University of Pune, Pune

Syllabus for

T. E. (AUTOMOBILE) ENGINEERING (2008 Course)

With Effect From July 2011

University of Pune, Pune
T. E. (AUTOMOBILE) ENGINEERING (2008 Course)
w. e. f. July 2011

Code	Subject	Teaching Scheme		Examination Scheme					
	Semester - I	**Lect.**	**Pract./ Dwg.**	**Paper Duration**	**Paper**	**TW**	**Oral**	**Pr.**	**Total**
316481	**Machine Design**	4	2	4 Hrs.	100	50	--	--	150
302042	**Heat Transfer***	4	2	3 Hrs.	100	--	--	50	150
302043	**Theory of Machines-II***	4	2	3 Hrs.	100	-	50	--	150
302044	**Industrial Engineering and Technology Management***	4	--	3 Hrs.	100	--	--	--	100
302045	**Computer oriented numerical methods***	4	2	3 Hrs.	100	--	--	50	150
316482	**Seminar**	--	2		--	50	--	--	50
	Total of First Semester	**20**	**10**		**500**	**100**	**50**	**100**	**750**
	Semester – II								
316483	**Automotive Engine Design**	4	2	4 Hrs.	100	--	50	--	150
311048	**Metrology and Quality Control***	4	2	3 Hrs	100	25	--	--	125
316484	**Automotive Transmission**	4	2	3 Hrs.	100	25	---	--	125
316485	**Autotronics**	4	2	3 HRS.	100	50	--	--	150
316486	**Vehicle Body Engineering**	4	2	3 Hrs.	100	25	--	--	125
316487	**Vehicle Maintenance Practices**	--	2	--	--	25	--	50	75
	Total of Second Semester	**20**	**12**	**--**	**500**	**150**	**50**	**50**	**750**

*Marked subjects are common with T. E. (Mechanical Engineering)

University of Pune
T.E. (Automobile) Part I (2008 Course)
316481. MACHINE DESIGN

Teaching Scheme	Examination Scheme
Lectures: 4 hrs/week	Theory: 100 Marks
Practical: 2 hrs/week	Term work: 50 Marks

Section – I

1. Design of Shafts, Keys and Couplings: 10

Shafts: Transmission shaft, shaft design on the basis of strength and torsional rigidity, A.S. M. E. code for shaft design, design based on lateral rigidity, Keys and Splines: Design of Parallel and taper key, Design of Gib headed key, sunk key, round key. Design of spilnes with different profiles. Couplings: Flange coupling, flexible coupling, Oldham coupling and star coupling. Hooke's Joint.

2. Design of Power Screw, Bolted Joints and Welded joints: 08

Power Screw and Bolted Joints: Forms of threads, torque analysis and design with square and trapezoidal threads, self locking of screw, and design of any type of screw jack, Basic types of fastenings, Design of bolted joints under tension, eccentrically loaded bolted joint in shear and parallel to axis of bolt, torque requirement for tightening.
Welded Joints: Types of welds, stresses in butt and fillet welds, strength of butt, parallel and transverse fillet welds, eccentric load in plane of weld, welded joints subjected to bending and torsion.

3. Design for Fluctuating Loads: 10

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.

Section – II

4. Design of Springs : 08

Types, applications and materials for springs, stress and deflection equations for helical compression and tension springs, style of ends for compression and tension springs, Helical torsion spring, leaf springs, multi layered leaf springs.

5. Sliding contact and Rolling contact Bearing: 08

Sliding contact Bearing: Theory of Hydrodynamic lubrication, mechanism of pressure development in oil film, Design of journal bearing, length to diameter ratio, unit bearing pressure, radial clearance and minimum oil film thickness.
Rolling contact Bearing: Static and dynamic load carrying capacities, equivalent bearing load, load life relationship, selection of bearing life, selection of rolling contact bearings form manufacturer's catalogue.

6. Design of Gears: 10

Classification of gears, types of gears, standard gear tooth system, Number of teeth and face width, force analysis, beam strength equation, velocity factor, load concentration factor, effective load on gear, wear strength (Buckingham's) equation, estimation of module beam

and wear strength (Numerical treatment limited to spur and helical gears). Transverse and normal module, virtual number of teeth for Helical and spiral gears. Construction of Differential gear box, worm gear box, Methods of lubrications for all types gears and failure of gears.

Term Work:

1. Term work shall consist of two design projects based on Power Screw and Gears; each design shall consist of two half imperial size (A2) sheets: One involves assembly drawing with part list and other involving drawings of individual components, which consists of manufacturing tolerances, surface finish symbols and geometric tolerances to make it working drawing. A design report giving all necessary calculations of design of components and assembly must be submitted in a separate file.
2. Design project should be in the form of 'design of mechanical system' comprising of machine elements studied in the syllabus. Design data book must be used wherever necessary for selection of components.
3. Three home assignments based on above units

Reference Books:

1. J. E. Shigley and C. R. Mischke, "Mechanical Engineering Design", McGraw Hill Inc. New York.
2. M. F. Spotts and T. E. Shoup, "Design of Machine Elements", Prentice Hall International.
3. V. B. Bhandari, "Design of Machine Elements", Tata McGraw Hill Publications, New Delhi.
4. P. H. Black and O. E. Adams, "Machine Design", McGraw Hill Inc. New York.
5. W. C. Orthwein, "Machine Component Design", West-Pub. Co. and Jaico Pub. House.
6. "Design Data Handbook", P.S. G. College of Technology, Coimbatore.
7. R. C. Juvinal, "Fundamentals of Machine Components Design", John Wiley and Sons.
8. A. S. Hall, A. R. Holowenko and H. G. Laughlin, "Theory and Problems of Machine Design", Schaum's Outline Series.

University of Pune
T.E. (Automobile) Part I (2008 Course)

302042. HEAT TRANSFER

Teaching scheme	**Examination scheme**
Lectures: 4 Hrs./week	Theory Paper:100 marks
Practical: 2 Hrs./ week	Practical : 50marks

Section - I

1. **Concepts and Mechanism of Heat Flow** **10**

   Steady and unsteady state heat transfer, Modes of heat transfer, their physical mechanism, Laws of heat transfer, thermal conductivity, variable thermal conductivity, heat transfer coefficient, isotropic and an-isotropic materials, insulating materials, electrical analogy of heat transfer. Three dimensional heat conduction equations in Cartesian coordinates and its reduction to Fourier, Poisson and Laplace equations. Three Boundary conditions (temperature, heat flux and convection). Three dimensional in cylindrical and spherical coordinates (no derivation) and its reduction to one dimensional form.

2. One dimensional steady state heat conduction 08

   One dimensional steady state heat conduction without heat generation in plain and composite wall, hallow cylinder, hallow sphere, thermal contact resistance, critical thickness of insulation on cylindrical and spherical bodies. One dimensional steady state heat conduction with heat generation in plain wall, cylindrical and spherical.

3. Extended Surfaces 08

   Types of fins, governing equation for constant cross sectional area fins, solution for infinitely long, short and adequately long (with insulated end) fins. Fin efficiency, fin effectiveness, overall fin effectiveness.

   Unsteady state heat conduction: Biot number, Fourier number, time constant and response of thermocouple, validity and criteria of lumped system analysis.

Section – II

4. Thermal Radiation 10

   Physics of radiation, Black body radiation, Spectral and total emissive power, real and gray surfaces, Stefan Boltzmann law, Radiation laws – Planks, Wiens, Kirchoff's and Lamberts cosine law, irradiation and radiosity, surface absorption, reflection and transmission, emissivity, Radiation view factor, theorems of view factor, radiation heat exchange between two black and diffuse gray surfaces, gas radiation, ray tracing and energy balance method, radiation shield.

5. Principle of Heat Convection 08

   Mechanism of natural and forced convection, local and average heat transfer coefficients, convection boundary layers: velocity and temperature, dimensionless numbers and their physical significance, laminar and turbulent flow over bodies, use of imperial correlations for forced and natural convection.

6. Condensation and Boiling 8

Film wise, drop wise condensation, types of boiling, pool boiling curve and forced boiling phenomenon (No numerical treatment)

Heat Exchangers: Classification of heat exchangers, temperature distribution in parallel, counter flow arrangement, condenser and evaporator, overall heat transfer coefficient, fouling factor, Log-mean temperature difference method and NTU – effectiveness method of analysis for rating and sizing of heat exchangers, Design criteria, practical applications of heat exchangers, introduction to heat transfer augmentation techniques, introduction to heat pipes.

Term Work

List of Experiments

Any eight experiments (1- 10) and one assignment (11-13) from the following list:

1. Determination of thermal conductivity of metal rod.
2. Determination of thermal conductivity of insulating powder.
3. Determination of thermal conductivity of composite wall.
4. Determination of heat transfer coefficient in natural convection.
5. Determination of heat transfer coefficient in forced convection.
6. Determination of temperature distribution, fin efficiency in natural/ forced convection.
7. Determination of emissivity of a test surface.
8. Determination of Stefan Boltzmann constant.
9. Determination of equivalent thermal conductivity of heat pipe.
10. Study of pool boiling phenomenon and determination of critical heat flux.
11. Determination of log-mean temperature difference, overall heat transfer coefficient and effectiveness of heat exchanger in parallel and counter flow arrangement.
12. One assignment to solve transient heat transfer problem using Heisler and Grober charts.
13. One assignment on steady state heat transfer by using any software (preferably CFD)/ finite difference method.

Reference Books:

1. J. P. Holman, Heat Transfer, VII edition, McGraw Hill Publications.
2. Y. A. Cengel, Heat Transfer – A Practical Approach, Tata McGraw Hill Publications, New Delhi.
3. M. M. Rathore, Engineering Heat and Mass Transfer, 2nd Edition, Laxmi Publications, New Delhi.
4. D. S. Kumar, Heat and Mass Transfer, S. K. Kataria and sons, New Delhi.
5. P. K. Nag, Heat Transfer, Tata McGraw Hill Publications, New Delhi.
6. S. P. Sukhatme, A Text Book on Heat Transfer (1989) 3rd Edition, Orient Longmans Ltd., New Delhi.
7. A. J. Chapman, Fundamentals of Heat Transfer, IVth Edition, John Wiley Inc.
8. M. Thirumaleshwar, Fundamentals of Heat and Mass Transfer, Pearson Education.
9. N. V. Suryanarayana, engineering Heat Transfer, Prenam International Mumbai.
10. Incropera and DeWitt, Fundamental of Heat and Mass Transfer, John Wiley Inc.
11. M. N. Ozisik, Heat Transfer – A Basic Approach, McGraw Hill, New York.
12. C. P. Kothandandarman, Heat Transfer Data Book, New Age (I), New Delhi.

University of Pune
T.E. (Automobile) Part I (2008 Course)

302043. THEORY OF MACHINES - II

Teaching scheme	**Examination scheme**
Lectures: 4 Hrs./week	Theory Paper:100 marks
Practical: 2 Hrs./ week	Oral : 50marks

Section - I

1. **Friction Clutches, Brakes and Dynamometers** 10
   Friction: Friction and types of friction, laws of friction, Friction in turning pairs, Friction Circle, Friction axis, friction in Four Bar and single slider mechanism.
   Friction Clutches: Pivot and Collar friction, Plate clutches, Cone clutch, Centrifugal clutch, Torque transmitting capacity.
   Brakes and Dynamometers: Different types of brakes, Shoe brake, External and Internal shoe brakes, Block brakes, Band brakes, Band and block brakes, braking torques, different types of absorption and transmission type dynamometers.
2. Cams and Followers: 08
   Types of cams and followers, analysis of standard motions to the follower, determination of cam profiles for given follower motions, analysis of cams with specified contours – circular arc cam, tangent cam, eccentric cam, Methods of control: pressure angle, radius of curvature and undercutting, Kinematically equivalent system, Jump phenomenon, Introduction to advanced cam curves.
3. Gyroscopes and Introduction to Governors: 08
   Gyroscopes, concept of gyroscopic action, gyroscopic couple, effect of gyroscopic couple on ship, aeroplanes, and vehicles.
   Introduction to Governors, Types of centrifugal governors (Watt, Porter and Hartnell governors only), controlling force, governor effort and governor power with numerical treatment, sensitivity, stability, isochronisms and hunting, friction and insensitiveness without numerical.

   Section – II
4. Kinematics of Spur Gears: 10
   Classification and applications of the gears, terminology of gearing, law of gearing, velocity of sliding, conjugate action, forms of teeth, path of contact, interference, undercutting methods of avoid interference and undercutting, effect of center distance variation, friction between gear teeth.
5. Kinematics of Helical, Bevel and Worm Gears: 08
   Helical gears - Terminology, virtual number of teeth, torque transmitted, Spiral gears – terminology and efficiency. Worm and Bevel gears – Terminology, geometrical relationships, tooth forces, torque transmitted.
6. Inertia of Geared systems and Gear Trains: 08
   Inertia of geared systems, types of gear trains – simple, compound and epicyclic gear trains, analysis of epicyclic gear trains, torque on sun and planet gears, compound epicyclic gear trains, bevel epicyclic gear trains.

Term work:

The term work shall consist of any eight of the following experiments:

1. To measure torque transmitting capacity of a friction clutch.
2. To measure the power transmitted by dynamometer or power absorbed by the brake.
3. To verify the cam jump phenomenon.
4. To draw cam profiles for various types of follower motion (at least two types).
5. To determine the characteristic curves for centrifugal governor and to find its coefficient of insensitiveness and stability.
6. To study various types of gear boxes such as: Industrial gear box, Synchromesh gear box, Differential gear box, PIV gear box.
7. To draw conjugate profile for any general type of gear tooth.
8. To generate involute gear tooth profile and to study the effect of undercutting by using rack shift model.
9. To measure torque transmitted and holding torque of epicyclic gear train.
10. To perform experiment on gyroscope to verify principle of gyroscope and to determine gyroscopic couple.

Reference Books:

1. Hannah and Stephans. “Mechanics of Machines”, Edward Arnold Publications.
2. T. Beven, “Theory of Machines”, Longman Publication.
3. J. E. Shigley and J. J. Uicker, “Theory of Machines and Mechanisms”, International Edition, McGraw Hill Publications.
4. P. L. Ballaney, “theory of Machines”, Khanna Publications New Delhi.
5. Jagdish Lal, “theory of machines”, Metropolitan Book Co Pvt. Ltd. New Delhi.
6. R. S. Khurami and J. K. Gupta, “theory of Machines”, Eurasia Publishing House (Pvt.) Ltd. New Delhi.
7. A. Ghosh and A. K. Malik, “Theory of Mechanisms and Machines”, East West Pvt. Ltd.
8. S. S. Ratan, “Theory of Machines”, Tata McGraw Hill, New Delhi.
9. V. P. Singh, “Theory of Machines”, Dhanpat Rai and sons.
10. C. S. Sharma and Kamalesh Purohit, “Theory of Machines and Mechanisms”, PHI
11. D. H. Myszka, “ Machines and Mechanisms”, PHI

University of Pune
T.E. (Automobile) Part I (2008 Course)

302044. INDUSTRIAL ENGINEERING AND TECHNOLOGY MANAGEMENT

Teaching scheme | **Examination scheme**
Lectures: 4 Hrs./week | Theory Paper:100 marks

Section – I

1. Management Science 08

Basic concepts and functions of management, Contribution of Taylor and Fayol to scientific management, Motivation and Control, Maslow's hierarchy of needs, Vroom's expectancy theory, Leadership styles, Contingency theory, Managerial grid.

Plant locations, Layout and Material Handling:

Location: Importance and factors affecting plant location, Single and Multi-facility location problems, Layout: Need, Importance, Objectives and Principles of good plant layout, Types of layout and applications, Material Handling: Objectives, functions, principles of material handling, Types of material handling equipments and selection.

2. Productivity and Work Study: 08

Productivity: Definition and types, Kinds of Productivity measures, Productivity improvement methods.

Work Study: Introduction, Techniques of work study, Method study – procedure, recording techniques, Principles of motion economy, Micro-motion analysis, Work measurement – Time study, work/ activity sampling, predetermined motion time standards, Job evaluation and merit rating – Procedures and methods.

3. Production Planning and Inventory Control: 10

Introduction, Functions of PPC, Forecasting models – moving average, exponential smoothing, Capacity planning, aggregate production planning – cost computation for pure and mixed strategies, Inventory control – Purpose, types, functions, basic EOQ, safety stock inventory control systems (Numerical Treatment), selective control of inventory ABC, FMS and VED.

Project Management: PERT/CPM, Cost accounting and control, elements of cost, depreciation, method for calculating depreciation, break even analysis, standard costing, variance analysis, zero based budgeting.

Section – II

4. Technology Management: 08

Concept and meaning of technology, evolution and growth of technology, role, and significance of management and technology, impact of technology on society and business, forms of technology, process technology and product technology.

Competitive advantages through new technologies: Product development – from scientific breakthrough to marketable product – role of government in technology development. Linkage between technology, development and competition, managing research and development (R &D) Managing intellectual property.

5. Technological Forecasting and Assessment: 08

Exploratory: Intuitive, extrapolation, growth curves, technology monitoring, normative: relevance tree, morphological analysis, mission flow diagram.

Technology Assessment: Technology choice, Technological leadership and followership, technology acquisition, meaning of innovation and creativity, innovation management.

6. Technology Strategy: 10

Concepts, types, key principles, framework for formulating technology strategy, technology forecasting: techniques and application

Technology Diffusion and Absorption: Rate of diffusion, innovation time and innovation cost, speed of diffusion, Project management in adoption and implementation of new technologies, Technology Transfer Process (TPR)

Reference Books:

1. Tarek Khalli, "Management of Technology", McGraw Hill, New Delhi.
2. V. K. Narayanan, "Managing Technology and Innovation for Competitive Advantage", Pearson Education Asia.
3. Gaynor, "Handbook of Technology Management", McGraw Hill, New Delhi.
4. Dinesh Seth and S. C. Rastogi, "Global Management Solutions", Cleanage Learning
5. S. N. Chary, "Production and Operation Management", Tata McGraw Hill, New Delhi.
6. ILO Introduction to Work Study.
7. O. P. Khanna, "Industrial Engineering and Management", Dhanpatrai Publications, New Delhi.
8. R. M. Curie and Faraday "Work Study".
9. A. K. Bewoor, "Production Planning Control", Satya Publications, New Delhi.
10. Gopalkrishnan, "Materials Management", John Wiley Publications.
11. L. C. Jhamb, "Materials Management", Everest Publications.

University of Pune
T.E. (Automobile) Part I (2008 Course)

302045. COMPUTER ORIENTED NUMERICAL METHODS

Teaching scheme	**Examination scheme**
Lectures: 4 Hrs./week	Theory Paper:100 marks
Practical: 2 Hrs./ week	Practical: 50marks

Section - I

1. Roots of Equations and Numerical Integration: 08
   Newton Raphson method, Modified Newton Raphson method, and Successive approximation method. Trapezoidal rule, Simpson's Rules ($1/3^{rd}$, $3/8^{th}$), Gauss Quadrature Method – 2Point, 3point, Double integration – Trapezoidal rule, Simpson's $1/3^{rd}$ rule.
2. Interpolation and Differentiation: 08
   Lagrange's Interpolation, Newton's interpolation – Forward, Backward, Hermit Interpolation. Spline interpolation – cubic, inverse interpolation, extrapolation Differentiation.
3. Simultaneous Equations: 10
   Gauss Elimination Method, Partial Pivoting, Thomas algorithm for tridiagonal matrix, Gauss-seidal method, Gauss-seidal method with relaxation.

Section – II

4. Curve Fitting and Errors: 08
   Least square technique – straight line, quadratic equation, power equation, exponential equation. Errors and approxiatins.
5. Numerical Solutions of ODE: 08
   Taylor's series method, Euler's Method, Runge Kutta Method – second order and fourth order, Predictor – corrector method, simultaneous equations.
6. Finite Difference Method, Boundary valued problems of exact differential equations limited to second order only. PDEs – parabolic – explicit, Crank Nicholson Method, Hyperbolic equations, and Elliptic equqtions.

List of Assignments:

1. Program on Roots of Equations.
2. Program on Numerical Integration.
3. Program on Interpolation.
4. Program on Simultaneous Equations.
5. Program on Curve Fitting.
6. Program on ODE.
7. Program on Finite Difference Method.
8. One assignment on all above topics using any suitable solver.

Note: All the assignments should be completed using any suitable solver.

Guidelines to conduct Practical Examination:

1. One Program on Unit No. 1
2. Any one Program from Unit 2 to 6 option within unit.

Reference Books:

1. S. C. Chapra and R. P. Canale, Numerical Methods for Engineers, 4/e, Tata McGraw Hill Publications.
2. B. S. Garewal, Numerical Methods in Engineering and Science, 7/e, Khanna Publications.
3. S. C. Chapra, Applied Numerical Methods with MATLAB for Engineers and Scientist, 2/e, Tata McGraw Hill Publications.
4. M. K. Jain, S. R. K. Iyengar, R. K. Jain, "Numerical Methods for Scientific and Engineering Computations, 5/e, New Age Publishers.
5. Gerold / Wheatley, Applied Numerical Analysis, 6/e, Pearson Education Asia 2002.
6. B. V. Ramana, Higher Engineering Mathematics, Tata McGraw Hill Publications.

University of Pune
T.E. (Automobile) Part I (2008 Course)
316482. Seminar

Teaching scheme
Practical: 2 Hrs. / week

Examination scheme
TW: 50marks

Topic:
The seminar topic may be

- Recent trends in Automobiles
- Based on interdisciplinary subjects.
- Recent trends in engineering field in relation vehicles, road safety etc.

The topic should be based on recent research papers published in international conferences and/ or engineering journals and magazines or articles published in print media.

Seminar Load:
Maximum five students shall work under one faculty of department. Each student should have different seminar topic and its presentation. In case more than one student is working on the same topic, then their scope of seminar must be distinct.
Seminar Term Work:
Seminar report should be of 15 to 20 pages. The seminar report must be spiral bound. For standardization of the seminar reports the following format should be strictly followed.

- Page size : Trimmed A_4
- Top margin : 1 Inches
- Bottom margin : 1.32 Inches
- Left Margin : 1.5 Inches
- Right margin : 1.00 Inches
- Para Text: Font – Times New Roman; 12 Points
- Line Spacing : 1.5 Lines
- Page Numbers: Right aligned and in footer; Font Times New Roman; 12 Points
- Headings: New Times Roman, 14 points, Boldface
- Certificate : All students should attach standard format of certificate as described by the Department
- The entire seminar report should be documented as one chapter. References should have the following format
  For Books:
  1. "Title of Book"; Authors; Publisher; Edition
  For Papers:
  1. "Title of paper"; Authors; Conference Details; Year

Marks:

1. Seminar Review 10
2. Seminar Report 15
3. Presentation 15
4. Question/ Answer 10

- Mid semester review must be taken to ensure that all the students have concluded the topic and must be evaluated for 10 Marks.

- All students have to present their seminar individually in front of panel of faculty members of department.
- Examination will be conducted by two internal examiners (among approved teachers only) appointed by the Principal of the concerned college.
- Schedule of seminar presentation must be displayed on the notice board at least two weeks in advance.

University of Pune
T.E. (Automobile) Part II (2008 Course)
316483. Automobile Engine Design

Teaching scheme	**Examination scheme**
Lectures: 4 Hrs. /week	Theory Paper: 100 marks
Practical: 2 Hrs. / week	Oral: 50 marks

Section - I

1. Thermodynamic Engine Design: 10

Analysis of thermal cycles – Otto cycle, Diesel cycle, Duel cycle, mean effective pressure, swept volume, clearance volume, PV diagram, work done, effect of clearance volume of efficiency, Decision on size i.e. bore diameter, length of stroke, rpm of the engine, Design of engine from first principle

2. Engine Functional Design: 08

Selection of engine type, Stroke & Bore, No. of cylinders, Cylinder arrangement, Design considerations for combustion chamber, Engine balancing, Selection of firing order and cooling system.

3. Design of Cooling & Lubrication System: 08

Heat calculations and Heat balance sheet for design of cooling system, Design of radiator, water pump, selection of lubricating oil and pump

Section – II

4. Engine Component Design: 10

Materials for Engine Components, Design of Piston, Piston pin, Connecting rod, Crankshaft, Cylinder liner, cylinder head, Design of Flywheel with turning moment diagram, Design of Valve, Rocker arm, Push rod, Cam shaft, cam and follower, Failure analysis of critical components.

5. Engine Testing Equipment: 08

Fault finding equipment, Vacuum gauge test, Mechanical fuel pump testing, Cylinder power balance, Cylinder compression test, Cylinder leakage test, Ignition timing, Exhaust gas CO and HC analyzer, Oscilloscope engine analyzers, and Distributor dwell-angle

6. Recent Trends in Automobile Engine: 08

Variable Timing Control (VTC), Variable-Valve Timing (VVT), Variable compression ratio (VCR) and Lift Electronic Control (VTEC), Homogenous Charge Compression Ignition (HCCI) Advanced Turbulent Flow Technology (ATFT),Dual Twin Spark –ignition(DTS-i), Stratified Charged Engine, Wankel Engine, Four valve engine and Dual fuel engine.

Term Work:

- Assembly & Detail drawing of existing engine by actual measurements
- Demonstration on stress concentration by photo elasticity
- Design of engine components

• Detail drawing of components sheet of A_1 size
• Engine assembly drawing sheet of A_1 size

Books Recommended:

1. S. P. Patil, "Mechanical System Design", Jaico Publications,
2. V. L. Maleev, "I. C. Engine", McGraw Hill Book Co. Ltd., New Delhi, Second Edition
3. Gill P. W., Smith J. H., Zurich E. J., Fundamentals of I. C. Engine, Oxford & IBH Pub. Co., New Delhi.
4. E. F. Obert, "I.C. Engine & Air Pollution", Harper & Row Publishers, New York
5. J.B. Heywood, "I. C. Engine Fundamentals", McGraw Hill Book Co., New Delhi
6. Litchy, I. C. Engine, McGraw Hill
7. V. B. Bhandari, "Design of Machine Elements", Second Edition, Tata McGraw-Hill Publishing Company Ltd., New Delhi
8. Joseph E. Shigley & Larry D. Mitchell, "Mechanical Engineering Design", Sixth Edition, McGraw-Hill International Book Company
9. M.F. Spotts & T.E. Shoup, "Design of Machine Elements", Seventh Edition, Pearson Education
10. George E. Dieter, "Engineering Design- A Material and Processing Approach", Second Edition, McGraw-Hill International Edition
11. Robert C. Junivall, "Fundamentals of Machine Component Design", John Wiley & Sons
12. Paul H. Black & O. Eugene Adams Jr., 'Machine Design', Third Edition, McGraw-Hill International Edition
13. P. Kannaih, "Machine Design", Scintech Publications (I) Pvt. Ltd., Second Edition
14. A. Kolchin and V. Demidov, "Design of Automotive Engines", Mir Publishers, Moscow, 1984
15. Gordon P.Blair, "Design and Simulation of Four-Stroke Engines", Society of Automotive Engineers, Inc., USA, 1999.
16. D. E. Winterbone and R. J. Pearson, "Design Techniques for Engine Manifolds, Wave action methods for I.C. Engines", Professional Engineering Publishing Ltd., UK, 2000.

University of Pune
T.E. (Automobile) Part II (2008 Course)
311048. METROLOGYAND QUALITY CONTROL

Teaching scheme	**Examination scheme**
Lectures: 4 Hrs. /week	Theory Paper: 100 marks
Practical: 2 Hrs. / week	TW: 25marks

Section - I

1. Measurement Standard and Comparators: 08
   Measurement Standard – Principle of Engineering Metrology, line end, wavelength, Types and sources of error, alignment, temperature, plastic deformation, Accuracy and Precision, Slip gauges and gauges block, Linear and Angular measurement (Sine bar, Sine centre, Auto collimator, Angle décor Dividing Head), Calibration
   Comparator – Mechanical, Pneumatic, Optical, Electronic (Inductive), Electrical (LVDT)
   Checking of geometrical forms, Machine tool alignment test: Lathe, Drilling, Milling M/c.
2. Interferometer: 08
   Interferometer – Principle, NPL Interferometer, Flatness measuring of slip gauges, Parallelism, Laser Interferometer.
   Surface Finish Measurement – surface texture, measuring surface finish by Stylus.
   Design of Gauges – Types of gauges, limits, fits, tolerances, Taylor's principle.
3. Metrology of Screw Thread: 10
   Measurement of thread form – Minor, Major, Effective, Flank angle, Types and effect of screw thread error, Floating carriage micrometer
   Gear Metrology – Gear error, Gear measurement: Gear tooth vernier, constant chord, base tangent, rolling, Profile Projector, Tool maker's microscope.
   Advancement in Metrology – Co-ordinate measuring machine, Universal Measuring machine, Laser in metrology, Automatic inspection system, Online-Offline inspection machine vision

Section – II

4. Introduction to Quality and Quality Tools: 08
   Deming's PDCA, PDSA cycles and Juran Trilogy approach, Quality Statements, Cost of Quality and Value of quality, Seven Quality Tools: check sheet, flow chart, Pareto analysis, cause and effect diagram, scatter diagram, Brain storming; Quality circle; Concurrent engineering; Malcom Balbridge National quality award.
5. Total Quality Management: 08
   Quality function deployment, 5S, Kaizen, Kanban, JIT, Poka yoke, QMS (ISO 9000, TS 16949, ISO 14000, Quality audit); TPM, FMECA, FTA; Zero defects.
6. Statistical Quality Control: 10
   Statistical quality control – Statistical concept, Frequency diagram, Concept of variance analysis, control chart for variable and attribute, Process capability, Statistical process control, concept of Six sigma: DMAIC
   Acceptance Sampling: Sampling inspection, OC Curve and its characteristics, sampling methods, sampling plan: comparison, calculation of sample size, AOQ, Probability of Acceptance.

Term Work:

A) Experiments (Any Eight)
   1. Determination of Linear/ Angular dimensions of part using precision/ non precision measuring instruments.
   2. Precision Angular Measurement using Sine Bar/ Sine centre, Autocollimator/ angle décor.
   3. Machine Tool Alignment Test on any two machine like – Lathe, Milling, Drilling.
   4. Measurement of screw threads using Floating carriage micrometer.
   5. Measurement of gear tooth thickness by gear tooth Vernier Caliper/ Constant chord/ Span micrometer.
   6. Measurement of circularity / Roundness using mechanical comparator.
   7. Calibration of dial gauge using Dial Calibration Tester.
   8. Interferometer – Study of surfaces using optical flat.
   9. Study and applications of profile projector and Tool maker's microscope.
   10. Inspection of Production job by statistical process control
B) Assignments – At least two assignments based on syllabus of quality control
C) Industrial visit report on study of metrology subject.

Reference Books: Metrology

1. K. J. Hume, Engineering Metrology, Mascdonald Publications.
2. A. W. Judge, "Engineering Precision Measurements", Chapman and Hall.
3. R. K. Jain, "Engineering Metrology" Khanna Publications.
4. K. L. Narayana " Engineering Metrology"
5. J. F. Galyer and C. R. Shotbolt, "Metrology for Engineers"
6. I. C. Gupta, "Engineering Metrology" Dhanpatrai Publications
7. V. A. Kulkarni and A. K. Bewoor, "Metrology and Measurements" Tata McGraw Hill co. Ltd. New Delhi.

Reference Books: Quality Control

8. J. M. Juran, "Quality Handbook" McGraw Hill Publications.
9. S. P. Grant, "Statistical Quality Control" Tata McGraw Hill Publications.
10. F. T. Farago and M. A. Curtis, Handbook on Dimensional Measurement.
11. M. Harrison, Wordsworth, Stefeen Godfrey, "Modern Methods for Quality Control and Improvements", Wiley Publications.
12. K. J. Hune and G. H. Sharp, " Practical Metrology" Macdnald Publications
13. ASTME, "Handbook of Industrial Metrology" Prentice Hall Of India.

University of Pune
T.E. (Automobile) Part II (2008 Course)
31684. AUTOMOTIVE TRANSMISSION

Teaching scheme	**Examination scheme**
Theory : 3 Hrs. / Week	Theory paper : 100 Marks
Practical : 2 Hrs./Week	Term Work : 25 Marks

Section - I

1. Vehicle Layouts: **04**

Introduction, Classification of automobile, Types of chassis layout with reference to power plant locations and type of drive, Types of chassis- fully forward, semi forward, Truck or bus chassis, two & three wheeler chassis layout.

2. Clutches: **06**

Principle, functions, general requirements, torque capacity, 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.

3. Gear Box: **07**

Necessity of gear box, Resistance to motion of vehicle, Requirements of gear box, Functions of gear box, Types, Sliding mesh, Constant mesh, Synchromesh. Principle, construction and working of synchronizing unit, Requirements & applications of helical gears, Gear selector mechanism, Two wheeler gear box, Lubrication of gear box, Overdrive gears, Performance characteristics.

4. Drive Lines: **04**

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,

Section – II

5. Final Drive & Rear Axle: **06**

Purpose of final drive & drive ratio, Different types of final drives, need of differential, Constructional details of differential unit, Non-slip differential, Differential lock, Differential housing, Function of rear axle, Construction, Types of loads acting on rear axle, Axle types - semi-floating, full floating, three quarter floating, Axle shafts, Final drive lubrication.

6. Transmission with Fluid Flywheel & Torque convertor: **04**

Operating principle, Construction and working of fluid flywheel, Characteristics, Advantages & limitations of fluid coupling, Torque convertor, and construction and working of torque converter, Performance characteristics, Comparison with conventional gear box.

7. Epicyclic Gear Boxes: **04**

Simple epicyclic gear train, Gear ratios, Simple & compound planet epicyclic gearing, Epicyclic gear boxes, Wilson Epicyclic gear train - Construction and operation, Advantages, Clutches and brakes in epicyclic gear train, compensation for wear, performance characteristics.

8. Automatic Transmission: **07**

Principle of semi automatic & automatic transmission, Hydramatic transmission, Fully automatic transmission, Semi automatic transmission, Hydraulic control system, Continuous variable transmission (CVT) – operating principle, basic layout and operation, Advantages and disadvantages

Term Work:

1. Demonstration, study and sketching of different vehicle layouts and its comparison
2. Demonstration, study and prepare dimensional sketch of single plate clutch
3. Demonstration, study and prepare dimensional sketch of centrifugal clutch.
4. Demonstration, study and prepare dimensional sketch of multi-plate clutch
5. Demonstration, study and prepare dimensional sketch of diaphragm clutch
6. Demonstration, study and prepare dimensional sketch of constant mesh gear box
7. Demonstration, study and prepare dimensional sketch of synchromesh gear box
8. Demonstration, study and prepare dimensional sketch of Continuous variable transmission unit (CVT)
9. Demonstration, study and prepare dimensional sketch of differential and final drive
10. Demonstration and study of fluid flywheel & torque converters
11. Demonstration and study of semi-automatic transmission
12. Demonstration and study of automatic transmission

Recommended Books:

1. Newton, Steed & Garrot, "Motor Vehicles", 13th Edition, Butterworth London,
2. A. W. Judge, "Modern Transmission", Chapman & Hall Std., 1989
3. Chek Chart, "Automatic Transmission", A Harper & Raw Publications
4. J. G.Giles, "Steering, Suspension & Tyres", – Lliffe Book Ltd., London
5. W. Steed, "Mechanics of Road Vehicles", Lliffe Book Ltd.
6. N. K. Giri, "Automotive Mechanics", Khanna Publishers, Delhi, Eighth Edition
7. Heisler, "Vehicle and Engine Technology", Second Edition, SAE International Publication.
8. Heisler, "Advanced Vehicle Technology", Second Edition, SAE International Publication.
9. J. Reimpell, H. Stoll and J. W. Betzler, "The Automotive Chassis", SAE International Publication.

University of Pune
T.E. (Automobile) Part II (2008 Course)
316485. Autotronics

Teaching Scheme	Examination Scheme
Lectures: 4 hrs/week	Theory: 100 Marks
Practical: 2 hrs/week	Term work: 50 Marks

Section-I

1. **Introduction to Autotronics:** **08**
   Measurement systems: Basic Principles of transductions related to Resistive, Capacitive, Inductive, Piezoelectric, Thermoelectric and Photovoltaic. Stages of measurement, static characteristics of instruments, and commonly used automobile and electronics components.

2. **Sensors in Automobile:** **08**
   Electromagnetic Sensors, Optical Sensor, Temperature Sensor, Manifold Absolute Pressure Sensor, Knock Sensor, Throttle position sensor, Exhaust Gas Sensors, Air flow measurement.

3. **Digital Signal Processing:** **08**
   Timing diagrams, sequential logic, A/D and D/A converters, Programming Logic Controllers: Ladder diagrams programming, input/output processing, timers, internal relays and counters, Components of Power window system, and its ladder programming

Section - II

4. **Engine Management Control System (EMS):** **08**
   Layout and working (open loop and closed loop control), ECU and microcontroller, group and sequential injection techniques, fuel system components, cold and warm start system, idle speed control, acceleration / deceleration and full load enrichment and fuel cut-off, fuel control MAPs. Electronic Ignition system and spark timing control.

5. **Vehicle Management System:** **08**
   ABS system, its need, layout and working. Electronic control of suspension – Damping control, Electric power steering, Supplementary Restraint System of air bag system – crash sensor, seat belt tightening, Cruise control, Vehicle security systems alarms, vehicle tracking system, Collision avoidance, Radar warning system, Introduction to Global Positioning Systems

6. **Vehicle Safety:** **08**
   Electronic Stability and Rollover Mitigation Systems, Introduction, Electronic Stability Program System Operation, Overview, Rollover Mitigation System Overview, Additional Optional Features.

Term Work:

1. Measurement of Temperature.
2. Speed measurement/ level measurement.
3. Measurement of Pressure
4. Measurement of Flow
5. Throttle Position Sensor

6. Lambda Sensor
7. Interfacing of analog sensors with micro-controller
8. Interfacing of frequency input from speed sensor to microcontroller
9. Study of Engine Management System
10. Study of Antilock Braking System
11. PLC programming for power windows

Total 8 experiments are to be carried out. Any 5 from 1 to 6, any one from 7 and 8, any one from 9 and 10, experiment no 11 is compulsory

Reference Books:

1. Steve V. Hatch, "Computerized Engine Controls", Edition 8, Cengage Learning, 2008, ISBN 1428399968, 9781428399969

2. Allan W. M. Bonnick, "Automotive Computer Controlled Systems", Butterworth-Heinemann Linacre House, Jordan Hill, Oxford, ISBN 0 7506 5089 3

3. Barry Hollembeak, Jack Erjavec, "Automotive Electricity and Electronics - Today's Technician", Edition 2, Delmar Publishers, 1997, ISBN 0827376359, 9780827376359

4. William Harry Crouse, "Automotive Electronics and Electrical Equipment", Edition 10, Gregg Division, McGraw-Hill, 1986, ISBN 0070148953, 9780070148956

5. William Harry Crouse, Donald L. Anglin, "Automotive Tune up", Automotive Technology Series, Publisher McGraw-Hill Gregg Division, 1977, ISBN 0070148104, 9780070148109

6. Frank C. Derato, "Automotive Electrical and Electronic Systems", Edition 2, Glencoe, 1994, ISBN 0028004124, 9780028004129

7. Ken Layne, "Automobile Electronics and Basic Electrical Systems", Volume 1, Wiley, 1989 ISBN 0471617636, 9780471617631

8. Boyce H. Dwiggins, "Automotive Air Conditioning", Edition 8, Delmar Thomson Learning, 2001, ISBN 0766807886, 9780766807884

9. Harper & Row, "Automotive Electrical and Electronic Systems", Volume 2, Chek-Chart automotive series, Roger Fennema, Chek-Chart (Firm), Edition 2, HarperCollins Canada, Limited, 1987 ISBN 0064540146, 9780064540148

University of Pune
T.E. (Automobile) Part II (2008 Course)
31686. VEHICLE BODY ENGINEERING

Teaching scheme	**Examination scheme**
Theory: 3 Hrs. / Week	Theory paper: 100 Marks
Practical: 2 Hrs./Week	Term Work : 25 Marks

Section – I

1. Vehicle Aerodynamics: **06**

Aerodynamic drag and its types and various forces and moments, its effects on performance, Various body optimization techniques for minimum drag, Problems on forces & moments, Wind tunnel testing, Scale model testing, Component balance to measure forces and moments.

2. Car Body Details: **06**

Types- Saloon, Convertibles, Limousine, Estate Van, Racing and sport cars, Regulations, Drivers visibility, Tests for visibility, Methods of improving visibility, Space in cars, safety design, car body construction, front assembly, Roof Assembly, Under floor, bonnet etc.

3. Bus Body Details: **07**

Types - Mini Bus, Single dekker, double dekker, two levels, split level and articulated bus, Bus body layout – floor height-engine locations –Entrance cum exit location-seating dimensions, construction details, frame construction, double skin construction, types metal sections used – regulations, conventional & integral type construction, Emergency door location, luggage space location, seating layouts, passenger comfort.

Section – II

4. Commercial Vehicle Body Details: **05**

Types of bodies, flat platform, drop side, fixed side, tipper body tanker body, light construction vehicle body types, Dimensions of driver seat in relation to control, driver cabin design.

5. Body Loads: **07**

Idealized structure, structural surfaces, shear panel method, symmetric & asymmetric Vertical loads in car longitudinal load, and load distribution on vehicle structure, stress analysis of bus body structure under bending and torsion-stress analysis in integral bus body, Design of Chassis Frame.

6. Ergonomics & Design Safety of Vehicle Body: **08**

Importance of ergonomics in automotive body design, Anthropometry, Drivers work station-Design of driver seat for comfort and safety, Types of seat used in automobiles, Types of safety belts, Air bags used in automobiles, Use of energy absorbing system in 27automobiles, Impact protection from steering controls Importance of Bumper in automobile, and its design of passenger seat for comfort and safety.

Term Work:

1. To study the ergonomics of human beings, driver's seat position, size and construction.
2. Study of typical Car - body construction with sketches.
3. To study passenger seat position, requirement and construction.
4. To study and prepare layouts of seating arrangement of a typical passenger bus.
5. To study the construction of typical truck body and draw sketches.
6. To prepare layout of luxury coach.
7. Calculation of aerodynamic forces and pitching, rolling, yawing moments.
8. Study / Measurement of drag, lift force of a scaled model in wind tunnel.
9. To prepare the analysis of the vehicle body weight and the weight distribution.
10. To demonstrate constructional and operational features of power window.
11. To test drivability of driver using driver testing unit.
12. Design a bus body structure.

Recommended Books:

1. Sydney F. Page, "Body Engineering", Chapman & Hill Ltd., London, 3rd Edition
2. J Fairbrother, "Fundamentals of Vehicle Body work", Hutchinson, London.
3. P.M. Heldt, "Automotive Chassis", Chilton Co. NK
4. John Fenton, "Vehicle Body Layout & Analysis", Hutchinson, London.
5. J Powloski, "Vehicle Body Engineering", Business Books Ltd., London.
6. J.G. Giles, "Body Construction and Design", Vol. 6., llefe Books/Butterworth & Co. London
7. Crouse W. H. & Anglin D. L., "Automotive Chassis", McGraw-Hill Int. Book Co.
8. P. L. Kohli, "Automotive Chassis & Body", Papyrus Publishing House, New Delhi.
9. Dr. V. Sumantran and Dr. Gino Sovram, Vehicle Aerodynamics Published by SAE International, USA
10. Wolf-Heinrich Hucho, "Aerodynamics of Road Vehicles" Published by SAE International, USA
11. A. Robinson, W. A. Livesey, "The Repair of Vehicle Bodies" Published by Butterworth-Heinemann LTD.
12. John Fenton, "Handbook of Automotive Body Construction and Design Analysis" Professional Engineering Publishing.

University of Pune
T.E. (Automobile) Part II (2008 Course)
316487. VEHICLE MAINTENANCE PRACTICES

Teaching scheme
Practical: 2 Hrs./ week

Examination scheme
Term Work :25 marks
Practical: 50 marks

Term Work:

1. Demonstration of garage, garage equipments & tools, preparation of different garage layouts
2. Demonstration of washing & greasing of vehicle
3. Engine oil change & periodic maintenance of vehicle
4. Clutch overhaul of light / heavy duty vehicle
5. Clutch overhaul of two or three wheeler vehicle
6. Dismantling & assembly of sliding mesh gearbox
7. Dismantling & assembly of synchromesh gearbox
8. Drive line overhaul (universal joint, propeller shaft, slip joint)
9. Final drive & differential overhaul
10. Rear axle hub greasing
11. Visit to modern garage