes. (Simple analytical treatment on COP calculation is expected) , | |
| **Unit IV** | 9 |
| Properties of Steam:- Formation of steam and its thermodynamic properties like Sensible Heat, Latent Heat, Critical State, Triple Point, Wet Steam, Dry Steam, Superheated Steam, Dryness Fraction, Enthalpy, Internal Energy of Steam, External Work Done during Evaporation, T-S Diagram, Mollier Chart, Work and Heat Transfer during various Thermodynamic Processes with steam as working fluid. Measurement of Dryness Fraction using various Calorimeters. (Analytical Treatment using steam table and Mollier chart is expected) , | |

| Unit V | 9 |
|---|---|
| Power Cycles: - Otto Cycle, Diesel Cycle, Dual Cycle, Brayton Cycle, Representation on P-v and T-s diagrams. The equation for work done, heat transfer, air standard efficiency, and mean effective pressure. Comparison of Otto, Diesel and Dual cycles. Introduction to simple vapour power cycle, i.e., Rankine cycle (Analytical treatment in terms of calculation Work done & efficiency analysis is expected on Otto Cycle, Diesel Cycle and Dual Cycle) | |
| **Total Hours** | 46 |

| Sr. No. | List of Tutorials |
|---|---|
| 01 | Application of first law to control mass (closed system) system |
| 02 | Application of first law to control volume (open system) system |
| 03 | Determination of Heat transfer, Work done, Change in Internal Energy and Enthalpy of various thermodynamic processes and cycles. |
| 04 | Determination of various properties of steam by using Steam table and Mollier chart |
| 05 | Application of second law to heat engine, refrigerator and heat pump. |
| 06 | Thermodynamic analysis of Otto cycle. |
| 07 | Thermodynamic analysis of Diesel cycle. |
| 08 | Thermodynamic analysis of Dual cycle and Brayton cycle. |

**References:**

**Text Books Recommended:**

1. Engineering Thermodynamics, P. K. Nag, Tata McGraw-Hill Publications
2. Thermodynamics, S. C. Gupta, Pearson Publications
3. Thermal Engineering, P. L. Ballani, Khanna Publications
4. Engineering Thermodynamics, S.S. Khandare, Charotar Publication House
5. Engineering Thermodynamics, R. K. Rajput, Laxmi Publication

**Reference Books Recommended:**

1. Thermodynamics and Engineering approach, Yunus A. Cengel, Michael A. Boles, Tata McGraw-Hill Publications
2. Engineering Thermodynamics, D. P. Mishra, Cengage Learning Publications
3. Engineering Thermodynamics, Gordon Rogers, Pearson Publications

## RTM Nagpur University-Mechanical Engineering
## B.Tech 4th Semester
## Computer Programming (BTME405P)
## Syllabus( Theory)

| Semester | Course Title (Subject) | Hours / Week | | | Credits | Maximum Marks | | | Exam Duration (Hrs.) |
|---|---|---|---|---|---|---|---|---|---|
| | | L | T | P | | Continual Assess | University Exam | Total | |
| IV | Computer Programming | - | 1 | 2 | 2 | 25 | 25 | 50 | - |

| Sr. No. | Course Objective The objective of this course is– |
|---|---|
| 1 | To to apply knowledge of basic concepts of programming in C to solve mechanical Engineering problems |
| **Course Outcomes** | |
| After successful completion of this course the student will be able to: | |
| CO1 | Understand and explore concepts in basic programming like data types, input/output functions, operators, programming constructs and user defined functions. |
| CO2 | Develop capabilities of writing „C" programs in optimized, robust and reusable code |
| CO3 | Apply appropriate concepts of data structures like arrays, structures implement programs for various applications |

| Computer Application/Programming SYLLABUS | |
|---|---|
| Contents | No of hours |
| **Introduction to C programming:**<br>Basic structure of C program, Features of C language, Character set, C tokens, Keywords and Identifiers, Constants, Variables, Data types | 05 |
| **Operators and Expressions:**<br>Arithmetic operators, Relational operators, Logical Operators, Assignment operators, Increment and decrement operators, Conditional operators, Bit-wise operators, Arithmetic expressions. Evaluation of expressions, Precedence of arithmetic operators, Type conversion in expressions, Operator precedence and associativity. | 05 |
| **Decision Making:**<br>Decision making with 'if' statement, Simple 'if' statement, the 'if...else' statement, nesting of 'if...else' statements, The 'else if' ladder, The 'switch' statement.<br>The while statement, The do while statement, The 'for' statement, Jumps in loops. | 05 |
| **Arrays:**<br>One dimensional arrays, Declaration of one dimensional arrays. Initialization of one dimensional arrays, Two dimensional arrays, Initializing two dimensional arrays. Declaring and Initializing String Variables, Reading Strings from Terminal, Writing strings to screen, String handling functions | 05 |
| **User-defined functions:**<br>Need for User Defined Functions, Definition of functions, Return values and their types, Function calls, Function declaration.<br>**Introduction to Pointers:** Introduction, Declaration and initialization of pointers. Examples Structures and Unions: Introduction, Structure and union definition, Declaring structure and union variables, Accessing structure members. | 05 |

| Sr. No. | Computer Application/Programming (List of Practical) |
|---|---|
| 01 | Development of programs in C To find area/surface area, volume for Planes, Solids. (Applications for cost involved for painting surface of any plane(square, rectangular, hexagonal etc), costing based on metal sheet material required for manufacturing cylinder(ends open/closed/one end open), cone, cube etc. with varying quantity of products) |
| 02 | Development of programs in C To find Stress with given force and cross sectional |

| | |
|---|---|
| | area(square, rectangle, circular etc) |
| 03 | Development of programs in C To find angular velocities and acceleration of the output and coupler link for four bar chain mechanism. |
| 04 | Development of programs in C for given inner, outer radii for single plate clutch and axial force calculate minimum, maximum, and average pressure acting on clutch plate.(or calculating inner outer radii, width of friction lining, axial force etc. for single/multi plate clutch or similar type of simple calculation programme for block brake. |
| 05 | Development of programs in C for Addition, Multiplication Matrices. |
| 06 | Development of programs in C for any Numerical methods like Newton Raphson, Gauss-Elimination, Gauss-Jordan, Crout's method and Gauss-Seidel Method. Development of programs in C / C+ + for any Numerical methods like Taylor's series method, Runge Kutta method, Euler's modified method, Milne's predictor corrector method, Iterative methods for eigen value & eigen vector determination. |
| 07 | Development of programs in C To determine type of flow of fluid(laminar/turbulent/transient) on the basis of Reynolds's Number |
| 08 | Development of programs in C To calculate specific density, specific weight, weight if specific gravity is given for liquid |

**Note:** During University practical examination of 50 marks, students are expected to prepare & execute computer programs in C of total 30 marks in one hours duration. Viva-Voce of 20 marks shall be conducted during University practical examination.

### References:

### Text Books Recommended:

1)Programming in C , P. Dey, M. Ghosh, First Edition, 2007, Oxford University press, ISBN (13): 9780195687910.

2. The C Programming Language, Kernighan B.W and Dennis M. Ritchie, Second Edition, 2005, Prentice Hall, ISBN (13): 9780131101630.
3. Turbo C: The Complete Reference, H. Schildt, 4th Edition, 2000,Mcgraw Hill Education, ISBN-13: 9780070411838.
4. Understanding Pointers in C, Yashavant P. Kanetkar, 4th Edition, 2003, BPB publications, ISBN-13: 978-8176563581
5. C IN DEPTH, S.K Srivastava, Deepali Srivastava, 3rd Edition, 2013, BPB publication, ISBN9788183330480

### Reference Books Recommended:

1. An Introduction to Data Structures with Applications, Trembly J. P. And Sorenson P. G., Tata McGraw Hill Pub. Co. Ltd.
2. Fundamentals of Computer Algorithms, Horowitz E. And Sahani S., Galgotia Publications Ltd.
3. Programming in C, Gotterfield B., Schaums Outline Series. 4. Mastering C, R. Venu Gopal Prasad, Tata McGraw Hill Pub. Co. Ltd.

## RTM Nagpur University-Mechanical Engineering
## B.Tech 4th Semester
## Professional Ethics (BTME406T)
## Syllabus(Theory)

| Semester | Course Title (Subject) | Hours / Week | | | Credits | Maximum Marks | | | Exam Duration (Hrs.) |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Continual Assessment | University Examination | Total | |
| | | L | T | P | | | | | |
| IV | **Professional Ethics** | 3 | - | - | 3 | 30 | 70 | 100 | 03 |

| Sr. No. | Course Objective<br>The objective of this course is– |
|---|---|
| 1 | The objective of this course is to inculcate the sense of social responsibility among learners and to make them realize the significance of ethics in professional environment so as to make them a global citizen |

| Course Outcomes | |
|---|---|
| After successful completion of this course the student will be able to: | |
| CO1 | Understand basic purpose of profession, professional ethics and various moral and social issues |
| CO2 | Analyze various moral issues and theories of moral development |
| CO3 | Realize their roles of applying ethical principles at various professional levels |
| CO4 | Identify their responsibilities for safety and risk benefit analysis. |
| CO5 | Understand their roles in dealing various global issues |

| Professional Ethics SYLLABUS (Theory ) | |
|---|---|
| Contents | No of hours |
| **Unit I** <br> Human Values, Morals, values and Ethics, Integrity, Work ethics, Service learning, Civic virtue, Respect for others, Living peacefully, Caring, Sharing, Honesty, Courage , | 08 |
| **Unit II** <br> Engineering Ethics, Senses of 'Engineering Ethics', Variety of moral issues, Moral dilemmas, Moral Autonomy, Kohlberg's theory, Gilligan's theory , | 07 |
| **Unit III** <br> Engineering as Social Experimentation, Engineering as Experimentation, Engineers as responsible Experimenters, Codes of Ethics, A Balanced Outlook on Law , | 07 |
| **Unit IV** <br> Safety, Responsibilities and rights, Safety and Risk, Assessment of Safety and Risk, Risk Benefit Analysis and Reducing Risk, Collective Bargaining, Professional Rights, Employee Rights | 07 |
| **Unit V** <br> Global issues, Multinational Corporations, Computer Ethics, Weapons Development, Engineers as Managers, Consulting Engineers, Engineers as Expert Witnesses and Advisors, Corporate Social Responsibility | 07 |

**References:**

**Text Books Recommended:**

1. Professional Ethics by R. Subramaniam – Oxford Publications, New Delhi.
2. Human Values And Professional Ethics by Jayshree Suresh and B. S. Raghavan, S. Chand Publications
3. Ethics in Engineering by Mike W. Martin and Roland Schinzinger – Tata McGraw-Hill – 2003.
4. Human Values & Professional Ethics by S. B. Gogate, Vikas Publishing House Pvt. Ltd., Noida.
5. Professional Ethics and Human Values by A. Alavudeen, R.Kalil Rahman, and M. Jayakumaran – University Science Press.
6. Engineering Ethics & Human Values by M.Govindarajan, S.Natarajan, and V.S.SenthilKumar-PHI Learning Pvt. Ltd – 2009.
7. Professional Ethics and Human Values by Prof.D.R.Kiran-Tata McGraw-Hill – 2013

## RTM Nagpur University-Mechanical Engineering
## B.Tech 4th Semester
## Skill Development (Training on Matlab) (BTME407P)
## Syllabus (Theory)

| Semester | Course Title (Subject) | Hours / Week | | | Credits | Maximum Marks | | | Exam Duration (Hrs.) |
|---|---|---|---|---|---|---|---|---|---|
| | | L | T | P | | Continual Assessment | University Examination | Total | |
| IV | Skill Development (Training on MATLAB) | - | - | 2 | 1 | 50 | - | 50 | - |

### Course Objective

This helps it create a simple environment for solving problems. This easy-to-use environment helps engineers solve high-level problems. It also makes it easier for them to express problems in a mathematical form. The most common uses of MATLAB include computation, development, prototyping and visualization
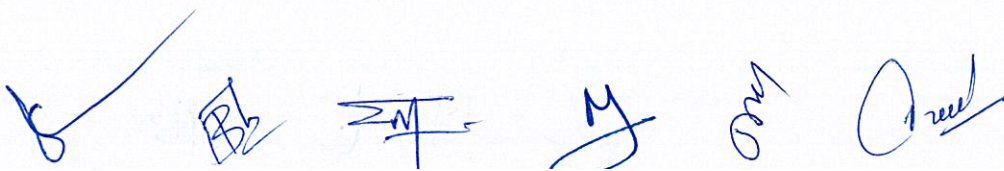
### Course Outcomes

After successful completion of this course the student will be able to use MATLAB to develop, design, simulate, and test their models before it can be developed in the real world. In the field of mechanical engineering, MATLAB will be used for solving problems related to dynamic and static systems, mechanical vibrations, control systems, statics, and more.

# Contents- MATLAB- IV Sem- Mechanical Engineering

1. Accessing MATLAB

2. Entering Matrices

3. Matrix operations, Array operations

4. Statements, expressions, Variables n saving a session

5. Matrix building functions

6. For, While, if ---- and relations

7. Scalar functions

8. Vector functions

9. Matrix functions

10. Command line editing and recall

11. Sub matrices and colon notation

12. M-Files, Script Files & Function Files

13. Text strings, error messages, input

14. Managing M-Files

15. Comparing efficiency of Algorithms, flops, tic, toc

16. Output format

17. Hard copy

18. Graphics.......

    Planar plots, hardcopy, 3-D line plots, mesh & surface plots, handle graphics

19. Sparse matrix computations

20. Indexing

21. Linear algebra

22. Operations on nonlinear functions

23. Data analysis

**References:**

**Text Books Recommended:**

1. Timothy A. Davis, MATLAB Primer, 8e, University of Florida, Chapman & Hall/CRC, 2011, ISBN: 978-1-4398-2862-5; Language: English

2. S Kermit, MATLAB Primer, 3e, University of Florida

3. Primer, MATLAB , MathWorks, Inc, 30e