ANNA UNIVERSITY, CHENNAI 600 025
UNIVERSITY DEPARTMENTS
R 2017
B.E. (PART TIME) AUTOMOBILE ENGINEERING
I TO VII SEMESTERS CURRICULUM AND SYLLABUS

SEMESTER I

SL. NO.	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	PTMA7151	Applied Mathematics	3	0	0	3
2.	PTGE7151	Computing Techniques	3	0	0	3
3.	PTGE7152	Engineering Mechanics	3	0	0	3
4.	PTPH7152	Materials Science	3	0	0	3
5.	PTPR7101	Production Processes	3	0	0	3
		TOTAL CREDITS	**15**	**0**	**0**	**15**

SEMESTER II

SL. NO.	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	PTAU7201	Automotive Petrol Engines	3	0	0	3
2.	PTEI7205	Electrical and Electronics Engineering	3	0	0	3
3.	PTAE7201	Mechanics of Solids	3	0	0	3
4.	PTMA7251	Numerical Methods	3	0	0	3
5.	PTAU7202	Thermodynamics and Thermal Engineering	3	0	0	3
		TOTAL CREDITS	**15**	**0**	**0**	**15**

SEMESTER III

SL. NO.	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	PTAU7301	Automotive Chassis	3	0	0	3
2.	PTAU7302	Automotive Diesel Engines	3	0	0	3
3.	PTAE7301	Engineering Fluid Mechanics and Machinery	3	0	0	3
4.	PTPR7301	Kinematics and Dynamics of Machines	3	0	0	3
PRACTICAL						
5.	PTAU7311	Automotive Engine and Chassis Components Laboratory	0	0	3	2
		TOTAL CREDITS	**12**	**0**	**3**	**14**

SEMESTER IV

SL. NO.	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	PTAU7401	Automotive Electrical and Electronics Systems	3	0	0	3
2.	PTAU7402	Automotive Transmission	3	0	0	3
3.	PTAU7403	Theory of Fuels and Lubricants	3	0	0	3
4.		Elective I	3	0	0	3
PRACTICAL						
5.	PTAU7411	Automotive Electrical and Electronics Laboratory	0	0	3	2
		TOTAL CREDITS	**12**	**0**	**3**	**14**

SEMESTER V

SL. NO.	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	PTAU7501	Automotive Components Design	3	0	0	3
2.	PTAU7502	Automotive Pollution and Control	3	0	0	3
3.	PTAU7503	Vehicle Body Engineering	3	0	0	3
4.		Elective II	3	0	0	3
PRACTICAL						
5.	PTAU7511	Engine Testing and Emission Measurement Laboratory	0	0	3	2
		TOTAL CREDITS	**12**	**0**	**3**	**14**

SEMESTER VI

SL. NO.	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	PTAU7601	Advanced Vehicle Technology	3	0	0	3
2.	PTAU7602	Electronic Engine Management System	3	0	0	3
3.		Elective III	3	0	0	3
4.		Elective IV	3	0	0	3
PRACTICAL						
5.	PTAU7611	Vehicle Testing Laboratory	0	0	3	2
		TOTAL CREDITS	**12**	**0**	**3**	**14**

SEMESTER VII

SL. NO.	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	PTAU7701	Vehicle Dynamics	3	0	0	3
2.		Elective V	3	0	0	3
3.		Elective VI	3	0	0	3
PRACTICAL						
4.	PTAU7711	Project Work	0	0	9	6
		TOTAL CREDITS	**9**	**0**	**9**	**15**

TOTAL NO OF CREDITS: 101

LIST OF ELECTIVES

SL. NO.	COURSE CODE	COURSE TITLE	L	T	P	C
1.	PTAU7001	Advanced Theory of IC Engines	3	0	0	3
2.	PTAU7002	Alternative Fuels and Energy System	3	0	0	3
3.	PTAU7003	Automotive Aerodynamics	3	0	0	3
4.	PTAU7004	Automotive Automation	3	0	0	3
5.	PTAU7005	Automotive Materials	3	0	0	3
6.	PTAU7006	Automotive Test Instrumentation	3	0	0	3
7.	PTAU7007	Combustion Thermodynamics and Heat Transfer	3	0	0	3
8.	PTAU7008	Computational Fluid Mechanics	3	0	0	3
9.	PTGE7071	Disaster Management	3	0	0	3
10.	PTAU7009	Finite Element Techniques	3	0	0	3
11.	PTGE7076	Fundamentals of Nano Science	3	0	0	3
12.	PTGE7073	Human Rights	3	0	0	3
13.	PTAU7010	Hybrid and Electric Vehicles	3	0	0	3
14.	PTAU7011	Hydraulic and Pneumatics Systems	3	0	0	3
15.	PTAU7012	Manufacturing of Automotive Components	3	0	0	3
16.	PTAU7013	Metrology and Measurement System	3	0	0	3
17.	PTAU7014	Noise, Vibration and Harshness	3	0	0	3
18.	PTAU7015	Off Highway Vehicles	3	0	0	3
19.	PTAU7016	Principles of Control Systems	3	0	0	3
20.	PTAU7017	Quality Control and Reliability	3	0	0	3
21.	PTPR7001	Quantitative Techniques in Management	3	0	0	3
22.	PTAU7018	Simulation of IC Engines	3	0	0	3
23.	PTGE7074	Total Quality Management	3	0	0	3
24.	PTAU7019	Two and Three Wheeler Technology	3	0	0	3
25.	PTAU7020	Vehicle Air-Conditioning	3	0	0	3
26.	PTAU7021	Vehicle Maintenance	3	0	0	3
27.	PTAU7022	Vehicle Multiplexing	3	0	0	3
28.	PTAU7023	Virtual Instrumentation in Automobile Engineering	3	0	0	3

PTMA7151 APPLIED MATHEMATICS L T P C
(Common to all branches of B.E / B.Tech (PT) Programmes) 3 0 0 3

OBJECTIVES :

- To facilitate the understanding of the principles and to cultivate the art of formulating physical problems in the language of mathematics.

UNIT I MATRICES 9

Characteristic equation – Eigen values and Eigenvectors of a real matrix – Properties of eigen values and eigenvectors – Cayley Hamilton theorem – Diagonalization of matrices - Reduction of a quadratic form to canonical form by orthogonal transformation.

UNIT II FUNCTIONS OF SEVERAL VARIABLES 9

Partial derivatives – Homogeneous functions and Euler's theorem – Total derivative – Differentiation of implicit functions – Change of variables – Jacobians – Partial differentiation of implicit functions – Taylor's series for functions of two variables - Maxima and minima of functions of two variables.

UNIT III ANALYTIC FUNCTION 9

Analytic functions – Necessary and sufficient conditions for analyticity – Properties – Harmonic conjugates – Construction of analytic function – Conformal Mapping – Mapping by functions $w = a + z$, az, $1/z$, **-** Bilinear transformation.

UNIT IV COMPLEX INTEGRATION 9

Line Integral – Cauchy's theorem and integral formula – Taylor's and Laurent's series – Singularities – Residues – Residue theorem – Application of Residue theorem for evaluation of real integrals – Use of circular contour and semicircular contour with no pole on real axis.

UNIT V LAPLACE TRANSFORMS 9

Existence conditions – Transforms of elementary functions – Basic properties – Transforms of derivatives and integrals –Inverse transforms – Convolution theorem – Transform of periodic functions – Application to solution of linear ordinary differential equations with constant coefficients.

TOTAL : 45 PERIODS

OUTCOMES :

- To develop the use of matrix algebra techniques this is needed by engineers for practical applications.
- To familiarize the student with functions of several variables. This is needed in many branches of engineering.
- To develop an understanding of the standard techniques of complex variable theory so as to enable the student to apply them with confidence, in application areas such as heat conduction, elasticity, fluid dynamics and flow the of electric current.
- To make the student appreciate the purpose of using transforms to create a new domain in which it is easier to handle the problem that is being investigated.

TEXT BOOK :

1. Grewal B.S., " Higher Engineering Mathematics ", Khanna Publishers, New Delhi, 43rd Edition, 2014.

REFERENCES :

1. Ramana. B.V., " Higher Engineering Mathematics ", McGraw Hill Education Pvt. Ltd, New Delhi, 2016.
2. Erwin Kreyszig ," Advanced Engineering Mathematics ", John Wiley and Sons, 10th Edition, New Delhi, 2016.
3. Glyn James, Advanced Modern Engineering Mathematics, Prentice Hall of India, Fourth Edition, 2011.
4. Bali, N.P. and Manish Goyal, A Text Book of Engineering Mathematics, Lakshmi Publications Pvt. Ltd., New Delhi, 2006.
5. Ray Wylie C and Barrett.L.C, " Advanced Engineering Mathematics " Tata McGraw Hill Education Pvt. Ltd, 6th Edition, New Delhi, 2012.

PTGE7151	COMPUTING TECHNIQUES	L	T	P	C
	(Common to all branches of Engineering and Technology)	**3**	**0**	**0**	**3**

OBJECTIVE

- To learn programming using a structured programming language.
- To provide C programming exposure.
- To introduce foundational concepts of computer programming to students of different branches of Engineering and Technology.

UNIT I INTRODUCTION 9

Introduction to Computers – Computer Software – Computer Networks and Internet - Need for logical thinking – Problem formulation and development of simple programs - Pseudo code - Flow Chart and Algorithms.

UNIT II C PROGRAMMING BASICS 9

Introduction to C programming – Fundamentals – Structure of a C program – Compilation and linking processes - Constants, Variables – Data Types – Expressions - Operators –Decision Making and Branching – Looping statements – Solving Simple Scientific and Statistical Problems.

UNIT III ARRAYS AND STRINGS 9

Arrays – Initialization – Declaration – One dimensional and two dimensional arrays - Strings- String operations – String Arrays - simple programs- sorting- searching – matrix operations.

UNIT IV POINTERS 9

Macros - Storage classes –Basic concepts of Pointers– Pointer arithmetic - Example Problems - Basic file operations

UNIT V FUNCTIONS AND USER DEFINED DATA TYPES 9

Function – definition of function – Declaration of function – Pass by value – Pass by reference – Recursion –Enumerators – Structures - Unions

TOTAL : 45 PERIODS

OUTCOMES

At the end of the course, the student should be able to:

- Write C program for simple applications
- Formulate algorithm for simple problems
- Analyze different data types and arrays
- Perform simple search and sort**.**
- Use programming language to solve problems.

TEXT BOOKS:

1. Pradip Dey, Manas Ghosh, "Computer Fundamentals and Programming in C", Second Edition, Oxford University Press, 2013
2. Ashok N. Kamthane, "Computer programming", Pearson Education, 2007.
3. Yashavant P. Kanetkar. "Let Us C", BPB Publications, 2011.

REFERENCES:

1. Kernighan,B.W and Ritchie,D.M, "The C Programming language", Second Edition, Pearson Education, 2006
2. Byron S Gottfried, "Programming with C", Schaums Outlines, Second Edition, Tata McGraw-Hill, 2006.
3. R.G. Dromey, "How to Solve it by Computer", Pearson Education, Fourth Reprint, 2007

PTGE7152 ENGINEERING MECHANICS L T P C

3 0 0 3

OBJECTIVE :

The objective of this course is to inculcate in the student the ability to analyze any problem in a simple and logical manner and to predict the physical phenomena and thus lay the foundation for engineering applications.

UNIT I STATICS OF PARTICLES 9

Fundamental Concepts and Principles, Systems of Units, Method of Problem Solutions, Statics of Particles - Forces in a Plane, Resultant of Forces, Resolution of a Force into Components, Rectangular Components of a Force, Unit Vectors. Equilibrium of a Particle-Newton's First Law of Motion, Space and Free-Body Diagrams, Forces in Space, Equilibrium of a Particle in Space.

UNIT II EQUILIBRIUM OF RIGID BODIES 9

Principle of Transmissibility, Equivalent Forces, Vector Product of Two Vectors, Moment of a Force about a Point ,Varignon's Theorem, Rectangular Components of the Moment of a Force, Scalar Product of Two Vectors, Mixed Triple Product of Three Vectors, Moment of a Force about an Axis, Couple-Moment of a Couple, Equivalent Couples, Addition of Couples, Resolution of a Given Force into a Force-Couple system, Further Reduction of a System of Forces, Equilibrium in Two and Three Dimensions-Reactions at Supports and Connections.

UNIT III DISTRIBUTED FORCES 9

Centroids of lines and areas –symmetrical and unsymmetrical shapes, Determination of Centroids by Integration , Theorems of Pappus-Guldinus, Distributed Loads on Beams, Center of Gravity of a Three-Dimensional Body, Centroid of a Volume, Composite Bodies ,Determination of Centroids of Volumes by Integration.

Moments of Inertia of Areas and Mass -Determination of the Moment of Inertia of an Area by Integration , Polar Moment of Inertia , Radius of Gyration of an Area , Parallel-Axis Theorem , Moments of Inertia of Composite Areas, Moments of Inertia of a Mass-Moments of Inertia of Thin Plates , Determination of the Moment of Inertia of a Three-Dimensional Body by Integration.

UNIT IV FRICTION 9

The Laws of Dry Friction. Coefficients of Friction, Angles of Friction, Wedges, Wheel Friction. Rolling Resistance , Ladder friction.

UNIT V DYNAMICS OF PARTICLES 9

Kinematics-Rectilinear Motion and Curvilinear Motion of Particles.
Kinetics-Newton's Second Law of Motion -Equations of Motions , Dynamic Equilibrium, Energy and Momentum Methods Work of a Force, Kinetic Energy of a Particle, Principle of Work and Energy, Principle of Impulse and Momentum, Impact.

L–45 TOTAL: 45 PERIODS

OUTCOME:

Upon completion of this course, students will be able to construct meaningful mathematical models of physical problems and solve them.

TEXT BOOK

1. Beer,F.P and Johnson Jr. E.R, "Vector Mechanics for Engineers", McGraw-Hill Education (India) Pvt. Ltd. 10th Edition, 2013.

REFERENCES

1. Hibbeller, R.C., Engineering Mechanics: Statics, and Engineering Mechanics: Dynamics, 13th edition, Prentice Hall, 2013.
2. J.L. Meriam& L.G. Karige, Engineering Mechanics: Statics (Volume I) and Engineering Mechanics: Dynamics, 7th edition, Wiley student edition, 2013.
3. P. Boresi & J. Schmidt, Engineering Mechanics: Statics and Dynamics, 1/e, Cengage learning, 2008. Irving H. Shames, G. Krishna MohanaRao, Engineering Mechanics -Statics andDynamics, Fourth Edition–PHI / Pearson Education Asia Pvt. Ltd., 2006.
4. Vela Murali, "Engineering Mechanics", Oxford University Press (2010)

PTPH7152 MATERIALS SCIENCE L T P C

(Common to Manufacturing, Industrial, Mining, Aeronautical, Automobile and Production Engineering) **3 0 0 3**

OBJECTIVE:

- To introduce the essential principles of materials science for mechanical and related Engineering applications.

UNIT I PHASE DIAGRAMS 9

Solid solutions - Hume Rothery's rules - The phase rule - single component system - one-component system of iron - binary phase diagrams - isomorphous systems - the tie-line rule - the lever rule - application to isomorphous system - eutectic phase diagram - peritectic phase diagram - other invariant reactions – free energy composition curves for binary systems - microstructural change during cooling.

UNIT II FERROUS ALLOYS AND HEAT TREATMENT 9

The iron-carbon equilibrium diagram - phases, invariant reactions - microstructue of slowly cooled steels - eutectoid steel, hypo and hypereutectoid steels - effect of alloying elements on the Fe-C system - diffusion in solids - Fick's law - phase transformations - T-T-T-diagram for eutectoid steel – pearlitic, baintic and martensitic transformations - tempering of martensite - heat treatment of steels - annealing - normalizing - quenching and tempering - case hardening - induction, flame and laser hardening - carburizing, cyaniding, carbonitriding and nitriding.

UNIT III MECHANICAL PROPERTIES 9

Tensile test - plastic deformation mechanisms - slip and twinning - role of dislocations in slip - strengthening methods - strain hardening - refinement of the grain size - solid solution strengthening - precipitation hardening - creep resistance - creep curves - mechanisms of creep - creep-resistant materials - fracture - the Griffith criterion - critical stress intensity factor and its determination - fatigue failure - fatigue tests - methods of increasing fatigue life - hardness - Rockwell and Brinell hardness - Knoop and Vickers microhardness.

UNIT IV MAGNETIC, DIELECTRIC AND SUPERCONDUCTING MATERIALS 9

Ferromagnetism – Domain theory – types of energy – hysteresis – hard and soft magnetic materials – ferrites - dielectric materials – types of polarization – Langevin-Debye equation – frequency effects on polarization - dielectric breakdown – insulating materials – Ferroelectric materials - superconducting materials, properties, types and applications.

UNIT V NEW MATERIALS 9

Ceramics – types and applications – Composites: classification, role of matrix and reinforcement – processing of fiber reinforced plastics – Metallic glasses – types , glass forming ability of alloys – Inoue criteria – melt spinning process – applications - Shape memory alloys – phases, shape memory effect, pseudoelastic effect – NiTi alloy – applications- Nanomaterials – preparation: ball milling and chemical vapour deposition - properties and applications – carbon nanotubes - Biomaterials

TOTAL: 45 PERIODS

OUTCOME:

- Upon completion of this course, the students can able to apply the different materials, their processing, and heat treatments in suitable application in mechanical engineering fields.

TEXT BOOKS:

1. Raghavan, V. “Physical Metallurgy: Principles and Practice”, Phi Learning (2009).
2. Balasubramaniam, R. “Callister's Materials Science and Engineering”, Wiley India Pvt. Ltd. (2014).
3. Palanisamy P.K., “Materials Science” , Scitech (2013).

REFERENCES:

1. Raghavan, V. “Materials Science and Engineering”, Printice Hall of India (2007).
2. Shackelford, J.F. “Introduction to Materials Science for Engineers”. Pearson India (2006).
3. Donald Askeland. “Materials Science and Engineering”, Brooks/Cole (2010).
4. Smith, W.F., Hashemi, J. and R.Prakash. “Materials Science and Engineering”,Tata Mcgraw Hill Education Private Limited (2014).

PTPR7101	PRODUCTION PROCESSES	L	T	P	C
	(Common to Aero/Auto/Rubber and Plastics)	3	0	0	3

OBJECTIVES:

- To impart the knowledge about the various production processes available
- To expose the student on the principle and applications of the processes
- To make a decision on a relevant process based on the merits and demerits.

UNIT I CASTING PROCESSES 10

Methods of production processes – comparison – sand casting – mould, pattern, die – pattern allowances – materials – types – 2 and 3 box moulding process – steps involved – core function and core making – runner, riser, gate-purpose – construction, principle, merits, demerits and applications of die casting, shell moulding, investment casting, centrifugal casting, continuous casting squeeze casting.

UNIT II METAL FORMING PROCESSES 8

Definition and companion of hot and cold forming – Principle, construction, types, merits, demerits and application of forging, rolling, extrusion, spinning processes – sheet metal operations – Types of dies used – Principle of powder metallurgy – steps involved – merits, demerits and applications.

UNIT III MACHINING PROCESSES 9

Machine and machine tool – construction, types operations in the following machines with block diagrams – Lathe, Milling, Drilling and Grinding – Concept of NC/CNC machines – Comparison of CNC with conventional machines – sample manual part programming for CNC Lathe and milling.

UNIT IV WELDING PROCESSES 9

Types of joining – soldering, brazing, welding, Chemical and mechanical – Fusion welding process – Gas welding – flame types – applications = Arc welding – types of joint – electrode – power supply – edge preparation – weld symbol – filler material – flux/ shielding gases – arc theory – Construction and applications of types of arc welding – Manual, GTAW, GMAW, SAW, ESW – Thermit welding, Pressure welding – resistance welding – spot, seam, projection and flash butt welding – stud welding – friction stir welding – diffusion bonding.

UNIT V UNCONVENTIONAL MACHINING PROCESSES 9

Need for unconventional – Construction, working principle merits, demerits and applications with block diagram only for AJM, AWJM, USM, CHM, ECM, EDM, EBM, LBM, PAM and IBM.

TOTAL: 45 PERIODS

OUTCOMES:

- Has enough knowledge on the various process available to make a part.
- Confident to select the process to based on cost of time and quantities.
- Can determine processes for new materials.

TEXT BOOKS

1. Serope Kalpakjian, Steven R. Schmid, Manufacturing Engineering and Technology - Anna University, 4/e, Pearson Education, 2014
2. P.C. Sharma, “A Text Book of Production Technology”, S.Chand and Co. Ltd., New Delhi, 2010.

REFERENCES:

1. B.H.Amstead, "Manufacturing Processes", Phillip F.Ostwald, L.Begemon, John Wiley and Sons, 8th Edition, 1998.
2. De Garmo, "Materials and Processes in Manufacturing", Prentice Hall of India, 8th Edition, 2008.
3. P.N.Rao, "Manufacturing Technology – I and II", Tata McGraw Hill Publishing Co., New Delhi – 2013.
4. Amitabha Ghosh, Asok Kumar Mallik, Manufacturing Science, EWP Pvt. Ltd, 2007

PTAU7201 AUTOMOTIVE PETROL ENGINES L T P C
3 0 0 3

OBJECTIVE

- To impart basic knowledge on IC engines and its types and to develop the knowledge on various additional systems which are helps to improve the engine characteristics. Also to give through knowledge on complete construction and working details of petrol engine and its different accessories.

UNIT I ENGINE CONSTRUCTION AND WORKING 9

Engine classifications, 4 stroke engine - Constructional details, working principle. Otto cycle, Actual indicator diagram, Fuel air & Actual cycles. Cylinder layout and configurations. Firing order and its significance. Engine balancing. Materials for engine components.

UNIT II FUEL AND IGNITION SYSTEM 9

Carburetor – requirements, working principle, types, different circuits – Compensation & Maximum power devices – Petrol injection in SI engines, Magneto coil and battery coil spark ignition system. Advance mechanism. Electronic ignition System – CDI.

UNIT III COOLING AND LUBRICATION SYSTEM 9

Need for cooling. Types of cooling system – air cooling and Liquid cooled systems. Forced circulation system, pressure cooling system, Evaporative cooling system – Need for Lubrication system. Mist lubrication system, wet & dry sump lubrication, Properties of lubricants, properties of coolant – Recent Technologies.

UNIT IV COMBUSTION AND COMBUSTION CHAMBERS 9

Combustion in SI engine – Stages of combustion – Flame propagation – Rate of pressure rise – Abnormal combustion – pre ignition and knock in SI engines – effect of engine variables on knock – Different combustion chambers for SI engine –Factors controlling combustion chamber design.

UNIT V TWO STROKE ENGINES 9

Two stroke engine – types, terminologies, definitions, construction and operation. Comparison of four stroke and two stroke engine operation. Theoretical scavenging processes. Merits and demerits, scavenging efficiency, Scavenging pumps, Rotary valve engine.

TOTAL : 45 PERIODS

OUTCOMES

Student can able to,

- identify various components of petrol engines and its sub systems.
- understand the actual engine working principle and its related components

- enhance their knowledge on other sub systems like ignition , lubrication etc.
- understand basic knowledge on petrol combustion and its related parameters

TEXT BOOKS

1. Ramalingam. K. K., Internal Combustion Engines, Scitech publications, Chennai, 2003
2. Ganesan.V., Internal Combustion Engines, Tata McGraw Hill Publishing Co., New York,1994.

REFERENCES

1. Heldt.P.M. High Speed Combustion Engines, Oxford IBH Publishing Co., Calcutta, 1975.
2. Obert E.F., Internal Combustion Engines Analysis and Practice, International Text Books:Co., Scranton, Pennsylvania, 1988.
3. William.H.Crouse, Automotive Engines, McGraw Hill Publishers, 1985.
4. Ellinger, H.E., Automotive Engines, Prentice Hall Publishers, 1992.

PTEI7205 ELECTRICAL AND ELECTRONICS ENGINEERING L T P C
3 0 0 3

OBJECTIVES

- Gain knowledge on network theorems.
- Understand the basics of AC circuits and the terms related to AC circuits.
- Gain knowledge on construction and working principle of AC and DC machines.
- Get exposed to basic electronic devices and their applications.
- Gain knowledge on logic gates and their applications in digital electronics.

UNIT I BASIC CONCEPTS AND D.C. CIRCUIT ANALYSIS 9

Ohm's law - Ideal voltage and current sources-Independent sources -dependent sources-circuit elements - Kirchhoff's law - voltage and current division in series and parallel circuits-Node and Mesh analysis - Star/Delta transformations- Thevenin's , Norton's and Super position theorem.

UNIT II A.C. CIRCUITS 9

Sinusoidal voltage and current-RMS and average value of periodic waves - Form factor - Phase and Phase difference – Simple RC.RL and RLC circuits - series and parallel resonance - power and power factor – introduction to three phase systems – power measurement in 3 phase system.

UNIT III ELECTRICAL MACHINES 9

DC Generators: Construction-Principle of Operation-EMF Equation and Applications- DC Motors: Back EMF-Voltage and torque equation- Principle of transformer- EMF Equation - Tests on transformer - AC motors: Construction and basic Principle of Operation-Starting and Running torques.

UNIT IV ANALOG ELECTRONICS 9

Semiconductors - Characteristics of PN Junction Diode and Zener Diode– Half wave and Full wave Rectifiers. Bipolar Junction Transistor – CB, CE, CC Configurations and Characteristics-Class A, B and C amplifiers (quantitative treatment).

UNIT V DIGITAL ELECTRONICS 9

Number systems – binary codes - logic gates - Boolean algebra, laws & theorems - simplification of Boolean expression - implementation of Boolean expressions using logic gates - standard forms of Boolean expression-Combinational circuits- Design of adder, subtractor, encoders, decoders, multiplexers and demultiplexers-Flip flops.

TOTAL : 45 PERIODS

OUTCOMES

- Able to analyze and solve problems for all types of electrical networks by applying various theorems.
- Able to understand and solve problems for basic AC circuits.
- Will be in a position to suggest suitable AC/DC machines for a given application.
- Able to analyze the characteristics of electronic devices such as PN junction and other diodes.

REFERENCES

1. Charles K. Alexander and Matthew N. Q. Sadiku, "*Fundamentals of Electric Circuits*", Third Edition, Mc Graw-Hill International Edition, 2007.
2. Theraja, B.L., " A Text Books of Electrical Technology ", S.S.Chand and Co., New Delhi, 1998.
3. Sudhakar.A and Shyam Mohan.S.P, "C*ircuits and Networks Analysis and Synthesis"*, Fourth edition, Tata McGraw Hill Publishing Company Ltd., New Delhi, 2010.
4. Boylestad & Nashelsky, "*Electronic Devices & Circuit Theory"*, Eighth edition, Prentice Hall Of India (P) Ltd., 2003.
5. Thomas L. Floyd, *"Electronic Devices",* Pearson Education, 9th Edition, 2011.
6. M. Morris Mano and Michael D. Ciletti, Digital Design, Pearson Education, 2013.

PTAE7201 MECHANICS OF SOLIDS L T P C
3 0 0 3

OBJECTIVES

- The objective of this course is to make the students to understand the concepts of stress and strain and their relationships by analysis of solids and structures, to analyze determinate and indeterminate axial members, torsional members, and beams, in order to determine axial forces, torque, shear forces, bending moments, stresses and deflections.

UNIT I STRESS-STRAIN – AXIAL LOADING 9

Definition of stress and strain- Stress-Strain relation- Relation between material constants.-Bar under axial loading- Statically determinate and indeterminate cases – Thermal stress-Impact Loading

UNIT II STRESSES IN BEAMS 9

Types of beams and loadings – Relation between shear force and bending moment - Shear force and bending moment diagrams – Euler beam theory - Bending stress in beams – Shear stress in beam – Composite beam.

UNIT III DEFLECTION OF BEAM 9

Various methods for statically determinate beams - Double integration method – Macaulay's method – Moment area method – Conjucate Beam method – Method of superposition

UNIT IV TORSION AND SPRINGS 9

Shear stress and twist relation for circular section – Comparison of hollow shaft and solid shaft – Compound shaft – Power transmission by circular shafts – Springs – Deflection expression for close coiled helical spring – Stress in springs.

UNIT V BIAXIAL STRESS 9

Thin walled cylinder under internal pressure – Principal stresses for general biaxial stress field – Mohr's circle - Stresses in combined loading

TOTAL : 45 PERIODS

OUTCOMES

At the end of the course, the students are expected to

- Know about how a solid (materials, structures) behaves when it is exposed to forces and deformations.
- Apply the fundamental concepts of principle of superposition, equilibrium, compatibility, force-deformation, and stress-strain relationships to the solid and structural mechanics problems
- Analyze determinate and indeterminate bars, beams, to determine axial forces, torques, shear forces, and bending moments
- Have physical insight into distribution of stresses and strains in structural members

TEXT BOOKS:

1. Stephen Timoshenko, 'Strength of Materials', Vol I & II, CBS Publishers and Distributors, 3rd edition, 2004.
2. William A. Nash, Merle C. Potter, "Schaum's Outline of Strength of Materials", 6th Edition, McGraw Hill Education, 2014

REFERENCES:

1. Clive L. Dym , Irving H. Shames, "Solid Mechanics : A Variational Approach, Augmented Edition", Springer publishers, 2013
2. R.K.Rajput, 'Strength of Materials', S Chand; 4th Rev. Edition 2007.
3. Timothy A. Philpot, "Mechanics of Materials: An Integrated Learning System," 3rd Edition, Wiley, 2012.
4. Ferdinand P. Beer, E. Russell Johnston Jr., John T. Dewolf and David Mazurek, "Mechanics of Materials," seventh edition, McGraw-Hill, 2014
5. Russell C. Hibbeler, "Mechanics of Materials", Ninth Edition, Pearson education, 2013
6. Roy R Craig, "Mechanics of Materials", Third Edition, John Wiley & Sons, 2011
7. James M Gere, Barry J Goodno, "Mechanics of Materials", Eighth Edition, Cengage Learning, 2012

PTMA7251 NUMERICAL METHODS L T P C

3 0 0 3

OBJECTIVES :

- To provide the mathematical foundations of numerical techniques for solving linear system, eigen value problems, interpolation, numerical differentiation and integration and the errors associated with them;
- To demonstrate the utility of numerical techniques of ordinary and partial differential equations in solving engineering problems where analytical solutions are not readily available.

UNIT I SOLUTION OF EQUATIONS AND EIGEN VALUE PROBLEMS 9

Solution of algebraic and transcendental equations - Fixed point iteration method – Newton - Raphson method - Solution of linear system of equations - Gauss elimination method – Pivoting – Gauss Jordan methods – Iterative methods of Gauss Jacobi and Gauss Seidel - Matrix Inversion by Gauss Jordan method - Eigen values of a matrix by Power method and by Jacobi's method.

UNIT II INTERPOLATION AND APPROXIMATION 9

Interpolation with unequal intervals - Lagrange interpolation – Newton's divided difference interpolation – Cubic splines - Interpolation with equal intervals - Newton's forward and backward difference formulae – Least square method - Linear curve fitting.

UNIT III NUMERICAL DIFFERENTIATION AND INTEGRATION 9

Approximation of derivatives using interpolation polynomials - Numerical integration using Trapezoidal, Simpson's 1/3 and Simpson's 3/8 rules – Romberg's method - Two point and three point Gaussian quadrature formulae – Evaluation of double integrals by Trapezoidal and Simpson's rules.

UNIT IV INITIAL VALUE PROBLEMS FOR ORDINARY DIFFERENTIAL EQUATIONS 9

Single step methods - Taylor's series method - Euler's method - Modified Euler's method - Fourth order Runge - Kutta method for solving first and second order equations – Multi step methods - Milne's and Adams - Bashforth predictor - corrector methods for solving first order equations.

UNIT V BOUNDARY VALUE PROBLEMS IN ORDINARY AND PARTIAL DIFFERENTIAL EQUATIONS 9

Finite difference methods for solving two - point linear boundary value problems - Finite difference techniques for the solution of two dimensional Laplace's and Poisson's equations on rectangular domain – One dimensional heat - flow equation by explicit and implicit (Crank-Nicholson) methods - One dimensional wave equation by explicit method.

TOTAL : 45 PERIODS

OUT COMES :

- Demonstrate understanding of common numerical methods and how they are used to obtain approximate solutions.
- Apply numerical methods to obtain approximate solutions to mathematical problems.
- Derive numerical methods for various mathematical operations and tasks, such as interpolation, differentiation, integration, the solution of linear and nonlinear equations, and the solution of differential equations.
- Analyse and evaluate the accuracy of common numerical methods.

TEXT BOOKS :

1. Grewal, B.S. and Grewal,J.S., "Numerical methods in Engineering and Science", Khanna Publishers, New Delhi, 9th Edition, 2007.
2. Burden, R.L and Faires, J.D, " Numerical Analysis " 9th Edition, Cengage Learning, 2016.

REFERENCES :

1. Brian Bradie, "A Friendly Introduction to Numerical Analysis", Pearson Education Asia, New Delhi, 1st Edition, 2007.
2. Gerald, C.F. and Wheatley, P.O., "Applied Numerical Analysis", Pearson Education Asia, New Delhi, 6th Edition, 2006.
3. Laurene V. Fausett, "Applied Numerical Analysis using MATLAB", Pearson Education, New Delhi, 1st print, 2nd Edition, 2009.
4. S. R. K. Iyengar, R. K. Jain, Mahinder Kumar Jain, "Numerical Methods for Scientific and Engineering Computation", 6th Edition, New Age International Publishers, New Delhi, 2012.
5. Sankara Rao . K, " Numerical Methods for Scientists and Engineers" PHI Learning Pvt Ltd. New Delhi, 2007.

PTAU7202 THERMODYNAMICS AND THERMAL ENGINEERING L T P C
3 0 0 3

OBJECTIVE:

- The objective of this course is to introduce the basic principles of thermodynamics and thermal engineering via real world engineering examples, to show students how thermodynamics is applied in engineering practice.

UNIT I BASIC THERMODYNAMICS 09

Systems, closed, open and isolated. Property, state, path and process, quasi-static process, Zeroth low, First law. Steady flow energy equation. Heat and work transfer in flow and non-flow processes. Second law, Kelvin-Planck statement – Clausius statement - Concept of Entropy, Clausius inequality, Entropy change in non-flow processes.

UNIT II AIR STANDARD CYCLES AND COMPRESSORS 09

Otto, Diesel, Dual combustion and Brayton cycles. Air standard efficiency. Mean effective pressure. Compressors, Classifications of compressors, Single stage and multi stage, Effect of intercooler in multi stage compressor, Perfect and imperfect intercooler, work done by the compressor, Reciprocating, Rotary, Axial, Vane compressors.

UNIT III STEAM AND JET PROPULSION 10

Properties of steam, Dryness fraction, Quality of steam by steam tables and Mollier chart – Rankine cycle, Work done, Steam rate – Steam Nozzles, Types of nozzles, Friction in nozzles - Simple jet propulsion system – Thrust rocket motor – Specific impulse.

UNIT IV REFRIGERATION AND AIR-CONDITIONING 08

Principles of refrigeration, Vapor compression – Vapor absorption types, comparison - Co-efficient of performance (COP), Properties of refrigerants – Basic Principle, Summer, winter and Year round Air conditioning.

UNIT V HEAT AND MASS TRANSFER 09

Modes of heat transfer, Heat conduction in parallel, radial and composite wall – Basics of Convective heat transfer. Fundamentals of Radiative heat transfer – Flow through heat exchangers, Logarithmic Mean Temperature Difference (LMTD) for parallel flow and Arithmetic Mean Temperature Difference (AMTD) counter flow heat exchangers.

TOTAL:45 PERIODS

(Use of standard Steam tables with mollier chart and Refrigerant tables are permitted)

OUTCOMES:

- Students will demonstrate a basic understanding of the nature of the thermodynamic processes for pure substances of ideal gases
- Student will demonstrate a basic understanding of the First law Thermodynamics and its application to systems and control volumes
- To analyze any problem in an engineering approach based on basic concepts and logic sequences.
- To understand the basics and modes of heat transfer, Refrigeration and Air-conditioners**.**

TEXT BOOKS:

1. Chattopadhyay. P Engineering Thermodynamics", oxford University Press, New Delhi, 2010.
2. Nag.P.K., "Engineering Thermodynamics", Tata McGraw-Hill, New Delhi, 2007.
3. Rathakrishnan E., "Fundamentals of Engineering Thermodynamics" Prentice-Hall India, 2005.

REFERENCES:

1. Ramalingam K.K. “Thermodynamics”, Sci-Tech Publications, 2006
2. Holman.J.P., “Thermodynamics”, 3rd Ed. McGraw-Hill, 2007.
3. Venwylen and Sontag, “Classical Thermodynamics”, Wiley Eastern, 1987
4. Arora C.P, “Thermodynamics”, Tata McGraw-Hill, New Delhi, 2003.
5. Merala C, Pother, Craig W, Somerton, “Thermodynamics for Engineers”, Schaum Outline Series, Tata McGraw-Hill, New Delhi, 2004.
6. Mathur& Sharma Steam Tables, Jain Publishers, New Delhi.

PTAU7301 AUTOMOTIVE CHASSIS L T P C
3 0 0 3

OBJECTIVES:

- The student shall gain appreciation and understanding function of front axle, types of stub axle, types of steering gear box, Shall be able to understand need of suspension and its types, types of tyre, tyre specification, tyre rotation, Student shall gain knowledge of design consideration braking system, suspension system and for chassis

UNIT I LAYOUT, FRAME, FRONT AXLE AND STEERING SYSTEM 9

Basic construction of chassis, Types of Chassis layout, with reference to Power Plant location and drive, various, types of frames, Loads acting on vehicle frame, Types of Front Axles and Stub Axles, Front Wheel Geometry. Condition for True Rolling Motion. Ackerman’s and Davi’s Steering Mechanisms, Steering Linkages, Different Types of Steering Gear boxes, Slip Angle, Over–Steer and Under–Steer, Reversible and Irreversible Steering, Power Steering.

UNIT II DRIVE LINE, FINAL DRIVE AND DIFFERENTIAL 9

Driving Thrust and its effects, torque reactions and side thrust, Hotchkiss drive, torque tube drive, radius rods and stabilizers, Propeller Shaft, Universal Joints, Constant Velocity Universal Joints, Final drive, different types of final drive, Worm and Worm wheel, straight bevel gear, spiral bevel gear and hypoid gear final drive. Differential principle. Constructional details of differential unit, Differential housings, Non–Slip differential, Differential locks.

UNIT III REAR AXLES, WHEELS, RIMS AND TYRES 9

Construction of rear axles, Types of Loads acting on rear axles, Full –Floating, Three–Quarter Floating and Semi–Floating Axles, Twist beam rear axle, Types, Multi axles vehicles. Wheels and Rims, Types of Tyres and their constructional details. tubeless, cross ply radial type, tyre sizes and designation

UNIT IV SUSPENSION SYSTEM 9

Requirement of Suspension System, Types of Suspension Springs, Constructional details and characteristics of Single Leaf, Multi–Leaf spring, Coil and Torsion bar Springs, Rubber, Pneumatic and Hydro – elastic Suspension Spring Systems, Independent Suspension System, Shock Absorbers, Types and Constructional details of Leaf and Coil Springs, Sprung and unsprung mass, torsion bar springs.

UNIT V BRAKE SYSTEMS 9

Need for Brake systems, Stopping Distance, Time and Braking Efficiency, Effect of Weight Transfer during Braking, Classification of brakes , Braking Torque, drum brake and disc Brake Theory, Types and Construction of Hydraulic Braking System, Mechanical Braking System, Pneumatic Braking System, Power–Assisted Braking System, Servo Brakes, Retarders – antilock braking systems(ABS).

TOTAL : 45 PERIODS

OUTCOMES

- Ability to know the steering geometry, what should be the tyre pressure for different vehicle, which type of brakes are best for vehicle.
- Ability to recognize which safety systems are best for vehicle and also for safety consideration.

TEXT BOOKS

1. Newton Steeds and Garret, “Motor Vehicles” 13th Edition, Butterworth, London, 2005.
2. Heinz Hazler, “Modern Vehicle Technology”, Butterworth, London, 2005.
3. Devaradjane. Dr. G., Dr. M. Kumaresan, "Automobile Engineering", AMK Publishers, 2013.

REFERENCES

1.Heldt P.M., “Automotive Chassis” Chilton Co., New York, 1990.
2.Giri. N.K., “Automotive Mechanics” Khanna Publishers, New Delhi, 2005.
3.“Motor Vehicles”, Newton, Steed and Garrot, 13th Edition, Butterworth London.
4.“Vehicle and Engine Technology”, Heisler, Second Edition SAE International Publication.

PTAU7302 AUTOMOTIVE DIESEL ENGINES L T P C
3 0 0 3

OBJECTIVES

- To impart knowledge on basic concepts of automotive diesel engines, combustion process involved in diesel engines and the various subsystems used along with their functions in detail.

UNIT I BASICS OF DIESEL ENGINES 9

Diesel engine classification, construction and operation. Two stroke and four stroke diesel engines. Diesel cycle – Fuel - air and actual cycle analysis problems. Diesel fuel properties. Ignition quality of diesel. Cetane number and cetane Index. Laboratory tests for diesel fuel. Standards and specifications.

UNIT II FUEL INJECTION IN DIESEL ENGINES 9

Requirements – solid injection. Function of components – conventional fuel injection system, common rail direct injection - Jerk and distributor type pumps. Pressure waves, Injection lag. Unit injector. Types of injection nozzle, Nozzle tests. Electronic fuel injection. Spray characteristics. Injection timing. Pump calibration. Split and Multiple injection. Mechanical and pneumatic governors.

UNIT III AIR MOTION, COMBUSTION AND COMBUSTION CHAMBERS 9

Air intake systems – Importance of air motion – Swirl, Squish and Tumble. Swirl ratio. Fuel air mixing. Stages of combustion. Delay period – factors affecting combustion. Knock in CI engines. Comparison of knock in CI & SI engines. Direct and indirect injection combustion chambers. Air cell chamber. Combustion chamber design – M-Combustion chamber. Combustion chambers for HCCI engines.

UNIT IV SUPERCHARGING AND TURBOCHARGING 9

Necessity and limitation of supercharging. Thermodynamic cycle with super charging. Types of supercharging and turbocharging – Relative merits. Intercooler. Matching of turbocharger.

Modification of an engine for supercharging. Effect of supercharging on engine performance. Variable geometry and variable nozzle turbocharger. E-Turbocharger. Problems.

UNIT V ENGINE TESTING AND RECENT DEVELOPMENTS 9

Automotive and stationary diesel engine testing and related standards – Engine power and efficiencies – performance characteristics. Variables affecting engine performance – Heat balance – Methods to improve engine performance - Introduction to Stratified charge engine, LHR engines, HCCI and RCCI engines. Problems.

TOTAL : 45 PERIODS

OUTCOMES

- On completion of the course the students will understand the basic principle of operation of diesel engine, its subsystems
- The students can be able to apply their knowledge in operating the diesel engine and analyzing the engine performance characteristics.

TEXT BOOKS

1. V. Ganesan, Internal Combustion Engines, Tata-McGraw Hill Publishing Co., New Delhi, 1994.
2. M.L. Mathur and R.P.Sharma, Internal Combustion Engine, Dhanpath Rai Publications (P) Ltd, New Delhi 110002

REFERENCES

1. K. K. Ramalingm, internal Combustion Engines, Scitech publications, Chennai, 2003.
2. Heldt, P.M., High Speed Combustion Engines, Oxford IBH Publishing Co., Calcutta, 1985.
3. Obert, E.F., Internal Combustion Engine analysis and Practice, International Text Book Co.,Scranton, Pennsylvania, 1988.
4. Maleev, V.M., Diesel Engine Operation and Maintenance, McGraw Hill, 1974.
5. Heinz Hesiler, Advanced engine technology. Butterworth Heinmann publications

PTAE7301 ENGINEERING FLUID MECHANICS AND MACHINERY L T P C
3 0 0 3

OBJECTIVE:

- The student is introduced to the mechanics of fluids through a thorough understanding of the properties of the fluids. The dynamics of fluids is introduced through the control volume approach which gives an integrated understanding of the transport of mass, momentum and energy. The applications of the conservation laws to flow though pipes and hydraulics machines are studied.

UNIT I INTRODUCTION 8

Units and dimensions- Properties of fluids- mass density, specific weight, specific volume, specific gravity, viscosity, compressibility, vapor pressure, surface tension and capillarity. Flow characteristics – concept of control volume - application of continuity equation, energy equation and momentum equation.

UNIT II FLOW THROUGH CIRCULAR CONDUITS 9

Hydraulic and energy gradient - Laminar flow through circular conduits and circular annuli- Boundary layer concepts – types of boundary layer thickness – Darcy Weisbach equation – friction factor- Moody diagram- commercial pipes- minor loses – Flow through pipes in series and parallel.

UNIT III DIMENSIONAL ANALYSIS 8

Need for dimensional analysis – methods of dimensional analysis – Similitude –types of similitude - Dimensionless parameters- application of dimensionless parameters – Model analysis.

UNIT IV TURBINES 10

Impact of jets - Euler's equation - Theory of roto-dynamic machines-Classification of turbines – heads and efficiencies – velocity triangles. Axial, radial and mixed flow turbines. Pelton wheel, Francis turbine and Kaplan turbines- working principles - work done by water on the runner –. Specific speed - unit quantities – performance curves for turbines .

UNIT V PUMPS 10

Various efficiencies– velocity components at entry and exit of the rotor- velocity triangles - Centrifugal pumps– working principle - work done by the impeller - performance curves - Reciprocating pump- working principle – Rotary pumps –classification.

TOTAL: 45 PERIODS

OUTCOME:

- On completion of the course, students will be familiar with all the basic concepts of fluids and fluid flow phenomenon, conservation equations and their applications to simple problems.

TEXT BOOKS:

1. Bansal, R.K., Fluid Mechanics and Hydraulics Machines, Laxmi Publications (P) Ltd., New Delhi, Ninth edition,2015.
2. Rathakrishnan. E, Fluid Mechanics, Prentice Hall of India (II Ed.), 2007.

REFERENCES:

1. Ramamurtham. S, Hydraulics, Fluid Mechanics and Fluid Machines, Dhanpat Rai Publishing Co Pvt., Ltd, 9th edition, 2012.
2. Kumar. K.L. Engineering Fluid Mechanics (VII Ed.) S Chand publishers Reprint Edition 2006 edition (1 December 2010)
3. Streeter. V. L., and Wylie, E.B., Fluid Mechanics, McGraw Hill, 1983.

PTPR7301 KINEMATICS AND DYNAMICS OF MACHINES L T P C
3 0 0 3

OBJECTIVE:

- To understand the basic concepts of mechanisms and machinery.

UNIT I MECHANISMS 10

Definition – Machine and Structure – Kinematic link, pair and chain – classification of Kinematic pairs – Constraint and motion – Degrees of freedom - Slider crank – single and double – Crank rocker mechanisms – Inversions, applications – Introduction to Kinematic analysis and synthesis of simple mechanisms – Determination of velocity and acceleration of simple mechanisms.

UNIT II FRICTION 9

Types of friction – friction in screw and nut – screw – plate and cone clutch – belt (Flat and V) and rope drives – creep in belts – open and crossed belt drives – Ratio of tensions – Effect of centrifugal and initial tensions – condition for maximum power transmission.

UNIT III GEARS AND CAMS 9

Gear – Types and profile – nomenclature of spur and helical gears – laws of gearing – interference – requirement of minimum number of teeth in gears – gear trains – simple, compound and reverted gear trains – determination of speed and torque in epicyclic gear trains – cams different types of followers – Cam – Types of cams and followers – Cam design for different follower motions.

UNIT IV VIBRATION 9

Free, forced and damped vibrations of single degree of freedom systems – force transmitted to supports – vibration Isolation – vibration absorption – torsional vibration of– critical speed of shafts.

UNIT V BALANCING 8

Static and dynamic balancing – single and several masses in different planes – primary and secondary balancing of reciprocating masses – Balancing of single and multi cylinder engines

TOTAL:45 PERIODS

OUTCOME:

The student shall be able to apply the kinematics and dynamics of machinery in design and analysis of engineering problems.

TEXT BOOKS:

1. Bansal R.K., "Theory of Machines", Laxmi Publications Pvt Ltd., New Delhi, 20th edition 2009.
2. Rattan S.S., "Theory of machines", Tata McGraw Hill publishing Co., New Delhi, 2nd edition 2011.

REFERENCES:

1. Rao J.S. and Dukkipati R.V., "Mechanism and Machine Theory", Second Edition, Wiley Eastern Limited, 2006.
2. Malhotra D.R. and Gupta H.C , "The Theory of machines", Satya Prakasam, Tech. India Publications, 2008.
3. Gosh A and Mallick A.K., "Theory of Machines and Mechanisms", Affiliated East West press, 2009.
4. Shigley J.E. and Uicker J.J., "Theory of Machines and Mechanisms", McGraw Hill, 2006.

PTAU7311	AUTOMOTIVE ENGINE AND CHASSIS COMPONENTS LABORATORY	L T P C 0 0 3 2

OBJECTIVES:

- To familiarize and train the students on the constructional arrangements of different engine system.
- Study of the following engines and its components by dismantling, comparing with recent engine components and assembling various parts.
- To familiarize and train the students on the constructional arrangements of different engine system.

LIST OF EXPERIMENT FOR AUTOMOTIVE ENGINE

1. Study the layout of chassis system
2. Study the layout of steering systems with different Steering gearboxes
3. Dismantling, study and Assembling of Transfer case
4. Dismantling, study and Assembling of Constant Velocity Joint(Front Axles)
5. Dismantling, study and Assembling of Clutch.
6. Dismantling, study and Assembling of sliding mesh gear box
7. Dismantling, study and Assembling of Constant mesh gear box
8. Dismantling, study and Assembling of Syncro mesh gear box
9. Dismantling, study and Assembling of Differential.
10. Study the Layout of Rear Axle.
11. Study the Layout of Braking system.
12. Study of different types of suspension system.
13. Study the Automatic transmission system.

STUDY OF THE FOLLOWING ENGINES AND ITS COMPONENTS:

1. Single Cylinder Four Stroke Diesel Engine
2. Two wheeler Two stroke Petrol engines
3. Two wheeler Four Stroke Petrol Engine
4. Three wheeler Engine
5. Multi cylinder inline diesel engine
6. Multi cylinder inline Petrol engine
7. Multi cylinder V type diesel Engine
8. MPFI engine
9. CRDI engine

TOTAL: 30 PERIODS

OUTCOMES

- Dismantle and Assemble the automobile chassis and Engine components
- Identify & differentiate components of SI & CI engines
- Understand working of braking, steering, clutch, transmission, Suspension systems.
- Differentiate various subsystems of two, three & Four wheeler vehicles
- Train on various types of frames.
- Develop skills in Dismantling and assembling of chassis components.
- Correct minor repairs and trouble shoots the breakdowns.

PTAU7401	AUTOMOTIVE ELECTRICAL AND ELECTRONICS SYSTEMS	L T P C 3 0 0 3

OBJECTIVES

- Knowledge in vehicle electrical and electronics components for engine operation.
- Enhancing the knowledge of revsor and microprocessor applications in vehicle control systems.
- Gaining information's on modern safety system in vehicle braking.

UNIT I BATTERIES AND STARTING SYSTEM 10

Different types of Batteries – principle, rating, testing and charging. Starter motors characteristics, capacity requirements. Drive mechanisms. Starter switches.

UNIT I CHARGING SYSTEM LIGHTING AND ACCESSORIES 9

DC Generators and Alternators their characteristics. Control unit – cut out, electronic regulators. Vehicle interior lighting system. Vehicle exterior lighting system. Wiring requirements. Lighting design. Dashboard instruments. Horn, trafficator.

UNIT III ELECTRONIC IGNITION AND INJECTION SYSTEM 9

Spark plugs. Advance mechanisms. Different types of ignition systems. Electronic fuel injection systems.

UNIT IV SENSORS AND MICROPROCESSORS IN AUTOMOBILES 9

Basic sensor arrangements. Types of sensors – oxygen sensor, hot wire anemometer sensor, vehicle speed sensor, detonation sensor, accelerometer sensor, crank position sensor. Microprocessor and microcomputer controlled devices in automobiles such voice warning system, travel information system, keyless entry system, automatic transmission system, electronic steering system.

UNIT V SAFETY SYSTEMS 8

Antilock braking system, air bag restraint system, voice warning system, seat belt system, road navigation system, anti theft system.

TOTAL : 45 PERIODS

OUTCOMES:

- The student will have to know about all automotive electrical and electronic components used in a vehicle.

REFERENCES:

1. Judge. A.W., modern Electrical Equipment of Automobiles, Chapman & Hall, London, 1992
2. Young.A.P., & Griffiths.L., Automobile Electrical Equipment, English Language Book Society & New Press, 1990
3. Spreadbury. F.G., Electrical Ignition Equipment, Constable & Co Ltd., London, 1962
4. Robert N Brady Automotive computers and Digital Instrumentation. A Reston Book, Prentice Hill, Eagle Wood Cliffs, New Jersey, 1988.

PTAU7402 AUTOMOTIVE TRANSMISSION L T P C

3 0 0 3

OBJECTIVES:

- The main objective of this course is to impart knowledge in detailed concept, construction and principle of operation of various types of mechanical transmission components, hydrodynamic devices, hydrostatic devices, automatic transmission system and electric drive used in road vehicles. At the end of course the students will have command over both mechanical transmission system, automatic transmission systems and their applications.

UNIT I CLUTCH 9

Requirement of transmission system, Types of transmission system, Clutches – Functions-Types of clutches, construction and operation of Single plate, multi plate and Diaphragm spring clutches.

UNIT II GEAR BOX 9

Purpose of gear box. Construction and working principle of sliding, constant and synchromesh gear boxes. Problems on performance of automobile such as Resistance to motion, Tractive effort, Engine speed & power and acceleration. Determination of gear box ratios for different vehicle applications.

UNIT III HYDRODYNAMIC TRANSMISSION 9

Fluid coupling – principles - Performance characteristics – advantages – limitations – drag torque – reduction of drag torque. Torque converter - principles - Performance characteristics – advantages – limitations – multistage and polyphase torque converters.

UNIT IV AUTOMATIC TRANSMISSION 9

Introduction to epicycle gear trains, Wilson gear box-Cotal electric transmission. Chevrolet "Turboglide" transmission. – four speed longitudinally mounted automatic transmission - Hydraulic control systems of automatic transmission. Continuously Variable Transmission (CVT) – types – Operations.

UNIT V HYDROSTATIC DRIVE AND ELECTRIC DRIVE 9

Hydrostatic drive; various types of hydrostatic systems – Principles of Hydrostatic drive system. Advantages and limitations. Comparison of hydrostatic drive with hydrodynamic drive, construction and working of typical Janny hydrostatic drive. Electric drive-types- Principle of early and modified Ward Leonard Control system-Advantages & limitations.

TOTAL :45 PERIODS

OUTCOMES:

Upon completion of the course, students will

- acquire knowledge in the construction and working principle of different types of mechanical transmission system, hydrodynamic, hydrostatic devices and electric drives.
- design the mechanical transmission system namely clutches and Gearboxes.
- have command over automotive transmission concepts and its applications in modern vehicles.

TEXT BOOKS:

1. Heldt,P.M., Torque converters, Chilton Book Co., 1962.
2. Newton and Steeds, Motor vehicles, Illiffe Publishers, 1985.

REFERENCES:

1. SAE Transactions 900550 & 930910.
2. Hydrostatic transmissions for vehicle applications, I MechE Conference, 1981-88.
3. Crouse,W.H., Anglin,D.L., Automotive Transmission and Power Trains construction, McGraw Hill, 1976.
4. Heinz Heisler, Advance vehicle Technology, Butterworth-Heinemann.

PTAU7403 THEORY OF FUELS AND LUBRICANTS L T P C
3 0 0 3

OBJECTIVE

- To understand the basic of manufacturing of fuels and lubricants along with properties of fuels and lubricants for the design and operation of the I.C engines.

UNIT I MANUFACTURE OF FUELS AND LUBRICANTS 9

Introduction to Structure of petroleum, refining process-Distillation, cracking processes, Catalytic reforming, alkylation, isomerisation and polymerization, finishing process- blending, products of refining process. Manufacture of lubricating oil base stocks, manufacture of finished automotive lubricants.

UNIT II THEORY OF LUBRICATION 9

Engine friction: introduction, total engine friction, effect of engine variables on friction, hydrodynamic lubrication, elasto hydrodynamic lubrication, boundary lubrication, bearing lubrication, functions of the lubrication system, introduction to design of a lubricating system.

UNIT III LUBRICANTS 9

Specific requirements for automotive lubricants, oxidation deterioration and degradation of lubricants, additives and additive mechanism, synthetic lubricants, classification of lubricating oils, properties of lubricating oils, tests on lubricants. Grease, classification, properties, test used in grease.

UNIT IV PROPERTIES AND TESTING OF FUELS 9

Properties and testing of fuels- density, calorific value, flash point, fire point, distillation, vapour pressure, spontaneous ignition temperature, viscosity, pour point, flammability, ignitability, diesel index, API gravity, aniline point, carbon residue, copper strip corrosion.

UNIT V FUEL RATING 9

SI Engines – flame propagation and mechanism of combustion, normal combustion, knocking, octane rating, fuel requirements. CI Engine, mechanism of combustion, diesel knock, cetane rating, fuel requirements. Additive - mechanism, requirements of an additive, petrol fuel additives and diesel fuel additives – specifications of fuels. ASTM and SAE standards.

TOTAL : 45 PERIODS

OUTCOMES

Student would have basic understanding of

- Various refinery processes
- Theory of lubricants
- Properties and testing of fuels
- Fuel ratings

TEXT BOOKS:

1. Ganesan.V., “Internal Combustion Engines”, Tata McGraw-Hill Publishing Co., New Delhi, 2003.
2. M.L. Mathur, R.P.Sharma “A course in internal combustion engines”, Dhanpatrai publication, 2003.

REFERENCES

1. Arthur J Caines “Automotive lubricants Reference book”, SAE International, Second edition 2004
2. Keith Owen and Trevor Coley “Automotive fuels reference book” SAE International, second edition 1995
3. Francis, W – Fuels and Fuel Technology, Vol. I & II
4. Hobson, G.D. & Pohl.W- Modern Petroleum Technology

5. A.R.Lansdown – Lubrication – A practical guide to lubricant selection – Pergamon press 1982.
6. Raymond.C.Gunther – Lubrication – Chilton Book Co., - 1971.
7. A R Lansdown “Lubrication and selection A practical guide” Third Edition,2014, Wiley

PTAU7411 AUTOMOTIVE ELECTRICAL AND ELECTRONICS LABORATORY **L T P C 0 0 3 2**

OBJECTIVE:

The main objective of this course is to impart practical knowledge in various automobile electrical and electronic components by testing, checking and programming.

LIST OF EXPERIMENTS:

1. Testing and checking of battery
2. Testing and checking of starting systems
3. Testing and checking of charging systems
4. Testing and checking of ignition systems
5. Study of automotive lighting system
6. Adjustment of head lights beam
7. Testing and checking of body controller systems
8. Logic gates, Adders, Flip flops
9. SCR and IC Timers
10. Interface circuit like amplifier, filter, Multiplexer and De Multiplexer
11. Interfacing seven segment displays
12. Basic microprocessor and microcontroller programming like arithmetic and Logic operation, code conversion, waveform generation, look up table etc
13. Interfacing ADC and DAC for Data Acquisition and Control Application
14. Interfacing Sensors for Measurements of position, displacement, velocity, force, temperature, proximity/range etc
15. Display, Keyboard, Stepper Motor and DC Motor interface using microcontroller.
16. EPROM Programming
17. Study of Virtual Instrumentation

TOTAL : 45 PERIODS

OUTCOMES:

• Students will gain an understanding of the automobile electrical and electronic components.
• Student will read and analyze electrical and electronic circuits.
• Students will study the sensor and actuators interface through programming

PTAU7501 AUTOMOTIVE COMPONENTS DESIGN **L T P C 3 0 0 3**

OBJECTIVE:

To familiarize the various steps involved in the design process and understand the principles involved in design.

UNIT I INTRODUCTION **9**

Classification of design -Principle of Design optimization – Engineering materials and their physical properties as applied to design – Selection of materials – Factors of safety in design – Endurance limit of materials –Determination of endurance limit for ductile materials – Notch sensitivity –Future trends – CAD Euler’s formula – Rankine’s formula – Tetmajer’s formula – Johnson formula – Reduction of stress Concentration

UNIT II DESIGN OF SHAFTS AND SPRINGS 9

Introduction – Material-Types-Standard size –Stresses in shaft –Design of shafts subjected to bending moment only, twisting moment only, and combined loading –Design of rear axle. Spring material- Types –Design of closed coiled helical springs and leaf springs.

UNIT III DESIGN OF FLYWHEELS 9

Introduction- Coefficient of Fluctuation of Speed - Fluctuation of Energy - Coefficient of Fluctuation of Energy. Design of Flywheel Rim, Flywheel Arms. Design of Hub - Key.

UNIT IV DESIGN OF BEARINGS 9

Types of bearings – Sliding contact bearings –Rolling contact bearings .Bearing life –Static load capacity – Dynamic load capacity – Bearing material – Boundary lubrication – Oil flow and temperature rise. Design of journal bearings - Ball and Roller bearings

UNIT V GEAR DESIGN 9

Types of gears **-** Terminology of gears- Design considerations – strength of gear teeth – Lewis equation —Dynamic tooth load – Design of spur gears – helical gears – herringbone gears – bevel gears and worm gears.

TOTAL :45 PERIODS

OUTCOMES:

The students will be able

- To identify the design requirements for any specific components.
- To design transmission parts.
- To explain the requirements of flywheel.

TEXT BOOK

1. Jain,R.K., Machine Design, Khanna Publishers, 1992.
2. Sundararaja Murthy,T.V., Machine Design, Khanna Publishers, New Delhi, 1991.
3. Bhandari,V.B., Design of Machine elements, Tata McGraw Hill Publishing Co. Ltd., New Delhi, 1990.

REFERENCES

1. Hall Allen,S. & Others, Machine Design, Schaum Publisher Co., 1982.
2. Sigley, Machine Design, McGraw Hill, 1981.
3. Design Data Book, PSG College of Technology, Coimbatore, 1992.

PTAU7502 AUTOMOTIVE POLLUTION AND CONTROL L T P C
3 0 0 3

OBJECTIVES:

- The main objective of this course is to impart knowledge in automotive pollution control.
- The detailed concept of formation and control techniques of pollutants like UBHC, CO, NOx, particulate matter and smoke for both SI and CI engine will be taught to the students. The instruments for measurement of pollutants and emission standards will also be introduced to the students. At the end of the course the students will have command over automotive pollution and control.

UNIT I INTRODUCTION 6

Introduction to SI Engine Combustion, CI Engine Combustion. Pollutants – sources – formation – effects of pollution on environment, human. Transient operational effects on pollution – Regulated – Unregulated emissions - Emission Standards. Introduction to noise pollution.

UNIT II EMISSION FROM SPARK IGNITION ENGINE AND ITS CONTROL 10

Emission formation in SI Engines- Carbon monoxide- Unburned hydrocarbon, NOx, Smoke - Effects of design and operating variables on emission formation – controlling of pollutants - Catalytic converters — Charcoal Canister — Positive Crank case ventilation system, Secondary air injection, thermal reactor, Laser Assisted Combustion.

UNIT III EMISSION FROM COMPRESSION IGNITION ENGINE AND ITS CONTROL 10

Formation of White, Blue, and Black Smokes, NOx, soot, sulphur particulate and Intermediate Compounds – Physical and Chemical delay — Significance Effect of Operating variables on Emission formation — Fumigation, EGR, HCCI, Particulate Traps, SCR — Cetane number Effect.

UNIT IV NOISE POLLUTION FROM AUTOMOBILES 9

Sources of Noise — Engine Noise, Transmission Noise, vehicle structural Noise, aerodynamics noise, Exhaust Noise. Noise reduction in Automobiles — Encapsulation technique for noise reduction — Silencer Design.

UNIT V TEST PROCEDURES AND EMISSION MEASUREMENTS 10

Constant Volume Sampling I and 3 (CVSI &CVS3) Systems- Sampling Procedures — Chassis dyno - Seven mode and thirteen mode cycles for Emission Sampling — Sampling problems - Emission analyzers —NDIR, FID, Chemiluminesecent, Smoke meters, Dilution Tunnel, SHED Test, Sound level meters.

TOTAL : 45 PERIODS

OUTCOMES:

By the end of this course, students will be able to

- Understand the various emissions formed in IC engines
- Understand the effects of pollution on human health and environment
- Understand the control techniques
- Understand the emission norms

TEXT BOOKS:

1. Springer and Patterson, Engine Emission, Plenum Press, 1990.
2. B.P.Pundir, " IC Engines Combustion and Emissions" Narosa Publishers, 2010

REFERENCES:

1. Ramalingam. K.K., Internal Combustion Engines, Scitech Publications, Chennai, 2003.
2. Ganesan,V., Internal Combustion Engines, Tata McGraw Hill Co., 1994.
3. SAE Transactions, Vehicle emission, 1982 (3 volumes).
4. Taylor,C.F., Internal Combustion Engines, MIT Press, 1972.
5. Heywood,J.B., Internal Combustion Engine Fundamentals, McGraw Hill Book Co., 1995.
6. Automobiles and Pollution SAE Transaction, 1995.

PTAU7503 **VEHICLE BODY ENGINEERING** **L T P C**
3 0 0 3

OBJECTIVES:

- The main objective of this course is to impart knowledge in the construction of vehicle, aerodynamics, paneling of passenger car and commercial vehicle body design. At the end of the course the student will be well versed in the design and construction of external body of all types of vehicles such as car, light commercial vehicles and heavy commercial vehicles.

UNIT I CAR BODY DETAILS 10

Types of Car body - Saloon, convertibles, Limousine, Estate Van, Racing and Sports car – Visibility- regulations, driver's visibility, improvement in visibility and tests for visibility. Driver seat design -Car body construction-Various panels in car bodies. Safety: Safety design, safety equipment for cars.

UNIT II BUS BODY DETAILS 9

Types of bus body: based on capacity, distance travelled and based on construction.– Bus body lay out, floor height, engine location, entrance and exit location. Types of metal sections used – Regulations – Constructional details: Conventional and integral.

UNIT III COMMERCIAL VEHICLE DETAILS 8

Types of commercial vehicle bodies - Light commercial vehicle body. Construction details of Flat platform body, Tipper body and Tanker body – Dimensions of driver's seat in relation to controls – Drivers cab design.

UNIT IV VEHICLE AERODYNAMICS 9

Objectives, Vehicle drag and types. Various types of forces and moments. Effects of forces and moments. Side wind effects on forces and moments. Various body optimization techniques for minimum drag. Wind tunnels – Principle of operation, Types. Wind tunnel testing such as: Flow visualization techniques, Airflow management test – measurement of various forces and moments by using wind tunnel.

UNIT V BODY MATERIALS, TRIM, MECHANISMS AND BODY REPAIR 9

Types and properties of materials used in body construction-Such as steel sheet, timber, plastics and GRP. Body trim items-body mechanisms. Hand tools-power tools for body repair. Vehicle corrosion-Anticorrosion methods-Modern painting process procedure.

TOTAL : 45 PERIODS

OUTCOMES:

Upon completion of the course, students will

- Know about different aspects of car body, bus body and commercial vehicle bodies.
- Role of various aerodynamic forces and moments, measuring instruments in vehicle body design.
- Knowledge about the material used in body building, tools used in body repairs and command over vehicle body engineering applications.

TEXT BOOKS:

1. Powloski, J., Vehicle Body Engineering, Business Books Ltd., 1998.
2. James E Duffy, Body Repair Technology for 4-Wheelers,Cengage Learning,2009.

REFERENCES:

1. Giles, G.J., Body construction and design, Illiffe Books Butterworth & Co., 1991.
2. John Fenton, Vehicle Body layout and analysis, Mechanical Engg. Publication Ltd., London, 1992.
3. Braithwaite, J.B., Vehicle Body building and drawing, Heinemann Educational Books Ltd., London, 1997.
4. Dieler Anselm., The passenger car body, SAE International, 2000

PTAU7511	ENGINE TESTING AND EMISSION MEASUREMENT LABORATORY	L T P C 0 0 3 2

OBJECTIVE:

- The main objective of this course is to impart knowledge in automotive Emission measurement and methods of testing engines. The detailed measuring techniques of pollutants like UBHC, CO, NOx, CO_2 and smoke for both SI and CI engines will be taught and compared with the emission standards. The knowledge about the instruments used for measurement of pollutants, engine performance and combustion parameters are to be explained with live example. At the end of the course the students will have knowledge about methods to test the engine and emission.

LIST OF EXPERIMENTS:

1. Study and use of IC engine testing Dynamometers.
2. Study and use of Pressure pickups, charge amplifier, storage oscilloscope and signal analyzers used for IC engine testing.
3. Performance study on petrol engine.
4. Performance study on diesel engine.
5. Determine the Frictional power on petrol engines.
6. Heat balance test on an automotive diesel engine.
7. Study of NDIR Gas Analyzer and FID.
8. Study of Chemiluminescent NO_x analyser.
9. Measurement of HC, CO, CO_2, O_2 and NO_x using exhaust gas analyzer.
10. Diesel smoke measurement.

TOTAL : 30 PERIODS

OUTCOMES:

By the end of this course, students will be able to

- Understand the various emission measuring instruments
- Understand the various engine testing instruments
- Understand the procedure to measure the emission
- Understand the procedure for measuring the engine performance and combustion parameters
- Understand the emission norms

TEXT BOOK:

1. Giles,J.G., Vehicle Operation and performance, Illiffe Books Ltd., London, 1989.

REFERENCES:

1. Crouse,W.H. and Anglin,D.L., Motor Vehicle Inspection, McGraw Hill Book Co., 1978.
2. Ganesan,V., Internal Combustion engines, Tata McGraw Hill Co., 1994.
3. BIS Code Books, IS-10000 series, 1988.

PTAU7601	ADVANCED VEHICLE TECHNOLOGY	L T P C 3 0 0 3

OBJECTIVES

- The course should enable the students to know about the basics about the vehicle and to understand the safety aspects in the vehicle. It also enables to acquire knowledge in sensors provided in the vehicle to avoid the crash and to detect the defects in the vehicle and to know about the comfort and convenience system.

UNIT I MODERN POWER PLANT AND POWER TRAIN 9

Modern Engine Technology like DTS- i, DTS – Fi, DTS – Si, VVT, Camless Engine, GDi, CRDI , Hybrid / Electric and Future Cars, Fuel Cell.

UNIT II PASSIVE SAFETY EQUIPMENTS AND CONVENIENCE SYSTEM 9

Seat belt, Seat belt tightener system and importance , collapsible steering column. Air bags and its activation .Designing aspcets of automotive bumpers and materials for bumpers. Steering And mirror adjustment, central locking system, Tire pressure control system, rain sensor system, automated wiper system.

UNIT III ACTIVE SAFETY 9

Antilock braking system, Stability Control. Adaptive cruise control, Lane Keep Assist System, Collision warning, avoidance system, Blind Spot Detection system, Driver alertness detection system.

UNIT IV VEHICLE INTEGRATION 9

Vision enhancement, road recognition system, Looking out sensors and Looking in sensors, intelligent vision system, Vehicle Integration system. Anti theft technologies, smart card system, number plate coding. Locking system- Central locking system- acoustic signaling devices.

UNIT V VEHICLE NAVIGATION SYSTEM 9

Traffic routing system - Automated highway systems - Lane warning system – Global Positioning System. Vehicle Navigation System. Road Network, Driver conditioning warning - Route Guidance and Navigation Systems- Driver Information System, driver assistance system.

TOTAL : 45 PERIODS

OUTCOMES:

The students should be able to:

- Know about the design of the bumper for safety.
- Know about the concept of crumble zone, and also the effect of acceleration and deceleration of the vehicle in the compartment of the vehicle.
- Know the various types of safety aspects such as active and passive safety, the active safety components and the working passive safety components such as air bags, seat belts
- Know the working of the compartment while moving of the vehicle, about the collapsible steering and tiltable steering column, about the collision avoidance system, front and rear object detection.

Know about the rear vehicle detection system, and the braking system, the comfort and convenience system for the vehicle such as central

TEXT BOOKS:

1. Nadovich, C., “Synthetic Instruments Concepts and Applications”. Elsevier,2005
2. Bitter, R., Mohiuddin, T. and Nawricki, M., “Labview Advanced programming Techniques”,CRC Press, 2nd Edition, 2007.
3. Robert N.Brandy, “Automotive Electronics and Computer Systems”, Prentice Hall ,2001
4. Ljubo Vlacic, Michel Parent, Fumio Harashima – “Intelligent Vehicle Technologies Theory and Applications” -Butterworth-Heinemann, 2001
5. J. Marek, H.-P. Trah, Y. Suzuki, I. Yokomori - “Sensors for Automotive Applications “ - WILEY-VCH Verlag GmbH & Co. 2003
6. Robert Bosch GmbH - “Safety, Comfort and Convenience Systems”- Wiley; 3rd edition , 2007

REFERENCES:

1. Bosch, “Automotive HandBook”, 6th edition, SAE, 2004.
2. J.Powloski - “Vehicle Body Engineering” - Business books limited, London - 1969.
3. Ronald.K.Jurgen - “Automotive Electronics Handbook” - Second edition- McGraw-Hill Inc., - 1999.
4. ARAI Safety standards

PTAU7602 ELECTRONIC ENGINE MANAGEMENT SYSTEMS L T P C
3 0 0 3

OBJECTIVE

- The objective of the course is to make the student to understand the need, role, components, control strategies used in an engine management system. The student will be familiarized in the fundamentals, operation, function of various sensors and actuators in an engine. The student will gain knowledge on various systems related to ignition and injection system, and various engine control algorithm used during engine operation.

UNIT I FUNDAMENTALS OF AUTOMOTIVE ELECTRONICS 9

Components for electronic engine management system, open and closed loop control strategies, PID control, Look up tables, introduction to modern control strategies like Fuzzy logic and adaptive control. Switches, active resistors, Transistors, Current mirrors/amplifiers, Voltage and current references, Comparator, Multiplier. Amplifier, filters, A/D and D/A converters.

UNIT II SENSORS AND ACTUATORS 9

Working principles, construction and location of sensors to measure speed, load, air flow, temperature, pressure, lambda, throttle position, knock, etc. Working principles, construction and location of actuators viz. Solenoid, relay, stepper motor etc. Design constraints.

UNIT III SI ENGINE MANAGEMENT 9

Layout, types and working of SI engine management systems (K, KE, Mono Jetronic, L, LH, Motronic). GDI. Development of ignition system – Transistor assisted, Contactless, Distributor less, CDI, Ignition Map, Knock control. Flowcharts for combined fuel injection and ignition control. Introduction to LASER Ignition system.

UNIT IV CI ENGINE MANAGEMENT 9

Fuel injection system parameters affecting combustion, noise and emissions in CI engines. Electronically controlled Unit Injection system. Common rail fuel injection system. Working of components like fuel injector, fuel pump, rail pressure limiter, flow limiter.

UNIT V DIGITAL ENGINE CONTROL SYSTEM 9

Control algorithm for different operating modes of engine. Pollution control devices. Integrated engine control system, Electromagnetic compatibility – EMI Suppression techniques – Electronic dash board instruments – Onboard diagnosis system.

TOTAL : 45 PERIODS

OUTCOMES

At the end of the course, the student should able to

- Describe basic electronic engine management theory
- Define the function, construction and operation of various sensors and actuators
- Demonstrate the principles and application of computerized engine control devices and electronic fuel and ignition management systems in the modern automobile.

TEXT BOOKS:

1. William Ribbens, "Understanding Automotive Electronics - An Engineering Perspective," 7th Edition, Elsevier Butterworth-Heinemann Publishers, 2012.
2. Allan W. M. Bonnick, "Automotive Computer Controlled Systems", Butterworth-Heinemann, 2001.
3. Bosch, "Automotive Sensors", Robert Bosch GmbH, 2001.
4. Eric Chowanietz, “Automobile Electronics,” SAE, 1995.

REFERENCES:

1. Tom Denton, “Advanced Automotive Fault Diagnosis,” Second edition, Elsevier Butterworth-Heinemann, 2006
2. Diesel Engine Management by Robert Bosch, SAE Publications, 3rd Edition, 2004.
3. Gasoline Engine Management by Robert Bosch, SAE Publications, 2nd Edition, 2004.
4. Forbes Aird, "Bosch Fuel Injection Systems", HP Books, 2001.
5. Bosch, "Gasoline Fuel Injection System", Robert Bosch GmbH, 1995.

PTAU7611	VEHICLE TESTING LABORATORY	L T P C 0 0 3 2

OBJECTIVES :

- To impart the knowledge on testing of vehicle and subsystems.

LIST OF EXPERIMENTS:

1. Minor and major tune up of gasoline and diesel engines
2. Calibration of Fuel pump
3. Engine fault diagnosis using scan tool
4. Fault diagnosis and service of transmission system
5. Fault diagnosis and service of braking system
6. Fault diagnosis and service of suspension system
7. Fault diagnosis and service of steering system
8. Fault diagnosis and service of Electrical system like battery, starting system, charging system, lighting system etc
9. Vehicle testing on chassis dynamometer
10. Practice the following:
    i. Adjustment of pedal play in clutch, brake, hand brake lever and steering wheel play.
    ii. Air bleeding from hydraulic brakes, air bleeding of diesel fuel system.
    iii. Wheel bearings tightening and adjustment.
    iv. Adjustment of head lights beam.
    v. Removal and fitting of tire and tube.

TOTAL : 30 PERIODS

OUTCOMES

- End of the course student would have deep practical knowledge on

PTAU7701 VEHICLE DYNAMICS L T P C
3 0 0 3

OBJECTIVE:

- The objective of this course is to provide fundamental knowledge of the dynamics of ground vehicles, knowledge of suspension design and function, basic concepts on concerning stability and control and to study about basic analysis of vehicle dynamics in performance, handling and ride modes.

UNIT I CONCEPT OF VIBRATION 9

Definitions, Modeling and Simulation, Global and Vehicle Coordinate System, Free, Forced, Undamped and Damped Vibration, Response Analysis of Single DOF, Two DOF, Multi DOF, Magnification factor, Transmissibility, Vibration absorber, Vibration measuring instruments, Torsional vibration, Critical speed.

UNIT II TYRES 9

Tyre forces and moments, Tyre structure, Longitudinal and Lateral force at various slip angles, rolling resistance, Tractive and cornering property of tire. Performance of tire on wet surface. Ride property of tyres. Magic formulae tyre model, Estimation of tyre road friction. Test on Various road surfaces. Tyre vibration.

UNIT III VERTICAL DYNAMICS 9

Human response to vibration, Sources of Vibration. State Space Representation. Design and analysis of Passive, Semiactive and Active suspension using Quarter car, Bicycle Model, Half car and full car model. Influence of suspension stiffness, suspension damping, and tire stiffness. Control law for LQR, H-Infinite, Skyhook damping. Air suspension system and their properties.

UNIT IV LONGITUDINAL DYNAMICS AND CONTROL 9

Aerodynamic forces and moments. Equation of motion. Tire forces, rolling resistance, Load distribution for three wheeler and four wheeler. Calculation of Maximum acceleration, Reaction forces for Different drives. Power limited acceleration and traction limited acceleration. Braking and Driving torque. Prediction of Vehicle performance. ABS, stability control, Traction control.

UNIT V LATERAL DYNAMICS 9

Steady state handling characteristics. Steady state response to steering input – Yaw velocity gain, Lateral acceleration gain, curvature response gain. Testing of handling characteristics. Transient response characteristics, Direction control of vehicles. Roll center, Roll axis, Vehicle under side forces. Stability of vehicle on banked road, during turn. Effect of suspension on cornering. Minuro Plot for Lateral Transient Response,

TOTAL : 45 PERIODS

OUTCOMES:

At the end of the courses, the students can able to

- Develop physical and mathematical models to predict the dynamic response of vehicles;
- Apply vehicle design performance criteria and how to use the criteria to evaluate vehicle dynamic response;
- Use dynamic analyses in the design of vehicles.

TEXT BOOKS:

1. Singiresu S. Rao, "Mechanical Vibrations," 5th Edition, Prentice Hall, 2010
2. J. Y. Wong, "Theory of Ground Vehicles", 4th Edition, Wiley-Interscience, 2008
3. Rajesh Rajamani, "Vehicle Dynamics and Control," 2nd edition, Springer, 2012
4. Thomas D. Gillespie, "Fundamentals of Vehicle Dynamics," Society of Automotive Engineers Inc, 2014

REFERENCES:

1. Dean Karnopp, "Vehicle Dynamics, Stability, and Control", 2nd Edition, CRC Press, 2013
2. R. Nakhaie Jazar, "Vehicle Dynamics: Theory and Application", 2nd edition, Springer, 2013
3. Michael Blundell & Damian Harty, "The Multibody Systems Approach to Vehicle Dynamics", Elsevier Limited, 2004
4. Hans B Pacejka, "Tyre and Vehicle Dynamics," 2nd edition, SAE International, 2005
5. John C. Dixon, "Tyres, Suspension, and Handling, " 2nd Edition, Society of Automotive Engineers Inc, 1996
6. Jan Zuijdijk, "Vehicle dynamics and damping," First revised edition, Author House, 2013.

PTAU7001 ADVANCED THEORY OF IC ENGINES L T P C
3 0 0 3

OBJECTIVES

- To impart knowledge in modern trends and developments in internal combustion engines. To develop knowledge in non conventional engines and their operation in detail and to acquire complete knowledge in engine modeling and combustion analysis of internal combustion engines

UNIT I COMBUSTION OF FUELS 9

Chemical composition and molecular structure of hydrocarbon fuels. Combustion Stoichiometry of hydrocarbon fuels – Chemical energy and heat of reaction calculations – Chemical equilibrium and adiabatic flame temperature calculation. Theory of SI and CI engine combustion – Flame velocity and area of flame front. Fuel spray characteristics – droplet size, depth of penetration and atomization.

UNIT II ENGINE CYCLE ANALYSIS 9

Ideal air, fuel air cycle and actual cycle analysis. Progressive combustion analysis in SI engines. Parametric studies on work output, efficiency and other engine performance.

UNIT III COMBUSTION MODELLING 9

Basic concepts of engine simulation – Governing equations, Classification of engine models- Thermodynamic models for Intake and exhaust flow process – Quasi steady flow - Filling and emptying - Gas dynamic Models. Thermodynamic based in cylinder models for SI engine and CI engines.

UNIT IV NON CONVENTIONAL IC ENGINES 9

Concept of L.H.R. engine and its recent developments. Variable compression ratio engine and its use in engine research. Wankel rotary combustion engine. Dual fuel engine concept for multi fuel usage in CI engines - performance studies on dual fuel engine. Free piston engine. Stratified charge and lean burn engines . Locomotive and marine engines.

UNIT V COMBUSTION ANALYSIS IN IC ENGINES 9

Photographic studies of combustion processes – Analysis of Pressure crank angle diagrams in SI and CI engines. Knock study for Pressure crank angle histories. Apparent heat release rate and Wiebe's law analysis for combustion. Calculation of Ignition delay and combustion duration. – Hot wire and laser Doppler anemometry and velocimetry for flow and combustion analysis in IC engines.

TOTAL : 45 PERIODS

OUTCOMES:

- Students will understand the recent developments and trends in internal combustion engines. They will be able to apply their knowledge in making changes in engine design for better engine performance.
- Students will become familiar with the non conventional engines and their importance, difficulties involved in using them for power generation
- They will also get familiarized with the equipment used for flow and combustion analysis.

TEXT BOOKS

1. John,B., Heywood, Internal Combustion Engine Fundamentals, McGraw Hill Publishing Co., New York, 1988.
2. Ramalingam. K.K., Internal combustion engines, Scitech publications, Chennai, 2003.

REFERENCES

1. Ganesan,V., Internal combustion engines, Tata McGraw Hill Publishing Co.,1994.
2. Ganesan.V. "Computer Simulation of spark ignition engine process", Universities Press (I) Ltd, Hyderbad, 1996.
3. Ganesan,V., Compute Simulation of Compression Ignition engine process, Universities Press (India) Ltd., Hyderabad, 1996.
4. Benson,R.S., Whitehouse,N.D., Internal Combustion Engines, Pergamon Press, Oxford, 1979.

PTAU7002 ALTERNATIVE FUELS AND ENERGY SYSTEMS L T P C
3 0 0 3

OBJECTIVES

- To acquire complete knowledge on availability of possible alternate fuels and their properties to use as fuel in CI and SI engines. To develop knowledge in changing the engine system, modifying the fuel for efficient use in the internal combustion engines and to understand the challenges and difficulties in using alternative fuels in internal combustion engines

UNIT I INTRODUCTION TO ALTERNATIVE FUELS 9

Need for alternative fuels. World and Indian energy scenario on alternative fuels. Availability of different alternative fuels for SI and CI engines. Production technologies for biofuels for internal combustion engines- Pyrolysis, gasification, digestion.

UNIT II ALCOHOLS AS FUELS 9

Alcohols as fuels. Production methods of alcohols. Properties of alcohols as fuels. Methods of using alcohols in CI and SI engines. Blending, dual fuel operation, surface ignition and oxygenated additives. Performance emission and combustion characteristics in CI and SI engines.

UNIT III VEGETABLE OILS AS FUELS 9

Various vegetable oils and their important properties. Different methods of using vegetable oils engines – Blending, preheating Transesterification and emulsification of Vegetable oils - Performance in engines – Performance, Emission and Combustion Characteristics in diesel engines. Role of Nano fluids, additives and cetane improvers for performance improvement of vegetable oils as fuel.

UNIT IV HYDROGEN AS ENGINE FUEL 9

Production methods of hydrogen. Combustive properties of hydrogen. Problems associated with hydrogen as fuel and solutions. Different methods of using hydrogen in SI and CI engines. Performance, emission and combustion analysis in engines. Hydrogen storage - safety aspects of hydrogen.

UNIT V BIOGAS, LPG AND NATURAL GAS AS FUELS 9

Production methods of Biogas, Natural gas and LPG. Properties studies. CO_2 and H_2S scrubbing in Biogas., Modification required to use in SI and CI Engines- Performance and emission characteristics of Biogas, NG and LPG in SI and CI engines.

TOTAL : 45 PERIODS

OUTCOMES

- Upon completion the course the students will have the complete knowledge on bio fuel production methods and their properties in detail.
- They will be able to apply their knowledge in making changes in engine design and fuel modification for the utilizing the alternative fuels effectively in the engines.

TEXT BOOKS

1. Richard L Bechtold P.E., Alternative Fuels Guide book, Society of Automotive Engineers, 1997 ISBN 0-76-80-0052-1.
2. Donald Klass, Biomass for Renewable Energy, Fuels, and Chemicals, 1998, Academic Press, ISBN: 978-0-12-410950-6.

REFERENCES

1. Ayhan Demirbas, ' Biodiesel A Realistic Fuel Alternative for Diesel Engines', Springer-Verlag London Limited 2008,ISBN-13: 9781846289941
2. Gerhard Knothe, Jon Van Gerpen, Jargon Krahl, The Biodiesel Handbook, AOCS Press Champaign, Illinois 2005.
3. Technical papers of SAE on Biofuels (Alcohols, vegetable oils, CNG, LPG, Hydrogen, Biogas etc.).
4. Science direct Journals (Biomass & Bio energy, Fuels, Energy, Energy conversion Management, Hydrogen Energy, etc.) on biofuels.

PTAU7003	AUTOMOTIVE AERODYNAMICS	L T P C
		3 0 0 3

OBJECTIVE

- To learn the basics of fluid mechanics on vehicle motion and expose to the optimization techiniques followed in automotive industry in reducing aerodynamics drag, fuel consumption and improving vehicle stability. This course will also expose the students to testing techniques practiced in industry.

UNIT I BASICS OF FLUID DYNAMICS ON VEHICLE MOTION 9

Importance of study - timeline developments -basics of fluid mechanics -flow phenomenon related to vehicles - external flow problem -various resistances to vehicle motion - performance, fuel consumption and traction force diagram of a passenger car.

UNIT II DRAG FRACTIONS AND LOCAL ORIGINS IN A PASSENGER CAR 9

Car as a bluff body - generation & transportation of vortices around car -types of aerodynamic drag forces& its contribution to total drag - analysis of aerodynamic drag at local origins - shape and detail optimization techniques with case studies.

UNIT III VEHICLE HANDLING 9

The origin of forces and moments on a vehicle - lateral stability problems - methods to calculate forces and moments – vehicle dynamics under side winds - the effects of forces and moments, dirt accumulation on the vehicle, wind noise. Add-ons to improve stability of road vehicles.

UNIT IV COMMERCIAL VEHICLE AERODYNAMICS 9

Tractive resistance & fuel consumption – Drag coefficients of various commercial Vehicles – Scope for reducing drag on commercial vehicles (Trucks with trailers and buses), Advantages of commercial vehicles aerodynamics & its effects – Vehicle soiling & its effects on driving.

UNIT V WIND TUNNELS FOR ROAD VEHICLES AERODYNAMICS 9

Need of a wind tunnel, principle of wind tunnel technology, problems with reduced scale models, full scale wind tunnels examples and case studies, instrumentation& measurement techniques, Introduction to numerical analysis (CFD).

TOTAL : 45 PERIODS

OUTCOMES :

- Know the forces & moments influencing drag
- Solve simple numericals related to fuel economy & drag
- Learn the techniques of optimization practiced in industry
- Learn the relation between drag, stability & fuel economy
- Expose to fundamentals of numerical & experimental testing

TEXT BOOKS:

1. R.H.Barnard - “Road vehicle aerodynamic design, An Introduction” , Mechaero publications, Third edition
2. Hucho .W.H. – “Aerodynamic of Road Vehicles – From Fluid Mechanics to Vehicle Engineering” , Society of Automotive Engineers,U.S,Fourth edition
3. Alan Pope, Jewel B. Barlow, William H. Rae “Low speed wind tunnel testing” , John Wiley & SonsThird edition

REFERENCES :

1. “Automotive Aerodynamic”, Update SP-706 – SAE – 1987
2. “Vehicle Aerodynamics” – SP-1145-SAE-1996.

PTAU7004 AUTOMOTIVE AUTOMATION L T P C
3 0 0 3

OBJECTIVE:

- To understand the various automated Automobile manufacturing activities and study the application of computer technology in the Automobile manufacturing activities.

UNIT I AUTOMATION IN AUTOMOBILE MANUFACTURING 9

Introduction: Automation-types, Introduction to CAD/CAM and CIM, evolution of CIM-Organization and information processing in manufacturing- Implementation of CIM- the future automated future .

UNIT II AUTOMATED MATERIAL HANDLING SYSTEMS 9

Automated assembly systems- Design principles and types – part feeding devices, automated material handling devices – conveyor systems- types and applications, AGVs – types and control applications ,rail guided vehicles-automated storage/retrieval systems-industrial robots-basic components-special features-applications.

UNIT III GROUP TECHNOLOGY AND FMS 9

Part families-visual-part classification and coding-production flow analysis, benefits of GT-FMS-workstations-FMS layouts configurations-computer control systems- planning the FMS- machine cell design-FMS application and benefits – automated work flow-automated flexible assembly systems.

UNIT IV AUTOMATED ASSEMBLY AND INSPECTION 9

Automated chassis assembly-car body assembly-engine assembly-transfer lines-visual inspection-machine visions application-CMM-types-principle and applications, industrial robots for assembly of automobile components-applications.

UNIT V SHOP FLOOR AND COMPUTER AIDED QUALITY CONTROL 9

Automated chassis assembly-car body assembly-engine assembly-transfer lines-visual inspection-machine visions application-CMM-types-principle and applications, industrial robots for assembly of automobile components-applications.

TOTAL: 45 PERIODS

OUTCOMES:

- Students will have a sound knowledge in the various automated manufacturing process.
- Students will be familiar in modern engineering manufacturing process and will have an update in recent scenario

TEXT BOOKS:

1. Mikel P.Groover “Automation production systems and computer integrated manufacturing“ Prentice Hall of india PVT LTD 1995.

REFERENCES:

1. N.Viswanathan and Y.Navahari “performance modelling of automated manufacturing systems” Prentice hall of India PVT LTD ,1995.
2. Mulachy .D.E “Material handling hand book” McGraw hill, New York ,1999
3. GROOVER M.P “Plant layout and automation”, John Wiley & sons Inc. New York 1994.
4. BLACK J.T “The design of factory with a future” McGraw hill inc, New York ,1991.

PTAU7005 AUTOMOTIVE MATERIALS

L	T	P	C
3	0	0	3

OBJECTIVES

- Knowledge on properties of engineering materials
- To select suitable materials for design
- Materials selection criteria for engine and transmission systems
- Different materials used for automotive structures.
- Different electronic materials for automotive applications

UNIT I ENGINEERING MATERIALS AND THEIR PROPERTIES 9

Classes of engineering materials - the evolution of engineering materials, Definition of materials properties, Displaying material properties using materials selection charts, Forces for change in materials selection and design, Materials and the environment-selection of materials for automotive, aerospace, marine and defence applications.

UNIT II BASIS OF MATERIAL SELECTION 9

Selection strategy, Attribute limits and Material indices, structural index Selection procedure: Design process - types of design, design requirements, Function, Material attributes, Shape and Manufacturing processes - Materials processing and design processes and their influence on design, Process attributes, Systematic process selection, Process selection diagrams, Process cost, Energy consumption for production, Material costs, Availability, Recyclability, Environmental consideration. Computer aided selection.

UNIT III MATERIALS FOR ENGINES AND TRANSMISSION SYSTEMS 9

Materials selection for IC engines: Piston, piston rings, cylinder, Engine block, Connecting rod, Crank shaft, Fly wheels, Gear box, Gears, Splines, Clutches.

UNIT IV MATERIALS FOR AUTOMOTIVE STRUCTURES 9

Materials selection for bearings, leaf springs, chasis & frames, Bumper, shock absorbers, wind screens, panels, brake shoes, Disc, wheels, differentials , damping and antifriction fluids, Tyres and tubes.

UNIT V ELECTRONIC MATERIALS FOR AUTOMOTIVE APPLICATIONS 9

Materials for electronic devices meant for engine control, ABS, Steering, Suspension, Sensors, anti-collision, Anti-fog, Head lamps.

TOTAL: 45 PERIODS

OUTCOMES

- Discuss different materials used for automotive component manufacturing.
- Select proper material for Automobile applications

TEXT BOOKS

1. Gladius Lewis, “Selection of Engineering Materials”, Prentice Hall Inc. New Jersey USA, 1995.
2. Charles J A and Crane. F A. A., “Selection and Use of Engineering Materials”, 3rd Edition, Butterworths, London UK, 1996.

REFERENCES

1. James A. Jacobs, Thomas F. Kilduff., “Engineering Materials Technology: Structure, Processing, Properties & Selection”, Prentice Hall, USA, 1996.
2. ASM Handbook, “Selection of Materials Vol. 1 and 2”, ASM Metals Park, Ohio. USA, 1991.
3. M F Ashby, “Materials Selection in Mechanical Design”, third edition, Butterworth-Heineman, New York, 2005.
4. ASM Handbook. “Materials Selection and Design”, Vol. 20- ASM Metals Park Ohio.USA, 1997.
5. Cantor,“ Automotive Engineering: Lightweight, Functional, and Novel Materials”, Taylor & Francis Group, London, 2006

PTAU7006 AUTOMOTIVE TEST INSTRUMENTATION L T P C
3 0 0 3

OBJECTIVES

- To develop complete knowledge in using sensors, actuators and instruments in automobiles. To understand their necessities, working principles and performance characteristics in detail and to impart knowledge in modern laboratory experimental techniques for testing automobiles

UNIT I MEASUREMENT SYSTEMS 9

Introduction to Measurement systems-static and dynamic measurement –closed and open loop system - Requirements and characteristics – Analysis of experimental detail. Error analysis

UNIT II TRANSDUCERS, MODIFIERS AND TERMINATING DEVICES 9

Transducers for Automotive Applications – Amplifiers- filters –data Acquisition- Indicators, Printers and displays –Signal Analyzing.

UNIT III MECHANICAL MEASUREMENT 9

Instrumentation for measuring Weight, Force, torque, pressure power, temperature, fluid flow, vibration, rotational speed, velocity, acceleration and angular motion.

UNIT IV ENGINE EXPERIMENTAL TECHNIQUES 9

I.S Code for Engine testing – Instrumentation for performance testing of engine, Instrumentation for Research and development, Instrumentation for noise, vibration, in cylinder gas flow, flame temperature, Dynamic Cylinder pressure measurements.

UNIT V VEHICLE EXPERIMENTAL TECHNIQUES 9

Laboratory tests- Study of chassis dynamometer- test tracks - Endurance Tests- crash tests- Vehicle performance test – Brake tests.

TOTAL: 45 PERIODS

OUTCOMES

- Upon completion of the course the students will be able to apply their knowledge in using all kind of sensors, actuators and instruments used in automobile testing
- They will be able to apply their knowledge in conducting different types of experiments in automobiles

TEXT BOOKS

1. Ernest O. Doebelin. Measurement systems: application and design. McGraw Hill Publishing Co, 2004, ISBN 0–07–243886–X.
2. Nicos Ladommatos and Hua Zhao, Engine Combustion Instrumentation and Diagnostics. SAE International, 2001-01-30, ISBN of 978-0-7680-0665-0.

REFERENCES

1. A.W. Judge, Engineering Precision Measurement, Chapman and Hall Ltd, Essex Street W.C.,1951,
2. T.G. Beckwith and Buck, Mechanical Measurements, Oxford and IBH Publishing House, New Delhi, 1995
3. D.Patambis, Principle of Industrial Instrumentation, Tata McGraw Hill Publishing Co, New Delhi, 1990.
4. Rangan, Sharma and Mani, Instrumentation Devices and systems, Tata McGraw Hill Publishing Co., Ltd., 1990
3. J.G. Giles, Engine and Vehicle Testing, Illiffe books Ltd., London, 1968.

PTAU7007 COMBUSTION THERMODYNAMICS AND HEAT TRANSFER L T P C
3 0 0 3

OBJECTIVES

- To make the students understand the principle of general and engine combustion.
- To understand engine heat release rate and various heat transfer models and to study the experimental methods for combustion and heat transfer in engines.

UNIT I THERMODYNAMICS OF COMBUSTION 9

Premixed and diffusion combustion process in IC engines. First and Second Law of Thermodynamics applied to combustion- combustion Stoichiometry- chemical equilibrium, spray formation and droplet combustion.

UNIT II CHEMICAL KINETICS OF COMBUSTION 9

Fundamentals of combustion kinetics, rate of reaction, equation of Arrhenius, activation energy. Chemical thermodynamic model for Normal Combustion.

UNIT III FLAMES 9

Laminar premixed – flame speed correlations- quenching, flammability, and ignition, flame stabilization, laminar diffusion flames, turbulent premixed flames-Reynolds and Damkohler numbers and their significance.

UNIT IV HEAT TRANSFER IN IC ENGINES 9

Engine Heat transfer and heat Balance. Measurement of Instantaneous heat transfer rate. Heat transfer modeling. Heat transfer coefficients, radiative heat transfer.

UNIT V EXPERIMENTS IN IC ENGINES 9

Cylinder pressure measurement. Rate of heat release calculation – hot wire and laser Doppler anemometry and velocimetry for flow and combustion analysis in IC engines.

TOTAL : 45 PERIODS

OUTCOMES

- Upon completion the students will understand the principle of engine combustion and the various heat transfer models and measuring methods of engine heat transfer in derail
- They will understand thermodynamics of combustion, grasp the basics of normal, abnormal combustion and heat transfer in engines
- They also understand experimental techniques in investigating the combustion and heat transfer processes in IC engines

TEXT BOOK

1. John. B. Heywood,'Internal Combustion Engines'", Tata McGraw Hill Co., Newyork, 1988.

REFERENCES

1. Spalding. D.B., "Some fundamental of Combustion", Butterworth Science Publications, London, 1985.
2. Taylor. E.F. "The Internal Combustion Engines ", International Text Book Co., Pennsylvania, 1982.
3. V.Ganesan, 'Internal combustion Engines', Tata McGraw Hill Book Co, Eighth Reprint, 2005.
4. Ashley Campbel, "Thermodynamic analysis of combustion engine", John book company, Newyork, 1979.

PTAU7008 COMPUTATIONAL FLUID MECHANICS L T P C
3 0 0 3

OBJECTIVE:

- To develop finite difference and finite volume discretized forms of the CFD equations and formulate explicit & implicit algorithms for solving the Euler Equations & Navier Strokes Equations.

UNIT I GOVERNING DIFFERENTIAL EQUATIONS AND FINITE DIFFERENCE METHOD 10

Classification, Initial and Boundary conditions – Initial and Boundary Value problems – Finite difference method, Central, Forward, Backward difference, Uniform and non-uniform Grids, Numerical Errors, Grid Independence Test.

UNIT II CONDUCTION HEAT TRANSFER BY FINITE DIFFERENCE METHOD AND FINITE VOLUME METHOD 10

Steady one-dimensional conduction, Two and three dimensional steady state problems, Transient one-dimensional problem, Two-dimensional Transient Problems.

UNIT III CONVECTION HEAT TRANSFER BY FINITE DIFFERENCE METHOD AND FINITE VOLUME METHOD 10

Steady One-Dimensional and Two-Dimensional Convection – diffusion, Unsteady one-dimensional convection – diffusion, Unsteady two-dimensional convection – Diffusion.

UNIT IV INCOMPRESSIBLE FLUID FLOW BY FINITE DIFFERENCE METHOD AND FINITE VOLUME METHOD 10

Governing Equations, Stream Function – Vorticity method, Determination of pressure for viscous flow, SIMPLE, Computation of Boundary layer flow - Finite difference approach.

UNIT V FINITE ELEMENT METHOD AND TURBULENCE MODELS 5

Introduction to finite element method – solution of steady heat conduction by FEM. Algebraic Models – One equation model, k – ε models - Standard and High and Low Reynolds number models, Prediction of fluid flow and heat transfer using standard codes – Prediction of flow in a sudden pipe contraction and pipe.

TOTAL: 45 PERIODS

OUTCOMES:

- The student will demonstrate an ability to recognize the type of fluid flow that is occurring in a particular physical system and to use the appropriate model equations to investigate the flow.
- The student will gain the confidence to simplify a real fluid-flow system into a simplified model problem, and select the proper governing equations involved in the system
- The student will analyze and interpret data obtained from the numerical solution of fluid flow problems.

TEXT BOOKS:

1. Muralidhar, K., and Sundararajan, T., “Computational Fluid Flow and Heat Transfer”, Narosa Publishing House, New Delhi, 2003.
2. Ghoshdasdidar, P.S.,“Computer Simulation of flow and heat transfer” Tata McGraw-Hill Publishing Company Ltd., 1998.
3. Subas, V.Patankar “Numerical heat transfer fluid flow”, Hemisphere Publishing Corporation, 1980.

REFERENCES:

1. Versteeg and Malalasekera, N, “An Introduction to computational Fluid Dynamics The Finite volume Method,” Pearson Education, Ltd., 2007.
2. Taylor, C and Hughes, J.B. “Finite Element Programming of the Navier-Stokes Equation”, Pineridge Press Limited, U.K., 1981.
3. Anderson, D.A., Tannehill, J.I., and Pletcher, R.H., “Computational fluid Mechanics and Heat Transfer “ Hemisphere Publishing Corporation, New York, USA, 2012.
4. Fletcher, C.A.J. “Computational Techniques for Fluid Dynamics 1” Fundamental and General Techniques, Springer – Verlag, 1991.
5. Fletcher, C.A.J. “Computational Techniques for fluid Dynamics 2” Specific Techniques for Different Flow Categories, Springer – Verlag, 1988.
6. Bose, T.K., “Numerical Fluid Dynamics” Narosa Publishing House, 1997.

PTAU7009 FINITE ELEMENT TECHNIQUES L T P C
3 0 0 3

OBJECTIVE:

- The objective of the course is to make the students to understand the general steps of finite element methods, FEM formulation, be able to derive equations in finite element methods for 1D, 2D and 3D problems and its application solid mechanics and heat transfer.

UNIT I INTRODUCTION 9

Review of various approximate methods – Raleigh Ritz’s, Galerkin and finite difference methods – Steps in FEM Analysis – Governing equation and convergence criteria of finite element method.

UNIT II DISCRETE ELEMENTS 9

Spring Element. Bar elements, uniform section, mechanical and thermal loading, varying section, truss analysis. Beam element - problems for various loadings and boundary conditions – Use of local and natural coordinates. Computer codes in discrete elements.

UNIT III CONTINUUM ELEMENTS 9

Plane stress, Plane strain and axisymmetric problems, constant and linear strain, triangular elements, stiffness matrix, axisymmetric load vector. Computer codes for CST and LST elements.

UNIT IV ISOPARAMETRIC ELEMENTS 9

Definitions, Shape function for 4, 8 and 9 nodal quadrilateral elements, Stiffness matrix and consistent load vector, Gaussian integration

UNIT V FIELD PROBLEM 9

Heat transfer problems, Steady state fin problems, Derivation of element matrices for two dimensional problems, longitudinal and lateral vibration of beams, torsion problems. Computer codes.

TOTAL: 45 PERIODS

OUTCOMES:

At the end of the course, the students can able to

- Understand and perform engineering analysis of structural members using FEM.
- Demonstrate the ability to evaluate and interpret FEA analysis results for design and evaluation purposes
- Develop computer codes for FEM Elements.

TEXT BOOKS:

1. Singiresu S. Rao, "The Finite Element Method in Engineering", Fifth Edition, Butterworth Heinemann, 2010.
2. David V Hutton, "Fundamentals of finite element analysis", 1st Edition, McGraw Hill Education, 2004
3. Daryl L Logan, "A First Course in the Finite Element Method", 5th Edition, CL Engineering, 2010

REFERENCES:

1. Reddy J.N., “An Introduction to Finite Element Method”, Third edition, McGraw Hill, 2000.
2. Krishnamurthy, C.S., Finite Element Analysis, Tata McGraw Hill, 2000.
3. Bathe, K.J. and Wilson, E.L., Numerical Methods in Finite Elements Analysis, Prentice Hall of India, 1985.
4. Robert D. Cook, David S. Malkus, Michael E. Plesha, Robert J. Witt, "Concepts and Applications of Finite Element Analysis", 4th Edition, John Wiley and Sons, Inc., 2001.
5. Tirupathi.R. Chandrapatha and Ashok D. Belegundu – Introduction to Finite Elements in Engineering – Printice Hall India, Third Edition, 2003.
6. O.C. Zienkiewicz, R.L. Taylor, "The Finite Element Method for Solid and Structural Mechanics", Sixth edition, Elsevier Butterworth-Heinemann, 2005.
7. Roger T Fenner, "Finite Element Methods for Engineers", Imperial College Press, 1996.
8. Saeed Moaveni, "Finite Element Analysis Theory and Application with ANSYS", Third Edition, Prentice Hall , 2007

PTAU7010	HYBRID AND ELECTRIC VEHICLES	L	T	P	C
		3	0	0	3

OBJECTIVE :

- To understand the basic concept of Hybrid, Electric Vehicles , energy Storage devices and controls.

UNIT I INTRODUCTION TO NEED FOR ALTERNATIVE SYSTEM 9

History of electric and hybrid vehicles. Need of electric and hybrid vehicles – comparative study of diesel, petrol, electric and hybrid vehicles. Limitations of electric vehicles. Specification of different electric and hybrid vehicles.

UNIT II ENERGY STORAGE DEVICES AND FUELL CELLS 9

Electromechanical batteries- types of batteries –lead acid batteries, nickel based batteries, lithium based batteries, electrochemical reactions, thermodynamic voltage, specific energy, specific power, energy efficiency and ultra-capacitors.

Fuel Cell- Fuel cell characteristics- Fuel cell types-Hydrogen fuel cell- Connecting cell in series- water management in the PEM fuel cell- Thermal Management of the PEM fuel cell

UNIT III ELECTRIC VEHICLES 9

Electric vehicle layout, performance of electric vehicles – traction motor characteristics, tractive effort, transmission requirements, vehicle performance, energy consumption, advantage and limitations, specifications, system components, electronic control system, safety and challenges in electric vehicles.

UNIT IV HYBRID VEHICLES 9

Concepts of hybrid electric drive train, types, architecture of series and parallel hybrid electric drive train, merits and demerits, hybrid electric drive train design, mild and full hybrids, plug-in hybrid electric vehicles and range extended hybrid electric vehicles.

UNIT V PROPULSION MOTORS AND CONTROLLERS 9

Types of electric motors – working principle of AC and DC motors. Characteristic of shunt, series and compound type of DC motors- permanent magnet and separately exited DC motors. AC single phase and 3-phase motor – inverters – DC and AC motor speed controllers.

TOTAL : 45 PERIODS

OUTCOMES

End of the course student would have deep knowledge on

- Basic of hybrid and electric vehicles
- Different energy storage devices
- Concepts of hybrid electric drive train
- Electric motors and controllers

TEXT BOOKS:

1. James Larminie and John Lowry, “Electric Vehicle Technology Explained “ John Wiley & Sons,2003
2. Iqbal Husain, “ Electric and Hybrid Vehicles-Design Fundamentals”, CRC Press,2003
3. Mehrdad Ehsani, “ Modern Electric, Hybrid Electric and Fuel Cell Vehicles”, CRC Press,2005

REFERENCES:

1. Ron HodKinson, “ light Weight Electric/ Hybrid Vehicle Design”, Butterworth Heinemann Publication,2005
2. Lino Guzzella, “ Vehicle Propulsion System” Springer Publications,2005

PTAU7011 HYDRAULIC AND PNEUMATICS SYSTEMS L T P C

3 0 0 3

OBJECTIVE:

- To understand the hydraulic and pneumatic principles, involved and their components as well as its selection.

UNIT I INTRODUCTION TO FLUID POWER 9

Introduction to fluid power control- Hydraulic and pneumatics- Selection criteria, application of fluid power, application of pascal’s law, equation, Transmission and multiplication of force pressure losses- fluids, selection and properties- ISO symbols

UNIT II FLUID POWER DRIVES 9

Fluid power drives- Pumps- working principle and construction details of gear, vane and piston pumps, hydraulic motor, Hydrostatic transmission drives and characteristics - Hydraulic supply Components- Pneumatic power supply- Compressor, air distribution, air motors. Case study related to automotive application.

UNIT III FLUID POWER ELEMENTS 9

Control valves- pressure, flow direction- working principles and construction- Special type valves- cartridge, modular, proportional and servo- Selection and actuation methods. Actuators- Selection and specification, cylinders- mounting, cushioning, pipe fittings- Fluid conditioning elements- Accumulators. Case study related to automotive application.

UNIT IV HYDRAULIC AND PNEUMATIC CIRCUITS DESIGN 9

Design of Hydraulic and Pneumatic circuits for automation, Selection and specification of circuit components, sequencing circuits, cascade and Karnaugh- Veitch map method- Regenerative, speed control, Synchronizing circuits. Case study related to automotive application.

UNIT V ELECTRO PNEUMATICS AND PLC CIRCUITS 9

Use of electrical timers, switches, solenoid, relay, proximity sensors etc. Electro pneumatic sequencing Ladder diagram- PLC: – elements, function and selection- PLC programming- Ladder and different programming methods- Sequencing circuits. Case study related to automotive application.

TOTAL: 45 PERIODS

OUTCOMES:

- Students will be able to design a hydraulic system circuit that can be incorporated in an automotive application.
- Students will gain ability to design Pneumatic circuit for an automotive component that meets desired specifications and requirements.

TEXT BOOKS:

1. Anthony Esposito, " Fluid power with applications" , 5th Edition, Pearson Education 2003.
2. Majumdar, " Oil Hydraulics: Principles and Maintenance", Tata McGraw Hill, 2004
3. Majumdar, "Pneumatic system: Prinicples and maintenance", Tata McGraw Hill,2004

REFERENCES:

1. William Kimberley," Bosch Automotive Handbook", 6th Edition, Robert Bosch GmbH,2004
2. William W.Reaves, "Technology of Fluid Power", Delmer Publishers,1997
3. Peter Rohner," Fluid Power Logic circuit Design" MacMillion Press Ltd., 1990.
4. Andrew Parr, " Hydraulics & Pneumatics" Jaico Publishing House,2004

PTAU7012 MANUFACTURING OF AUTOMOTIVE COMPONENTS L T P C
3 0 0 3

OBJECTIVE:

- To study in detail about the modern casting, forging, molding and machining processes followed in automotive components. To enhance the knowledge of the students in the field of non – ferrous materials, emerging metallic and non-metallic materials like polymers, fiber reinforced plastics (FRP), engineering ceramics, metal matrix composites (MMCs) and its manufacturing methods, selection criteria, properties and applications for automotive components.

UNIT I ENGINE COMPONENTS 9

Overview - Material selection and Manufacturing methods for the Engine Components. Engine block – Casting – Conventional and expendable pattern.Cylinder head – Casting, machining and thermal barrier coating. Crank shaft, connecting rod, camshaft – Forging, machining and heat treatment. Piston - Gravity, squeeze, die casting, machining and finishing. Gudgeon Pin - Machining and Finishing, Valve forging, friction welding, machining, thermal barrier coating, heat treatment and surface improvement. Cylinder Liners, Piston ring - Centrifugal, HPDC, LPDC, machining and finishing. Castings Processes for Oil pan and Carburetors. Push Rods, Rocker Arm, Tappets, Spark Plug – Forging, Machining, Finishing and Heat treatment.

UNIT II TRANSMISSION COMPONENTS 9

Overview - Material selection and Manufacturing methods for transmission system. Flywheel - Casting and Machining. Clutch - Friction plate, clutch housing, pressure plate conventional and fine blanking, composite friction lining. Methods of Gear manufacture – Gear hobbing and gear shaping machines - gear generation - gear finishing and shaving – Grinding and lapping of hobs and shaping cutters – gear honing – gear broaching. Gearbox - Casting, precision forging, powder metallurgy, heat treatment and finishing. Propeller shaft - Continuous casting, extrusion, dies heat treatment and surface hardening. Axle-Differential – Axle Shaft – Bearing – fasteners-Forging, casting and machining. Leaf and coil spring - Forging and machining, composite leaf spring and wrap forming of coil spring.

UNIT III BODY COMPONENTS 9

Surface treatment – Plastics – Plastics in Automobile vehicles – Processing of plastics - Body Panel - Thermoforming and hydro forming, press forming, stretch forming. Emission control system – catalytic converter – Hydro forming of exhaust manifold and lamp housing. Welding – Resistance welding and other welding processes with the use of Robots in Body weldment. Instrument Panel - Principle of injection molding, injection molding of instrument panel. Bumpers - Molding of bumpers, reinforced reaction injection molding, tooling and tooling. Manufacture of polymer panels.

UNIT IV CHASSIS COMPONENTS 9

Material selection and manufacturing methods for Vehicle Frame Manufacturing, Wheel drum, Brake drum, Brake shoes, wheel rim and wheel housing manufacturing. Steering systems, shock absorbers, dead axle – casting, forging, machining and finishing operation. Heat treatment procedures for chassis components.

UNIT V TYRES AND ADVANCED MATERIALS MANUFACTURING 9

Tire and tube manufacturing, spray painting, powder coating, Prototype Manufacturing - RPT, 3-D Printing, chemical vapour deposition, physical vapour deposition, cryogenic grinding of powders, sealants, sound proof materials, structural adhesives, MMC liners –Selection of materials for Auto components.

TOTAL: 45 PERIODS

OUTCOMES:

At the end of this course the student should

- Will be able to select an appropriate manufacturing process for particular Automotive Components.
- Have in-depth knowledge of various engineering materials used in automobile engineering and the corresponding manufacturing processes for the same.

TEXT BOOKS:

1. Heldt P M, “High Speed Combustion Engines”, Oxford IBH publishing Co., Calcutta, 1996.
2. Kalpakjian, “Manufacturing Engineering and Technology”, Pearson Education, 2005.

REFERENCES:

1. John A S, “Introduction to Manufacturing Processes”, Tata McGraw-Hill, 2012.
2. Philip F O and JairoMunuz, “Manufacturing Processes and Systems”, John Wiley & Sons, New York, 1998.
3. Degarmo E P, “Materials and process in Manufacturing”, Macmillan Publishing Co, 1997.
4. Kalpakjian, “Manufacturing Processes For Engineering Materials”, Pearson Education, 2009.
5. B.P. Bhardwaj, “The Complete Book on Production of Automobile Components & Allied Products”, NIIR Project Consultancy Services, 2014.

PTAU7013 METROLOGY AND MEASUREMENT SYSTEM L T P C
3 0 0 3

OBJECTIVE:

- To understand the different degree of accuracy obtained from different types of instruments and the process of reducing uncertainties in measurements

UNIT I SCIENCE OF MEASUREMENT 8

Mechanical measurement – direct comparison and indirect comparison – the generalized measurement system – types of input quantities – measurement standards – calibration – uncertainty – systematic and random errors – common types of errors – classifications of errors– zero, Sensors – transducers. Resistive, Capacitive and Inductive Sensors – Static characteristics– Dynamic characteristics of instruments.

UNIT II LINEAR AND ANGULAR MEASUREMENT 8

Linear measuring instruments: Vernier, micrometer, interval measurement, Slip gauges and classification, interferometer, optical flats, limit gauges – Comparators: Mechanical, pneumatic and electrical types, applications.

Angular measurements:-Sine bar, optical bevel protractor, angle Decker–Taper measurements, coordinate measuring machine (CMM)

UNIT III FORM MEASUREMENT 8

Measurement of screw threads – Thread gauges, floating carriage micrometer – measurement of gears –tooth thickness-constant chord and base tangent method – Gleason gear testing machine – radius measurements – surface finish, straightness, flatness and roundness measurements.

UNIT IV PRESSURE, FORCE AND TORQUE MEASUREMENT 11

Bourdon tube, diaphragm, bellows and pressure capsules: Transducers used in pressure measurement – potentiometer, strain gauges, LVDT, capacitive and variable reluctance type transducers. Dynamic pressure measurement piezo electric and piezo resistive transducers. Farnboro engine indicator. Low pressure measurement – Mc leod gage, Pirani gauge, thermal conductivity type pressure measurement.

Force measuring devices – Balances, platform scales, weigh bridges, load cells, proving ring. Torque measurement – prony brake, rope brake and fan type brakes. Dynamometers – hydraulic, electric cradle and eddy current dynamometers.

UNIT V MEASUREMENT OF TEMPERATURE AND FLOW 10

Measurement of temperature – liquid in glass thermometer –partial and total immersion thermometers – resistance thermometers – thermistor – thermo electric thermometers – laws of thermocouples – industrial thermocouples and their ranges – pyrometers – optical total radiation and photo electric

Measurement of flow – need for flow metering – orifice plate, venture meter, flow nozzles, pitot tube rotameter – theory and constructional details – magnetic flow meters – hotwire anemometers-turbine flow meter - flouted tube flow meter-ultrasonic flow meter

TOTAL: 45 PERIODS

OUTCOMES:

The Students will

- Be able to demonstrate their knowledge about different measurement method and devices used in industries.
- Have the ability to handle and interpret measurement data, to estimate measurement uncertainties
- Design measuring equipments for the measurement of Pressure Force, temperature and flow.

TEXT BOOKS:

1. Ernest O Doeblin, “Measurement systems”, McGraw Hill Publishers, 2011.
2. R. K . Jain, “Engineering Metrology”, Khanna Publishers, New Delhi, 2012.

REFERENCES:

1. I.C Gupta, “Engineering Metrology”, Danpat Rai Publications, 2004.
2. Beckwith Thomas G, “Mechanical Measurements”, Pearson Education, 2008.

PTAU7014 NOISE, VIBRATION AND HARSHNESS L T P C
3 0 0 3

OBJECTIVE:

- To provide introduction to students the fundamentals of noise and vibration related to generation, transmission, control techniques and the effect of human sensitivity.To enable the students acquaint with principles and fundamentals in NVH instrumentation and signal analysis techniques

UNIT I FUNDAMENTALS OF NOISE, VIBRATION AND HARSHNESS 9

Theory of Sound—Predictions and Measurement, Sound Sources, Sound Propagation in the Atmosphere, Sound Radiation from Structures and Their Response to Sound, General Introduction to Vibration, Vibration of Simple Discrete and Continuous Systems, Random Vibration, Response of Systems to Shock, Passive Damping.

UNIT II EFFECTS OF NOISE, BLAST, VIBRATION AND SHOCK ON HUMANS 9

General Introduction to Noise and Vibration Effects on People and Hearing Conservation, Sleep Disturbance due to Transportation Noise Exposure, Noise-Induced Annoyance, Effects of Infrasound, Low-Frequency Noise, and Ultrasound on People, Auditory Hazards of Impulse and Impact Noise, Effects of Intense Noise on People and Hearing Loss, Effects of Vibration on People, Effects of Mechanical Shock on People, Rating Measures, Descriptors, Criteria, and Procedures for Determining Human Response to Noise. Noise limits in India.

UNIT III TRANSPORTATION NOISE AND VIBRATION – SOURCES, PREDICTION AND CONTROL 9

Introduction to Transportation Noise and Vibration Sources, Internal Combustion Engine Noise— Diesel and Gasoline Engines, Tire/Road Noise, Aerodynamic Sound Sources in Vehicles, Transmission and Gearbox Noise and Vibration, Brake Noise. Introduction to Interior Transportation Noise and Vibration Sources, Automobile, Bus, and Truck Interior Noise and Vibration, Noise and Vibration in Off-Road Vehicle Interiors.

UNIT IV ACOUSTICAL DESIGN OF MUFFLERS AND SILENCERS 9

Exhaust and Intake Noise in Diesel and Gasoline Engines - Electro-Acoustic Modeling, Transfer Matrix Modeling, Simple Expansion Chamber, Extended Tube Expansion Chamber, Extended Concentric Tube Resonator, Plug Muffler, Multiply Connected Muffler, Absorptive Ducts and Mufflers, Combination Mufflers, Acoustic Source Characteristics of I.C. Engines, Designing for Adequate Insertion Loss, Mufflers for High Pressure Vents and Safety Valves, Design of Muffler Shell and End Plates, Helmholtz Resonators, Active Noise Control in a Duct and Pressure Drop Considerations.

UNIT V NOISE AND VIBRATION TRANSDUCERS ANALYSIS EQUIPMENT, SIGNAL PROCESSING, AND MEASURING TECHNIQUES. 9

General Introduction to Noise and Vibration Transducers, Measuring Equipment, Measurements, Signal Acquisition, and Processing, Acoustical Transducer Principles and Types of Microphones, Vibration Transducer Principles and Types of Vibration Transducers, Sound Level Meters, Noise Dosimeters, Analyzers and Signal Generators, Equipment for Data Acquisition, Noise and Vibration Measurements, Determination of Sound Power Level and Emission Sound Pressure Level, Sound Intensity Measurements, Noise and Vibration Data Analysis, Calibration of Measurement Microphones, Calibration of Shock and Vibration Transducers, Metrology and Traceability of Vibration and Shock Measurements.

TOTAL : 45 PERIODS

OUTCOMES:

At the end of this course the student should

- Identify sources of noise and vibration from an automobile.
- Solve complicated problems in Noise and Vibration.
- Able to design and select the appropriate Muffler/Silencer for the control of tail pipe noise from an IC engine.
- Demonstrate the knowledge of noise, vibration and physiological effects on Humans.
- Exposed to acoustic instrumentation and noise control techniques

TEXT BOOKS:

1. Malcolm J. Crocker "Handbook of Noise and Vibration Control", John Wiley & Sons, Inc., 2007
2. M L Munjal "Noise and Vibration Control" IISc Lecture Notes Series, World Scientific Publishing Co. Ptv. Ltd. 2013

REFERENCES:

1. M L Munjal"Acoustics of Ducts and Mufflers", 2nd Edition, John Wiley & Sons, Chichester, UK, February 2014.
2. David A.Bies and Colin H.Hansen "Engineering Noise Control: Theory and Practice " Spon Press , London . 2009
3. Randall F Barron, "Industrial Noise Control and Acoustics", Marcel Dekker, Inc. 2003
4. Gang Sheng "Vehicle Noise, Vibration and Sound Quality", SAE International, 2012
5. C.Sujatha "Vibration and Acoustics – Measurement and Signal Analysis", 1st Edition, McGraw Hill Education (India) Pvt Ltd, 2009
6. Allan G. Piersol ,Thomas L. Paez "Harris' shock and vibration hand book" , McGraw-Hill , New Delhi, 2010
7. Clarence W. de Silva , "Vibration Monitoring, Testing, and Instrumentation ",CRC Press, 2007
8. Colin H Hansen "Understanding Active Noise Cancellation " , Spon Press , London .2003
9. Matthew Harrison "Vehicle Refinement: Controlling Noise and Vibration in Road Vehicles ", Elsevier Butterworth-Heinemann, Burlington, 2004

PTAU7015 OFF HIGHWAY VEHICLES L T P C
3 0 0 3

OBJECTIVE:

- The main objective of this course is to introduce the concept and principle of operation ofspecial vehicles such as Bulldozers, Ditchers, Bucket excavators, farm equipments, military vehicles etc. At the end of the course, the students can have a better understanding of the application of the Off Highway Vehicle in the excavation of earth.

UNIT I EARTH MOVING EQUIPMENTS 9

Construction layout, capacity and applications of earthmovers like dumpers, front-end loaders, bulldozers, backhoe loaders, scrappers, hydraulic shovels, Bucket conveyors etc. Selection criteria of prime mover for dumpers and front end loaders based on vehicle performance characteristics. Surface Miners – Highwall Miners, Off-Highway Mining Trucks.

UNIT II CONSTRUCTIONAL EQUIPMENTS 9

Layout of Constructional equipments, excavators, Jip Cranes, hoist, motor graders, Mixing machine, concrete ready mixers, drillers, ramming machines for construction of bridges and working principles, Power generators. Loader-mounted and self-propelled snow blower. Articulated Trucks, Asphalt Pavers, Vibratory Compactors, road reclaimers, Graders.

UNIT III FARM EQUIPMENTS 9

Classification of tractors – Main components of tractor. Working attachment of tractors – Auxiliary equipment – Trailers and body tipping mechanism - plowing - paddy plantation machine harvesting machines. Sugarcane harvesting, power trailers. Feller Bunchers, forest machines and forwarders.

UNIT IV INDUSTRIAL APPLICATIONS 9

Constructional features, capacity and stability of jib cranes. Dragliners, Utility vehicles and man-lift chassis, Foundation and oil field drill rigs carriers, Concrete pump carriers, knuckle boom loaders, Material Handlers. forklifts, Pipe layers. Towing vehicles. fork lift trucks, alternative front end equipment (attachments) – Jib arm, shovel bucket, squeeze clamp, boom, fork extensions, barrel forks. Scissors lift trucks. Case studies.

UNIT V MILITARY AND COMBAT VEHICLES 9

Ride and stability characteristics, power take off, special implementations. Special features and constructional details of Main Battle tankers, gun carriers and transport vehicles, bridge builders, communication vehicles.

TOTAL: 45 PERIODS

OUTCOMES:

At the end of this course the student should

- Know the concept and principle of operation of special vehicles such as bull dozers , ditchers bucket excavators far equipments military vehicles etc
- Have better understanding of the application of the Off Highway Vehicle in the excavation.
- Understand earth moving and constructional equipments
- Learn the basics of power train concepts for special vehicles
- Grasp the maintenance of farm equipments, military and combat vehicles

TEXT BOOKS:

1. Abrosimov. K. Bran berg.A. andKatayer.K., " Road making Machinery ", MIR Publishers, Moscow, 1971.
2. SAE Handbook Volume III
3. Wong.J.T., " Theory of Ground vehicles ", John Wiley & Sons, New York, 1987.
4. Rodichev and G.Rodicheva, Tractor and Automobiles, MIR Publishers, 1987.
5. Peurifoy R.L “Construction Planning, Equipment and Methods”, Tata McGraw-Hill, New Delhi, 2002.
6. Ian Graham, “Off-Road vehicles”, Heinemann Library, 2008
7. Wong J “ Terramechanics and Off-Road Vehicle Engineering”, Butterworth-Heinemann, 2009

REFERENCES:

1. B. Geleman and M. Moskovin, Farm tractors, MIR publishers, Moscow.
2. Off the road wheeled and combined traction devices - Ashgate Publishing Co. Ltd. 1998.
3. Bart H Vanderveen, Tanks and Transport vehicles, Frederic Warne and Co ltd., London.
4. Astokhov, Truck Cranes, MIR Publishers, Moscow.
5. Kolchin,A., and V.Demidov, Design of Automotive Engines for Tractor, MIRPublishers, 1972.

PTAU7016 PRINCIPLES OF CONTROL SYSTEMS L T P C
3 0 0 3

OBJECTIVES :

The student should be able to state, explain and illustrate a set of key concepts related to Control Systems qualitatively in the context of an engineering application

UNIT I SYSTEM AND THEIR REPRESENTATION 9

Basic elements in control systems-Open loop and Closed loop system-Feedback characteristics- Effects of feedback-mathematical modeling of physical systems:- mechanical, Thermal, hydraulic and Pneumatic systems-Transfer function- AC and DC servomotor- Block diagram reduction techniques-signal flow graph- control system components – computer simulation.

UNIT II TIME RESPONSE ANALYSIS 9

Time response- Types of test inputs- First and Second order responses- Error coefficient-Generalized error series- Steady state error- Time domain specifications- Problems related to automotive domain- Computer simulation

UNIT III FREQUENCY RESPONSE ANALYSIS 12

Frequency response- Frequency domain specifications-Bode plot-Polar plot- Determination of phase margin and gain margin- Constant M and N circles-Nichols chart- Determination of closed loop responses from open loop response- Problems related to automotive domain Computer simulation.

UNIT IV STABILITY OF CONTROL SYSTEM 6

Concepts of stability- Location of roots in S-plane for stability- Routh Hurwitz criterion- Root locus techniques- Construction-Nyquist stability criterion- Problems related to automotive domain -Computer simulation

UNIT V CONTROL SYSTEM DESIGN 9

PID controllers – Performance criteria- Selection of controller modes-lag, Lead, and lag-Lead networks-Compensator design for desired response using root locus and Bode diagrams-Problems related to automotive domain -Computer simulation

TOTAL: 45 PERIODS

OUTCOMES :

- To understand the methods of representation of system and thier transfer finction models
- To provide adquate knowledge in the time response of systems and steady state error analysis
- To give basic knowledge in obtainig the open loop and closed loop frequency responses of systems
- To understand the concept of stablity of control system and methos of stablity analysis
- To study the three way of designing compensators for a control system

TEXT BOOKS:

1. Gopal, M., " Control System, Prinicples and Design",Tata MCGraw-Hill Pub. Co., 2nd Edition,New Delhi,2006.
2. Nagrath, I.J. and Gopal,M., "Control System Engineering", New Age International(p),4th Edition, Tata McGraw Hill, 2004

REFERENCES:

1. Ogata, K., " Modern Control Engineering", Prentice hall of India Ltd., 4th Edition, New Delhi,2006
2. Dorf Bishop, "Modern Control System",Prentice Hall,2004
3. Kuo, B.C., "Automatic Control System' Prentice Hall of India Ltd., New Delhi,2003

PTAU7017 QUALITY CONTROL AND RELIABILITY L T P C
3 0 0 3

OBJECTIVE:

- Teach the essentiality of Quality Control, sampling and reliability engineering. Study on various types of control charts, six sigma and process capability to help the students understand various quality control techniques. Reliability engineering focuses on the dependability, failure mode analysis, reliability prediction and management of a system.

UNIT I STATISTICAL PROCESS CONTROL 9

Quality control – Definition – Quality Assurance Variation in process – Factors – control charts – variables XR and XÃ, - Attributes P, C and U-Chart Establishing and interpreting control charts process capability – Quality rating – Short run SPC.

UNIT II ACCEPTANCE SAMPLING 9

Lot by lot sampling types – probability of acceptance in single, double, multiple sampling plans – OC curves – Producer's risk and consumer's risk. AQL, LTPD, AOQL, Concepts Design of single sampling plan – standard sampling plans for AQL and LTPD – Use of standard sampling plans – Sequential sampling plan. Acceptance sampling plan – Acceptance sampling plan for continuous production - CSP-1 plan CSP-2 Plans.

UNIT III EXPERIMENTAL DESIGN AND TAGUCHI METHOD 9

Fundamentals – factorial experiments – meantime to failure – maintainability and availability – reliability – system reliability – OC curves – reliability improvement techniques – Reliability testing techniques – Pareto analysis.

UNIT IV RELIABILITY AND ITS PREDICTION 9

Life testing – Failure characteristics – MTBA MTTF – System reliability – OC curve Availability and Maintainability – Reliability Improvement techniques.

UNIT V FAILURE DATA ANALYSIS 9

Real time distribution, exponential, normal, log normal, gamma and weibull – reliability data requirements – Graphical evaluation.

TOTAL : 45 PERIODS

OUTCOMES:

At the end of this course the student should

- Will be able to select an appropriate SPC and Sampling process for the Quality Control in particularly for manufacturing Automotive Components.

- Have in-depth knowledge of the Reliability and Failure Data Analysis.
- Will be able to design the experiment based on Taguchi methods

TEXT BOOKS:

1. Amita Mitra “Fundamentals of Quality Control and Improvement” Pearson Education, 2002
2. Modares, “Reliability & Risk Analysis” Marcel Decker Inc. 1993.
3. D. C. Montgomery, “Introduction to Statistical Quality Control”, John Wiley & Sons, 3rd Edition

REFERENCES:

1. Bester field D.H., “Quality Control” Prentice Hall, 7th edition 2003
2. Manohar Mahajan, “Statistical Quality Control” Dhanpal Rai & Sons, 2001
3. Sharma S.C., “Inspection Quality Control and Reliability”, Khanna Publications, 2004.
4. Charles E Ebling, "An Introduction to Reliablity and Maintainability Engineering" Tata Mc Graw Hill, 2000.
5. D. C. Montgomery and G C Runger, “Applied Statistics and Probability for Engineers”, John Wiley & Sons, 4th Edition

PTAU7018 SIMULATION OF IC ENGINES L T P C
3 0 0 3

OBJECTIVES

- To impart knowledge in simulating IC engine processes. The detailed concept of air standard, fuel air cycle, progressive and actual cycle simulation of SI engine will be taught to the students. At the end of the course the students will have command over simulation of IC engine process.

UNIT I INTRODUCTION TO SIMULATION 9

Introduction to Simulation, Advantages of computer simulation, Classification of engine models. Intake and exhaust flow models – Quasi steady flow -Filling and emptying -Gas dynamic Models. Thermodynamic based in cylinder models. Step by step approach in SI engine simulation. .

UNIT II STOICHIOMETRY AND ADIABATIC FLAME TEMPERATURE 9

Reactive processes, Heat of reaction, measurement of URP, measurement of HRP. Introduction - combustion equation for hydrocarbon fuels. Calculation of minimum air, excess air and stoichiometric air required for combustion. Introduction, complete combustion in C-H-N-O systems, constant volume adiabatic combustion, constant pressure adiabatic combustion, calculation of adiabatic flame temperature, isentropic changes of state.

UNIT III SI ENGINE SIMULATION 9

SI Engine simulation with air as working medium, deviation between actual and ideal cycle. Fuel air cycle analysis - Temperature drop due to fuel vaporization, full throttle operation, work output and efficiency calculation, part-throttle operation, engine performance at part throttle, super charged operation. SI Engines simulation with progressive combustion. Models for mass burnt fraction.

UNIT IV SI ENGINE SIMULATION WITH GAS EXCHANGE PROCESS 9

Introduction, gas exchange process, Heat transfer process, friction calculations, compression of simulated values, validation of the computer code, engine performance simulation, pressure crank angle diagram, brake power, brake thermal efficiency, effect of speed on performance.

UNIT V CI ENGINE SIMULATION 9

Zero, one and multi zone models for diesel engine combustion. Wiebe's Model, Whitehouse model and Watson model for diesel combustion. Heat release rate and heat transfer models. Equilibrium calculations. Parametric studies on simulated engine performance.

TOTAL : 45 PERIODS

OUTCOMES

- Students will understand the classifications and applications of engine cycle simulation model and grasp the major modeling and simulation methods and the influence of model parameters on engine performance.
- Students will become familiar with the modeling of progressive combustion and gas exchange processes and ability to build up control-oriented simulation model of internal combustion engines
- They will get familiarized with the essential models of engine cycle simulation and theoretical knowledge to control the calculation accuracy and calculation efficiency of engine performance, combustion and emission.

TEXT BOOK

1. Ganesan.V. "Computer Simulation of spark ignition engine process", Universities Press (I) Ltd, Hyderbad, 1996.

REFERENCES

1. John. B. Heywood, 'Internal Combustion Engines'", Tata McGraw Hill Co., Newyork, 1988.
2. Benson.R.S., Whitehouse.N.D., "Internal Combustion Engines", Pergamon Press, oxford, 1979
3. Ramoss.A.L., "Modelling of Internal Combustion Engines Processes", McGraw Hill Publishing Co., 1992.
4. Ashley Campbel, "Thermodynamic analysis of combustion engines", John Wiley & Sons, New York, 1986

PTAU7019 TWO AND THREE WHEELER TECHNOLOGY L T P C
3 0 0 3

OBJECTIVE:

- To develop the basic knowledge of the students in constructional details of two and Three Wheelers. Dissect the skills of the students in the operating principles.

UNIT I POWER UNIT 9

Two stroke and four stroke SI & CI engine Construction and Working, merits and demerits, Symmetrical and unsymmetrical valve & port timing diagrams. Types of scavenging processes, merits and demerits – scavenging efficiency. Scavenging pumps – Rotary valve engine.

UNIT II FUEL AND IGNITION SYSTEM 9

Fuel system – Different circuits in two wheeler fuel systems, fuel injection system. Lubrication system, Ignition systems - Magneto coil and battery coil spark ignition system, Electronic ignition System, and starting system - Kick starter system – Self starter system. Recent technologies.

UNIT III CHASSIS AND SUB – SYSTEMS 9

Main frame for two and three wheelers, its types, Chassis and different drive systems for two wheelers, Single, multiple plates and centrifugal clutches, Gear box and its and various gear controls in two wheelers. Front and rear suspension systems. Shock absorbers. Panel meters and controls on handle bar, Freewheeling devices

UNIT IV BRAKES AND WHEELS 9

Drum brakes & Disc brakes Construction and Working and its Types, Front and Rear brake links lay-outs. Brake actuation mechanism. Spoked wheel, cast wheel, Disc wheel & its merits and demerits. Tyres and tubes Construction & its Types- vulcanizing methods. Steering column construction, steering geometry for two & three wheelers.

UNIT V TWO & THREE WHEELER CASE STUDY 9

Case study of Sports bike, Motor cycles, Scooters and Mopeds - Auto rickshaws, Pick up van, Delivery van and Trailer. Importance of maintenance – general maintenance schedule – Servicing of two and three wheeler – periodic checkups. Recent developments.

TOTAL: 45 PERIODS

OUTCOMES

On successful completion of this course students will be able to:

- Explain the working of two and four stroke engines.
- Illustrate the functioning of clutch and gear box.
- Demonstrate the wheels, tyres, suspensions and braking systems.
- Identify the latest models of two wheelers.
- Define the operations of three wheelers and latest models of three wheelers

TEXT BOOK:

1. Irving,P.E., Motor cycle Engineering, Temple Press Book, London, 1992.
2. Marshal Cavandedish, 'Encyclopedia of Motor cycling', New York, 1989
3. Srinivasan.S., 'Motor cycle, Scooter, Mopeds', New century book house, 1988.

REFERENCES:

1. The Cycle Motor Manual, Temple Press Ltd., London, 1990.
2. K. K. Ramalingam, Two Wheelers, Scitech publications, Chennai,
3. Encyclopedia of Motor cycling, 20 volumes, Marshall Cavensih, New York and London, 1989.
4. Bryaut,R.V., Vespa Maintenance and Repair series.
5. Raymond Broad, Lambretta – A practical guide to maintenance and repair, 1987.

PTAU7020 VEHICLE AIR-CONDITIONING L T P C

3 0 0 3

OBJECTIVES :

- The objective of the course is to impart knowledge in the area of pychrometry, refrigerant and to understand the various components of vehicle air conditioning. Also the Servicing and repairing aspects of vehicle air conditioning will be covered.

UNIT I AUTOMOTIVE AIR CONDITIONING FUNDAMENTALS 9

Purposes of Heating, Ventilation and Air Conditioning- Environmental Concerns- Ozone layer depletion- Location of air conditioning components in a car – Schematic layout of a vehicle refrigeration system. Psychrometry – Basic terminology and Psychrometric mixtures- Psychrometric Chart- Related problems

UNIT II AUTOMOTIVE COOLING AND HEATING SYSTEM 9

Vehicle Refrigeration System and related problems- Fixed thermostatic and Orifice tube system- Variable displacement thermostatic and Orifice tube system- Vehicle air conditioning operation Types of compressor- Compressor Clutches- Compressor Clutch electrical circuit- Compressor lubrication- Condensers- Evaporators- Expansion devices- Evaporator temperature and

pressure controls- receiver-drier- Accumulators- refrigerant hoses, Connections and other assemblies- Heating system

UNIT III AIR-CONDITIONING CONTROLS, DELIVERY SYSTEM AND REFRIGERANTS 9

Types of Control devices- Preventing Compressor damage- Preventing damage to other systems- Maintaining drive ability- Preventing Overheating Ram air ventilation- Air delivery Components- Control devices- Vacuum Controls Containers – Handling refrigerants – Discharging, Charging & Leak detection – Refrigeration system diagnosis – Diagnostic procedure – Ambient conditions affecting system pressures.

UNIT IV AUTOMATIC TEMPERATURE CONTROL 9

Different types of sensors and actuators used in automatic temperature control- Fixed and variable displacement temperature control- Semi Automatic- Controller design for Fixed and variable displacement type air conditioning system

UNIT V SYSTEM SERVICING AND TESTING 9

Special tools for servicing vehicle air conditioning – Diagnosing components and air conditioning systems- Diagnosing cooling system- Air delivery system- Automatic temperature Control system diagnosis and service

TOTAL : 45 PERIODS

OUTCOMES:

- Student will understand the fundamental principles and operation of the heating, cooling, ventilation and air-conditioning system.
- Student will able to solve the simple problems related to pychrometry and refrigerant
- Enable the student to understand the operation of the individual components of the A/C
- System, sensors, actuators and electronic control
- Enable the reader to understand the range of techniques that can be used in diagnosing
- faults which affect system performance
- To provide adquate knowledge in safe working practice. understanding the correct procedures for A/C service and repair

TEXT BOOKS:

1. Warren Farnell and James D.Halderman, Automotive Heating, Ventilation, and Air Conditioning systems, Classroom Manual, Pearson Prentice Hall,2004
2. William H Crouse and Donald L Anglin, Automotive Air conditioning, McGraw Hill Inc., 1990.

REFERENCES:

1. Mitchell Information Services, Inc., Mitchell Automatic Heating and Air Conditioning Systems, Prentice Hall Inc., 1989.
2. Paul Weisler, Automotive Air Conditioning, Reston Publishing Co. Inc., 1990.
3. McDonald,K.L., Automotive Air Conditioning, Theodore Audel series, 1978.
4. Goings,L.F., Automotive Air Conditioning, American Technical services, 1974.

PTAU7021 VEHICLE MAINTENANCE L T P C
3 0 0 3

OBJECTIVE :

- To impart the knowledge on basics of vehicle maintenance and maintenance of engine subsystems and drive line components.

UNIT I MAINTENANCE, WORKSHOP PRACTICES, SAFETY AND TOOLS 9

Maintenance – Need, importance, classification of maintenance, basic problem diagnosis. Automotive service procedures – workshop operations – Safety – Personnel, machines and equipment, vehicles, fire safety - First aid. Basic tools – special service tools – measuring instruments.

UNIT II ENGINE AND ENGINE SUBSYSTEM MAINTENANCE 9

General Engine service- Dismantling of Engine components- Engine repair- Service of basic engine sub systems- cooling and lubricating system, fuel system, Intake and Exhaust system, electrical system - Electronic fuel injection and engine management service - fault diagnosis- servicing emission controls

UNIT III TRANSMISSION AND DRIVELINE MAINTENANCE 9

Clutch- general checks, adjustment and service- Dismantling, identifying, checking and reassembling transmission, transaxle- road testing- Removing and replacing propeller shaft, servicing of cross and yoke joint and constant velocity joints- Rear axle service points- removing axle shaft and bearings- servicing differential assemblies- fault diagnosis.

UNIT IV STEERING, BRAKE, SUSPENSION, WHEEL MAINTENANCE 9

Maintenance and Service of steering system-Inspection, Maintenance and Service of brake system- Drum brake, Disc brake, Parking brake. Bleeding of brakes. Inspection, Maintenance and Service of Mc person strut, coil spring, leaf spring, shock absorbers-Dismantling and assembly procedures. Wheel alignment and balance, removing and fitting of tyres, tyre wear and tyre rotation. Inspection,

UNIT V AUTO ELECTRICAL AND AIR CONDITIOING MAINTENANCE 9

Maintenance of batteries, starting system, charging system and body electrical -Fault diagnosis using Scan tools. Maintenance of air conditioning parts like compressor, condenser, expansion valve, evaporator - Replacement of hoses- Leak detection- AC Charging- Fault diagnosis Vehicle body repair like panel beating, tinkering, soldering, polishing, painting.

TOTAL : 45 PERIODS

OUTCOMES

End of the course student would have deep knowledge on

- Importants of Vehicle maintenance
- Service procedure of engine and subsystems
- Service procedure of drive line
- Maintenance of electrical and air conditioning system

TEXT BOOKS

1. William H Crouse and Donald L Anglin “Automotive Mechanics” Tenth Edition, Mc Graw Hill Publications, 2007
2. Ed May, Automotive Mechanics Volume One , Mc Graw Hill Publications, 2003
3. Ed May, Automotive Mechanics Volume Two , Mc Graw Hill Publications, 2003

REFERENCES

1. Bosch Automotive Handbook, Sixth Edition,2004
2. Vehicle Service Manuals of manufacturers

PTAU7022 VEHICLE MULTIPLEXING L T P C
3 0 0 3

OBJECTIVE:

- The objective of the course is to impart knowledge in the areas of vehicle networking, various vehicle networking standards and multiplexing buses

UNIT I INTRODUCTION TO VEHICLE NETWORKING CONCEPTS 9

Historical Perspective- Multiplexing Paradox- Vehicle multiplexing comparison to industry- Why multiplexing – Popularity of multiplexing- SAE Classification- Intra Module Versus Intermodule communication- Examples of Vehicle Nodes – Terminology like : open architecture , Broad cast, Peer to peer, Baud rate versus Bit rate, protocol Synchronous and asynchronous protocol- On board Diagnostics- Encoding- Error Handling- Media Characteristics etc.

UNIT II VARIOUS MULTIPLEXING LEVEL 9

The vehicle Level- Topologies- Network Design issues- Development Tools- Service tools- Vehicle Level Testing- The Electronic Control Level- Integrated Control- Unexpected message delays- message synchronization- local loss of power and ground- Integrated circuit level- Partitioning – General digital tradeoffs- Digital CAN implementation- Electromagnetic compatibility

UNIT III MULTIPLEXING STANDARDS 9

ISO standards- SAE international standards- Class A protocols- Class B protocols- Class C protocols- Diagnostic Protocols- Air Bag Protocols- Wireless Protocols- Data Link Usage- Future Trends

UNIT IV CAN: FROM CONCEPT TO REALITY 9

The CAN bus: general-CAN: its protocol, its properties, its novel features-The CAN physical layer-Medium, implementation and physical layers in CAN-Components, applications and tools for CAN-Event-triggered and time-triggered aspects-TTCAN – Time-triggered communication on CAN-Towards high-speed, X-by-Wire and redundant systems

UNIT V NEW MULTIPLEXED BUS CONCEPTS 9

LIN – Local Interconnect Network-Think ‘Bus’, think ‘Fail-safe SBC’, ‘Gateways’ -Safe-by-Wire-Audio-video buses

TOTAL: 45 PERIODS

OUTCOMES :

- Students will acquire knowledge in multiplexing terminology and Standards relevant to vehicle
- Student can able to understand the current state of the CAN protocol, all the possible subdivisions of the physical layers and everything relating to conformity problems.
- Student can able to know the importance of various new multiplexed bus concepts

TEXT BOOKS:

1. Vehicle Multiplex Communication by Christopher Albert Lupini , SAE International ISBN 0-7680-1218-X, 2004
2. Multiplexed Networks for Embedded System by Dominique Paret, John Wiley & sons, 2007

PTAU7023 VIRTUAL INSTRUMENTATION IN AUTOMOBILE ENGINEERING **L T P C 3 0 0 3**

OBJECTIVE :

- To learn and understand the programming, data acquistion hardware and implementing small automotive related projects in virtual instrumention.

UNIT I INTRODUCTION **9**

Virtual Instrumentation-Definition and flexibility-Block diagram and Architecture of Virtual Instrumentation- Virtual instruments versus Traditional Instruments- Review of software in virtual Instrumentation- VI programming techniques- VI, sub VI, Loops and charts, Arrays, Clusters and Graphs, Case and Sequence Structures, Formula nodes, string and File Input / Output.

UNIT II DATA ACQUISITION IN VI **9**

A/D and D/A Converters, plug-in Analog input / Output cards- Digital Input and Output cards, Organization of the DAQ VI system- Opto Isolation- Performing analog input and analog output- Scanning multiple analog channels- issues involved in selection of data acquisition cards- Data acquisition modules with serial communication- Design of digital voltmeter with transducer input- Timers and Counters.

UNIT III COMMUNICATION NETWORKED MODULES **9**

Introduction to PC buses-Local buses:-ISA,PCI,RS232,RS422 and RS 485- Interface buses:-USB,PCMCIA,VXI,SCXI and PXI – Instrumentation Buses:- Modbus and GPIB- Networked buses-ISO/OSI reference model, Ethernet and TCP/IP Protocols.

UNIT IV REAL TIME CONTROL IN VI **9**

Design of ON/OFF controller and proportional controller for a mathematically described processes using VI software- Modeling and basic control of level and Reactor Processes- Case Studies on development of HMI, SCADA in VI.

UNIT V AUTOMOTIVE APPLICATIONS **9**

PC based digital storage oscilloscope- Sensor technology and signal processing- virtual laboratory- spectrum analyzer- wave form generator- Data visualization and multiple locations:-Distributed monitoring and control-Vision and motion control. Case study related to automotive applications

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Nadovich, C., “Synthetic Instruments Concepts and Applications”. Elsevier,2005
2. Bitter, R., Mohiuddin, T. and Nawricki, M., “Labview Advanced programming Techniques”, CRC Press, 2nd Edition, 2007.
3. Gupta, S. and Gupta J. P., “PC Interfacing for Data Acquisition and Process Control”, 2nd Edition, Instrument Society of America, 1994.

REFERENCES:

1. Jamal, R. and Picklik, H., “Labview-Applications and Solutions “, National Instrument Release
2. Johnson, G.,” Labview Graphical programming “ , McGraw-Hill, Newyork,1997.
3. Wells, L.K and Travis, J., “ Labview for Everyone”, Prentice Hall, New Jersey, 1997
4. Buchanan, W., ”Computer Busses ”, CRC Press, 2000

PTPR7001 QUANTITATIVE TECHNIQUES IN MANAGEMENT L T P C
4 0 0 4

OBJECTIVE:

- To introduce the various quantitative techniques and optimization techniques and to make the students apply these techniques for modeling and solving many engineering situations in general and manufacturing situations in particular.

UNIT I LINEAR PROGRAMMING 12

Problem formulation - Graphical method – simplex method – Special cases – transportation and assignment method – applications**.**

UNIT II REPLACEMENT MODELS AND GAME THEORY 12

Basic replacement model – individual and group replacement problems – applications – game theory – terminology – decision criteria – solution to a 2 x 2 and 2 x n games – applications of LP in game theory – applications.

UNIT III QUEUING MODELS AND SIMULATION 12

Elements of queue – queue discipline – Poisson arrival and exponential service – queue length – waiting time – steady state conditions – applications – concept of simulation – Monte Carlo method – applications.

UNIT IV FORECASTING, SEQUENCING AND LINE BALANCING 12

Forecasting – purpose – methods – measures of forecast error; scheduling – priority rules - sequencing – methods of sequencing – Johnson's rule – Heuristic approach, line balancing – applications.

UNIT V PROJECT NETWORK ANALYSIS AND DECISION TREE ANALYSIS 12

Network – CPM/PERT – Project time estimation – critical path – crashing of network, Decision tree analysis – applications

TOTAL: 60 PERIODS

OUTCOME:

- The students shall able to select and apply techniques for typical engineering and industrial situations.

TEXT BOOKS:

1. Panneerselvam R., "Operation Research", Prentice Hall of India, 2008.
2. Hamdy A.Taha, "Operations Research – An Introduction", Prentice Hall of India, 8th edition 2008.

REFERENCES:

1. Guptha. P.K. and Man-Mohan, "Problems in Operations Research", Sultan chand and Sons, 2014.
2. Monks. J.G, "Operations Management theory and Practice", McGraw Hill, 2nd edition 1996.
3. Ravindran, Philips and Sojberg, "Operations Research Principles and Practice", John Wiley and Sons, Singapore, 2nd edition,2007.
4. Sharma J.K., "Operations Research Theory and Applications", Macmillan India Ltd., 4th edition, 2009.

PTGE7071 DISASTER MANAGEMENT L T P C
3 0 0 3

OBJECTIVES:

- To provide students an exposure to disasters, their significance and types.
- To ensure that students begin to understand the relationship between vulnerability, disasters, disaster prevention and risk reduction
- To gain a preliminary understanding of approaches of Disaster Risk Reduction (DRR)
- To enhance awareness of institutional processes in the country and
- To develop rudimentary ability to respond to their surroundings with potential disaster response in areas where they live, with due sensitivity

UNIT I INTRODUCTION TO DISASTERS 9

Definition: Disaster, Hazard, Vulnerability, Resilience, Risks – Disasters: Types of disasters – Earthquake, Landslide, Flood, Drought, Fire etc - Classification, Causes, Impacts including social, economic, political, environmental, health, psychosocial, etc.- Differential impacts- in terms of caste, class, gender, age, location, disability - Global trends in disasters: urban disasters, pandemics, complex emergencies, Climate change- Dos and Don'ts during various types of Disasters.

UNIT II APPROACHES TO DISASTER RISK REDUCTION (DRR) 9

Disaster cycle - Phases, Culture of safety, prevention, mitigation and preparedness community based DRR, Structural- nonstructural measures, Roles and responsibilities of- community, Panchayati Raj Institutions/Urban Local Bodies (PRIs/ULBs), States, Centre, and other stake-holders- Institutional Processess and Framework at State and Central Level- State Disaster Management Authority(SDMA) – Early Warning System – Advisories from Appropriate Agencies

UNIT III INTER-RELATIONSHIP BETWEEN DISASTERS AND DEVELOPMENT 9

Factors affecting Vulnerabilities, differential impacts, impact of Development projects such as dams, embankments, changes in Land-use etc.- Climate Change Adaptation- IPCC Scenario and Scenarios in the context of India - Relevance of indigenous knowledge, appropriate technology and local resources

UNIT IV DISASTER RISK MANAGEMENT IN INDIA 9

Hazard and Vulnerability profile of India, Components of Disaster Relief: Water, Food, Sanitation, Shelter, Health, Waste Management, Institutional arrangements (Mitigation, Response and Preparedness, Disaster Management Act and Policy - Other related policies, plans, programmes and legislation – Role of GIS and Information Technology Components in Preparedness, Risk Assessment, Response and Recovery Phases of Disaster – Disaster Damage Assessment.

UNIT V DISASTER MANAGEMENT: APPLICATIONS AND CASE STUDIES AND FIELD WORKS 9

Landslide Hazard Zonation: Case Studies, Earthquake Vulnerability Assessment of Buildings and Infrastructure: Case Studies, Drought Assessment: Case Studies, Coastal Flooding: Storm Surge Assessment, Floods: Fluvial and Pluvial Flooding: Case Studies; Forest Fire: Case Studies, Man Made disasters: Case Studies, Space Based Inputs for Disaster Mitigation and Management and field works related to disaster management.

TOTAL: 45 PERIODS

OUTCOMES:

The students will be able to

- Differentiate the types of disasters, causes and their impact on environment and society
- Assess vulnerability and various methods of risk reduction measures as well as mitigation.
- Draw the hazard and vulnerability profile of India, Scenarious in the Indian context,
- Disaster damage assessment and management.

TEXT BOOKS:

1. Singhal J.P. “Disaster Management”, Laxmi Publications, 2010. ISBN-10: 9380386427 ISBN-13:978-9380386423
2. Tushar Bhattacharya, “Disaster Science and Management”, McGraw Hill India Education Pvt. Ltd., 2012. **ISBN-10:** 1259007367, **ISBN-13:** 978-1259007361]
3. Gupta Anil K, Sreeja S. Nair. Environmental Knowledge for Disaster Risk Management, NIDM, New Delhi, 2011
4. Kapur Anu Vulnerable India: A Geographical Study of Disasters, IIAS and Sage Publishers, New Delhi, 2010.

REFERENCES

1. Govt. of India: Disaster Management Act , Government of India, New Delhi, 2005
2. Government of India, National Disaster Management Policy,2009.

PTGE7072 ENGINEERING ETHICS AND HUMAN VALUES L T P C
3 0 0 3

OBJECTIVES

- To emphasise into awareness on Engineering Ethics and Human Values.
- To understand social responsibility of an engineer.
- To appreciate ethical dilemma while discharging duties in professional life.

UNIT I HUMAN VALUES 3

Morals, Values and Ethics – Integrity – Work Ethic – Honesty – Courage –Empathy – Self-Confidence – Discrimination- Character.

UNIT II ENGINEERING ETHICS 9

Senses of 'Engineering Ethics' - variety of moral issued - types of inquiry - moral dilemmas - moral autonomy - Kohlberg's theory - Gilligan's theory - consensus and controversy – Models of Professional Roles - theories about right action - Self-interest –Professional Ideals and Virtues - uses of ethical theories. Valuing Time – Co-operation – Commitment

UNIT III ENGINEERING AS SOCIAL EXPERIMENTATION 9

Engineering as experimentation - engineers as responsible experimenters - codes of ethics – Importance of Industrial Standards - a balanced outlook on law – anticorruption- occupational crime -the challenger case study.

UNIT IV ENGINEER’S RIGHTS AND RESPONSIBILITIES ON SAFETY 12

Collegiality and loyalty – Respect for authority – Collective Bargaining – Confidentiality- Conflict of interest – Occupational Crime – Professional Rights – IPR- Safety and risk - assessment of safety and risk - risk benefit analysis and reducing risk - the Three Mile Island, Bhopal Gas plant and chernobyl as case studies.

UNIT V GLOBAL ISSUES 12

Multinational corporations - Environmental ethics - computer ethics - weapons development - engineers as managers-consulting engineers-engineers as expert witnesses and advisors -moral leadership-Sample code of conduct.

TOTAL : 45 PERIODS

OUTCOMES

- Students will have the ability to perform with professionalism, understand their rights, legal, ethical issues and their responsibilities as it pertains to engineering profession with engaging in life-long learning with knowledge of contemporary issues.

TEXT BOOKS

1. Mike Martin and Roland Schinzinger, “Ethics in Engineering”, McGraw-Hill, New York 2005.
2. Charles E Harris, Michael S. Protchard and Michael J Rabins, “Engineering Ethics – Concepts and Cases”, Wadsworth Thompson Leatning, United States, 2000 (Indian
3. Govindarajan M, Natarajan S, Senthil Kumar V. S, “Engineering Ethics”, Prentice Hall of India, New Delhi, 2004.

REFERENCES

1. Charles D. Fleddermann, “Engineering Ethics”, Pearson Education / Prentice Hall, New Jersey, 2004
2. Charles E Harris, Michael S. Protchard and Michael J Rabins, “Engineering Ethics – Concepts and Cases”, Wadsworth Thompson Leatning, United States, 2000
3. John R Boatright, “Ethics and the Conduct of Business”, Pearson Education, New Delhi, 2003.
4. Edmund G Seebauer and Robert L Barry, “Fundamentals of Ethics for Scientists and Engineers”, Oxford Press , 2000
5. R.Subramanian , “Professional Ethics “,Oxford University Press ,Reprint ,2015.

PTGE7073 HUMAN RIGHTS L T P C
3 0 0 3

OBJECTIVES :

- To sensitize the Engineering students to various aspects of Human Rights.

UNIT I **9**

Human Rights – Meaning, origin and Development. Notion and classification of Rights – Natural, Moral and Legal Rights. Civil and Political Rights, Economic, Social and Cultural Rights; collective / Solidarity Rights.

UNIT II **9**

Evolution of the concept of Human Rights Magana carta – Geneva convention of 1864. Universal Declaration of Human Rights, 1948. Theories of Human Rights.

UNIT III **9**

Theories and perspectives of UN Laws – UN Agencies to monitor and compliance.

UNIT IV **9**

Human Rights in India – Constitutional Provisions / Guarantees.

UNIT V **9**

Human Rights of Disadvantaged People – Women, Children, Displaced persons and Disabled persons, including Aged and HIV Infected People. Implementation of Human Rights – National and State Human Rights Commission – Judiciary – Role of NGO’s, Media, Educational Institutions, Social Movements.

TOTAL : 45 PERIODS

OUTCOME :

- Engineering students will acquire the basic knowledge of human rights.

REFERENCES:

1. Kapoor S.K., “Human Rights under International law and Indian Laws”, Central Law Agency, Allahabad, 2014.
2. Chandra U., “Human Rights”, Allahabad Law Agency, Allahabad, 2014.
3. Upendra Baxi, The Future of Human Rights, Oxford University Press, New Delhi.

PTGE7074 TOTAL QUALITY MANAGEMENT L T P C
3 0 0 3

AIM

- To provide comprehensive knowledge about the principles, practices, tools and techniques of Total quality management.

OBJECTIVES

- To understand the need for quality, its evolution, basic concepts, contribution of quality gurus, TQM framework, Barriers and Benefits of TQM.
- To understand the TQM Principles.
- To learn and apply the various tools and techniques of TQM.
- To understand and apply QMS and EMS in any organization.

UNIT I INTRODUCTION 9

Introduction - Need for quality - Evolution of quality - Definition of quality - Dimensions of product and service quality –Definition of TQM-- Basic concepts of TQM –-Gurus of TQM (Brief introduction) -- TQM Framework- Barriers to TQM –Benefits of TQM.

UNIT II TQM PRINCIPLES 9

Leadership--The Deming Philosophy, Quality council, Quality statements and Strategic planning-- Customer Satisfaction –Customer Perception of Quality, Feedback, Customer complaints, Service Quality, Kano Model and Customer retention – Employee involvement – Motivation, Empowerment, Team and Teamwork, Recognition & Reward and Performance Appraisal--Continuous process improvement –Juran Trilogy, PDSA cycle, 5s and Kaizen - Supplier partnership – Partnering, Supplier selection, Supplier Rating and Relationship development.

UNIT III TQM TOOLS & TECHNIQUES I 9

The seven traditional tools of quality – New management tools – Six-sigma Process Capability– Bench marking – Reasons to bench mark, Bench marking process, What to Bench Mark, Understanding Current Performance, Planning, Studying Others, Learning from the data, Using the findings, Pitfalls and Criticisms of Bench Marking – FMEA – Intent of FMEA, FMEA Documentation, Stages, Design FMEA and Process FMEA.

UNIT IV TQM TOOLS & TECHNIQUES II 9

Quality circles – Quality Function Deployment (QFD) – Taguchi quality loss function – TPM – Concepts, improvement needs – Performance measures-- Cost of Quality - BPR.

UNIT V QUALITY MANAGEMENT SYSTEM 9

Introduction—Benefits of ISO Registration—ISO 9000 Series of Standards—Sector-Specific Standards—AS 9100, TS16949 and TL 9000-- ISO 9001 Requirements—Implementation—Documentation—Internal Audits—Registration--**ENVIRONMENTAL MANAGEMENT SYSTEM:** Introduction—ISO 14000 Series Standards—Concepts of ISO 14001—Requirements of ISO 14001—Benefits of EMS.

TOTAL: 45 PERIODS

OUTCOMES:

- Ability to apply TQM concepts in a selected enterprise.
- Ability to apply TQM principles in a selected enterprise.
- Ability to apply the various tools and techniques of TQM.
- Ability to apply QMS and EMS in any organization.

TEXT BOOK:

1. Dale H.Besterfiled, Carol B.Michna,Glen H. Besterfield,Mary B.Sacre,Hemant Urdhwareshe and Rashmi Urdhwareshe, “Total Quality Management”, Pearson Education Asia, Revised Third Edition, Indian Reprint, Sixth Impression,2013.

REFERENCES:

1. James R. Evans and William M. Lindsay, “The Management and Control of Quality”, (6th Edition), South-Western (Thomson Learning), 2005.
2. Oakland, J.S. “TQM – Text with Cases”, Butterworth – Heinemann Ltd., Oxford, Third Edition, 2003.
3. Suganthi,L and Anand Samuel, “Total Quality Management”, Prentice Hall (India) Pvt. Ltd., 2006 .
4. Janakiraman,B and Gopal, R.K, “Total Quality Management – Text and Cases”,Prentice Hall (India) Pvt. Ltd., 2006.

PTGE7075 INTELLECTUAL PROPERTY RIGHTS L T P C
3 0 0 3

OBJECTIVE:

- To give an idea about IPR, registration and its enforcement.

UNIT I INTRODUCTION 9

Introduction to IPRs, Basic concepts and need for Intellectual Property - Patents, Copyrights, Geographical Indications, IPR in India and Abroad – Genesis and Development – the way from WTO to WIPO –TRIPS, Nature of Intellectual Property, Industrial Property, technological Research, Inventions and Innovations – Important examples of IPR.

UNIT II REGISTRATION OF IPRs 10

Meaning and practical aspects of registration of Copy Rights, Trademarks, Patents, Geographical Indications, Trade Secrets and Industrial Design registration in India and Abroad

UNIT III AGREEMENTS AND LEGISLATIONS 10

International Treaties and Conventions on IPRs, TRIPS Agreement, PCT Agreement, Patent Act of India, Patent Amendment Act, Design Act, Trademark Act, Geographical Indication Act.

UNIT IV DIGITAL PRODUCTS AND LAW 9

Digital Innovations and Developments as Knowledge Assets – IP Laws, Cyber Law and Digital Content Protection – Unfair Competition – Meaning and Relationship between Unfair Competition and IP Laws – Case Studies.

UNIT V ENFORCEMENT OF IPRs 7

Infringement of IPRs, Enforcement Measures, Emerging issues – Case Studies.

TOTAL :45 PERIODS

OUTCOME:

- Ability to manage Intellectual Property portfolio to enhance the value of the firm.

TEXT BOOKS

1. V. Scople Vinod, Managing Intellectual Property, Prentice Hall of India pvt Ltd, 2012
2. Intellectual Property Rights and Copy Rights, Ess Ess Publications.

REFERENCES

1. Deborah E. Bouchoux, “Intellectual Property: The Law of Trademarks, Copyrights, Patents and Trade Secrets”, Cengage Learning, Third Edition, 2012.
2. Prabuddha Ganguli,”Intellectual Property Rights: Unleashing the Knowledge Economy”, McGraw Hill Education, 2011.
3. Edited by Derek Bosworth and Elizabeth Webster, The Management of Intellectual Property, Edward Elgar Publishing Ltd., 2013.

PTGE7076 FUNDAMENTALS OF NANO SCIENCE L T P C

3 0 0 3

OBJECTIVES:

- To learn about basis of nanomaterial science, preparation method, types and application

UNIT I INTRODUCTION 8

Nanoscale Science and Technology- Implications for Physics, Chemistry, Biology and Engineering-Classifications of nanostructured materials- nano particles- quantum dots, nanowires-ultra-thinfilms-multilayered materials. Length Scales involved and effect on properties: Mechanical, Electronic, Optical, Magnetic and Thermal properties. Introduction to properties and motivation for study (qualitative only).

UNIT II GENERAL METHODS OF PREPARATION 9

Bottom-up Synthesis-Top-down Approach: Co-Precipitation, Ultrasonication, Mechanical Milling, Colloidal routes, Self-assembly, Vapour phase deposition, MOCVD, Sputtering, Evaporation, Molecular Beam Epitaxy, Atomic Layer Epitaxy, MOMBE.

UNIT III NANOMATERIALS 12

Nanoforms of Carbon - Buckminster fullerene- graphene and carbon nanotube, 92 Single wall carbon Nanotubes (SWCNT) and Multi wall carbon nanotubes (MWCNT)- methods of synthesis(arc-growth, laser ablation, CVD routes, Plasma CVD), structure-property Relationships applications- Nanometal oxides-ZnO, TiO_2,MgO, ZrO_2, NiO, nanoalumina, CaO, $AgTiO_2$, Ferrites, Nanoclays-functionalization and applications-Quantum wires, Quantum dotspreparation, properties and applications

UNIT IV CHARACTERIZATION TECHNIQUES 9

X-ray diffraction technique, Scanning Electron Microscopy - environmental techniques, Transmission Electron Microscopy including high-resolution imaging, Surface Analysis techniques- AFM, SPM, STM, SNOM, ESCA, SIMS-Nanoindentation

UNIT V APPLICATIONS 7

NanoInfoTech: Information storage- nanocomputer, molecular switch, super chip, nanocrystal, Nanobiotechlogy: nanoprobes in medical diagnostics and biotechnology, Nano medicines, Targetted drug delivery, Bioimaging - Micro Electro Mechanical Systems (MEMS), Nano Electro Mechanical Systems (NEMS)- Nanosensors, nano crystalline silver for bacterial inhibition, Nanoparticles for sunbarrier products - In Photostat, printing, solar cell, battery

TOTAL : 45 PERIODS

OUTCOMES:

Upon completing this course, the students

- Will familiarize about the science of nanomaterials
- Will demonstrate the preparation of nanomaterials
- Will develop knowledge in characteristic nanomaterial

TEXT BOOKS

1. A.S. Edelstein and R.C. Cammearata, eds., “Nanomaterials: Synthesis, Properties and Applications”, Institute of Physics Publishing, Bristol and Philadelphia, 1996.
2. N John Dinardo, “Nanoscale charecterisation of surfaces & Interfaces”, 2nd edition, Weinheim Cambridge, Wiley-VCH, 2000

REFERENCES

1. G Timp (Editor), “Nanotechnology”, AIP press/Springer, 1999.
2. Akhlesh Lakhtakia (Editor),“The Hand Book of Nano Technology,Nanometer Structure, Theory, Modeling and Simulations”. Prentice-Hall of India (P) Ltd, New Delhi, 2007.