



**Shivaji University, Kolhapur**  
**REVISED SYLLABUS FOR B.E. (AUTOMOBILE)**  
**COURSE STRUCTURE**

**CLASS : T.E. (Automobile) Revised (To be introduced from July 2004) PART – I**

Sr. No	Name of the subject	Teaching Scheme				Examination Scheme			
		L	P	Dr	Total	TH	TW	P/O	Total
1	Automobile Engines– I	3	2	-	5	100	25	25	150
2	Automobile Systems – I	3	2	-	5	100	25	25	150
3	Theory of Machines – II	3	2*	-	4	100	25	-	125
4	Machine Design	3	-	2*	4	100	25	-	125
5	Metrology & Quality Control	3	2	-	5	100	25	-	125
6	Industrial Organization & Management	3	-	-	3	100	-	-	100
7	Machine Shop	-	2	-	2	-	25	-	25
8	CAD/CAM Laboratory – I	-	2	-	2	-	25	-	25
	<b>Total</b>	<b>18</b>	<b>11</b>	<b>01</b>	<b>30</b>	<b>600</b>	<b>175</b>	<b>50</b>	<b>825</b>

\* Practicals will be conducted alternate weeks

**CLASS : T.E. (Automobile) Revised PART – II**

Sr. No	Name of the subject	Teaching Scheme				Examination Scheme			
		L	P	Dr	Total	TH	TW	P/O	Total
1	Automobile Engines – II	3	2	-	5	100	25	25	150
2	Automobile Systems – II	3	2*	-	4	100	25	-	125
3	Mechanical Measurement & Control	3	2	-	5	100	25	-	125
4	Heat Transfer	3	2*	-	4	100	25	-	125
5	Automobile System Design	3	-	2	5	100	50	25	175
6	Turbo machinery	3	2*	-	4	100	25	-	125
7	Garage Practice	-	2*	-	1	-	25	#25	50
8	CAD/CAM Laboratory – II	-	2	-	2	-	25	**25	50
9	@ Industrial Case Study	-	-	-	-	-	-	-	-
	<b>Total</b>	<b>18</b>	<b>10</b>	<b>02</b>	<b>30</b>	<b>600</b>	<b>225</b>	<b>100</b>	<b>925</b>

\* Practicals will be conducted alternate weeks

@ Industrial case study to be carried out after T.E. Part – II in vacation and its evaluation will be carried out in B.E. Part – I

\*\* Oral examination will be based on CAD/CAM Laboratory I & II

# Combined Practical / Oral examination of Auto. Systems – II and Garage Practice



# Shivaji University, Kolhapur

## REVISED SYLLABUS FOR B.E. (AUTOMOBILE)

### T. E. (Automobile) Revised Part – I

#### 1. AUTOMOBILE ENGINES - I

Teaching scheme :  
Lectures: 3hrs/week  
Practical: 2hrs/week

Examination scheme :  
Theory paper: 100 marks (3 hrs duration)  
Term work : 25 marks  
Practical and oral examination: 25 marks

#### Section – I

##### 1. Fundamentals:

Engine terminology, engine classification, Working principle of two stroke and four-stroke engine, Scavenging, scavenging processes, Thermodynamic cycles for automobile engine- Air standard cycle, Otto cycle, Diesel cycle, Dual cycle, Comparison between different cycles, Valve timing diagram for engine under different conditions, Firing order, Factors affecting on selection of firing order

- 4

##### 2. Performance Testing of Engine

Losses in the engine, Performance parameters, Performance curves, Methods of improving performance of engine, Testing of engine, Classification of testing, Basic measurement- Speed, Fuel consumption, Air consumption, Mean effective pressure, Brake power, Indicated power, Frictional power (with different methods), Mechanical efficiency, Thermal efficiency, volumetric efficiency, Heat balance sheet, Engine analyzer.

- 6

##### 3. Combustion in S.I. Engine

Ignition limits, Stages of combustion in petrol engine, Ignition lag, Effect of engine variables on ignition lag, Effect of engine variables on flame propagation, Abnormal combustion, Detonation, Effects of detonation, Theories of detonation, Effects of engine variables on knock, Control of knock. Surface ignition, Pre ignition, Post ignition, S.I. engine combustion chamber design, Types of combustion chambers for S.I. engine, Very high output combustion chamber engines

- 5

##### 4. Combustion in C.I. Engine

Air fuel ratio in C.I. engine, Stages of combustion in C.I. engine, Delay period, Variables affecting on delay period, Diesel knock, Methods of controlling diesel knock, C.I. engine combustion chamber, Direct injection type, Open type, Turbulent type, Prechamber, M combustion chamber, Cold starting of C.I. engine- decompression devices, heater plug, inlet manifold heater, Chemical spray

- 5

**Section - II****5. Fuels For I.C. Engine**

Gaseous, Liquids and solid fuels, Properties of engine fuels, Fuels for S.I. engine, Knock rating of S.I. engine fuel, Diesel fuels Cetane number, Fuel additives, Alternative fuels- Benzol, alcohol, ammonia, methanol, ethanol, comparison of alcohol with diesel and petrol, Hydrogen, LPG, CNG, Vegetable oil, Biogas, Hybrid vehicle. - 4

**6. Petrol Engine Fuel Supply System**

Methods of fuel supply system- gravity system, pressure system, Vacuum system, pump system, Fuel injection system, Components of fuel supply system –Fuel tank, fuel pump (Mechanical and Electrical) Vapour return line, Air cleaner, Fuel filters, Carburetion, Functions of carburetor, simple carburetor, Limitations of simple carburetor, Types of carburetor, Special features of modern carburetor, Carter carburetor, Zenith carburetor, Solex carburetor, SU carburetor. - 4

**7. Diesel Engine Fuel Supply System**

Comparison of diesel engine with petrol engine, Requirements of diesel injection system, Fuel feed pump, Types of injection system, fuel injection pump, fuel injectors, Fuel filter, Air cleaner, Phasing and calibration of fuel injection pump, Injector Testing (pressure test, leak test) - 4

**8. Supercharging**

Objects of supercharging, Relative power with and without supercharging, Supercharging of spark ignition engine, Supercharging of C.I. engine, Effects of supercharging on performance of engine, Supercharging limits for S.I. and C.I. engine, Methods of super charging, Supercharges, Turbo charging, Comparison with supercharging, Methods of turbo charging, Limitations of turbo charging. - 5

**9. Non-conventional Engines**

Stratified engine, Sterling engine, Wankel engine, Variable compression ratio engine, Free piston engine, Steam engine (descriptive treatment for all engines) - 3

**Term Work (Any Ten)**

1. Measurement of air fuel ratio of I. C. engine
2. Trial on scooter engine-torque and power measurement
3. Trial on multi cylinder petrol engine (Morse test)
4. Trial on multi cylinder petrol engine (variable speed test)
5. Trial on single cylinder diesel engine(Heat balance sheet)
6. Trial on computerized single cylinder diesel engine
7. Testing of performance of petrol engine by using engine analyzer
8. Dismantling of modern carburetor used in car and reassembly
9. Study of MPFI system used for modern car
10. Study of governors
11. Study of CNG kit as a fuel supply system

## References

1. Automobile Mechanics by W. Crouse/ Anglin, Tata McGraw Publication, Delhi
2. Automobile Mechanics by Joseph Heitner, Affiliated East-West Press Pvt. Ltd., Delhi
3. Automobile Engineering by Kripal Singh, Standard Pub. & Distributors, Delhi.
4. Automobile Engineering by R. B. Gupta, Satya Prakashan, Delhi
5. I.C. Engine by Maleev V. L., McGraw Hill Book, Co.
6. Fundamentals of I.C. Engine by Gill P.W., Smith J. H., Zurich E.J, Oxford & IBH Pub. Co., New Delhi
7. Automobile Mechanics Understanding New Technology by Don Knowles, A Mreston Book Prentice Hall
8. I. C. Engine & Air Pollution – E. F. Obert, Harper & Row Publishers, New York

★★★★★ B+

## T.E. (Automobile) Revised Part – I 2. AUTOMOBILE SYSTEMS - I

Teaching scheme :  
Lectures: 3hrs/week  
Practical: 2hrs/week

Examination scheme :  
Theory paper: 100 marks (3 hrs duration)  
Term work : 25 marks  
Practical and oral examination: 25 marks

### Section – I

#### 1. Vehicle Layouts:

Introduction, Classification of automobile, Types of chassis layout with reference to power plant locations and drive, vehicle frames, Various types of frames. Requirements of transmission - 03

#### 2. Clutches:

Location, functions, general requirements, operating principal, types of clutches, cone clutch, single-plate clutch, diaphragm spring clutch, multi-plate clutch, centrifugal clutch, electromagnetic clutch, lining materials, over-running clutch, Clutch control systems, Applications of clutch for two wheeler - 06

#### 3. Gear Box:

Necessity of gear box, resistance to motion of vehicle, requirements of gear box, functions of gear box, different types, sliding mesh, constant mesh, synchromesh. Principle, construction, and working of synchronizing unit, requirements & applications of helical gears, effects of engagement & disengagement, need of double-declutching, gear selector mechanism, Two wheeler gear box., overdrive gears- performance characteristics. - 09

**4. Drive Lines:**

Effect of driving thrust and torque reaction, propeller shaft-universal joints, hooks and constant velocity U.J., Drive line arrangements – Hotchkiss drive & torque tube drive, rear wheel drive & front wheel drive layouts, tandem – axle drives for heavy duty vehicles. - 04

**Section – II****5. Final Drive & Rear Axle:**

Purpose of final drive, Different types of final drives, need of differential, differential principle, constructional details of differential unit, non-slip differential, differential lock, need of backlash & setting between crown and bevel pinion, differential housing, function of rear axle, construction, types of loads acting on rear axle, types - semi-floating, full floating, three quarter. Final drive lubrication, Gear axle ratio. - 06

**6. Transmission with Fluid Flywheel & Torque convertor:**

Operating principle, advantages of fluid coupling, Advantages & limitations of fluid coupling, construction details with operation of fluid coupling. Basic operating principle, performance characteristics, advantages, comparison with convential gear box, basic construction and operation of torque convertor. - 04

**7. Epicyclic Gear Boxes:**

Basic Epicyclic gearing, advantages, basic construction and operation, Types of Epicyclic gear set, Wilson Epicyclic gear train – construction – operation, overdrive gears - purpose, need, advantages, Overdrive ratios and engine speeds – performance characteristics. - 04

**8. Automatic Transmission:**

Semi-automatic transmission for cars and heavy vehicles with layout and operation, Automatic transmission – advantages, basic construction and operation, automatic transmission for passenger cars, hydraulic control system with function and operation, continuous variable transmission (CVT) – operating principle, basic layout and operation with advantages and disadvantages - 04

**Term Work**

Term work consist of report on any ten experiments from the following:

1. Sketching of different vehicle layouts and comparison
2. To open the single plate clutch, observe the arrangement, sketch the components & system
3. To open the centrifugal clutch of moped / two wheeler, observe the arrangement, sketch the system
4. To open the multiplate clutch of two wheeler, observe the arrangement, sketch the system
5. To open the diaphragm clutch of light duty vehicle, observe the arrangement, sketch the system
6. To open the two wheeler gear box, observe the arrangement, sketch the system

7. To open the synchromesh gear box of light / heavy duty vehicle, observe the arrangement, sketch the system
8. To open the Continuous variable transmission unit (CVT) of Kinetic Honda, observe the arrangement, sketch the system
9. To open the differential, sketch the unit with bearing locations and assemble
10. Demonstration of the propeller shaft arrangement with different drive arrangement, wheels & tyres
11. Study of fluid flywheel & torque converters
12. Study of automatic transmission

### References :

1. Giles J. G., Steering, Suspension & Tyres – Liffé Book Ltd.
2. Newton, Steed & Carrot, Motor Vehicles, Butterworths London
3. Kirpal Singh, Automobile Engineering, Standard Publishing Distributors, New Delhi
4. Narang G.B.S., Automobile Engineering, Khanna Publications, New Delhi
5. Judge A. W., Modern Transmission, Chapman & Hall Std., 1989
6. Chek Chart, Automatic Transmission, A Harper & Row Publications
7. Steed W., Mechanics of Road Vehicles, Liffé Book Ltd.
8. Gupta R. B., Automobile Engineering, Satya Prakashan, New Delhi

★★★★★ B+

### T.E. (Automobile) Revised Part - I

### 3. THEORY OF MACHINES - II

Teaching scheme :

Lectures : 3 Hrs. /Week

Practical : 2 Hrs./Alternate Week

Examination scheme :

Theory Paper : 100 Marks (3 hrs duration)

Term Work : 25 Marks

#### Section -I

#### 1. Toothed Gearing :

Geometry of motion, Gear geometry, Types of gear profile- involute & cycloidal, Theory of Spur, Helical & Spiral gears, Interference in involute tooth gears and methods for its prevention, Contact ratio, Path of contact, Efficiency and center distance of spiral gears.

- 05

#### 2. Gear Trains :

Types of Gear trains- Simple, Compound, Epicyclic, Reverted gear train, Tabular method for finding the speeds of elements in epicyclic gear train, Differential gear box. Equivalent mass and Moment of Inertia applied to gear trains.

- 05

#### 3. Kinetic Analysis of Mechanisms :

Inertia Force and Torque, D'Alembert's Principle, Dynamically equivalent system, force analysis of reciprocating engine mechanism, Function of flywheel and study of turning moment diagrams.

- 08

**4. Gyroscope :**

Gyroscopic couple, Spinning and Precessional motion, Gyroscopic couple and its effect  
 on i) Aero plane ii) Ship iii) Four-Wheeler iv) Two –Wheeler - 03

**Section -II**

**5. Balancing :**

Static and Dynamic balancing of rotary and reciprocating masses, Primary and Secondary forces and couples, Direct and Reverse cranks. Balancing of Single cylinder, Multi cylinder- In-line and V-Engines. - 06

**6. Vibrations :**

Basic concepts and definitions, vibration measuring parameters- Displacement, Velocity and acceleration, Free and forced vibrations. Types of damping, Equivalent Springs - 03

**7. Single Degree of Freedom Systems :**

Free vibrations with and without damping (Rectilinear, Torsional & Transverse), degree of damping. Logarithmic decrement, equivalent viscous damping, Coulomb damping. - 05

8. Forced vibrations with viscous damping, magnification factor, frequency response curves, vibration isolation and transmissibility, Whirling of Shafts and Critical speeds (No numerical treatment) - 05

**Term Work (Any Five)**

1. Experiment on Gyroscope
2. Generation of involute gear tooth profile
3. Problems on Epicyclic gear train using tabular method
4. Determination of M.I. by Bi-filar suspension, Trifilar suspension or Compound pendulum
5. Balancing of rotary masses (Static and Dynamic)
6. Determination of logarithmic decrement (Free Damped Vibrations)
7. Forced vibration characteristics (Undamped and Damped vibrations)

**Books Recommended**

1. Theory of Machines by Rattan S.S., Tata McGraw Hill Pub. Co. Ltd., New Delhi
2. Theory of Machines by Thomas Bevan, C.B.S. Publishers & Distributors
3. Theory of Machines & Mechanisms by Shigley J.E., McGraw Hill International Book Ltd.
4. Mechanism and Machine Theory by Rao J.S. , Dukkipati R. V., Wiley Eastern Ltd.
5. Theory of Machines by Dr. V.P.Singh
6. Mechanical Vibrations by Grover G. K., New Chand & Bros., Roorkee.
7. Theory of Machines by Ballaney P. L., Khanna Publishers, Delhi
8. Theory of Machines by Jagdishlal, Metropolitan Book Co. Pvt. Ltd., New Delhi

★★★★★ B+

**T.E. (Automobile) Revised Part - I****4. MACHINE DESIGN**

Teaching scheme :	Examination scheme :
Lectures: 3hrs/week	Theory Paper: 100 marks (3 hrs duration)
Practical: 2hrs/Alternate weeks	Term work : 25 marks

**Section – I****1. Fundamentals of Machine Design:**

The Meaning of Design, Mechanical Engineering Design, The Phases of Design, Design Considerations & Procedures, Factor of safety, Theories of Failures. - 3

**2. Selection of Materials and Manufacturing Processes:**

Designation of materials & ISI specifications, material properties, use of design data book, general principles of design for manufacturing & assembly, Limits fits, & tolerances, Standardization. - 3

**3. Design of Bolts, Joints & Coupling:**

Design of bolts, Design of joints- Design of Cotter Joint, Socket & Spigot Joint, Knuckle Joint & Turn Buckle. Design of shafts for torsion, bending, combined loading and rigidity. Design of Coupling- Muff, Flange & Flexible, Marine. - 6

4. Design considerations and selection of standard components-such as belts, chain, ropes, pulleys, oil seals, gaskets, electric motors. - 4

**5. Design for Fluctuating Loads:**

Fluctuating stresses, S-N diagram for fatigue loading, Endurance limit, Endurance strength modifying factors, Stress concentration-causes and remedies, Notch sensitivity, Design for finite and infinite life under reverse stresses, Cumulative damage in fatigue failures, Soderberg and Goodman diagrams, Modified Goodman diagram, Fatigue design for components such as shafts, bolted joints and springs under combined stresses. - 5

**Section – II**

**6. Gears:** Design consideration of gears, material selection, Types of gear failures, Gear lubrication.

**Spur Gears:** Force analysis, Number of teeth, Face width & Beam strength of gear tooth. Dynamic tooth load. Effective load on gear tooth. Estimation of module based on beam strength. Wear strength of gear tooth. Estimation of module based on wears strength. Spur gear design for maximum power transmission. - 4

**Helical Gears:** Virtual number of teeth, Tooth proportions, Force analysis, Beam strength of helical gears, Effective load on gear tooth, Wear strength of helical gears, Design of helical gears. - 2

**Bevel Gears:** Terminology of bevel gears, Force analysis, Beam strength of bevel gears, Wear strength of bevel gear, Effective load on gear tooth, Design of bevel gear. - 2

**Worm Gears:** Force analysis, Friction in worm gear, Vector method, Strength rating of worm gears, Wear rating of worm gear. - 2

### 7. Miscellaneous Design:

Design of power screw- Self-locking of power screws, Recalculating ball screws, Design of levers- Hand lever, foot lever, bell crank lever, rocker arm, & c- clamp. - 3

### 8. Design of Bearings:

Rolling Contact Bearing: Types of rolling contact bearings, static and dynamic load capacities, Stribeck's Equation, Equivalent bearing load, load life relationship, Bearing life, Load factor, Selection of bearings from manufacturers catalogue. Lubrication and mountings, dismounting and preloading of bearings, Oil seals and packing. - 3

Sliding Contact Bearings: Bearing material and their properties, Bearing types, and their constructional details, Hydrodynamic Lubrication- Basic theory, Design consideration in hydrodynamic bearings, Raimondi and Boyd method relating bearing variables, - 4

### Term work:

1. Design of levers
2. Problems on design of components under fluctuating loads
3. Study of ball bearing, Mounting & it's Selection
4. Design of power screw
5. Design of gear systems –spur, helical, bevel etc.

### Books Recommended:

1. Joseph E. Shigley & Larry D. Mitchell, "Mechanical Engineering Design", Fourth Edition, McGraw-Hill International Book Company.
2. M.F. Spotts & T.E. Shoup, "Design of machine Elements", Seventh Edition, Pearson Education.
3. Bhandari V. B., "Design of machine Elements", Tata McGraw-Hill Publishing Company Ltd., New Delhi.
4. George E. Dieter, "Engineering Design- A Material and Processing Approach", Second Edition, McGraw-Hill International Edition.
5. Robert C. Junivall, "Fundamentals of Machine Component Design", John Wiley & Sons.
6. Paul H. Black & O. Eugene Adams, Jr., "Machine Design", Third Edition, McGraw-Hill International Edition.
7. Bearing Manufacturers Catalogues
8. PSG Design Data Book.

★★★★★ B+

**T.E. (Automobile) Revised Part - I****5. METROLOGY & QUALITY CONTROL**

Teaching scheme :  
Lectures: 3hrs/week  
Practical: 2hrs/ week

Examination scheme :  
Theory Paper: 100 marks (3 hrs duration)  
Term work : 25 marks

**Section –I****1. Measurements:**

International standards of length-Line and end measurement, Need of measurement, possible errors in measurement, slip gauges, precision & accuracy, Sources of errors in measurement. - 4

**2. Tolerances and Gauging:**

Unilateral and bilateral tolerances, Limits, Fits, Types of Fits, IS specifications of limits. Importance of limits, System in mass production, limit gauges used for plain and taper works. - 4

**3. Magnification :**

Principles and characteristics of measuring instruments, Mechanical, Optical, electrical, Pneumatic method of magnification, different types of Verniers, Micrometers, Dial gauges, Mechanical and pneumatic types of comparators. Use of comparators in inspection. - 3

**4. Measurement of Angles, Tapers and Radius:**

Bevel Protractor, Spirit level, Clinometers, angle Decker, standard balls and rollers for angle measurement, angle slip gauges, radius measurement of circular portion, measurement of concave and convex surface radius. -3

**5. Straightness and Flatness:**

Straight edge, use of level beam comparator, autocollimator testing of flatness of surface plate (Theoretical treatment only) -3

**6. Surface Finish:**

Types of textures obtained during machine operation, range of C.L.A. value in different operations in numerical assessment of surface finish (B.I.S. Specifications of C.L.A. value)-sample length of different machining operations, Direction of lay, texture, symbols, instruments used in surface finish assessment. -3

**Section –II****7. Measurement of External Threads:**

Different errors in screw threads, measurement of forms of thread with profile projector, pitch measurement, measurement of thread diameter with standard wire, screw thread micrometer. - 3

**8. Measurement of Spur Gears:**

Run out checking, Pitch measurement, profile checking, backlash checking, tooth thickness measurement, alignment checking, errors in gears, checking of composite errors. - 3

**9. Quality Control :**

A) Concept of Quality and quality control, elements of quality and its growth, purpose, setup, policy and objective, factors controlling and quality of design and conformance, balance between cost and quality and value of quality, Specification of quality, planning through trial lots and for essential information. - 4

B) Introduction to topic such as in process quality, quality circles, quality management, total quality control, TQM - 2

**10. Statistical Quality Control:**

Importance of statistical methods in quality control, measuring of statistical control, variables and attributes, Measurement/inspection, different types of control charts( X Bar, R & P charts) and their constructions and their applications. - 3

**11. Acceptance Sampling :**

Sampling inspection and percentage inspection, basic concept of sampling inspection, operating characteristic curves, conflicting interests of consumer and producer, producer and consumers risks, AWQL, LTPD,ADGL, single and double sampling plans. - 2

**12. Recent trends in Quality Control :**

1) QS9000 / TS 2) CAQC 3) Zero defect 4) KAIZEN - 3

**Term Work**

- 1) Study and use (care & maintenance) of various measuring instruments
- 2) Measurement of machined automobile components
- 3) Use of comparator
- 4) Screw thread measurement using floating carriage diameter measuring machine
- 5) Gear inspection like tooth thickness & profile, composite error, module etc.
- 6) Use of optical profile projector
- 7) Use of sine bar
- 8) Use of standard balls and rollers for angle measurement.
- 9) X Bar and R chart

- 10) P chart
- 11) O.C. curves

### Reference Books

- 1) Text Book of Engg. Metrology- I.C. GUPTA, Dhanpat Rai & Sons, New Delhi
- 2) Practical Engg. Metrology- Sharp K.W.B. Pitman, London
- 3) Statistical Quality Control- E.L. Grant, McGraw Hill Book Co., New Delhi
- 4) Engg. Metrology- 11<sup>th</sup> Edition, R.K.Jain, Khanna Publishers, Delhi
- 5) Metrology-Taher
- 6) Statistical Quality Control – 3<sup>rd</sup> Edition, R.C. Gupta, Khanna Publishers, Delhi
- 7) I.S. 919/1963
- 8) I.S. 2709/1964
- 9) Engg. Metrology-Hume K.G., MC Donald, Technical & Scientific, London
- 10) Total Quality Management-Dalela
- 11) Statistical Quality Control-Mahajan S.N., Dhanpat Rai & Co., New Delhi

★★★★★ B+

## T.E. (Automobile) Revised Part - I

### 6. INDUSTRIAL ORGANISATION & MANAGEMENT

Teaching scheme :  
Lectures : 3 Hrs. per Week

Examination scheme :  
Theory Paper : 100 Marks (3 hrs duration)

#### Section - I

##### 1. Business Environment:

Introduction, Environmental factors influencing business, external environment, General environment, Task environment, business ethics and social responsibility of business, Effect of Globalization. - 2

##### 2. Functions of Management:

Definition of Management, Management environment, Planning – Need, Objectives, Strategy, policies, Procedures, Steps in Planning, Decision making, Forecasting.

Organizing -- Process of Organizing importance and principle of organizing, departmentation, Organizational relationship, Authority, Responsibility, Delegation, Span of control.

Staffing -- Nature, Purpose, Scope, Human resource management, Policies, Recruitment procedure training and development, appraisal methods.

Leading -- Communication process, Barriers, remedies, motivation, importance, Theories, Herzberg's theory, Maslow's theory, McGregor's theory, leadership style.

Controlling- Process, requirement for control Management, accountability. 10

##### 3. Engineering Economics :

Introduction to basic economics terms such as demand and supply, Introduction, Time value of money, cash flows, depreciation, Types of depreciation, reasons for depreciation, Methods of computing depreciation, sinking fund method, Declining

balance method, Investment decisions for capital assets, evaluation criteria for Investment decisions, Payback period, average rate of return. Benefit cost ratio (BCR), cost accounting.  
- 4

#### **4. Financial Management :**

Sources of Finance, Financial institutions, financial statements, Balance sheet and P & L Account (Contents only), use and importance, Break even Analysis and its applications, accounting ratios, Cost and Cost Control - Classification of cost - Direct material, Direct labour, Direct expenses, Factory overhead, Methods of costing, cost control and cost reduction.  
- 4

### **Section – II**

#### **5. Marketing :**

Marketing Concepts – Objective –Types of markets  
Market Segmentation, Market strategy- 4 AP's of market  
Market Research, Salesmanship, Advertising.  
- 3

#### **6. Production Management:**

Selection of site, plant layout – objectives, principles, types, merits & demerits of different types of layout, function of PPC, PERT / CPM, Maintenance Management, Introduction to Industrial Engineering, Work Study, Method study, Work Management, wages & incentives.  
- 4

#### **7. Materials Management :**

Definition , Scope, advantages of materials management ,functions of materials management, Materials requirements planning, Purchasing objectives, 5-R Principles of purchasing, Functions of Purchase department ,Purchasing cycle, Purchase policy & procedure, Evaluation of Purchase Performance. Vendor development. Make or buy decisions, Inventory Control - ABC Analysis, EOQ, Inventory cost relationships.  
- 5

#### **8. Personal Management :**

Functions of personal department, Industrial relations, training & development, important provisions & rules of Indian Factories Act.  
- 2

#### **9. Industrial Safety:**

Reasons for accidents, prevention of accidents, Promotion of safety mind ness. - 1

#### **10. EDP and SSI :**

Modern concept of an entrepreneur, Scheumpeter's and Peter Drucker's concepts of an entrepreneur, Qualities required to become entrepreneurs, Factors conducive for promoting entrepreneurship reasons for entrepreneurial failure, entrepreneurship development, Role of Industrial interaction, Schools, training in the development of entrepreneurship.

S S I : Definition of SSI, Procedure to start Small Scale Industry. Institutions of offering assistance to SSI, Incentives offered to SSI, Problems of SSI, Feasibility report writing.

- 4

### **11. Introduction to E- Commerce :**

Introduction to Management Information System (MIS), Introduction to ISO 9000 procedures.

- 1

### **Reference Books**

1. Management – James A.F. Stoner, R. Edward Freeman, Prentice Hall of India New Delhi.
2. Management, Today – Principles and Practice – Gene Burton and Manab Thakur, Tata McGraw Hill Publishing Company, New Delhi.
3. Essentials of Management – Koontz & O’ Donell.
4. Human Behaviour at Work Organisational Behaviour – Keith Davis, Tata McGraw Hill Publishing Company, New Delhi.
5. Business Management – J.P.Bose, S. Talukdar, New Central Agencies (P) Ltd.,
6. Industrial Organisation & Management - M. T. Telsang – S. Chand
7. Industrial Organisation & Engineering Economics – T. R. Banga/S.C Sharma – Khanna Publishers
8. Industrial Engineering & Management – O.P. Khanna.
9. Industrial Engineering & Production Management – M. T. Telsang – S. Chand
10. Marketing Management – Philip Kotler, Prentice Hall of India New Delhi.
11. Management Information System, Conceptual Foundation – W.S. Jawadekar Venus Prakashan.

★★★★★ B+

### **T.E. (Automobile) Revised Part - I**

#### **7. MACHINE SHOP**

Teaching scheme :  
Practical : 2 Hrs. per Week

Examination scheme :  
Term Work : 25 Marks

A Job consisting following operation with 3 to 5 components (Composite Job) excluding standard and commercial components. Operations like Turning, Boring, Drilling, Taping, Threading, Milling, Shaping, Taper turning etc.

★★★★★ B+

**T.E. (Automobile) Revised Part - I**

**8. CAD/CAM LABORATORY - I**

Teaching scheme :  
Practical : 2 Hrs./Week

Examination scheme :  
Term Work : 25 Marks

**Term Work**

1. One assignment on CAD/CAM definition, its significance in product cycle and automation, Hardware requirements for CAD System.
2. Automation in Manufacturing, NC Manufacturing, CNC, DNC, advantages and disadvantages. One Assignment based on this topic.
3. Fundamentals of part programming, manual part programming, G and M Codes, Subroutines, Canned cycles, do loops, One assignment based on this topic.
4. Developing any four part programs out of the following lathe and milling operations.
  - i) Plain turning and facing .
  - ii) Taper and profile turning.
  - iii) Thread cutting.
  - iv) Plain Milling.
  - v) Key way Milling.
  - vi) Pocket Milling.
5. Introduction to FMS – merits, demerits and applications. (One assignment based on this topic.)

**Reference Books**

1. CAD/CAM by M.P.Grover. and E.W.Zimmer, Prentice Hall of India Pvt. Ltd.,
2. Computer Aided Design by Krishnamorthay & Rajeev, Narora Publication.
3. CAD/CAM –Theory and Practice by Zeid, Tata McGraw Hill.
4. Design of Machine Element by V.B.Bhandari,.
5. CAD/CAM/CIM by P. RadhaKrishna & S. Subramanyan.

★★★★★ B+



**Shivaji University, Kolhapur**  
**SYLLABUS FOR B.E. (AUTOMOBILE)**  
**T.E. (Automobile) Revised Part - II**

**1. AUTOMOBILE ENGINES - II**

Teaching scheme :  
 Lectures: 3hrs/week  
 Practical: 2hrs/week

Examination scheme :  
 Theory paper: 100 marks (3 hrs duration)  
 Term work : 25 marks  
 Practical and oral examination: 25 marks

**Section –I**

**1. Constructional Details**

Engine cylinder, Cylinder Head, Cylinder block, Cylinder liner, Oil pan, Inlet and Outlet manifold gaskets, Piston for C.I. and S.I. engine, Piston rings, Piston pin, Connecting rod, Crank shaft, Main bearings, Cam shaft, Engine mountings and Engine balancing, Vibration Damper, Cam shaft drives, Inlet and exhaust valves, Valve actuating mechanism, Air cleaner, Manifold – intake and exhaust, silencer, tail pipe. 7

**2. Engine Friction, Lubrication And Lubricants.**

Total engine friction, Effects of engine variables on engine friction, Lubrication- Objectives of lubrication, Lubricants used, Requirements & selection of lubricants, Viscosity rating, Multi grade oil, Additives used in lubricant, Effects of engine variables on lubricating oil, Oil consumption, Different parts of engine to be lubricated, Types of lubrication system- petroil system, Wet sump method, Dry sump method, Fully and partially pressurized lubrication system, Components of lubrication system- oil strainer, Oil filter and its types. 6

**3. Engine Cooling System:**

Distribution of heat supplied to engine, Necessity of engine cooling, Piston and engine Cylinder temperatures, Factors affecting on piston temperature, Types of cooling system, Air cooling system, Water cooling system, Thermosyphon cooling, Cooling with thermostatic regulator. Components of water cooling system-Radiator, Pressure Cap, Expansion Reservoir, Thermostat, Water Pump, Comparison between water cooling and air cooling, Other cooling methods- liquid cooling, steam cooling. Effects of over cooling. 7

**Section – II**

**4. Engine Component Design :**

Engine power requirements,  
 Selection of engine type,  
 Stroke & Bore,  
 Combustion chamber design,  
 Piston design,  
 Piston pin,

Connecting Rod design,  
 Crankshaft,  
 Cylinder,  
 Valve mechanism (Valve, rocker arm, Push rod, cam shaft and cam follower etc.),  
 Flywheel, engine balancing, firing order. 20

### Term Work

Term work consist of report on the following:

1. Dismantling and reassembly of S.I. engine
2. Dismantling and reassembly of C.I. engine
3. Study & Demonstration of water cooling system of 4 stroke engine
4. Study & Demonstration of lubrication system of 4 stroke diesel engine
5. Dismantling of fuel injection pump used in diesel engine and reassembly
6. Testing of fuel injector used for diesel engine
7. Design of Engine Components like – (Minimum three)
  - a) Piston
  - b) Connecting Rod
  - c) Crankshaft
  - d) Cylinder Block
  - e) Valve Mechanism etc.

### References

1. Automobile Engineering by A. W. Judge, B.I. Publication, Bombay
2. Automobile Mechanics by William Crouse/ Anglin, Tata McGraw Publication, Delhi
3. Automobile Mechanics by Joseph Hitner , Affiliated East-West Press Pvt. Ltd., Delhi
4. Automobile Engineering by Kripal Singh , Standard Pub. & Distributors, Delhi.
5. Automobile Engineering by R. B. Gupta, Satya Prakashan, Delhi
6. I.C. Engine by Mathur Sharma
7. Automotive Electrical Equipment by P. L. Kolhi, Tata McGraw Hill Hill Pub. Co. Ltd., New Delhi
8. Automobile Engineering Theory by Kapil Dev.
9. Engine Design – P. M. Heldt
10. Engine Design – Recordo
11. Engine Design – Giles
12. Engine Dynamics – Biezenowgrammel
13. I. C. Engine & Air Pollution – E. F. Obert, Harper & Row Publishers, New York

★★★★★ B+

**T.E. (Automobile) Revised Part - II****2. AUTOMOBILE SYSTEMS - II**

Teaching scheme :

Lectures: 3hrs/week

Practical: 2hrs/ Alternate week

Examination scheme :

Theory paper: 100 marks (3 hrs duration)

Term work : 25 marks

**Section - I****1. Front Axle and Steering System:**

Functions of front axle, types of front axle, constructional details, front wheel geometry- its significance with different characteristics – castor, camber, king – pin inclination, toe-in, toe-out, correct steering angle, the effect of incorrect steering geometry, adjusting and checking of front wheel geometry, Steering geometry – Akerman's & Davis, steering linkages, Different types of steering gear boxes, Power & power assisted steering, Numerical problems on Akerman's steering. - 9

**2. Vehicle Suspension Systems:**

Need of suspension system, different types, types of different suspension springs with their requirements, constructional details and characteristics of leaf spring, coils spring and torsion bar springs, Independent suspension, rubber suspension, pneumatic suspension, hydro-elastic suspension, use of anti-roll bar and stabilizer bar, shock absorbers- need, operating principles different types. - 9

**Section - II****3. Braking Systems:**

Need, functions and requirements of braking system, drum brake arrangements, disc brake arrangement, brake friction material, hydraulic brake system & components, hydraulic brake fluids, air brakes, vacuum servo assisted braking, parking brake systems, hydraulic power brakes, anti-lock brakes, engine exhaust brake, dual brake system, regenerative brake system, fail-safe brake, brake efficiency & testing, Weight transfer, braking ratio, numerical problems. - 10

**4. Wheels and Tyres:**

Basic requirements of wheels & tyres, types of road wheels, construction of wheel assembly, wheel balancing, tyre construction, types – tubeless, cross ply, radial type, Tyre sizes and designation, aspect ratio, tyre trade pattern, tyre valve, tyre inflation pressure, Safety precautions in tyres, Tyre rotation & matching, types of tyre wear and their causes, Selection of tyres under different applications, tyre retreading – hot & cold, Factors affecting on tyre performance. - 8

**5. Lighting System**

Introduction, Insulated & earth return system, negative & positive earth system, the automobile battery, lead acid battery, alkaline battery, electrical car battery, battery rating, battery testing, wiring harness, wiring colour Codes. - 4

**Term work (Any Five)**

1. To open the master cylinder, wheel cylinder, identify the different components, sketch & assemble
2. To open the front & rear axles, identify the type of axle arrangement, sketch & assemble
3. Study of compressed air servo, vacuum servo and parking brake
4. Study of power steering
5. Study & demonstration of independent suspension
6. Demonstration of shock absorbers
7. Study of wiring system for light / heavy duty vehicle

**References :**

1. Giles J. G., Steering, Suspension & Tyres – Iliffe Book Co.
2. Newton, Steed & Carrot, Motor Vehicles, Butterworths London
3. Kirpal Singh, Automobile Engineering, Standard Publishing Distributors, New Delhi
4. Narang G.B.S., Automobile Engineering, Khanna Publications, New Delhi
5. William Crouse, Automotive Mechanics, McGraw Hill Publishers, New Delhi
6. Judge A. W., Modern Transmission, Chapman & Hall Std., 1989
7. Steed W., Mechanics of Road Vehicles, Iliffe Book Ltd.
8. Gupta R. B., Automobile Engineering .

★★★★★ B+

**T.E. (Automobile) Revised Part - II**

**3. MECHANICAL MEASUREMENT & CONTROL**

Teaching scheme :

Lectures : 3 Hrs. /Week

Practical : 2 Hrs./ Week

Examination scheme :

Theory Paper : 100 Marks (3 hrs. duration)

Term Work : 25 Marks

**Section -I**

**1. Mechanical Measurement:**

Need of Mechanical Measurement, Instruments, Measurement methods, Generalized measurement system and its functional elements instrument characteristic: static and dynamic and analytical treatment calibration, Classification and various types of transducers. - 2

**2. Measurement of Temperature:**

Importance of temperature measurement, Thermometer, Thermocouple-Principle, types, calibration, RTD, Thermister measurement of low temperature. - 2

**3. Measurement of Pressure and Vacuum:**

Importance of pressure and vacuum measurement, range of high pressure and vacuum, Bourdon tubes, Dead weight pressure gauge tester, Diaphragm gauge, LVDT, Pizo electrical pressure gauge, low vacuum gauges-McLeod gauge, thermal conductivity gauge, Pitot gauge, Ionization gauge. - 4

**4. Measurement of Angular Speed:**

Importance of angular speed measurement, mechanical tachometers, Electrical tachometers- Drag cup, Tacho generator, Inductive, capacitive and photo electric pick up. - 3

**5. Measurement of Flow:**

Importance of flow measurement, Water meter, Rota meter, Gas flow meter, Hot wire anemometer, drag press flow meter (analytical treatment) - 2

**6. Measurement of Strain:**

Classification of strain gauges, principle of electrical strain gauge, gauge factor (analytical treatment) analysis of whetstone's network using strain gauges, types of electrical strain gauges, mounting, application to measure –load/force, torque. - 3

**7. Measurement of Vibration and Sound:**

Importance of vibration measurement, classification of vibration measuring instruments, importance of acoustical measurement, sound pressure and power levels, types of microphones- capacitive, crystal, electrodynamics, carbon, sound level meter. - 3

**Section –II**

**8. Need for Control :** Manual Vs Automatic Control, advantages of automatic control, Open loop Vs Closed lop control, generalized control system, Introduction to Hydraulics & Pneumatic systems, Merits, demerits and application. - 2

**9. Mathematical Conversion of Control Components:**

Helical spring, Viscous damper & their combinations, resister, inductors, capacitor, series and parallel electrical circuits and mech. systems, thermal and fluid systems, direct and inverse analog, grounded chair representation for material system. - 4

**10. Block Diagram Algebra:** Rules of block diagram algebra, reduction of block diagrams, block diagrams transfer functions representation of speed, temperature & fluid systems, AC & DC Motors - 5

11 Linearization of nonlinear functions, Linearization of operating curves, Steady state analysis & equilibrium. - 4

**12. Modes of Control :** a) On Off Control b) Proportional (P) Control c) Integral (I) Control d) Devolutic (D) Control e) P + I f) P + D g) P + I + D (including analytical treatment ) - 5

**13. Transient Response:**

Distinct zeros, Repeated zeros, Complex conjugate Zeros, Damping and Natural frequency, General form of transient response, Routz's stability criteria. - 2

**Term Work**

Temperature measurement using Thermocouple, RTD & Thermister

1. Preparation of Thermocouple bit and Calibration
2. Calibration of pressure gauge & vacuum gauge
3. Calibration of Angular speed measuring instrument
4. Flow Measurement using Water Rotameter
5. Measurement of force / load using Strain Gauges & calibration of load cells
6. Vibration Measurement using Seismic Instrument and acoustic measurement using a sound level meter
7. Experiment on On Off Temperature Controller
8. Experiment on DC/AC Motor speed control
9. Experiment on various modes of control IP, P + I, P + D, P + I + D.

**Books recommended**

1. Mechanical Measurements and Control by D.S.Kumar.
2. Mechanical Measurements by Sorihi & Dr. Radhakrishnan.
3. Mechanical Measurements by Beckwith & Buck and Roy D. Marangoni, Narora Publishing House, New Delhi.
4. Automatic Control Engineering by F.H. Raven 5<sup>th</sup> Edition. McGraw Hill Student Edition)
5. Modern Control Engineering by K. Ogata.
6. Control Engineering by B.C. Kuo.

★★★★★ B+

**T.E. (Automobile) Revised Part - II****4. HEAT TRANSFER**

Teaching scheme :

Lectures : 3 Hrs. /Week

Practical : 2 Hrs./Alternate Week

Examination scheme :

Theory Paper : 100 Marks (3 hrs duration)

Term Work : 25 Marks

**Section –I****1. Introduction :**

Modes of heat transfer, The laws of heat transfer, Thermal conductivity and coefficient of heat transfer.

- 2

Simple steady state problems in heat conduction, concept of thermal resistance and conductance Electrical analogy of thermal circuits, General equation of temperature field in three dimensional Cartesian co-ordinate system, Laplace and Poisson's equations, Deduction of one dimensional steady state conduction equations, Application of above (one dimensional case) equation to the system of plane wall (including composite structure) as well as to the system with radial heat conduction i.e. cylinders & Sphere (including composite structures) steady state conduction one dimensional) through extended surface (fins) of constant cross section, Heat Transfer through fins and fin

efficiency and effectiveness, One dimensional steady state heat conduction with uniform heat generation, (plane wall & solid cylinder) critical radius of insulation.

Thermal conductivity of engineering materials, Effect of temperature on the conductivity of material, Influence of thermal conductivity variation on the temperature profile and rate of heat conduction for one dimensional steady state system. (for plane wall)

Concept of unsteady state heat conduction, Transient heat flow system with negligible internal resistance. - 9

## **2. Radiation :**

Nature of thermal radiation, definitions of absorptivity, reflectivity, transmissivity, monochromatic emissive power, total emissive power and emissivity, Concept of black body & gray body, Kirchoffe's laws, Wein's law and Plancks law, Deduction of Stefan Boltzman equation, Lambert's cosine rule, Intensity of radiation, Energy exchange by radiation between two black surfaces with non-absorbing medium in between and in absence of reradiating surfaces, Geometric shape factor, Energy exchange by radiation between two gray surfaces without absorbing medium and absence of reradiation and radiosity, Radiation network method, network for two surfaces which see each other and nothing else. - 8

## **Section –II**

## **3. Convection :**

Nature of convection, free and forced convection, convective heat transfer coefficient (h) and Nusselt number, Knowledge of the methods of evaluation of 'h' dimensional analysis, exact and approximate boundary layer analysis by analogical method ( knowledge of boundary layer analysis be only descriptive in nature and must not include derivations or solutions of mathematical equations for any particular cause), Concept of reference temperature, Empirical correlations for forced and free convection as applied to some simple cases of tubes, plates (in different positions) etc. - 8

## **4. Boiling and Condensation :**

Nucleate and film boiling phenomenon: drop wise and film wise condensation, Nusselt's theory of condensation nature of heat transfer in such phenomenon. - 2

## **5. Heat Exchangers :**

Types of Heat exchangers direct transfer type, Storage types, Direct contact types heat exchangers, Tubular heat exchangers, Extended surface heat exchangers, Classification according to flow arrangement, Fouling factor, mean temperature difference, LMTD for parallel flow, counter flow, mean temperature for cross flow, correction factor, special cases. The effectiveness by NTU method, effectiveness of parallel, counter flow and cross flow heat exchangers like radiators & other design consideration. Heat pipe component and working principle. (Elementary treatment only) - 7

**6. Automobile Application of Heat Transfer :**

Cooling system, necessity of cooling, types of cooling and components of cooling system.

- 4

**Term Work :**

- Experiment must be set simultaneously and the number of students in each group working on a setup shall not exceed 05 students.
1. Determination of thermal conductivity of insulating powder
  2. Determination of thermal conductivity of Metals at different temperatures
  3. Determination of Heat Transfer Coefficient for natural convection and forced convection
  4. Determination of Emissivity.& Stefan Boltzmann Constant
  5. Boiling & Condensation Heat Transfer.
  6. Trial on Heat Exchangers

**References**

1. Heat Transfer – A Practical approach by – Yunus -A – Cengel ( Tata McGraw Hill)
2. A Text Book on Heat Transfer by Dr. S. P. Sukhatme.
3. Heat Transfer by J.P. Holman , McGraw Hill Book Company, New York.
4. Heat Transfer by Chapman A.J. McGraw Hill Book Company, New York.
5. Heat and Mass Transfer, S.C. Arora and S. Dokoundwar, Dhanpat Rai and Sons, Delhi.
6. Fundamentals of Heat and Mass Transfer by R.C. Sachdev, Willey Eastern Ltd.,
7. Fundamentals of Heat and Mass Transfer by C.P. Kothandaraman
8. Heat and Mass Transfer by R.K. Rajput, S. Chand & Company Ltd., New Delhi. 110055
9. Heat and Mass Transfer by Dr. D. S. Kumar S.K. Kataria & Sons, Delhi.
10. Heat Transfer by P.K. Nag, Tata McGraw hill Publishing Company Ltd., New Delhi.
11. Special books on Automobile Engineering Applications

★★★★★ B+

**T.E. (Automobile) Revised Part - II**  
**5. AUTOMOBILE SYSTEM DESIGN**

Teaching scheme :  
 Lectures: 3hrs/Week  
 Practical: 2hrs/Week

Examination scheme :  
 Theory Paper: 100 marks (3 hrs duration)  
 Term Work : 50 Marks  
 Oral : 25 marks

**Section – I****1. Statistical Considerations in Design:**

Statistics in design, design for natural tolerances, statistical analysis, mechanical reliability.

- 4

**2. Optimum Design:**

Introduction to optimum design, for mechanical elements, adequate & optimum design, Johnson's method of optimum design-Simple problems in optimum design like axially loaded members like shaft subjected to torsional and bending moments and other machine elements. - 5

**3. Selection of Tyres and determination of final drive ration. - 2****4. Clutches:**

Design requirements of friction clutches, selection criterion, torque transmission capacity, single plate clutch, multi-plate clutch, and centrifugal clutch, lining material. -5

**5. Design of Gearbox:**

Design considerations of gearbox, selection of proper gear ratios for an automobile gearbox, design of shafts, splines, and gears, design of gear & shaft for gear box -6

**Section-II****6. Brakes:**

Design considerations in brakes, band, internal expanding shoe, external contracting-long, and short, Energy equations, Thermal considerations and rating of brakes. - 5

**7. Design of Axles & Propeller Shafts:**

Design of front and rear axle for automobiles, Design of Propeller shafts for bending, torsion, & rigidity, universal joints and slip joints. - 5

**8. Design of Suspension System:**

Types & applications, material of spring, Stress-deflection Equation for helical springs, Wahl Correction Factor, Design of helical springs, Buckling of Compression springs, Tension springs, Springs in Series & in parallel, Design Considerations of Belleville springs, Elastomeric springs, Air (Pneumatic) springs, Design leaf spring for automobile suspension system, Design of coil spring for front independent suspension system. - 8

**Term Work:**

1. Design & working drawing of details and assembly of clutch system
2. Design & working drawing of details and assembly of gear box

**Reference Books:**

1. Joseph E. Shigley & Larry D. Mitchell, "Mechanical Engineering Design", Fourth Edition, McGraw-Hill International Book Company.

2. M.F. Spotts & T.E. Shoup, "Design of machine Elements", Seventh Edition, Pearson Education.
3. Bhandari V. B., "Design of machine Elements", Tata McGraw-Hill Publishing Company Ltd., New Delhi.
4. Pandya N.C.& Shah C.S., "Elements of Machine Design", Twelfth Edition, 1994, Charotar Publishing House.
5. R.C. Johnson, "Optimum Design of Mechanical Elements", John Wiley & Sons.
6. Mehta N.K., "Machine Tool Design & Numerical Control", Second Edition, 1997, Tata McGraw-Hill Publishing Company Ltd., New Delhi.
7. J.S. Arora, "Introduction to Optimum Design", McGraw-Hill Book Company Ltd.

★★★★★ B+

### T.E. (Automobile) Revised Part - II

#### 6. TURBO MACHINERY

Teaching scheme :

Lectures :3 Hrs. per Week

Practical : 2 Hrs/Alternate Week

Examination scheme :

Theory Paper :100 Marks (3 hrs duration)

Term Work : 25 Marks

#### Section – I

##### 1. Introduction to Water Turbines:

Impulse & reaction water turbines, Principle of operation, construction & working of Francis & Kaplan Turbine, Draft tube, velocity triangles, calculation of efficiency, power, discharge etc., Governing of turbine. Performance characteristic of turbines  
- 6

##### 2. Centrifugal Pumps:

Working principles, Construction, types ,various heads, multistage pumps, velocity triangles, minimum starting speed, cavitation, MPSH and NPSH. Methods of priming calculations of efficiencies, discharge, blade angles, head, power required, impeller dimensions etc., Similarity Principles of centrifugal pumps, Performance characteristic.  
- 8

##### 3. Reciprocating Pumps :

Principle, construction, working, gear pumps, vane pumps, types, applications, Air vessels, Performance characteristics.  
- 4

#### Section - II

##### 4. Air Compressors:

Application of compressed air, classification of compressor, reciprocating compressors, construction, work input, necessity of cooling, isothermal efficiency, heat rejected, effect of clearance volume, volumetric efficiency, necessity of multistaging, construction, optimum intermediate pressure for minimum work required, after cooler, free air delivered, air flow measurement, capacity control. Roots blower and vane blower (descriptive treatment)  
- 6

**5. Rotodynamic Air Compressors :**

Centrifugal compressor, velocity diagram. Theory of operation, losses, Adiabatic efficiency, effect of compressibility, diffuser, prewhirl, pressure coefficient, slip factor, performance.

Axial flow compressors, velocity diagram, degree of reaction, polytropic efficiency, surging, choking, stalling, performance, comparison with centrifugal. - 6

**6. Gas Turbines :**

Working principles, applications, open, closed cycle and their comparison, Cycle modified to regeneration, reheat, inter cooling performance, Calculation of gas turbine work ratio, efficiency etc. - 6

**7. Jet Propulsions :**

Types, construction, working principle, applications. - 2

**Term Work**

1. Study & Trial on Pelton wheel
2. Study & Trial on Francis/ Kaplan turbine
3. Study and trial on Reciprocating pump & Centrifugal pump
4. Study and trial on reciprocating compressor
5. Study / Trial on centrifugal blower
6. Study of hydraulic devices- Intensifier, Accumulator, Hydraulic jacks, press, Crane

**References**

1. Hydraulic Machines by V.P. Vasantdani
2. Fluid flow machines by N.S. Govindrao
3. Turbo machines by S.M. Yahya
4. Fluid power Engineering by D.S. Kumar
5. Steam & gas Turbines by R. Yadav
6. Steam & gas Turbines by V. Ganeshan
7. Thermal Engg. by Kumar Vasantdani
8. Thermal Engg. By P.L. Balleny
9. Gas turbines & Compressor by Cohen & Rogers
10. Thermodynamics & Heat Engines – Vol-II by R. Yadav

★★★★★ B+

**T.E. (Automobile) Revised Part - II****7. GARAGE PRACTICE**

Teaching scheme :  
Practical : 2 Hrs./ Alternate Week

Examination scheme :  
Term Work : 25 Marks  
Practical & Oral Exam : 25 Marks

**Term Work**

1. Study of representative garage layout and recent practices
2. Study of tools & tackles, equipment & machinery for garage practices

3. Minor adjustments for vehicle like clutch, brake, steering etc.
4. Study & demonstration of wheel balancing & wheel alignment
5. Servicing of two & four wheeler vehicles
6. Visit to modern garage to study the garage practices  
( A journal based on above term work to be written)

# Combined Practical and Oral examination of Auto System – II & Garage Practice.

★★★★★ B+

**T.E. (Automobile) Revised Part - II**  
**8. CAD/CAM LABORATORY - II**

Teaching scheme :  
Practical : 2 Hrs./Week

Examination scheme :  
Term Work : 25 Marks  
Oral Exam : 25 Marks\*\*

1. To develop and run ‘ C ’ Programs for following items in Machine Design (Any Three)
  - a) Design of Knuckle Joint or Turn Buckle
  - b) Design of Power Screw
  - c) Design of Bolted or Riveted Joints
  - d) Design of Springs
  - e) Selection of ‘ V ’ belts or Flat belts as per manufacturers catalogue
2. Solid Modelling using AutoCAD2002 or above ANSYS / NISA / ALGOR / Pro Engg / CATIA / IDEAS or equivalent software- Four assignments on 3 D wire frame/Surface/Solid Modeling using any advanced modeling software such as ADAMS CAR & packages mentioned above containing solid models of complicated machine parts and simple 3 D assembly containing 05 or more parts.
3. Industrial visit to study the CAD / CAM. (A detail report to be submitted)

**Reference Books**

1. CAD/CAM by M.P.Grover. and E.W.Zimmer, Prentice Hall of India Pvt. Ltd.,
2. Computer Aided Design by Krishnamorthay & Rajeev, Narora Publication.
3. CAD/CAM –Theory and Practice by Zeid, Tata McGraw Hill.
4. Design of Machine Element by V.B.Bhandari,.
5. CAD/CAM/CIM by P. RadhaKrishna & S. Subramanyan.

\*\* Oral examination based on CAD/CAM Lab-I and II

★★★★★ B+

**T.E. (Automobile) Revised Part - II**  
**9. INDUSTRIAL CASE STUDY**

**Objective :**

Students are expected to get exposed to Industrial Working Environment for THREE TO FOUR Weeks during summer vacation.

**Study Topics :**

A) Maintenance and Repairs – (Related with AUTOMOBILES minimum Two weeks)

B) Case Study on any one of the following -

Product design and analysis, process improvement, rejection analysis, value engineering, material handling, computer application, material selection, etc.

**Industries :**

Small, Medium or Large Scale Industries in Automobile Manufacturing / Service Sector.

**Reporting :**

Report on above certified by concerned Industries should be submitted on A 4 Size paper Type written in THREE Copies ( about 20 to 25 pages)

**Assessment :**

Assessment of the report will be done at B. E. Part – I by the concerned Batch Teacher by conducting presentation & Oral Examination during practical hours.

★★★★★ B+

fn: T.E.(Automobile) Part-I & II/BIRJE

**SURESH P SAWANT-BOS**

**BIRJE S.R./JC**