SCHEME OF INSTRUCTION & EXAMINATION

B.E. IIIrd YEAR
(PRODUCTION ENGINEERING)

SEMESTER - I

Sl. No.	Syllabus Ref. No.	SUBJECT	Scheme of Instruction		Scheme of Examination		
			Periods per week		Duration In Hours	Maximum Marks	
			L	D/P		Univ. Exam	Sessionals
		THEORY					
1.	MP 301	Applied Thermodynamics & Heat Transfer	4	-	3	75	25
2.	ME 302	Dyanmics of Machines	4	-	3	75	25
3.	ME 303	Design of Machine Elements	4	-	3	75	25
4.	MP 303	Machine Tool Engineering	4	-	3	75	25
5.	MP 304	Metal Forming Technology	4	-	3	75	25
		PRACTICALS					
1.	MP 331	Applied Thermodynamics & Heat Transfer Lab.	-	3	3	50	25
2.	MP 332	Machine Tool Engineering Lab.	-	3	3	50	25
3.	MP 333	Metal Forming Technology Lab	-	3	3	50	25
		Total	**20**	**9**	--	**525**	**200**

MP 301
APPLIED THERMODYNAMICS & HEAT TRANSFER

Instruction	4	Periods per week
Duration of University Examination	3	Hours
University Examination	75	Marks
Sessional	25	Marks

UNIT-I

Reciprocating Air Compressors: Single stage and multi stage compressors, work done, Efficiency of multi stage compression. Effect of clearance volume on work done and efficiency. After cooling and inter cooling. Uses of compressed air.

UNIT-II

Internal Combustion Engines: Classification, Working principles. Deviation of actual cycles from air standard cycles, Index of compression and expansion for variable specific heats, Performance of I.C. engines-Determination of Indicated power, brake power, frictional power, brake thermal efficiency, mechanical efficiency, indicated thermal efficiency, relative efficiency, volumetric efficiency, specific fuel consumption based on brake power and indicated power, Heat balance sheet .

UNIT-III

Combustion Phenomena: Combustion Phenomena in Spark ignition and compression ignition engines, Detonation, Knocking, effect of engine variables on combustion; Working principle of simple and zenith carburetors, fuel pump and fuel injectors, Cooling and Lubrication systems of Internal Combustion Engines, Types of combustion chambers in SI and CI engines along with merits and demerits.

UNIT-IV

Modes of heat transfer: Laws of heat transfer - Fourier, Newton, Stefan-Boltzmann General conduction equation in Cartesian, cylindrical coordinates, One dimensional steady state conduction through slabs, hollow cylinders and spheres with and without heat generation, Effects of

variable thermal conductivity in heat transfer of one dimensional steady state conduction of plates, cylinders Steady state heat transfer through composite slabs and cylinders, Critical radius of insulation.

UNIT-V

Convection: Dimensional analysis and its use in free and forced convection, Buckingham theorem, Physical significance of different dimensionless numbers.

Radiation: Definition of absorptivity, reflectivity and transmissivity, Concept of black-body and emissivity. Kirchoff's law, Planck's black body spectral distribution, Wien's and Steffan Boltzmann law.

Heat Exchangers: Classification, Simple problems on parallel flow and Counter-flow heat exchangers with LMTD concept.

Suggested Reading:

1. Ganeshan, V., " *Internal Combustion Engines*", Tata Mcgraw Hill Publishing, New Delhi, 2004
2. Ballaney, P.L., "*Thermal Engineering*", Khanna Publishers, New Delhi, 2004
3. Rajput, R. K.,"*Thermal Engineering*", Laxmi Publishers, New Delhi, 2004
4. Holman, J.P., "*Heat Transfer*", McGraw Hill Publication, New Delhi, 2004
5. Sachdeva,R.C., "*Fundamentals of Engineering Heat and Mass Transfer*", New Age International (P) Ltd Publishers, New Delhi, 2004

ME 302

DYNAMICS OF MACHINES

Instruction	4	Periods per week
Duration of University Examination	3	Hours
University Examination	75	Marks
Sessional	25	Marks

UNIT-I

Static and Dynamic: Force analysis of Four bar and slider crank mechanisms. Study of dynamically equivalent system, Inertia forces on connecting rod..

Gyroscope: Gyroscopic couple, gyroscopic effects in vehicles.

UNIT-II

Governors: Classification of governors, Watt, Porter, Hartnell and Hartung governors, Controlling Force, Stability, Isochronism, Sensitivity, Power and Effort of governors.

Flywheels: Functions, Differences between flywheel and governor. Turning moment diagrams, flywheel analysis for I.C. Engines and Presses.

UNIT-III

Forces: Forces on bearings due to rotating shaft carrying several masses in several planes. Determination of balance masses from the forces on the bearings, Shaking forces in single cylinder engine, Partial balancing of reciprocating engine. Balancing of two cylinder locomotive engine. Balancing of multi cylinder in-line engines. Balancing of radial engines by direct and reverse cranks method.

UNIT-IV

Vibrations: Vibrations of Single degree freedom system (axial, transverse and torsional). Equivalent system of combination of springs, stepped shaft, whirling speed of shafts.

Damped vibrations: Types of damping, Vibrations with viscous damping.

Forced vibrations: Vibrations with harmonically applied force with viscous damping. Dynamic magnifier, Resonance, Vibration isolation and Transmissibility.

UNIT-V

Torsional: Torsional Vibrations of Two rotor, Three rotor and Geared systems. Natural frequencies of two degree freedom systems. Modes of vibration. Approximate methods for determining natural frequencies: Dunkerley's method, Rayleigh's method and Holzer's method for multi rotor system.

Suggested Reading:

1. S.S. Rattan, *"Theory of Machines"*, Tata McGraw Hill, Tata McGraw Education Pvt. Ltd., New Delhi 2010.
2. Thomas Bevan, *"The Theory of Machines"*, CBS Publishers & Distributors.
3. John J. Uicker, Jr., Gordon R. Pennock, Joseph E. Shigley, *"Theory of Machines and Mechanisms"*, Oxford University Press, 2003.
4. J.S. Rao and Gupta, *"Theory and Practice of Mechanical Vibrations"*, Prentice Hall, 1984.
5. R.L. Norten, *"Kinematics and Dynamics of Machinery"* Tata McGraw Education Pvt. Ltd., New Delhi 2009.

ME 303

DESIGN OF MACHINE ELEMENTS

Instruction	4	Periods per week
Duration of University Examination	3	Hours
University Examination	75	Marks
Sessional	25	Marks

UNIT-I

Design considerations of Machine Elements. Materials used in machine design and their specifications according to Indian Standards. Codes and standards used in design. Important mechanical properties of materials used in design. Preferred numbers. Manufacturing considerations in design. Review of types of loads and simple stresses. Stresses due to Biaxal andTriaxal loads. Factor of safety. Theories of failures. Design of components subjected to impact loading.

UNIT-II

Design for Fatigue: Fluctuating stresses, fatigue strength and endurance limit Stress concentration factor and Notch sensitivity. Factors affecting fatigue strength. S-N diagram, Soderberg and Modified Goodman's diagrams for fatigue design. Cumulative fatigue - Miner's rule.

UNIT-III

Design of shafts: solid, hallow and splined shafts under torsion and bending loads. Design of keys. Design of couplings - Muff, Split muff, Flange, Flexible, Marine type couplings.

UNIT-IV

Design of Joints: Cotter and Knuckle joints. Design of pulleys. Design of chain drives linked and laminated chains. Design of bolts and nuts, Locking devices for nuts, Bolts of uniform strength. Bolted joints under eccentric loads. Design of gasket joints.

UNIT-V

Design of Screws: Design of power Screws and screw jack. Differential and Compound Screws. Design of rivetted and welded joints under direct and eccentric loads.

Suggested Reading:

1. M.F. Spotts, "*Design of Machine Elements*", Pearson Edu, 7th edn. 2003.
2. V. B. Bhandari, "*Design of Machine Elements*", Tata McGraw-Hill Publ, 3rd Edn. 2010.
3. P.C. Sharma & D.K. Aggarwal, *"Machine Design"*, S.K. Kataria & Sons, 10th edn, 2003.
4. P. Kannaiah, *"Machine Design"*, Sci-Tech Publ., 2009.
5. J.E. Shigley & Charles R. Mischke "*Mechanical Engineering Design*", Tata McGraw-Hill., 6th ed. 2010.

MP 303

MACHINE TOOL ENGINEERING

Instruction	4 Periods per week
Duration of University Examination	3 Hours
University Examination	75 Marks
Sessional	25 Marks

UNIT-I

Orthogonal and oblique cutting: Cutting forces in turning, drilling, milling and grinding. Merchant's analysis, Shear angle, friction angles. Experimental methods for estimation of shear angle, cutting forces and power of chips. Built up edge phenomena and its effects. Chip breakers. Sources of heat, its distribution and measurement. Different types of cutting fluids.

UNIT-II

Tool wear and tool life: Criteria for tool wear, flank and crater wear theories, criteria for tool life in roughing and finishing, Measurement of tool wear, Taylor's tool life equation, factors effecting tool life, Machinability. Single point cutting tool design: Geometry, tool nomenclature, American, DIN, max. rake system. Interrelation between normal rake and orthogonal rake, tool signature, effect of basic tool angles on its performance. Selection of size and angles of S.I.Tools, form tools. Design feature of multi point cutting tools.

UNIT-III

Outline of cutting forces involved and kinematic scheme for each type of machine tool.

Lathe: Types of constructional features, size of lathe, various operations that can be performed on lathe. Capstan and Turret lathes, Bar work and chuck work and tool holding devices, **thread production:** Taps and dies, chaser, thread rolling and thread cutting machines.

Drilling Machines: Types and constructional features, and applications.

UNIT-IV

Boring Machines: Types and constructional features of **Milling machines**: Classification and types, various operations on milling machines, Up and Down milling. Types of milling cutters and bars. Dividing head and its application, single and differential indexing. **Gear cutting machines:** Methods of gear cutting, Types and classification of gear hobbing and gear shaping machines, Bevel gear cutting.

Shaping, Planning & Slotting Machines: Types, Constructional features, Types of work done on it. Quick return motion, manipulation of cutting speeds and feeds, work and tool holding devices, comparison of these machines.

UNIT-V

Grinding machines: Types, Classification. Abrasives and bonds used for grinding wheel, Selection of grinding wheel.

Computer Aided Manufacturing: Features of NC, Positional, paraxial and contouring types. Manual part programming-G and M codes, Canned cycles. Introduction to APT and Types of Statements. Introduction to CNC, DNC, Adaptive Control Systems, Group Technology-Part families, CAPP, FMS and CIMS.

Suggested Reading:

1. P.N.Rao *"Manufacturing Technology (Metal Cutting & Machine Tools)"*, Tata McGraw Hill Book Company, 2010.
2. B.I. Juneja and Shekon, *"Fundamentals of Metal Cutting & Machines Tools"*, Wiley Eastern Ltd., 1987.
3. M.C.Shaw, *"Metal Cutting Principles"*, Clarendon Press, Oxford, 1984.
4. Hazara Choudary, *"Workshop Technology"*, Vol. II, Media Publ. New Delhi.
5. Yoram Koren, *"Computer Control of Manufacturing Systems"*, McGraw Hill Int, New York, 1994.

MP 304

METAL FORMING TECHNOLOGY

Instruction	4	Periods per week
Duration of University Examination	3	Hours
University Examination	75	Marks
Sessional	25	Marks

UNIT-I

Theory of Plastic deformation: Crysto plasticity and thermo plasticity, work hardening of metals, plasticity cycle. Advantages and disadvantages of cold working and hot working. Stress strain relations, Yielding criteria, Yielding under uni-axial, bi-axial and tri-axial states of stress. Plane stress and plane strain conditions, examples.

UNIT-II

Sheet metal working: Classification of presses, specifications and their applications.. Sheet metal working operations-shearing, blanking, piercing, bending, drawing and squeezing operations, estimation of loads and energy required for these operations. Simple, compound, progressive and combinational tools.

UNIT-III

Drawing and Extrusion: Loads required for drawing and extrusion. Homogenous deformation. Maximum reduction in drawing and extrusion, effect of friction, Die angles, Deformation speeds, die materials and lubrication in these operations. Stretch forming, spinning and flow forming.

UNIT-IV

Forging: Methods of heating and furnaces. Open and closed die forging. Hammers, presses and forging machines, their principles of operation and applications. Examples, of the design of the forging dies for drop forging, Machine forging and press forging. Isothermal forging and hot isostatic pressing.

UNIT-V

Rolling: Principle of metal rolling, Classification and description of rolling equipment and rolling mills. Roll load, roll torque and mill power following

homogenous deformation technique. Rolling procedure for typical shapes. Powder rolling and Roll bending.

Suggested Reading:

1. Serope Kalpakjian, *"Manufacturing Engineering and Technology"*, Addison-Wesley Publishing Company.
2. George.E. Dieter, *"Mechanical Metallurgy"*, SI Metric Edition, McGraw-Hill Book Company.
3. Jain, R.K and Gupta, S.C., *"Production Technology"*, Khanna Publications, 1995.
4. RoyA. Liudberg, *"Materials and Processes of Manufacture"*, Prentice Hall of India, 1995.
5. P.N. Rao, *"Manufacturing Technology"*, Tata McGraw Hill Publ., 2nd edition, 1990.

MP 331

APPLIED THERMODYNAMICS & HEAT TRANSFER LAB

Instruction	3	Periods per week
Duration of University Examination	3	Hours
University Examination	50	Marks
Sessional	25	Marks

1. Applied Thermodynamics
2. Determination of Valve/Port timing diagram of an IC engine
3. Determination of Performance characteristics of a multi-cylinder petrol engine
4. To conduct Morse test on multi cylinder petrol engine
5. Determination of Performance characteristics of two-stroke petrol engine
6. To conduct performance test on a variable compression ratio petrol engine
7. To conduct performance test on diesel engine
8. To determine volumetric efficiency, isothermal efficiency of multi-stage reciprocating air compressor
9. Heat Transfer
10. Determination of Thermal conductivity of metal bar
11. Determination of convective heat transfer coefficient under Natural/ Forced convection phenomena
12. Determination of Heat transfer coefficient in parallel and counter flow heat exchanger.
13. Determination of Emissivity of a given plate.
14. Determination of the value of Stefan-Boltzman constant.
15. Determination of thermal conductivity of composite wall

MP 332

MACHINE TOOL ENGINEERING LAB

Instruction	3	Periods per week
Duration of University Examination	3	Hours
University Examination	50	Marks
Sessional	25	Marks

1. Study of various types of machine tools, their working principles and main operational characteristics.
2. Turning and facing, step-turning operations on lathe machine.
3. Taper turning and knurling operations.-
4. Thread cutting operation.
5. Measurement of cutting forces during machining on lathe machine, milling machine, grinding machine and drilling machine.
6. Measurement of tool-chip interface temperatures using thermocouple method.
7. Cutting gear teeth using a) simple indexing b) compound indexing and c) Differential indexing.
8. Machining of slots, grooves and flat shapes using slotting and shaping machines.
9. Grinding of tool angles using tool and cutter grinder.
10. Conducting tool life tests and finding the index of equation for HSS and Carbide tools.
11. Finding shear angle experimentally in any machining operations.
12. Grinding of flat surfaces using surface grinding machine and measurement of its surface finish using Talysurf.
13. Practice of PCD drilling, counter sinking and tapping.
14. Exposure to operations like Trepanning, Lapping, Honing, Broaching and Buffing.

MP 333

METAL FORMING TECHNOLOGY LAB

Instruction	3	Periods per week
Duration of University Examination	3	Hours
University Examination	50	Marks
Sessional	25	Marks

1. Evaluation of True-Stress and Tue - Strain characteristics of Ferrous and Non Ferrous metals in a tensile test.
2. Studying the normal anisotropy characteristics of materials.
3. Evaluation of formability of sheet metals in Erichsen Cupping test.
4. Study of simple dies and performing blanking and piercing operations using, mechanical presses and measurement of forces in the operation and comparing with the theoretical loads.
5. Study of compound die and production of a typical component on the same.
6. Study of progressive die and production of a typical component on the same.
7. Study of combination die and production of a cup on the same.
8. Drawing operation to produce cup in a hydraulic press and measurement of load during the operation and comparing with the theoretical loads.
9. Demonstration of wire drawing operation.
10. Demonstration of extrusion of lead material.
11. Forging practice.
12. Sheet metal's die operations for bending.
13. Computer simulation of typical forming operations.
14. Spinning/flow forming exercises.