

B.E. (PTDC) Mechanical Engineering
SEMESTER – VI

BRANCH	SUBJECT TITLE	SUBJECT CODE	Period per week			
			L	T	P	C
B.E. PART TIME MECHANICAL	Energy Conversion System -III	PTME-601	3	1	--	4

Commercial Energy Scenario: Review of energy sources, present energy consumption/utilization pattern sector-wise in India, environmental impact of fossil fuels, growth of energy sector and its planning in India

Solar Energy : Solar radiation at the earth's surface, solar radiation measurements, estimation of average solar radiation, solar thermal flat plate collectors, concentrating collectors, solar thermal applications; heating, cooling, desalination, drying, cooking, etc, principle of photovoltaic conversion of solar energy, types of solar cells, photovoltaic applications.

Wind Energy: Power in the wind, Betz limit, site selection, wind energy conversion devices, characteristics, applications, offshore wind energy, Hybrid systems, safety and environmental aspects, wind energy potential and installation in India.

Bio-Energy: Biomass resources and their classification, biomass conversion processes, thermo chemical conversion, biomass gasification, pyrolysis and liquefaction, biochemical conversion, anaerobic digestion, alcohol production from biomass, bio diesel production, urban waste to energy conversion, biomass energy programs in India.

Other Types of Renewable Energy: Principle of ocean thermal energy conversion (OTEC), ocean thermal power plants, ocean wave energy conversion, tidal energy conversion, geothermal energy, geothermal power plants, hydrogen & fuel cell - sources of energy

Reference Books:

1. Solar Energy: Principles of Thermal Collections and Storage by Sukhatme, S.P., McGraw Hill Publishing Co.
2. J. A. Duffie and W. A. Beckman, Solar Engineering of Thermal Process, 2nd Ed., John Wiley, New York
3. Soteris A. Kalogirou, Solar Energy Engineering – Process and Systems, Academic Press
4. Twidell, J.W. and Weir, A., Renewable Energy Sources, EFN Spon Ltd.
5. Kishore VVN, Renewable Energy Engineering and Technology, Teri Press, New Delhi
6. Bent Sorensen, Renewable Energy, Elsevier Academic Press, 3rd Edition
7. Peter Gevorkian, Sustainable Energy Systems Engineering, McGraw Hill
8. D. Y. Goswami, F Kreith and J. F. Kreider, Principles of Solar Engineering, Taylor and Francis, Philadelphia 9. Godfrey Boyle, Renewable Energy, Power for a Sustainable Future, Oxford University Press, U.K.

Course Outcome:

After learning the course the students should be able to:

1. Understand the basic concept of renewable energy engineering.
2. Acknowledge, access and analysis various renewable energy system & technology.
3. Evaluate renewable energy related system for a particular application

BRANCH	SUBJECT TITLE	SUBJECT CODE	Period per week			
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B.E. PART TIME MECHANICAL	Turbo Machinery	PTME-602	3	1	2	6

Unit I: Energy transfer in turbo machines:

application of first and second laws of thermodynamics to turbo machines, moment of momentum equation and Euler turbine equation, principles of impulse and reaction machines, degree of reaction, energy equation for relative velocities, one dimensional analysis only.

Unit II: Steam turbines:

impulse staging, velocity and pressure compounding, utilization factor, analysis for optimum U.F Curtis stage, and Rateau stage, include qualitative analysis, effect of blade and nozzle losses on vane efficiency, stage efficiency, analysis for optimum efficiency, mass flow and blade height. **Reactions staging:** Parson's stages, degree of reaction, nozzle efficiency, velocity coefficient, stator efficiency, carry over efficiency, stage efficiency, vane efficiency, conditions for optimum efficiency, speed ratio, axial thrust, reheat factor in turbines, problem of radial equilibrium, free and forced vortex types of flow, flow with constant reaction, governing and performance characteristics of steam turbines.

Unit III: Water turbines:

Classification, Pelton, Francis and Kaplan turbines, vector diagrams, and work-done, draft tubes, governing of water turbines. **Centrifugal Pumps:** classification, advantage over reciprocating type, definition of mano-metric head, gross head, static head, vector diagram and work done. **Performance and characteristics:** Application of dimensional analysis and similarity to water turbines and centrifugal pumps, unit and specific quantities, selection of machines, Hydraulic, volumetric, mechanical and overall efficiencies, Main and operating characteristics of the machines, cavitations.

Unit IV: Rotary Fans, Blowers and Compressors:

Classification based on pressure rise, centrifugal and axial flow machines.

Centrifugal Blowers Vane shape, velocity triangle, degree of reactions, slip coefficient, size and speed of machine, vane shape and stresses, efficiency, characteristics, fan laws and characteristics. **Centrifugal Compressor** – Vector diagrams, workdone, temp and pressure ratio, slip factor, work input factor, pressure coefficient, Dimensions of inlet eye, impeller and diffuser. **Axial flow Compressors** – Vector diagrams, work done factor, temp and pressure ratio, degree of reaction, Dimensional Analysis, Characteristics, surging, Polytrophic and isentropic efficiencies.

Unit V: Power Transmitting turbo machines:

Application and general theory, their torque ratio, speed ratio, slip and efficiency, velocity diagrams, fluid coupling and Torque converter, characteristics, **Positive displacement machines** and turbo machines, their distinction. Positive displacement pumps with fixed and variable displacements, **Hydrostatic systems** hydraulic intensifier, accumulator, press and crane.

References:

1. Venkanna BK; turbomachinery; PHI
2. Shepherd DG; Turbo machinery
3. Csanady; Turbo machines
4. Kadambi V Manohar Prasad; An introduction to EC Vol. III-Turbo machinery; Wiley Eastern Delhi
5. Bansal R. K; Fluid Mechanics & Fluid Machines;
6. Rogers Cohen & Sarvan Multo Gas Turbine Theory
7. Kearton W. J; Steam Turbine: Theory & Practice

BRANCH	SUBJECT TITLE	SUBJECT CODE	Period per week			
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B.E. PART TIME MECHANICAL	Industrial Engg. & Operation research	PTME-603	3	1	2	6

Introduction: Definition of industry and industrial engineering, scope and role of industrial engineering fields of applications.

Productivity:

Production and productivity, production systems and their impact on productivity, its significance and benefits of higher productivity. Long term and short term factors affecting productivity, productivity cycle.

Work Study:

Introduction, its relation with productivity aims, objectives and application of work study, basic procedure and techniques of work study . Human factors in work study. Role of manager, supervisor and workers.

Working conditions, environment of industry affecting work study. Method Study:

Definition objectives, basic procedures of methods study. Recording techniques, operation process chart, flow process chart, machine chart, flow diagrams, string diagrams, two hand process charts, questioning technique procedure to develop, install and maintain new methods. Principles of Motion Economy:

Meaning, basic rules design of efficient work place- layout, classification of human body movements and their preferred order.

Material Handling and Plant

Layout Importance and its effects on productivity, requirements of good material handling system, classification and selection of material handling equipment. Requirements of good layout. Effect of bad layout, Factors affecting plant layout, types of layout, advantages and limitations of each type of layout selection of layout, factors affecting the plant location. Micro Motion Study:

Definition and objectives, techniques of micromotion study, therbligs and their symbols, use of therbligs, SIMO chart and its application.

Work Measurement:

Definition, Basic procedure and technique to work measurement. Stop watch time study, types of stop watch study, factors considered in selecting a job for time study, qualified and representative workers, procedure of stop watch time study, job element and their need of identification, general rules for breakdown of job into elements, work cycle, methods of time measurement, performance rating, its meaning, standard rating, rating of operators, conditions for operators variation at work place rating scales, rating factors, calculation of basic time. Allowances- purpose, types. Calculation of standard time synthesis Method- meaning, data, complication, advantages and limitations.

Linear system and distribution models: Mathematical formulation of linear systems by LP, solution of LP for two variables only, special cases of transportation and assignment and its solution, Vogel s forward looking penalty method, cell evaluation degeneracy, use of SW Lindo, Tora, Excell.

LIST OF EXPERIMENTS: S.No.

EXPERIMENT PRACT.

1. Preparation of flow process chart for existing and improved process.
2. Preparation of man and machine chart for existing and improved process.
3. Preparation of L.H. and R.H. charts for existing and improved process.
4. Use of decimal minute watch.
5. Performance rating.
6. Establishing standard time for given operation using time study techniques.
7. Use of Shewharts bowl and actual production for frequency distribution.
8. Preparation of X and R charts.
9. Preparation of p- chart and c- chart.

10. Work measurement using MOST.
11. Acceptance sampling by attributes (single and double sampling plans)
12. Determination of the percentage utilization of equipment (work sampling) .
13. Application of principals of motion economy.

1. Introduction To Industrial Engineering by Philip Hicks (McGraw Hills).
2. Productivity Means Property (Asian Productivity Organisation, Tokyo).
3. Introduction To Work Study (International Labour Office).
4. Work Study by M.D. Schmid & Subrammaniam.
5. Motion and Time Study by Ralph M. Barnes John Willey New York.
6. Work Study by Dalela. 7. Wage Administration by D.K. Roy. (N.P.C. Publication).
8. Quality Assurance Engineering by M.D. Schmid & Subramaniam.
9. S.Q.C. by E.L.Grant.
10. S.Q.C. by R.C. Gupta.
11. Industrial Engineering & Management by O. P. Khanna.
12. Industrial Engineering by Saxena.
13. MOST Work Measurement Systems, Kjell B. Zandin, Marcel Dekkar Inc. New York
14. Material Handling Equipment (N. Rudenki Place Pub).
15. Learning Package In Industrial Engineering by O.D.C. , T.T.T.I Bhopal .
16. Laboratory Manual Industrial Engineering by O.D.C. , T.T.T.I Bhopal .
17. Audyogiki Abhiyantran (Hindi) by J.C. Varshneya. (Deepak Prakashan, Gwalior).
18. Audyogik Engineering (Hindi) by K.D. Saxena . (Deepak Prakashan, Gwalior).

BRANCH	SUBJECT TITLE	SUBJECT CODE	Period per week			
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B.E. PART TIME MECHANICAL	Automobile Engineering	PTME-604	3	1	2	6

Unit-I: Chassis & Body Engg: Types, Technical details of commercial vehicles, types of chassis, lay out, types of frames, testing of frames for bending & torsion on unutilized body frame, vehicle body and their construction, driver s visibility and methods for improvement, safety aspects of vehicles, vehicle aerodynamics, optimization of body shape, driver s cab design, body materials, location of engine, front wheel and rear wheel drive, four wheel drive.

Unit-II: Steering System: front axle beam, stub axle, front wheel assembly, principles of types of wheel alignment, front wheel geometry viz. camber, Kingpin inclination, castor, toe-in and toeout, condition for true rolling motion, centre point steering, directional stability of vehicles, steering gear, power steering, slip angle, cornering power, over steer & under steer, gyroscopic effect on steering gears.

Unit-III: Transmission System: Function and types of clutches, single plate, multi-plate clutch, roller & spring clutch, clutch lining and bonding, double declutching, types of gear Boxes, synchroniser, gear materials, determination of gear ratio for vehicles, gear box performance at different vehicle speed, automatic transmission, torque converters, fluid coupling, principle of hydrostatic drive, propeller shaft, constant velocity universal joints, differential gear box, rear axle construction.

Unit-IV: Suspension system : Basic suspension movements, Independent front & rear suspension, shock absorber, type of springs: leaf spring, coil spring, air spring, torsion bar, location of shackles, power calculations, resistance to vehicle motion during acceleration and breaking, power & torque curve, torque & mechanical efficiency at different vehicle speeds, weight transfer, braking systems, disc theory, mechanical, hydraulic & pneumatic power brake systems, performance, self-energisation, airbleeding of hydraulic brakes, types of wheels and tyres, tyre specifications, construction and material properties of tyres & tubes.

Unit-V: Electrical and Control Systems: storage battery, construction and operation of lead acid battery, testing of battery, principle of operation of starting mechanism, different drive systems, starter relay switch, regulator electric fuel gauge, fuel pump, horn, wiper, Lighting system, head light dazzling, signaling devices, battery operated vehicles, choppers. importance of maintenance, scheduled and unscheduled maintenance, wheel alignment, trouble Shooting probable causes & remedies of various systems, microprocessor based control system for automobile, intelligent automobile control systems.

Unit-VI: Emission standards and pollution control: Indian standards for automotive vehicles- Bharat I and II, Euro-I and Euro-II norms, fuel quality standards, environmental management systems for automotive vehicles, catalytic converters, fuel additives, and modern trends in automotive engine efficiency and emission control.

References:

1. Crouse , Automotive Mechanics TMH.
2. Srinivasan S; Automotive engines; TMH
3. Gupta HN; Internal Combustion Engines; PHI;
4. Joseph Heitner, Automotive Mechanics, Principles and Practices, CBS Pub.
5. Kripal Singh, Automotive Engineering Khanna Pub.
6. Newton & Steeds , Automotive Engineering
7. Emission standards from BIS and Euro I and Euro-III

List of experiments (please expand it):

Study of chassis, suspension, steering mechanisms, transmission, gear-box, differential systems, and electrical systems of various light and heavy automotive vehicles;

BRANCH	SUBJECT TITLE	SUBJECT CODE	Period per week			
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B.E. PART TIME MECHANICAL	Minor Project	PTME-605	-	-	2	2

Minor Project

Provision of Minor project is made as preparation phase-I for major project or to take it as an Independent small project. For details of project see PTME-804-Major project