

# PEOPLE'S UNIVERSITY, BHOPAL

Program: **B. Tech. (Mechanical Engineering)**

Semester: **III**

Subject Title	Subject Code	Credits			Theory		
Engineering Mathematics-II	BT-301	L	T	P	Externals (70)	Internals (30)	Total (100)
		3	1	-	(D Grade)	Min: Nil	Min: 40 (D Grade)

**Duration of Theory (Externals): 3 Hours**

**Theory Internal - Max Marks: 30**

Best of Two Mid Semester Test – Max Marks: 20

Assignment / Quiz/Attendance – Max. Marks: 10

Unit	Contents (Theory)
I	<b>FOURIER SERIES:</b> Introduction of Fourier series, Fourier series for Discontinuous Functions, Fourier series for even and odd function, half range series and method of Least Squares.
II	<b>LAPLACE TRANSFORMATIONS :</b> Introduction of Laplace Transform of elementary functions, Properties of Laplace transform ,Change of scale property, second shifting property, Laplace transform of the derivative, Inverse Laplace transform and its properties, Convolution theorem and Applications of Laplace Transformation to solve the ordinary differential equations
III	<b>SECOND ORDER LINEAR DIFFERENTIAL EQUATIONS with VARIABLE COEFFICIENTS:</b> Methods one integral is known, removal of first derivative, changing of independent variable and variation of parameter, Solution by Series Method.
IV	<b>LINEAR &amp; NON – LINEAR DIFFERENTIAL EQUATIONS of FIRST ORDER :</b> Formulation of partial differential equations, solution of equation by direct integration, Lagrange's Linear equation, charpit's method, Linear partial differential equation of second and higher order, Linear homogeneous and Non-homogeneous partial differential equation of nth order with constant coefficients.
V	<b>VECTOR CALCULUS :</b> Differentiation of vectors, scalar and vector point function, geometrical meaning of Gradient, Unit Normal vector and directional derivative, physical interpretation of divergence and curl, line integral, surface integral and volume integral, Green's Stroke's and gauss divergence theorem.

## REFERENCES:

1. Engg. Mathematics - 2, D.C. Agarwal
2. Higher Engineering Mathematics by BS Grewal, Khanna Publication
3. Mathematics for Engineers by S.Arumungam, SCITECH Publications
4. Advanced Engineering Mathematics by Erwin Kreyszig, Wiley India
5. Advance Engineering Mathematics by D.G.Guffy
6. Engineering Mathematics by S S Sastri. P.H.I.
7. Advanced Engineering Mathematics by Peter V.O'Neil, Thomson Learning
8. Higher Engineering Mathematics by John Bird, Elsevier

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Semester: **III**

Subject Title	Subject Code	Credits			Theory		
Applied Thermodynamics	MET- 302	L	T	P	Externals (70)	Internals (30)	Total (100)
		3	1	-	(D Grade)	Min: Nil	Min: 40 (D Grade)

**Duration of Theory (Externals): 3 Hours**

**Theory Internal - Max Marks: 30**

Best of Two Mid Semester Test	– Max Marks: 20
Assignment / Quiz	– Max. Marks: 10

Unit	Contents (Theory)
I	<b>Fundamental Concepts &amp; Definitions:</b> microscopic & macroscopic, introduction of engineering thermodynamic Systems, Characteristics of system boundary and control surface, Thermodynamic properties, Thermodynamic state, point, path and process, quasi-static process, cyclic and non-cyclic; processes; Thermodynamic equilibrium, Zeroth law of thermodynamics, Temperature; concepts, scales.
II	<b>Work and Heat:</b> Mechanics, definition & their limitations, sign convention. Displacement work; as a part of a system boundary, as a whole of a system boundary, expressions for displacement work in various processes through p-v diagrams. Shaft work; Heat Transfer; definition, units and sign convention, Heat transfer in various processes through p-v diagrams. Numerical.
III	<b>Law of Thermodynamics:</b> First Law of Thermodynamics: Joules experiments, equivalence of heat and work. Statement of the First law of thermodynamics, extension of the First law to non - cyclic processes, energy, energy as a property, modes of energy, Specific heat, enthalpy at constant volume, constant pressure, steady state-unsteady flow energy equation. Numerical, Second Law of Thermodynamics: Heat Pump, Heat Engines, Refrigerator, Thermal Reservoir, schematic representation and efficiency, coefficients of performance. Limitations of first law of thermodynamics, Kelvin - Planck statement; PMM I and PMM II, Clausius statement, Equivalence of the two statements; Reversible and irreversible processes; factors that make a process irreversible, reversible heat engines, Carnot cycle, Carnot principles. Numericals
IV	<b>Entropy:</b> Clausius inequality; Statement, proof, application to a reversible cycle. Entropy, change of entropy, principle of increase in entropy, entropy as a quantitative test for irreversibility, Available and unavailable energy. <b>Pure Substances:</b> T-S, H-S and P-V diagrams, triple point and critical points. Sub cooled liquid, saturated liquid, mixture of saturated liquid and vapour, saturated vapour and superheated vapour states of pure substance with water as example. PVT diagram, Enthalpy of change of phase (Latent heat). Dryness fraction, representation of various processes of steam on these diagrams. Steam tables and its use. Separating and throttling calorimeter

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V	<p><b>Thermodynamic Relationships:</b> Helmholtz and Gibbs functions, isothermal compressibility, Differential relations of internal energy, Maxwell's Relation, T-ds equations, Clapeyron equation, Joule Thomson's coefficients.</p> <p><b>Equation of state:</b> Ideal gas equation of state, Real gas deviation with ideal gas, limitations of ideal gas equation, Vander wals equation, Evaluation of its Constants, Limitations of the equation.</p>
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### References:

1. Basic Engineering Thermodynamics, A.Venkatesh, Universities Press.
2. Basic and Applied Thermodynamics, P.K.Nag, 2nd Ed., Tata McGrawHill Pub.
3. Thermodynamics, Arora and Domkundwar.
4. Engineering Thermodynamics, J.B.Jones and G.A.Hawkins, John Wiley and Sons.
5. Fundamentals of Classical Thermodynamics, G.J.Van Wylen and R.E.Sonntag, Wiley Eastern.
6. An Introduction to Thermodynamics, Y.V.C.Rao, Wiley Eastern.
7. Basic Thermodynamics B.K Venkanna, Swati B. Wadavadagi , PHI, New Delhi.

# PEOPLE'S UNIVERSITY, BHOPAL

Program: **B. Tech. (Mechanical Engineering)**

Semester: **III**

Subject Title	Subject Code	Credits			Theory			Practical		
Mechanics of Materials	MET-303	L	T	P	Externals (70)	Internals (30)	Total (100)	Externals (35)	Internals (15)	Total (50)
		3	1	2	(D Grade)	Min: Nil	Min: 40 (D Grade)	(D Grade)	Min: Nil	Min: 20 (D Grade)

**Duration of Theory (Externals): 3 Hours**

**Theory Internal - Max Marks: 30**

Best of Two Mid Semester Test –Max Marks: 20

Assignment / Quiz – Max. Marks: 10

**Practical Internal - Max Marks: 15**

Lab work & Sessional –Max Marks: 10

Assignment / Quiz – Max. Marks: 05

Unit	Contents (Theory)
I	<b>Introduction</b> : Mechanical Properties of Materials, Behavior of Materials Under Tension, Compression, Bending, Shear; Ductile and Brittle Materials & Their Failure Under Tension, Stress-Strain Diagram, Hooke's Law, Modulus of Elasticity, Stresses in the Components Subjected to axial Multi-loads, Deformation Under Axial Loading, Analysis of Simple Structures, Stepped Rods, Members in Series and Parallel, Elastic and Plastic Behavior of Materials, Poisson's Ratio, Bulk Modulus, Shear Strain, Relation Among Elastic Constants, Residual Stress, Temperature Stresses, Factor of Safety.
II	<b>Principal Stresses And Strain:</b> Transformation of Stresses, Principal Stresses, Normal And Shear Stress, Torsion & Axial Loads, Mohr's Circle and its Application to Two and Three Dimensional Analysis, Principal Strains, Strain Energy. <b>Thin cylindrical shells:</b> hoop or circumferential stress, longitudinal stress, maximum shear stress, change in dimensions of thin cylindrical shell due to internal fluid pressure, thin cylindrical shell with hemispherical ends, spherical shells.
III	<b>Shear Force &amp; Bending Moment:</b> Types of Beam & Support, Theory of Simple Bending, Bending Equation, Traverse Shear Stress Distribution in Circular, Hollow Circular, I & T Section, Shear Force And BM Diagram, Pure Bending, point of contra- flexure. <b>Deflection Of Beam:</b> Relation Between Slope, Deflection and Radius of Curvature, Solution of Beam Deflection (simply supported beam only), Problem by Macaulay's Method, Moment Area Method.
IV	<b>Torsion:</b> Deformation in Circular Shaft, Angle of Twist, Shafts Angular Deflection, Hollow and Stepped Circular Shaft. <b>Springs:</b> Types of spring, analysis of close coiled and open coiled helical springs, leaf spring, springs in series and parallel.
V	<b>Theories of failures:</b> Maximum Normal Stress & Shear Stress Theory; Maximum Normal And Shear Strain Energy Theory; Maximum Distortion Energy Theory; Application of Theories to Different Materials And Loading Conditions <b>Columns and struts:</b> Stability of Structures, Euler's Formula for Columns With Different End Conditions, and Rankin's Formula.

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## **References:**

1. Ryder; Strength of materials, Macmillan Publications.
2. Rattan; Strength of materials; TMH
3. Nash William; Schaum's Outline Series; Strength of Materials; TMH.
4. I.H.Shames; Introduction to Solid Mechanics ;PHI
5. R.K. Rajput; Strength of Materials;Dhanpat Rai& Sons.
6. Dr. Sadhu Singh, Strength of Materials; Khanna publication.

## **List of Experiments (Expandable):**

1. Study of Universal Testing Machine.
2. Determination of Yield Point Stress, Ultimate stress, Breaking Stress, Percentage elongation for Mild Steel specimen under tension.
3. Determination of Rockwell Hardness Test.
4. To Determine the Brielle Hardness Number of Mild Steels, Cast Iron & Aluminum Brass.
5. To perform the Charpy impact test and find the impact toughness for CI. MS. AL specimens.
6. To find the Modulus of rigidity of Mild Steel using Torsion Apparatus.
7. Determination of Modulus of Elasticity by Deflection Method.
8. To determine the stiffness of the spring & modulus of rigidity of the Spring Wire.

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Semester: **III**

Subject Title	Subject Code	Credits			Theory			Practical		
		L	T	P	Externals (70)	Internals (30)	Total (100)	Externals (35)	Internals (15)	Total (50)
<b>Material Science</b>	<b>MET-304</b>	3	1	2	(D Grade)	Min: Nil	Min: 40 (D Grade)	(D Grade)	Min: Nil	Min: 20 (D Grade)

**Duration of Theory (Externals): 3 Hours**

**Theory Internal - Max Marks: 30**

Best of Two Mid Semester Test – Max Marks: 20

Assignment / Quiz – Max. Marks: 10

**Practical Internal - Max Marks: 15**

Lab work & Sessional –Max Marks: 10

Assignment / Quiz – Max. Marks: 05

Unit	Contents (Theory)
I	<b>Structure of Materials:</b> and crystallization, electronic structure of atoms, Crystalline structure of solid: Concept of unit cell and space lattice, correlation of crystal structure , miller indices , defects in crystal, point line and surface, defects, Dislocations edge and core, burgers vectors, slip plane , material properties, super conductivity yielding and strain hardening. Baushinger effect, grain boundaries, grain growth, effect of grain size on properties of metals.
II	<b>Phase Diagrams:</b> Theory of alloying, phases in metals and alloys, solid solution, solidification of pure metals and alloys, ordered and disordered, substitution and interstitial solution. Hume Rothery's rules of substitution solid solution Phase diagrams of monotectic, eutectic, eutectoid, peritectic and peritectoid & other systems. Mechanical properties, binary equilibrium diagram, phase rule, lever rule.
III	<b>Heat treatment and surface treatment;</b> Introduction, purpose of heat treatment, effects of heat treatment on properties of materials, allotropy of iron, iron carbon phase diagram, T.T.T. diagrams, continuous cooling curves, classification, annealing normalizing, hardening, spheroidizing, tempering transformation during tempering austempering martempering, precipitation hardening, case carburizing, nitriding, cyaniding, carbonitriding, induction hardening, flame hardening, and hardenability.
IV	<b>Ceramics:</b> Introduction, nature, types & properties, mechanical behavior of ceramics, glass; their types properties& uses, abrasives, insulators, refractory; their properties & classifications, uses; refractory materials.
V	<b>Polymers:</b> Classifications & applications, molecular structure, polymerization, copolymers, cross linking of polymers deformation & behaviors of polymers, visco-elasticity

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## **References:**

1. K. Hazra Choudhury, Material Science & Processes.
2. O. P. Khanna, A Textbook of Material Science and Metallurgy.
3. William D Callister Jr, Material Science and Engineering, John Wiley and Sons, New York.
4. Raghavan V, Material Science and Engineering – A First Course, Prentice Hall of India, New Delhi.
5. Nayak S.P., Metallurgy for engineering.
6. R.K.Jain , Production Technology, Khanna Publishers.

## **List of Experiments (Expandable):**

1. To study crystal structures of a given specimen.
2. To study crystal imperfections in a given specimen.
3. To study microstructures of metals/ alloys.
4. To study heat treatment processes (hardening and tempering) of steel specimen.
5. To study microstructure of heat-treated steel.
6. To study the creep behavior of a given specimen.
7. To study the mechanism of chemical corrosion and its protection.
8. To study the properties of various types of plastics.
9. To study Bravais lattices with the help of models.
10. To study crystal structures and crystals imperfections using ball models.

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Subject Title	Subject Code	Credits			Theory			Practical		
		L	T	P	Externals (70)	Internals (30)	Total (100)	Externals (35)	Internals (15)	Total (50)
Machine Drawing	MET-305									
		3	1	2	(D Grade)	Min: Nil	Min: 40 (D Grade)	(D Grade)	Min: Nil	Min: 20 (D Grade)

**Duration of Theory (Externals): 4 Hours**

**Theory Internal - Max Marks: 30**

Best of Two Mid Semester Test	– Max Marks: 20
Assignment / Quiz	– Max. Marks: 10

**Practical Internal - Max Marks: 15**

Lab work & Sessional	–Max Marks: 10
Assignment / Quiz	– Max. Marks: 05

Unit	Contents (Theory )
I	<p><b>Drawing conventions:</b> drawing and dimensioning IS codes, Conventional representation of surface finish, Roughness number symbol, Symbols of Machine elements and welded joints.</p> <p><b>Limits, Fits and Tolerances:</b> Nominal size and basic dimensions, Definitions, Basis of fit or limit system, Systems of specifying tolerances, Designation of holes, Shafts and fits, Commonly used holes and shafts.</p> <p><b>Fasteners:</b> Drawings of various views of Screw threads, metric and BSW threads, Square thread and multi-start threads. Nut bolts, Washers, Setscrew, Locknuts and foundation bolts.</p> <p><b>Riveted joints:</b> Forms and proportions of rivet heads, Different views of different types of riveted Lap and Butt joints.</p>
II	<p><b>Drawings of various views (sectioning) of Machine Elements:</b> Cotter joint, Knuckle joint, Muff and Flange coupling. Shaft bearing: Solid and bush bearing, Plummer block, Footstep bearing.</p> <p><b>Pipe joint:</b> Flanged joint, Socket and Spigot joint.</p>
III	<p><b>Assembly Machine Drawing:</b> Basic concept, plotting technique, assembly and blow up of parts, bill of materials, product data; Cotter and Knuckle joints, pedestal and footstep bearings, crosshead, stuffing box, IC engines parts - piston and connecting rods; lathe parts.</p>
IV	<p><b>Basic design concepts,</b> design process, stages/phases in design, flowchart, problem formulation, design considerations (strength, manufacturing, maintenance, environment, economics and safety); design for recycle and reuse, Design and safety factors for steady and variable loads, impact and fatigue considerations, reliability and optimization, standardization in design. Introduction to Compute Aided Drafting software for 2D and 3D Modelling</p>

**\*Note: Unit III will have 40% weightage; Study of assembly production drawing/blue print is to be practiced in the tutorial/practical. Few drawings are to be practiced on AutoCAD.**



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### **References:**

1. N.D. Bhatt; Machine Drawing; Charotar
2. A. Singh ; Machine Drawing; TMH
3. Narayana and Reddy; Machine Drawing; New age, Delhi.
4. Agarwal and Agrawal; Engineering Drawing; TMH
5. KC John; Text Book Of Machine Drawing; PHI Learning
6. SG Kulkarni; Machine Design; TMH

### **List of experiments (Expandable):**

Drawing of Machine parts contained in the syllabus.

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Subject Title	Subject Code	Credits			Practical		
		L	T	P	Externals (35)	Internals (15)	Total (50)
<b>C++ Programming</b>	<b>BT-306</b>	-	-	2	(D Grade)	Min: Nil	Min: 20 (D Grade)

**Practical Internal - Max Marks: 15**

Lab work & Sessional

– Max Marks: 10

Assignment / Quiz

– Max. Marks: 05

Unit	Contents ( <i>Practical</i> )
I	<b>C++ Basics:</b> Structure of a C++ program, Data types, Declaration of variables, Expressions, Operators, Operator Precedence, Evaluation of expressions, Type conversions, Pointers, Arrays, Strings, Structures, conditional statement, control structure, switch-case, break, go to statements.
II	<b>OOP :</b> Introduction to OOP methodology, difference between OOP and Procedure Oriented Programming, OOP principles.
III	<b>FUNCTIONS &amp; CLASSES :</b> <b>Functions:</b> Scope of variables, Parameter passing, Default arguments, inline function, Recursive function, Dynamic memory allocation and reallocation, operators-new and delete, Preprocessor directives, <b>Classes:</b> Class Definition, Class Structure, Class Scope, object, Friend function, Static class members, Constructors and Destructors, Dynamic creation and destruction of objects, Data Abstraction.
IV	<b>INHERITANCE:</b> Inheritance: Defining a class hierarchy, Different forms of inheritance, Defining the Base and Derived classes, Access to the base class member.
V	<b>POLYMORPHISM :</b> Function overloading, Operator Overloading, Virtual Function Polymorphism: Static and Dynamic binding, Base and Derived class virtual functions, Pure virtual functions, Abstract classes, Exception Handling and File Handling in C++, Comparison of C++ with C, Java and C#.

**References:**

1. Object Oriented programming with C++, E. Balaguruswamy, TMH.
2. Let us C++, Yashwant P. Kanetkar, BPB Publications
3. C++ complete reference, Herbert Schildt, Tata Mc-Graw – Hill publications
4. Learning C++, Eric Nagler, Jaico Publications.

**List of experiments (expandable):**

1. Program to print any Message
2. Program for Conditional Statements, Looping Statements and Switch Case
3. Program to implement Arrays, Strings and Pointers
4. Program to implement Functions and Dynamic Memory Allocation
5. Program to implement Class and Objects
6. Program to implement Friend Functions and Constructors
7. Program for Inheritance
8. Program for Polymorphism
9. Program for File Handling
10. Program for Exception Handling

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Subject Title	Subject Code	Credits			Practical		
		L	T	P	Externals	Internals (50)	Total (50)
Professional Skills – I	BT-307	-	-	2	Nil	Min: 20 (D Grade)	Min: 20 (D Grade)

**Practical Internal - Max Marks: 50**

Assignment / Quiz

– Max. Marks: 50

Contents
<p><b>Working in Teams</b></p> <p>Understand and work within the dynamics of a groups. Tips to work effectively in teams, Establish good rapport, interest with others and work effectively with them to meet common objectives, Tips to provide and accept feedback in a constructive and considerate way, Leadership in teams, handling frustrations in group.</p> <p><b>Task Management</b></p> <p>Introduction to Task identification Task planning, organizing and execution, closing the task.</p> <p><b>Business communication</b></p> <p>Business communication covering, Role of communication in information age; concept and meaning of communication; skills necessary for technical communication; Communications in a technical organization; Barriers to the process of communication;</p> <p>Style and organization in technical communication covering, Listening, speaking, reading and writing as skills; Objectivity, clarity, precision as defining features of technical communication; Various types of business writing: Letters, reports, notes, memos; Language and format of various types of business letters; Language and style of reports; Report writing strategies; Analysis of a sample report.</p>

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Subject Title	Subject Code	Credits			Practical		
		L	T	P	Externals	Internals (50)	Total (50)
<b>Mechanical Engineering Software Lab – I</b>	<b>MET-308</b>	-	-	2	Nil	Min: 20 (D Grade)	Min: 20 (D Grade)

**Practical Internal - Max Marks: 50**

Lab work & Sessional

– Max Marks: 25

Assignment / Quiz

– Max. Marks: 25

Contents (Practical)	
<p style="text-align: center;"><b>Students have to understand the working of AutoCAD</b></p> <p>Introduction to Computer Aided Drafting software for 2D and 3D Modeling, benefit, software's basic commands of drafting entities like line, circle, polygon, polyhedron, cylinders; transformations and editing commands like move, rotate, mirror, array.</p> <ul style="list-style-type: none"> <li>• Practicing commands under Draw and Dimension Menu</li> <li>• Practicing commands under Modify Menu.</li> <li>• Practicing commands under Tool Menu.</li> <li>• Practicing commands under Format Menu.</li> <li>• Practicing commands under Express Menu.</li> </ul>	