PEOPLE'S UNIVERSITY, BHOPAL

Programme: **B. Tech. (Mechanical Engineering)** **Semester -V**

Subject Title	Subject Code	Credits			Theory		
		L	T	P	External (70)	Internal (30)	Total (100)
Entrepreneurship & IPR	BT- 501	3	1	-			Min: 40 (D Grade)

Duration of Theory (External): 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	**Entrepreneurship**: definition and functions of an entrepreneur, qualities of a good entrepreneur; Role of Entrepreneur in economic development; theories of entrepreneur, socio, economic, cultural and psychological; entrepreneur traits and behavior, roles in economic growth, employment, social stability, export promotion and indigenization, creating a venture, opportunity analysis competitive and technical factors, sources of fund. Forms of business organizations/ownership - formation of a Company - procedures and formalities for setting up of new industry-sources of information to contact for what and where.
II	**Management:** Importance, definition and functions; dimensions of organizations, size/specialization, behavior formalization, authority centralization, departmentalization, spam and line of control, technology and Minzberg organization typology, line, staff & matrix organization. **Motivation theories** - Maslow, Mc Cullen - Motivation model - need, want, motive and behavior – attitude towards work - self assessment and goal setting - Achievement, motivation and behavior measurement, SWOT analysis and TA analysis - Stress and conflict management; with uncertainty; creativity and innovation.
III	**Marketing:** Importance, definition, core concepts of need want and demand, Project identification and formulation: Sources of information - opportunity guidance - choice of technology and its evaluation; consumer behavior; market survey and research; preliminary project report, detailed project report, assessing viability and feasibility of a report. Exchange & relationships, product value, cost and satisfaction (goods and services) marketing environment; selling, marketing and societal marketing concepts; four P's, product, price, placement, promotion. **Finance:** Nature and scope, forms of business ownerships, balance sheet, profit and loss account, fund flow and cash flow statements, breakeven point (BEP) and financial ratio analysis, pay-back period, NPV and capital budgeting. Subsidies and concessions for SSI - role of State and Central Government Agencies in promotion of Small Scale Industry
IV	**Concept of Property:** Theories of Property, Types of Intellectual Property- Origin and Development, Theories of Intellectual Property Rights, Need for Protecting Intellectual Property, Commercialization of Intellectual Property Rights by Licensing, Determining Financial Value of Intellectual Property Rights, Negotiating Payments Terms in Intellectual Property Transaction
V	**Introduction to Patent Law**, (a) Paris Convention , (b) Patent Cooperation Treaty, (c) WTO- TRIPS , Indian Patent Law, The Patents Act, 1970, Patentable Subject Matter, Patentability Criteria, Procedure for Filing Patent Applications, Patent Granting Procedure, Revocation, Patent Infringement and Remedies, Relevant Provisions of the Biological Diversity Act, 2002, Access and Benefit Sharing Issues

References:

1 Handbook for New Entrepreneurs, EDII, Ahmadabad.
2 Entrepreneurial Development by P.Saravanavel.
3 Environment and Entrepreneur – Tandon B.C. (Asian Publishers, New Delhi)
4 Emerging Trends in Entrepreneurship Development Theories & Practices – Singh P.Narendra Entrepreneurship &
5 Growth of Enterprise in Industrial Estates – Rao Gangadhara N

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Subject Title	Subject Code	Credits			Theory		
		L	T	P	External (70)	Internal (30)	Total (100)
Metal Cutting Processes	MET- 502	3	1	-			Min: 40 (D Grade)

Duration of Theory (External): 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	**Lathe:** Principle of operation, basic parts of a lathe, types – speed lathe, engine, bench, tool room, capstan, turret, automatic, specification, construction, operations, work holding devices & tools, mechanism and attachments for various operations. **Drilling**: Principle of operation, parts, drill nomenclature, types of drilling machines, other operations like counter boring, counter sinking, spot facing etc.
II	**Shaper:** Principle of operation, parts, types- horizontal, vertical, universal, Operations – horizontal cutting, vertical cutting, angular cutting, irregular cutting, specification, Quick return Mechanisms. Table feed mechanism, work holding devices. Numerical **Planner:** Principle of operation, parts, and types – double housing, open side, pit type, plate type, and divided table. Specification, types of drives. **Grinding:** Principle of operation, parts, and types of grinding, grinding machines.
III	**Milling:** Principle of operation, parts, specification, types- horizontal, vertical, universal, milling operations – plain, face, slotting, gear cutting mechanisms and attachments for milling, indexing-simple, compound and differential. **Broaching**: Principle of operation, parts, types of broaches- horizontal, vertical, pull, surface-internal and external broaching machines, nomenclature of broach.
IV	**Unconventional Machining:** Advantages, application and limitation, survey of Non-conventional machining processes, mechanics of metal removal, tooling, equipment, process parameters and surface finish obtained & specific application of following processes - EDM, ECM, USM, AJM, EBM and LBM.
V	**Numerical Control Machines**: Types, design, coordinates axes of NC System, control & optimizing of NC, Programming Codes-G Code, M-code, basic part programming methods, CAPP, PLC, CNC, DNC, Adaptive Control, Advantages, limitations, comparison.

References:

1. Manufacturing Technology (Vol. – I & II) – P.N. Rao – Tata McGraw Hill, New Delhi
2. A Text Book of Production Technology(Manufacturing Processes) – P.C. Sharma – S. Chand and Company Ltd., New Delhi
3. Manufacturing Science – A. Ghosh& A.K. Mallik – East West Press Pvt. Ltd., New Delhi
4. Manufacturing Engineering and Technology – S. Kalpakjian& S.R. Schmid – Addision Wesley Longman
5. Production Technology – R.K. Jain – Khanna Publishers, New Delhi
6. A Text Book of Production Technology (Vol. I & II) – O.P. Khanna – DhanpatRai& Sons, New Delhi..
7. Manufacturing Process (Vol-I&II)-H.S. Bawa-Tata McGraw Hill Pub. Company, New Delhi

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Subject Title	Subject Code	Credits			Theory			Practical		
		L	T	P	External	Internal	Total (100)	External	Internal	Total (50)
Theory of Machines -II (Dynamics)	MET- 503	3	1	2	(70)	(30)	Min: 40 (D Grade)	(35)	(15)	Min: 20 (D Grade)

Duration of Theory (External): 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	**Dynamics of Engine Mechanisms**: Displacement, velocity and acceleration of piston; turning Moment on crankshaft, turning moment diagram; fluctuation of crankshaft speed.
II	**Governor Mechanisms**: Types of governor, characteristics of centrifugal governor, gravity and spring controlled centrifugal governor, hunting of centrifugal governor, inertia governor. Performance parameter: Sensitivity, stability, Isochronism, Governor effort and power controlling force diagram. Flywheel. Numerical.
III	**Gyroscope**: angular velocity and acceleration, gyroscopic torque/ couple; gyroscopic effect on naval ships; stability of two and four wheel vehicles, rigid disc at an angle fixed to a rotating shaft. **Dynamometer:** types, Prony brake, rope brake and band brake dynamometers, belt transmission dynamometer, torsion dynamometer, hydraulic dynamometer.
IV	**Balancing:** Balancing of Rotating Components: static balance, dynamic balance, balancing of rotating masses, two plane balancing, graphical and analytical methods, balancing of rotors, balancing machines, field balancing. Balancing of Reciprocating Parts: Balancing of single cylinder engine, balancing of multi cylinder; inline, radial and V type engines, firing order.
V	**Vibration:** types, One dimensional longitudinal, Transverse, and torsional vibrations, Natural frequency, Free and forced vibration of single degree of freedom systems; effect of damping; Effect of damping on vibrations, Different types of damping. Forced vibration, Forces and displacement, Transmissibility, Vibration Isolation, vibration absorber, Whirling of shafts with single rotor.

References:

1. Theory of Machine- S.S.Rattan - Tata McGraw Hill
2. The Theory of Machines - Thomas Bevan, - CBS/ Cengage Publishers
3. Theory of Machines – J. E. Shigley – McGraw Hill
4. Theory of Mechanisms and Machines- A. Ghosh, A. K. Mallik – EWP Press .
5. Theory of Machine – P.L. Ballaney – Khanna Publishers

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List of Experiments:

1 Analytical determination of velocity and acceleration in simple mechanism using Roven's M.
2 To study all inversions of four-bar mechanisms using models
3 Determination of velocity and acceleration in above using method of graphical differentiation
4 To perform experiment on Watt governor to prepare performance characteristic curves, and to find stability & sensitivity.
5 To perform experiment on Porter Governor to prepare performance characteristic curves, and to find stability & sensitivity.
6 To perform experiment on Hartnell Governor to prepare performance characteristic curves, and to find stability & sensitivity.
7 To perform static & dynamic balancing on static balancing machine apparatus.
8 To study of various types of dynamometer
9 Study of universal gyroscope
10 To find out frequency of damped free vibration and rate of decay of vibration-amplitude in the system
To observe the phenomenon of 'whirl' in a horizontal light shaft and to determine the critical speed of the shaft.

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Programme: **B. Tech. (Mechanical Engineering)** **Semester -V**

Subject Title	Subject Code	Credits			Theory			Practical		
		L	T	P	External (70)	Internal (30)	Total (100)	External (35)	Internal (15)	Total (50)
Heat and Mass Transfer	MET-504	3	1	2			Min: 40 (D Grade)			Min: 20 (D Grade)

Duration of Theory (External): 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	**Basic Concepts:** Modes of heat transfer, Fourier's law, Newton's law, Stefan Boltzmann law; thermal resistance and conductance, analogy between flow of heat and electricity, combined heat transfer process; **Conduction:** Fourier heat conduction equation, its form in rectangular, cylindrical and spherical coordinates, thermal diffusivity, linear one dimensional steady state conduction through a slab, tubes, spherical shells and composite structures, electrical analogies, critical-insulation-thickness for pipes, effect of variable thermal conductivity. Numerical**.**
II	**Extended surfaces (fins):** Heat transfer from a straight and annular fin (plate) for a uniform cross section; error in measurement of temperature in a thermometer well, fin efficiency, fin effectiveness, applications; **Unsteady heat conduction:** Transient and periodic conduction, heating and cooling of bodies with known temperatures distribution, systems with infinite thermal conductivity, Response of thermocouples.
III	**Convection:** Introduction, free and forced convection; principle of dimensional analysis, Buckingham 'pie' theorem, application of dimensional analysis of free and forced convection, empirical correlations for laminar and turbulent flow over flat plate and tubular geometry; calculation of convective heat transfer coefficient using data book.
IV	**Thermal radiation**: Nature of radiation, emissive power, absorption, transmission, reflection and emission of radiation, Planck's distribution law, radiation from real surfaces; radiation heat exchange between black and gray surfaces, shape factor, analogical electrical network, radiation shields. **Boiling and condensation:** Film wise and drop wise condensation; Nusselt theory for film wise condensation on a vertical plate and its modification for horizontal tubes; boiling heat transfer phenomenon, regimes of boiling, boiling correlations.
V	**Heat exchangers**: Types- parallel flow, counter flow; evaporator and condensers, overall heat transfers coefficient, fouling factors, log-mean temperature difference (LMTD), method of heat exchanger analysis, effectiveness of heat exchanger, NTU method; **Mass transfer:** Fick's law, equi-molar diffusion, diffusion coefficient, analogy with heat transfer, diffusion of vapour in a stationary medium.

***Note: Use of HMT data book is permitted in exams**

References:

1. Heat Transfer – S.P. Sukhatme – Tata McGraw Hill
2. Heat Transfer – J.P. Holman – Tata McGraw Hill
3. Heat transfer- C P Arora, Tata McGraw Hill
4. Heat & Mass Transfer – K. Kannan – Anuradha Agencies
5. Heat Transfer – A Practical Approach–Yunus A. Cengel – McGraw Hill
6. Heat Transfer – Ghosh, Dastudhar – Oxford University Press
7. Heat & Mass Transfer – D.S. Kumar – S.K. Kataria & Sons.

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Programme: **B. Tech. (Mechanical Engineering)** **Semester -V**

List of Experiments:

1 To determine Thermal Conductivity of given metal rod
2 To study the transfer phenomenon and compare the performance of heat pipe with two geometrical similar pipes of copper and stainless steels
3 To measure the Emissivity of the test surface in comparison to black surface
4 To determine Forced convention heat transfer coefficient for flow through the given horizontal tube
5 To visualized the pool boiling over the heater wire in different regions up to the critical heat flux point at which the wire melts
6 To calibrate a thermocouple and find the corresponding curve-fit correlation
7 To determine the Stefan Boltzmann constant of radiant heat transfer
8 To determine the natural convection heat transfer coefficient for the vertical tube exposed to atmospheric air
9 To determine the Temperature difference (LMTD) and overall co-efficient of given Heat Exchanger
10 To determine Free convection from extended surfaces

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Subject Title	Subject Code	Credits			Theory			Practical		
		L	T	P	External	Internal	Total (100)	External	Internal	Total (50)
Turbo Machinery	MET- 505	3	1	2	(70)	(30)	Min: 40 (D Grade)	(35)	(15)	Min: 20 (D Grade)

Duration of Theory (External): 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	**Introduction to Turbo Machinery**: Basic principles, Classification, Impulse & Reaction type, Fundamental equations, Euler's equation, Impulse momentum principle, Force exerted by the jet on stationary flat and curved plate, degree of reaction. **Fluid system:** Hydraulic accumulator, Hydraulic intensifier, Hydraulic Press, Hydraulic crane, Hydraulic lift, Hydraulic Ram, Hydraulic coupling, Hydraulic torque converter, Air lift pump.
II	**Hydraulic Turbines:** Classification layout of hydraulic power plant, Different efficiencies, velocity triangles, design parameters, Maximum efficiency of, Pelton turbine, Francis turbine, Kaplan and Propeller turbines, Draft tubes- Types and functions, characteristic curve of hydraulic turbines, specific speed, governing of turbines. Numerical.
III	**Steam Turbine :** Principle and working of impulse and reaction turbines, pressure and velocity compounding, Velocity triangles for various types, stage efficiency, diagram efficiency, steam speed to blade speed ratio for optimum performance, losses in steam turbines, performance at part loads, governing of turbines. Numerical.
IV	**Centrifugal Pumps:** Classification and parts of centrifugal pump, different heads and efficiencies of centrifugal pump, Minimum speed for starting the flow, Maximum suction lift, Net positive suction head, characteristic curve of centrifugal pump, Cavitations, Need for priming. Numerical.
V	**Compressors:** Centrifugal Compressors**:** Stage velocity triangles, slip factor, power input factor, Stage work, Pressure developed, stage efficiency and surging and problems, Axial flow Compressors: Expression for pressure ratio developed in a stage, work done factor, efficiencies & stalling. Numerical.

References:

1. Mechanics of Fluid – Massey B.S. – English Language Book Society (U.K.)
2. Hydraulic Machines - Jagdish Lal – S.K. Kataria & Sons
3. Introduction to Fluid Mechanics and Fluid Machines – S.K. Som & G. Biswas - TMH
4. A text of Fluid Mechanics – R. K. Rajput – S. Chand & Company Ltd.
5. Fluid Mechanics and Fluid Power Engineering – D.S. Kumar– Kataria & Sons
6. Hydraulics and Fluid Mechanics – Modi P.N, Seth S.M. – Standard Book House

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List of Experiments (Expandable/Suggested):

1. To study the constructional details of a Pelton turbine and draw its fluid flow circuit.
2. To draw the following performance characteristics of Pelton turbine-constant head, constant speed and constant efficiency curves.
3. To study the constructional details of a Francis turbine and draw its fluid flow circuit.
4. To draw the constant head, constant speed and constant efficiency performance characteristics of Francis turbine.
5. To study the construction details of a Kaplan turbine and draw its fluid flow circuit.
6. To draw the constant head, speed and efficiency curves for a Kaplan turbine.
7. To study the constructional details of a Centrifugal Pump and draw its characteristic curves.
8. To study the constructional details of a Reciprocating Pump and draw its characteristics curves.
9. To study the construction details of a Gear oil pump and its performance curves.
10. To study the constructional details of a Hydraulic Ram and determine its various efficiencies.
11. To study the constructional details of a Centrifugal compressor.
12. To study the model of Hydro power plant and draw its layout

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Subject Title	Subject Code	Credits			Practical		
		L	T	P	External (35)	Internal (15)	Total (50)
Metal Cutting Workshop	MET- 506	-	-	2			Min: 20 (D Grade)

Practical Internal - Max Marks: 15

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

List of Experiments (Expandable/Suggested):

1. To make a job on mild steel rod on lathe.
2. To study the characteristic features of Shaper.
3. To study the characteristic features of planer
4. To study of drilling machine
5. To study of grinding machine.
6. To study the characteristic features of milling machine.
7. To study the characteristic features of unconventional machine.
8. Study of G Codes & M codes.

List of Experiments/ Programs:

Experiment/Programs to be performed based on the topics contained in the syllabus.

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Subject Title	Subject Code	Credits			Practical		
		L	T	P	External	Internal	Total (50)
Mechanical Engineering Software Lab – II	MET-507	-	-	2	(Nil)	(50)	Min: 20 (D Grade)

Practical Internal - Max Marks: 50

Lab work & Sessional – Max Marks: 25
Assignment / Quiz – Max. Marks: 25

Contents (Practical)
MATLAB
Introduction: Introduction to MATLAB, Study of MATLAB programming environment, Modeling, Design and development of Program. The following contents beginning with a broad overview of MATLAB.
Basic MATLAB: The MATLAB Workspace, Working with Vectors, Working with Matrices, Solving Systems of Linear Equations, Working with Loops, Working with Plots.
Statics and Structures: Computing reaction forces acting on a truss, Computing reaction internal shear force and bending moment. **Fluid Mechanics**: Solving for the friction coefficient, Computing the head loss for flow through a pipe. **Heat Transfer:** Analyzing the ice build-up on a body of fluid. **Dynamics:** Modeling a damped spring-mass system using Simulink, The logistic equation.

References:

http://www.colorado.edu/MCEN/programs/undergraduate/matlab_tutorials/

List of Experiments/ Programs:

Programs to be performed based on the topics contained in the syllabus.

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Programme: **B. Tech. (Mechanical Engineering)** **Semester -V**

Subject Title	Subject Code	Credit			Practical		
		L	T	P	External	Internal	Total (50)
Industrial Training-I	MET-508	-	-	2	(Nil)	(50)	Min: 20 (D Grade)

Practical internal - max marks: 50

Assignment /quiz – Max Marks: 50

Duration: 2 weeks after the IVsemester in the summer break. Assessment in V semester.

Marks of various components in industry should be awarded to the student, in consultation with the Training and Placement Officer (TPO)/ faculty of the institute, who must establish contact with the supervisor/ authorities of the organization where, students have taken training, to award the marks for term work. During training, students will prepare a first draft of the training report in consultation with the section in charge. After training they will prepare final draft with the help of the TPO / faculty of the institute. Then, they will present a seminar on their training and will face viva-voce on training in the institute.