BHARATHIDASAN UNIVERSITY, TIRUCHIRAPPALLI – 620 024.
B.Sc. Automobile Science - Course Structure under CBCS
For the candidates admitted from the academic year 2010-2011 onwards)

Semester	Part	Course	Title	Instr Hours/ Week	Credit	Exam Hours	Marks		Total
							Int.	Extn.	
I	I	Language Course – I (LC) – Tamil*/Other Languages ** #		6	3	3	25	75	100
	II	English Language Course - I (ELC)		6	3	3	25	75	100
	III	Core Course – I (CC)	Applied Mechanics	6	5	3	25	75	100
		Core Course – II (CC)	Engineering Drawing. Lab	3	3	3	40	60	100
		First Allied Course –I (AC)	Mathematics	5	3	3	25	75	100
		First Allied Course – II (AC)	Applied Physical Science Lab	4	-	***	-	-	-
		TOTAL		30	17				500
II	I	Language Course – II (LC) - – Tamil*/Other Languages ** #		6	3	3	25	75	100
	II	English Language Course – II (ELC)		6	3	3	25	75	100
	III	Core Course – III (CC)	Basic Workshop Lab	4	3	3	40	60	100
		Core Course – IV (CC)	Applied Thermo Dynamics	4	3	3	25	75	100
		First Allied Course – II (AC)	Applied Physical Science Lab	2	4	3	40	60	100
		First Allied Course – III (AC)	Applied Physical Science	4	3	3	25	75	100
	IV	Environmental Studies		2	2	3	25	75	100
	IV	Value Education		2	2	3	25	75	100
		TOTAL		30	23				800
III	I	Language Course – III (LC) – Tamil*/Other Languages ** #		6	3	3	25	75	100
	II	English Language Course - III (ELC)		6	3	3	25	75	100
	III	Core Course – V (CC)	Automobile Engineering	6	5	3	25	75	100
		Second Allied Course – I	Manufacturing Process	**6**	3	3	25	75	100
		Second Allied Course – II	Manufacturing Process & Machine Drawing Lab.	**4**	-	***	-	-	-
	IV	Non Major Elective I - for those who studied Tamil under Part I a) Basic Tamil for other language students b) Special Tamil for those who studied Tamil upto +2 but opt for other languages in degree programme	Basic Concepts of 4 wheeled Automobiles	2	2	3	25	75	100
		TOTAL		30	16				500
IV	I	Language Course –IV (LC) - Tamil*/Other Languages ** #		6	3	3	25	75	100
	II	English Language Course – IV (ELC)		6	3	3	25	75	100

	III	Core Course – VI (CC)	Automobiles Engine Components Lab.	4	3	3	40	60	100
		Core Course – VII (CC)	Mechanics of Materials	3	3	3	25	75	100
		Second Allied Course - II	Manufacturing Process & Machine Drawing Lab.	4	4	3	40	60	100
		Second Allied Course - III	CAD/CAM	3	3	3	25	75	100
	IV	Non Major Elective II - for those who studied Tamil under Part I a) Basic Tamil for other language students b) Special Tamil for those who studied Tamil upto +2 but opt for other languages in degree programme	Basic Concepts of 2 & 3 wheeled Automobiles	2	2	3	25	75	100
	IV	Skill Based Elective **I**		2	**4**	3	25	75	100
		TOTAL		30	**25**				800
V	III	Core Course – VIII (CC)	Automobile Science Lab.	5	5	3	40	60	100
		Core Course – IX (CC)	Automotive Chassis System	5	5	3	25	75	100
		Core Course – X (CC)	Automobile Electrical & Electronics	6	5	3	25	75	100
		Core Course – XI (CC)	Autotronics & Vehicle Maintenance	5	5	3	25	75	100
		Major based Elective – I	Automobiles Body Structures	5	5	3	25	75	100
	IV	Skill based Elective –II		2	**4**	3	25	75	100
		Skill based Elective – III		2	**4**	3	25	75	100
		TOTAL		30	**33**				700
VI	III	Core Course – XII(CC)	Automotive chassis components Lab.	**6**	5	3	40	60	100
		Core Course – XIII (CC)	Basics of Body Building	**6**	5	3	25	75	100
		Core Course – XIV (CC)	Automobile Transmission	6	5	3	25	75	100
		Major based Elective II	Alternative fuels & Energy System *	**6**	5	3	25	75	100
		Major based Elective III	Vehicle steering & Braking system	**5**	4	3	25	75	100
	V	Extension activities		-	1	-	-	-	-
		Gender Studies		1	1	3	25	75	100
		Total		30	26				600
		Grand Total		180	140				3900

*** Alternative fuels & Energy Sources என்ற தலைப்புக்கு பதிலாக Alternative fuels & Energy System என்று பாடத்திட்டக்குழுத் தலைவர் 21.02.2011 அன்று கடிதம் வாயிலாக தெரிவிக்கப்பட்டுள்ளது.**

Note:

	Internal Marks	**External Marks**
1. Theory	25	75
2. Practical	40	60

3. Separate passing minimum is prescribed for Internal and External marks

The passing minimum for CIA shall be 40% out of 25 marks [i.e. 10 marks]

The passing minimum for University Examinations shall be 40% out of 75 marks [i.e. 30 marks]

* for those who studied Tamil upto +2 (Regular Stream)

** Syllabus for other Languages should be on par with Tamil at Degree level

\# those who studied Tamil upto 10th or +2, but opt for other languages in degree level under Part I should study special Tamil in Part IV

*** Examination at the end of the next semester.

Extension activities shall be out side the instruction hours.

குற்பிக்கும் கால அளவு

மோழிப் பாடங்கள் - 1 மதிப்பீடு = 2 மணிநேரம் கற்பித்தல் வகுப்பு

குலை மற்றும் அறிவியல் பாடங்கள் :1 மதிப்பீடு = 1 மணிநேரம் கற்பித்தல் வகுப்பு [Lecture]

= 2 மணிநேரம் பயிற்சி வகுப்பு [Tutorial]

= 2-3 மணிநேரம் செய்முறை வகுப்பு [Practical]

Eligibility criteria

A pass in the HSC (Academic) or its equivalent with the minimum average percentage in the relevant subjects as prescribed :

OR

A pass in any one the following HSC (Vocational Stream) with Engineering / Technology Vocational subjects and any ONE or Two of the related subjects like Mathematics, Physics or Chemistry with minimum average percentage in the relevant subjects as prescribed below:

Vocational subjects prescribed for B.Sc. Automobile Science Degree admission

Sl.No.	**Name of the Vocation Course**
1.	Auto Mechanic
2.	Building Maintenance
3.	Business Machines and Computer Programming
4.	Diesel Mechanic
5.	Domestic Electonic Equipment (Project Equipment)
6.	Draughtsman (Civil)
7.	Draughtsman (Mechanical)
8.	Electrical Domestic Appliance, repairs and maintenance
9.	Electrical Motor Rewinding
10.	Farm Machines and Post Harvest Technology
11.	Fitting
12.	Foundry
13.	General Machinist
14.	Leather Technology

15.	Maintenance and Servicing of Electrical Machines including generators
16.	Metal Finishing
17.	Radio and Television (Maintenance and repair)
18.	Repair and Maintenance of Refrigeration and Air conditioning Equipments
19.	Repair and Maintenance of Two Wheelers
20.	Sheet metal works
21.	Soil Conservation and Rural Construction Technology
22.	Textile Technology
23.	Tractor repair and maintenance
24.	Welding

OR

A pass in one of the following Diploma in Engineering / Technology of the State Board of Technical Education and Training, Tamilnadu with minimum average Percentage of marks in the semester examinations as prescribed below:

Sl.No.	Name of the Branch in Diploma
1.	Agricultural Engineering
2.	Agricultural Engineering and Farm Equipment Technology
3.	Architectural Assistantship
4.	Automobile Engineering
5.	Ceramic Technology
6.	Chemical Technology
7.	Civil and Rural Engineering
8.	Civil Engineering
9.	Computer Science and Engineering
10.	Computer Technology
11.	Electrical and Electronics Engineering
12.	Electronics (with specialization in Instrumentation)
13.	Electrical and Communication Engineering
14.	Fisheries Technology
15.	Foundry Technology
16.	Instrument Technology
17.	Machine Design and Drafting
18.	Machine Tool Maintenance and Repair
19.	Man Made Fibre Technology
20.	Mechanical and Rural Engineering
21.	Mechanical Engineering
22.	Metallurgy
23.	Paper and Pulp Technology
24.	Petro – Chemical Technology
25.	Polymer Technology
26.	Production Engineering
27.	Prosthetics and Orthetics
28.	Refrigeration and Air Conditioning
29.	Textile Designing and Weaving
30.	Textile Engineering
31.	Textile Manufacture (Sand Wich)

32.	Textile Marketing and Management
33.	Textile Processing
34.	Textile Technology
35.	Tool Engineering

OR

Any other equivalent qualification for the Degree of B.Sc. Automobile Science programme admissions approved by the State Board of Technical Education and Training, Tamilnadu / Higher Secondary Board of Tamilnadu / Bharathidasan University.

Semester – I

Core Course- I (CC) - APPLIED MECHANICS

UNIT- I STATICS OF PARTICLES

Concept of particle and rigid bodies – Composition of concurrent forces in plane and space-problems involving the equilibrium of a particle – free body diagram; Equilibrium of a particle in space – simple problems.

UNIT-II FRICTION

Laws of friction – Coefficient of friction, problems involving dry friction – wedge, ladder, screw (simple) and belt friction (open belt drive only) – Analysis of simple place trusses by method of joints and method of sections.

UNIT-III CENTROIDS, CENTRE OF GRAVITY AND MOMENT OF INERTIA

Centroids of lines, areas and masses; composite areas – determination of moment of inertia of place figures; polar moment of inertia, radius of gyration – mass moment of inertia of rectangular and triangular plates and of cylinder.

UNIT-IV KINEMATICS OF PARTICLES

Introduction – Degrees of freedom; rectilinear motion; curvilinear motion (Plane) – rectangular coordinates; projectile – normal and tangential components, relative motion – concept and simple problems

UNIT-V IMPULSE AND MOMENTUM

Work energy method – Potential energy – kinetic energy – Conservation of energy – simple problems – Impulse – Momentum Principle

TEXT BOOK

1. "Engineering Mechanics", Kumar, K.L., Tata Mc Graw Hill.

REFERENCE

1. "Vector Mechanics for Engineers – Statics and Dynamics", Beer, F.P. and Johnson, E.R., Mc Graw Hill International Book Co.,

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CORE COURSE – II (CC)
ENGINEERING DRAWING

UNIT -1 INTRODUCTION, PROJECTION OF POINTS AND LINES

Use of drawing instruments – BIS Convention and specifications-size, layout lettering and dimensioning practice. Special curves-Ellipse – parabola Hyperbola involutes. Introduction to orthographic projections – projection of points-projection of straight lines in the first quadrant-line is parallel to both planes-inclined to one plane and parallel to other – inclined to both the planes.

UNIT –II PROJE CTION OF PLANES AND SOLIDS

Projection of planes like polygonal lamina and circular lamina. Projection of simple solids like cube, prism, pyramid, cylinder, cone. Auxiliary projections.

UNIT – III SECTION OF SOILDS AND ORTHOGRAPHIC PROJECTION

Section of solids like Prism, Pyramid, cylinder, cone in simple positions true shape and section for above. Convention of pictorial views to orthographic view of simple machine members.

UNIT – IV INTERSECTION OF SOLIDS AND DEVELOPMENT OF SURFACES

Intersection of solids-prism to prism-cylinder to cylinder-cone to cylinder.Development of surface-development of surface of solids-prism, pyramid, cylinder, cone and cut solids.

UNIT –V ISOMETRIC PROJECTION AND PERSPECTIVE PROJECTION

Isometric Projection of simple solids like prism, pyramid, cylinder, cone and cut solids. Perspective projection-visual ray method-vanishing point method-point, straight line, lamina, prism, pyramid.

TEXT BOOK

1. K.V. Natarajan A text book of Engineering Drawing, Dhanalakhmi Publication, Chennai

REFERENCE

1. N.D. Bhatt., Engineering Drawing, Charotar book stall, Anand

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FIRST ALLIED COURSE-I (AC)

MATHEMATICS

UNIT – I MATRICES

The characteristic equation, eigen values and eigen vectors of a real matrix, some properties of eigen values, Cayley – Hamiltonian theorem, reduction of a real matrix to a diagonal form, orthogonal matrices – properties, reduction of a quadratic form to canonical form by orthogonal transformation.

UNIT – II GEOMETRICAL APPLICATIONS OF DIFFERENTIAL CALCULUS

Curvature – Cartesian and polar co-ordinates, circle of curvature, involutes and evolutes, envelopes, properties of envelopes, envelopes of normal to a curve.

UNIT – III FUNCTIONS OF SEVERAL VARIABLES

Total differential derivative of implicit functions, partial derivative of a Function of two functions, Taylor's expansion for a function of two variables, maxima and minima, jacobians, differentiation under the integral sign.

UNIT – IV DIFFERENTIAL EQUATIONS;

First order equations – variables separable – Homogeneous equations – Exact equations – integrating factors – Linear equation – Reduction of order.

UNIT – V DIFFERENTIAL EQUATIONS

Simultaneous linear equations with constant coefficients, homogeneous linear equations of Euler type, equation reducible to homogenous form, linear equations of second order with variable coefficients, Method of reduction of order, transformation of the equation by changing the dependent variable, method of variation of parameters.

TEXT BOOK

1. Venkataraman, M.K. "Engineering Mathematics" – First year – national publishing company, Chennai – 1998.

REFERENCE

1. Veerarajan, T, "Engineering Mathematics". Tata McGraw Hill Publishing Co., New Delhi, 1999.

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FIRST ALLIED COURSE - II (AC)

APPLIED PHYSICAL SCIENCES LAB

LIST OF EXPERIMENTS:

1. Torsional Pendulum – Rigidity modulus of a wire
2. Thickness of Thin Films (Fizzaeu's fringes)
3. Spectrometer grating and Hg spectrum
4. Carey – Foster's bridge – Resistance calculation
5. Laser Grating
6. Moment of Inertia of Circular Disc
7. Newton's Rings – Radius of Curvature of lens
8. Carey – Foster's bridge – Temperature coefficient of resistance of a coil
9. EMF of a Thermo couple
10. Fiber optics experiments

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Semester – II

Core Course – III (CC) - BASIC WORKSHOP LAB

CARPENTY

Tools and Equipments-Planning Practice-making Tee Halving Joint-Dove Tail joint-Lap Joint-Mortise and Tennon Joint

FITTING

Tools and Equipments-Practice in Chipping, Filling-making vee joints, square and dove tail joints

SHEET METAL

Tools and Equipments-Fabrication of tray, cone, etc., with sheet metal

FOUNDRY

Tools and Equipments- Preparation of moulds of simple objects like flange, gear,v-grooved pulley etc.

SMITHY

Tools and Equipments-Demonstration for making simple parts like keys, bolts etc

REFERENCES:

1. V.S. Venkatachalapathy., "First year Engineering Practice", Raamalinga Publications, Madurai.
2. P.Kanaiah, K.C.Narayana., "Manual on Workshop Practice", Scitech Publications", Chennai.

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CORE COURSE - IV (CC) - APPLIED THERMO DYNAMICS

UNIT – I FIRST LAW OF THERMODYNAMICS

System, thermodynamic equilibrium, state, property, process, cycle, zeroth law of thermodynamics, energy, work, heat, first law of thermodynamics, PMM I, application of first law of thermodynamics to closed and open systems, pressure – volume diagrams, steady flow process, application of steady flow energy equation.

UNIT – II SECOND LAW OF THERMODYNAMICS

Limitations to the first law- heat engine and reversed heat engines- Kelvin Plank and Clausius Statements-reversibility-corollaries- Carnot cycle-thermodynamic temperature scale-entropy-Clausius inequality – PMM II

UNIT – III GAS AND VAPOURS

Mixture of gas and vapour-Dalton's Law of partial pressures-properties of water and air- vapour mixtures-psychometric chart-psychometric calculations.

UNIT – IV RECIPROCATING AIR COMPRESSORS

Single acting and double acting air compressors, work required effect of clearance volume, volumetric efficiency, isothermal efficiency, free air delivery, multistage compression, and condition for minimum work.

UNIT-V FUNDAMENTALS OF REFRIGERATION AND REFRIGERATION CYCLES

Fundamentals of refrigeration, C.O.P., reversed carnot cycle, simple vapour compression refrigeration system, T-S, P-H diagrams, simple vapour absorption refrigeration system, desirable properties of an ideal refrigerant.

TEXTBOOK

1. P.K.Nag- Engineering Thermodynamics, Tata McGraw Hill Publishing Company Ltd, New Delhi,2002

REFERENCES

1. C.P.Gothandaraman- Engineering Thermodynamics, Danpatra Publications, New delhi.

2. P.L.Ballany- Thermal Engineering, Khanna Publishers, New Delhi

3. R.S.Khurmi, J.K.Gupta - A textbook of thermal Engineering- S.Chand & company Ltd- 2003.

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FIRST ALLIED COURSE - II (AC)

APPLIED PHYSICAL SCIENCES LAB

List of Experiments

1. Estimation of Fe^{2+} using dichrometry and disphenylamine indicator
2. Estimation of CI by Mohr's method using potassium chromate indicator
3. Extimation of Fe^{2+} by potentiometric titration
4. Estimation of available chlorine in bleaching powder
5. Critical Solution Temperature – Phenol water system
6. Estimation of copper by iodometry

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FIRST ALLIED COURSE - III (AC)
APPLIED PHYSICAL SCIENCE

UNIT-I PROPERTIES OF MATTER

Elasticity: Definitions of linear stress and linear strain - statement of Hooke's law -definitions of young 's modulus, Bulk modulus and rigidity modulus .**Viscosity:** Definitions of streamline and turbulent motion. Definition of coefficient of viscosity - experimental comparison of viscosities of two liquids **Surface Tension**:Definitions of surface Tension and angle of contact. Derivation of the formula for surface tension of a liquid by capillary rise method.

UNIT-II LASER, FIBRE OPTICS AND SOUND

Principles of Laser-Laser characteristics – Ruby – NDYAG, HE-Ne, CO_2, and semiconductor lasers-Types of optical fibres, applications of optical fibres-Optical wave guides and sensors. Definitions of longitudinal waves, transverse waves, progressive waves, stationary waves, wave length- frequency and velocity - experiment of determine the frequency of a tuning fork. Accoustics of buildings - reverberation - reverberation - time - echo coefficient of absorption of sound energy.

UNIT-III HIGH POLYMERS AND ELECTROCHEMICAL CELLS

Types of polymerization – Addition, Condensation polymerization – Classification of high polymers – Plastics – Properties of polymers– Natural and synthetic rubber– conducting polymers. Galvanic cells, Single electrode potentials, Standard electrode potentials, Electromotive force, Electromotive series, Measurement of EMF of a cell, Reference electrodes – Hydrogen, Calomel and Glass electrodes, Batteries – Primary and secondary cells, Lead acid storage cell.

UNIT-IV FUELS AND COMBUSTION

Varieties of coal – Coke manufacture – Hydrogenation of coal – Liquid fuel production by cracking methods – Production of producer and water gas – LPG – Natural Gas – Biogas.Combustion of fuel – Spontaneous ignition temperature – Explosive range – Calorific values Calculation of calorific value using Dulong's method – Calculation of air quantities for complete combustion of fuel.

UNIT-V CORROSION AND METALLIC COATINGS.

Types of corrosion: Dry or chemical Corrosion, Wet or electrochemical corrosion, Galvanic corrosion – Different types of corrosion: General or uniform corrosion, Fitting corrosion, water one corrosion, Stress corrosion – Prevention of corrosion.Anodic and cathodic coatings – Hot dipping – Cladding – Cementation process – Electroplating – Immersion plating – Chemical conversion coating – Anodizing.

TEXT BOOKS

- Applied physics for engineers,2nd edn, V.Rajendran, M.Marikani,Tata McGraw Hill
- "Engineering Chemistry" Jain and Jain, Dhanpat Rai Publishing company, New Delhi, 1999.

REFERENCES:

- Fiber optics, John Gower, Prentice Hall of India New Delhi, 1954.

"Chemistry in Engineering & Technology", Vol I and II, J.C. Kuriacose & J. Rajaraman, Tata McGraw Hill.

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Semester - III
CORE COURSE – V (CC) - AUTOMOBILE ENGINEERING

UNIT – I PETROL ENGINES

Petrol Engines - Working principle of two stroke and four stroke engines -comparison - main bearings connecting rod - bearings - major parts of an engine - engine block, Cylinder head, Liner, Piston, crank shaft, cam shaft - Types of engines, Straight V.Square engine - combustion chamber deign - types – valves- static balance and dynamic balance - analysis of performance of single and multi cylinder engines - Firing order - Detonation / Petrol knock - Octane number.

UNIT II PETROL FUEL FEED SYSTEMS & CARBURETORS

Fuel feed system — layout —construction and working of mechanical and Electrical fuel feed pumps- Fuel filters- Air filter, types - carburetion — principles — simple carburetors — drawbacks of simple carburetors — compensating system — carburetor circuit —Solex carburetor — S.U Carburetor, Mikuni carburetor, Inlet and Exhaust manifolds- Mufflers and silencers.

UNIT III COOLING & LUBRICATION SYSTEM

Cooling system - Air cooling system, water cooling system - Comparison - types — thermostat —types and construction— water pump - Radiators — types - constructional details — Lubrication system — types — Characteristics of lubricating oils-classification and identification of SAE oils – Filters - oil pumps - type - construction and operation - Pressure Relief valve — oil pressure gauge Bourdon type — positive crank case ventilation system - construction draft tube - coolent type cooling system - vapour cooling system.

UNIT IV DIESEL ENGINES & DIESEL FUEL FEED SYSTEM

High Speed Diesel Engines - Two stroke and four strokes - combustion of Diesel fuel, phase of combustion in four stroke engines - diesel knock, Cetane number fuel dopes - Types of Diesel engine combustion chamber— Piston crown design for diesel engines . Diesel fuel system - Layout - Feed pump single and double acting - Fuel injection pump, jerk and distributor type — construction and operation — Diesel filters — Pre filter and Micro filter — water separator —Injectors and nozzles — Open type and closed type, single hole and multi hole, pintle and pintaux type nozzles.

UNIT V GOVERNORS, SUPER CHARGERS AND EMISSION CONTROLS

Governors - Mechanical and pneumatic type - Phasing and Calibration of fuel injection pumps — Injection timing — Testing of Injectors .Super charging — Its effect — Types of super chargers — roots type sliding vane and centralized types of Turbo chargers. Emission control in petrol and diesel engines — catalytic converters- un leaded petrol — petrol engine tune - up maintenance - Engine analysis of gas emission - working principle of gas analyzer.

TEXT BOOK

1.Ganesan,V., Internal Combustion Engines,Tata McGraw Hill Co., 1994

REFERENCES

1. Heywood.J.B.,Internal Combustion Engines Fundamentals,McGraw Hill Book Co.,1995
2. Automobile Engines - William H.Grouse
3. Ramalingam. K.K ,Internal Combustion Engines, SciTech Publications,Chennai,2003

SECOND ALLIED COURSE – I (AC)
MANUFACTURING PROCESS

UNIT - I FORGING AND POWDER METALLURGY

Hot working - advantages of hot working -hot working operations - rolling - forging hammer or smith forging drop forging, upset forging, press forging - roll forging. Methods of manufacturing metal powders - atomization reduction of oxides and electrolytic deposition —pressing operation — sintering — hot pressing — sizing — infiltration — mechanical properties of parts made by powder metallurgy — design rules for the powder metallurgy process.

UNIT - II HEAT TREATMENT OF METALS

Heat treatment processes — purpose —procedures — application of various heat treatment processes — iron carbon equilibrium diagram —full annealing — process annealing — stress relief annealing — spherodising annealing — isothermal annealing — normalizing - hardening - tempering - quenching medium - different types and their relative merits —case hardening — pack carbursing — cyaniding — nitriding — induction hardening and flame hardening.

UNIT III METROLOGY, PRESS WORKING AND NON-CONVENTIONAL MACHINING PROCESS METROLOGY:

Metrology concepts — Measuring instruments —comparators — mechanical, electrical, optical and pneumatic comparators —profile measurements - optical flat — surface finish measurements — profilometers. Types of presses — mechanical and hydraulic presses — press tools and accessories- press working operations - Ultrasonic machining — chemical machining —electro chemical grinding — electrical discharge machining — plasma arc machining — laser machining.

UNIT - IV LATHE AND THEORY OF METAL CUTTING

Types of lathes — specifications — simple sketches — principal parts — head stock — back geared types — all geared type - tumbler gear mechanism quick change gear box — apron mechanism —carriage cross slide — automatic, longitudinal - and cross feed mechanism —tail stock and its function —work holding services —face plate —three jaw chuck —four jaw chuck —catch plate and carrier —types of centers — machining operations done on lathe —lathe attachments — tool post grinders —milling attachments.

UNIT-V METAL CUTTING PROCESS

Planner, Shaper, Slotter, Drilling machines, Milling machines, Grinding machines, Broaching, Boring and Jip boring - Types - specifications — principles of operation — drives — quick return mechanism — feed mechanism — types, work holding devices and special fixtures — types of tools — various operations. Gear manufacturing practice - Forming and Generating process in milling- Generating process - gear shaper - gear hobbing - gear finishing processes - gear materials.

TEXT BOOKS

1. Production Technology - HMT
2. Elements of Workshop Technology - Vol I & II Hajra Choudry & Battacharya

REFERENCES

1. Production Tech - Jam & Gupta
2. Manufacturing Engineering & Technology by Kalpakjian

SECOND ALLIED COURSE - II (AC)

MANUFACTURING PROCESS AND MACHINE DRAWING LAB

LIST OF EXPERIMENTS

1. LATHE PRACTICE
    - PLAIN TURNING AND STEP TURNING
    - TAPER TURNING
    - THREAD CUTTING
    - ECCENTRIC TURNING
2. DRILLING PRACTICE
    - DRILLING
    - REAMING
    - TAPPING
3. MILLING PRACTICE
    - PLAIN MILLING
    - UNDERCUT STEP MILLING
    - HEXAGONAL MILLING
    - CONTOUR MILLING
4. SHAPING AND PLANNING PRACTICE
    - CUTTING KEY WAYS
    - DOVE TAIL HEXAGONAL MACHINING
5. SURFACE GRINDING PRACTICE
6. WELDING PRACTICE
    - GAS WELDING
    - ELECTRIC ARC WELDING

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SECOND ALLIED COURSE- II (AC)

MANUFACTURING PROCESS AND MACHINE DRAWING LAB

List of Experiments

- 1. Drawing of automobile components such as
- 2. piston,
- connecting rod,
- valves,
- manifold
- Crank shaft.
- Assembly drawing of
- screw jack,
- piston – connecting rod assembly
- valve assembly
- clutch assembly

12.Gear box assembly.

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NON MAJOR ELECTIVE I

BASIC CONCEPTS OF FOUR WHEELED AUTOMOBILES

(Basic qualitative treatment only : Construction and Functions)

UNIT – I VEHICLE STRUCTURE AND ENGINES

Types of four wheeled Automobiles - Vehicle Construction – Chassis – Frame and Body – Aerodynamics. Engine components – Functions and Materials - Cooling and Lubrication systems in Engine.

UNIT – 2 ENGINE AUXILIARY SYSTEMS

Carburetor–working principle. Construction, Operation of Lead Acid Battery - Electrical systems – generator – Starting Motor and Drives – Lighting and Ignition (Battery, Magneto Coil and Electronic Type)-Regulators-cut outs.

UNIT – 3 TRANSMISSION SYSTEMS

Clutch – Types and Construction – Gear Boxes, Manual and Automatic – Simple Floor Mounted Shift Mechanism – Over Drives – Transfer Box– Propeller shaft – Slip Joint – Universal Joints – Differential and Rear Axle – Hotchkiss Drive and Torque Tube Drive.

UNIT – 4 STEERING, BRAKES AND SUSPENSION

Wheels and Tyres – Wheel Alignment Parameters - Steering Geometry and Types of steering gear box– Power Steering – Types of Front Axle – Suspension systems – Braking Systems – Types and Construction

UNIT – 5 SERVICING AND MAINTENANCE OF 4 WHEELED VEHICLES

Brake adjustment, Wheel bearing adjustments, Steering adjustment, clutch pedal adjustment, Wheel balancing, Tyre maintenance and preventive maintenance of some of the 4 wheelers.

TEXT BOOK

1.Kirpal Singh “Automobile Engineering Vol. 1& 2”, Standard Publishers, New Delhi.

REFERENCES:

1.Crouse and Anglin “Automotive Mechanism”, 9th Edition. Tata McGraw-Hill, 2003.

2. Srinivasan.S , “ Automotive Mechanics” 2nd edition, 2003, Tata McGraw-Hill.

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CORE COURSE – VI (CC)

AUTOMOBILE ENGINE COMPONENTS LAB

1. Dismantling, Studying and Assembling the piston and connecting rod assembly.
2. Dismantling, Studying and Assembling the given A.C. Mechanical fuel pump and Solex Carburettor.
3. Dismantling, Studying and Assembling the given fuel injection pump.
4. Dismantling, Studying and Assembling the given Single plate clutch assembly and to practice to adjust clutch free play.
5. Dismantling, Studying and Assembling the given type of gearbox.
6. Dismantling, Overhauling and assembling the differential unit and also practicing to adjust the backlash.
7. Determine the gear ratio, final transmission ratio and overall ratio for a gear box.
8. Learning to 'overhaul', 'adjust the brake shoe' and 'bleed the air' in the hydraulic brake system.
9. Dismantling, Studying and Assembling the given steering gearbox, and also knowing to adjust the backlash and end play.
10. Measure wheel base, wheel track, ground clearance, angle of approach, minimum turning circle radius for a vehicle, steering ratio, lock-to-lock angle.
11. Dismantling, Studying and Assembling the various parts of battery coil ignition system such as distributor, spark plug and etc.
12. Dismantling, Studying and Assembling of the Multi cylinder Petrol and Diesel engine.

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CORE COURSE -VII (CC) - MECHANICS OF MATERIALS

UNIT - I STRESS STRAIN AND DEFORMATION OF SOLIDS

Rigid and Deformable bodies – Strength, Stiffness and Stability – Stresses; Tensile, Compressive and Shear – Deformation of simple and compound bars under axial load – Thermal stress – Elastic constants – Strain energy and unit strain energy – Strain energy in uniaxial loads.

UNIT - II BEAMS - LOADS AND STRESSES

Types of beams: Supports and Loads – Shear force and Bending Moment in beams – Cantilever, Simply supported and Overhanging beams – Stresses in beams – Theory of simple bending – Stress variation along the length and in the beam section – Effect of shape of beam section on stress induced – Shear stresses in beams – Shear flow

UNIT - III TORSION

Analysis of torsion of circular bars – Shear stress distribution – Bars of Solid and hollow circular section – Stepped shaft – Twist and torsion stiffness – Compound shafts – Fixed and simply supported shafts – Application to close-coiled helical springs – Maximum shear stress in spring section including Wahl Factor – Deflection of helical coil springs under axial loads – Design of helical coil springs – stresses in helical coil springs under torsion loads

UNIT - IV BEAM DEFLECTION

Elastic curve of Neutral axis of the beam under normal loads – Evaluation of beam deflection and slope: Double integration method, Macaulay Method, and Moment-area Method –Columns – End conditions – Equivalent length of a column – Euler equation – Slenderness ratio – Rankine formula for columns

UNIT - V ANALYSIS OF STRESSES IN TWO DIMENSIONS

Biaxial state of stresses – Thin cylindrical and spherical shells – Deformation in thin cylindrical and spherical shells – Biaxial stresses at a point – Stresses on inclined plane – Principal planes and stresses – Mohr's circle for biaxial stresses – Maximum shear stress - Strain energy in bending and torsion.

TEXT BOOK:

1. Beer F. P. and Johnston R," Mechanics of Materials", McGraw-Hill Book Co, Third Edition, 2002.

REFERENCES:

1. Kazimi S.M.A, "Solid Mechanics", Tata McGraw-Hill Publishing Co., New Delhi, 1981.
2. Popov E.P, "Engineering Mechanics of Solids", Prentice-Hall of India, New Delhi, 1997

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SECOND ALLIED COURSE - III (AC) - CAD/ CAM

UNIT-I INTRODUCTION

Fundamental concepts in manufacturing and automation-Need for automation-Automation stages-Economic analysis and production – Fundamentals of CIM

UNIT-II COMPUTER AIDED DESIGN (CAD)

Elements of CAD system - Graphics hardware- ALU-CPU- Input/Output devices- Geometric modeling — Automated drafting.

UNIT-III MANUFACTURING SYSTEMS

Basics of numerical control - Types of NC systems - CNC and DNC machines - Machining centre - Tool magazine - NC tape format - Programming - Manual part programme- Simple programmes - Computer assisted part programming- APT language - Simple examples.

UNIT-IV FLEXIBLE MANUFACTURING SYSTEMS

Group technology - Part families - Part classification and coding - Production flow analysis - Machine cell design - Description of FMS - Equipment, Tooling and fixture.

UNIT-V COMPUTER AIDED MANUFACTURING

Computers in manufacturing - Automated manufacturing systems- Work piece handling - Types of transfer - Continuous, Intermittent and Non-synchronous walking beam - Computer aided process planning - Computer aided inspection - Computer aided quality control - Basic model of CIMS - interfacing methods of CAD and CAM-Computer Process Monitoring.

TEXT BOOK

1. Groover,M.P., Automation Production Systems and CAM, Prentice Hall, 1990.

REFERENCES

1. Groover,M.P., CAD/CAM Computer Aided Design and Manufacturing, Prentice Hall, 1990.
2. Niebel, Modern Manufacuring Process Engineering, McGraw Hill, 1989.

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NON MAJOR ELECTIVE II

BASIC CONCEPTS OF TWO & THREE WHEELED AUTOMOBILES

UNIT I INTRODUCTION

Classification of two wheelers and three wheelers Motor cycles, Scooter, mopeds, racing bikes, auto-rickshaws, three wheeled pick-up delivery and trailer vehicles. Basic design considerations-Overall weight and dimension limitations, power requirements and stability problems, Gyroscopic effect-Rake, Trail, Pendulum effect and cornering forces.

UNIT II POWER UNITS

Two-stroke and four stroke engines for two wheelers. Design criteria for cylinders and cylinder head, cooling system and lubrication system. Carburaters-types for two and three wheelers. Ignition systems-Magneto, battery coil and Electronic ignition.

UNIT III CLUTCHES AND TRANSMISSION

Clutch types for two and three wheelers, Gears, Gear changing mechanisms. Clutch operating mechanisms, belt, chain and shaft drives. Free wheeling devices, Lubrication of transmission system.

UNIT IV FRAMES AND SUSPENSION

Various types of frames used. Basics of designing of frames for fatigue strength, torsional stiffness and lateral stability. Front and Rear forks. Springs for suspension and dampers.

UNIT V WHEEL, TYRES AND BRAKING

Wheel types, method of wheel attachment. Tyre selection. Brakes-types. Operating mechanisms.

TEXT BOOK

1. Irving. P.E., Motor cycle Engineering, Temple Press Book, London, 1992.
2. Srinivasan S., Motor car Mechanism, New century book house private Ltd,1987.

REFERENCES

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

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CORE COURSE-VIII (CC) – AUTOMOBILE SCIENCES LAB

List of Experiments

1. Torsion Test
- Testing of springs
- Hardness Test (I) Vickers, (Ii) Brinell, (Iii) Rockwell
- Moment of Inertia of Connecting Rod
- Determination of Discharge Coefficient for Venturimeter.
- Determination of Friction Factor for Turbulent Flow
- Characteristics of Centrifugal Pump
- Determination of Point Velocity Using Pitot tube
- Determination of Pressure Drop In Packed Bed
- Determination of Friction Factor for Laminar Flow
- Study on Performance Test on Centrifugal Pump
- Study on Performance Test on Pelton wheel turbine

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CORE COURSE-IX (CC) - AUTOMOTIVE CHASSIS SYSTEM

UNIT-ILAYOUT, FRAME, FRONT AXLE AND STEERING SYSTEM

Types of chassis layout with reference to power plant locations and drive. Power required for propulsion and various resistances to motion of the vehicle. Vehicle frames. Various types of frames. Constructional details. Materials. Unitized frame body construction Loads acting on vehicle frame. Testing of vehicle frames. Types of front axles. Constructional details. Materials. Front wheel geometry viz., Castor Camber, King pin Inclination, Toe in. Conditions for true rolling motion of wheels during steering. Steering geometry. Ackerman and Davis steering. Constructional details of steering linkages. Different types of see ring gear boxes. Effect of side force on tyres, slip angle, oversteer and understeer. Steering linkages and layouts. Power and power assisted steering, Steering of crawler tractors.

UNIT-II DRIVE LINE, FINAL DRIVE AND DIFFERENTIAL

Effect of driving thrust. Torque reactions and end thrust. hotchkiss drive, torque tube drive and radius rods. Propeller shaft. Universal joints. Constant velocity universal joints. Front wheel drive. Different types of final drive. Worm and Worm wheel, straight bevel gear. Spiral bevel gear and hypoid gear final drives. Double reduction and twin speed final drives. Differential principles. Differential Construction details of differential unit, differential housings. Non-slip diferential. Differential locks.

UNIT-III REAR AXLES, WHEELS, RIMS AND TYRES

Construction of rear axles. Types of loads acting on rear axles; Full floating, Three quarter floating and semi floating rear axles. Rear axle housing. Construction of different types of axle housings. Multi axled vehicles. Construction details of multi drive axle vehicles. Types of wheels, constructional details of wheels and rims, solid and pneumatic tyres, constructional details of tyres, life of tyres.

UNIT-IV SUSPENSION SYSTEM

Need of suspension system -Types of suspension -Suspension springs -Constructional details and characteristics of leaf, coil and torsion bar springs -Independent suspension. Effect of roll in the case of vehicle with: rigid axle, independent suspension. Rubber suspension -Pneumatic suspension -Shock absorbers.

UNIT-V BRAKING SYSTEM

Need for braking system, stopping distance, time and brake efficiency, effect of weight transfer during braking. Classification of brakes -Drum brakes & Disc brakes. Constructional details. Braking torque developed by brake shoes. Mechanical, hydraulic and pneumatic brakes. Power and power assisted brakes -Different types of retarders like eddy current and hydraulic retarder -Anti lock braking systems. Brake testing

TEXT BOOK

1. Kirpal Singh “Automobile Engineering Vol. 1& 2”, Standard Publishers, New Delhi.

REFERENCES

1. Crouse and Anglin “Automotive Mechanism”, 9th Edition. Tata McGraw-Hill, 2003.
2. Newton, Steeds and Garet, “Motor vehicles”, Butterworth Publishers, 1989.

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CORE COURSE - X (CC)

AUTOMOBILE ELECTRICAL AND ELECTRONICS

UNIT – I BATTERIES AND ACCESSORIES

Principle and construction of lead acid battery, characteristics of battery, rating capacity and efficiency of batteries, various tests on batteries, maintenance and charging. Lighting system: insulated and earth return system, details of head light and side light, LED lighting system, head light dazzling and preventive methods – Horn, wiper system and trafficator.

UNIT – II STARTING SYSTEM

Condition at starting, behavior of starter during starting, series motor and its characteristics, principle and construction of starter motor, working of different starter drive units, care and maintenances of starter motor, starter switches.

UNIT – III CHARGING SYSTEM

Generation of direct current, shunt generator characteristics, armature reaction, third brush regulation, cutout. Voltage and current regulators, compensated voltage regulator, alternators principle and constructional aspects and bridge rectifiers, new developments.

UNIT – IV FUNDAMENTALS OF AUTOMOTIVE ELECTRONICS

Current trends in automotive electronic engine management system, electro magnetic interference suppression, electromagnetic compatibility, electronic dashboard instruments, onboard diagnostic system, security and warning system.

UNIT – V SENSORS AND ACTIVATORS

Types of sensors: sensor for speed, throttle position, exhaust oxygen level, manifold pressure, crankshaft position, coolant temperature, exhaust temperature, air mass flow for engine application. Solenoids, stepper motors, relay.

TEXT BOOKS

- Young A.P. & Griffiths. L. “Automotive Electrical Equipment”, ELBS & New Press- 1999.
- William B.Riddens “Understanding Automotive Electronics”, 5th edition - Butter worth Heinemann Woburn, 1998.

REFERENCES

1. Bechhold “Understanding Automotive Electronics”, SAE, 1998.
- Crouse, W.H “Automobile Electrical Equipment”, McGraw-Hill Book Co., Inc., New York, 3rd edition, 1986.
- Judge A.W “Modern Electrical Equipment of Automobiles”, Chapman & Hall, London, 1992.
- Kholi.P.L “Automotive Electrical Equipment”, Tata McGraw-Hill Co., Ltd., New Delhi, 1975.
- Robert Bosch “Automotive Hand Book”, SAE (5th Edition), 2000.

CORE COURSE – XI (CC)

AUTOTRONICS AND VEHICLE MAINTENANCE

UNIT –I FUNDAMENTAL OF AUTOMOTIVE ELECTRONICS

Current trends in modern automobiles, Open loop and closed loop systems - Components for electronic engine management. Electronic management of chassis system - Vehicle motion control.

UNIT - II SENSORS AND ACTUATORS

Introduction, basic sensor arrangement, types of sensors such as - oxygen sensors, Crank angle position sensors - Fuel metering / vehicle speed sensor and detonation sensor - Altitude sensor, flow sensor. Throttle position sensors, solenoids, stepper motors, and relays.

UNIT-III ELECTRONIC FUEL INJECTION AND IGNITION SYSTEMS

Introduction, Feed back carburettor systems (FBC) Throttle body injection and muli port or point fuel injection, Fuel injection systems, injection system controls. Advantages of electronic ignition systems. Types of solid state ignition systems and their principle of operation, Contact less electronic ignition system, Electronic spark timing control.

UNIT - IV MAINTENANCE RECORDS AND SCHEDULE

Importance of maintenance. Scheduled and unscheduled maintenance. Preparation of check lists. Chassis lubrication. Cost effectiveness. Pre-trip. Inspection forms. Log books. Trip sheets. Other maintenance record forms.

UNIT – V MAINTENANCE OF ALL VEHICLE COMPONENTS

Maintenance, repair, overhauling and servicing of Engine, Chassis drive line components, Electrical systems, Cooling system, Lubrication system, Fuel system and Vehicle body

TEXT BOOK

1. William B.Riddens, " Understanding Automotive Electronics ", 5th Edition, Butterworth, Heinemann Woburn, 1998.
2. JOHN Doke, " Fleet management ", McGraw Hill Co, 1984.

REFERENCES

1. Crouse. W.H., " Automobile Electrical equipment ", McGraw Hill Book Co Inc., New York, 1955.
2. Bechtold., " Understanding Automotive Electronic ", SAE, 1998.
3. Venk.Spicer." Automotive Maintenance and Trouble shooting ".
4. " Vehicle Service Manuals of reputed manufactures ".

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MAJOR BASED ELECTIVE – I

AUTOMOBILE BODY STRUCTURES

UNIT I GEOMETRICAL PROPERTIES OF SECTIONS OF VEHICLE BODY

Introduction, center of gravity, centroid – determination of centroid of angles, channels, I and T sections. Moment of Inertia – definition. Parallel axes theorem and perpendicular axes theorem. M.I of angles, channel, I and T sections –no derivations required.

UNIT II BODY LOADS AND STRESS ANALYSIS

Idealized structure, Structural surface, Symmetric & Asymmetrical Vertical loads and Longitudinal loads in a car. Different loading situations. Load distribution on vehicle structure. Types of load carrying structure - Closed Integral structure, Open Integral Structure – Flat or Punt type structure.

UNIT III STRENGTH OF BODY ELEMENTS

Basic principles - Utilization of the material, Influence on Rigidity of material, Forces in end load carrying members and panels, Spot welded joints and Forces act in the weld, Body testing, Body trim, Body mechanisms.

UNIT IV DESIGN OF THE BODY STRUCTURES

Structure of Passenger cars, Bus & Coach bodies, Light commercial vehicles, Truck cab construction. Body mounts.

UNIT V ITEMS ADDITIONAL TO THE BASIC BODY STRUCTURE

Doors – Door skeleton, Door windows. Glazing of the vehicle body, Seats and their design, Air conditioning, Heating and Ventilation systems.

TEXT BOOK

1. Powloski J, Vehicle Body Engineering, Business Books Ltd, 1989.

REFERENCES

1. Giles G.J. Body Construction & Design Illiffe Books Butter worth & co., 1971.
2. John Fenton Vehicle Body Layout and Analysis, Mechanical Engineering Publication Ltd., London, 1980.

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CORE COURSE -XII (CC)
AUTOMOTIVE CHASSIS COMPONENTSLAB

List of Experiments

1. **STUDY AND MEASUREMENT OF THE FOLLOWING CHASSIS**

a. Tata

b. Leyland

c. Ambassador

d. Premier Padminj

e. Maruthi car (Front engine, front wheel drive & constant velocity joint)

f. Mahindra & Mahindra Jeep

g. Tata Mini Lorry

2. **STUDY, DISMANTLING & ASSEMBLING**

a. Front axle –Rzeppa joint assembly

b. Rear axle

c. Clutch 2 types -Coil spring& Diaphragm spring clutches

d. Gear box -Sliding mesh, Constant mesh & Synchromesh Gear Box

e. Transfer case

f. Steering system

g. Braking system

h. Differential mechanism

i. Power steering mechanism.

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CORE COURSE – XIII (CC)
BASICS OF BODY BUILDING

UNIT I BODY CONSTRUCTION

Types of Car body and Bus body. Types of body constructions-Conventional and Integral body construction. Car body & Bus body construction – Construction regulations for bus body – Layout dimensions.

UNIT II PRELIMINARY DESIGN

Preliminary design considerations-Floor height, Side slope and Space Utilization. Visibility-Visibility tests, Methods to improve visibility, Visibility regulations and Rear view mirror design. Safety requirements in designing the vehicle body.

UNIT III VEHICLE AERODYNAMICS

Objectives-Vehicle drag and types, various types of forces & moments and their effect. Various body optimization techniques for minimum drag. Wind tunnel testing – Flow visualization techniques, scale model testing.

UNIT IV COMMERCIAL VEHICLE BODIES

Different types of commercial vehicle bodies. Constructional details of platform body, Tipper body and Tanker body. Dimension of drivers seat in relation to controls. Drivers cab design.

UNIT V BODY MATERIALS MAINTENANCE AND SURFACE FINISH

Steel sheet, Aluminium, Timber, Plastics, GRP and PRP. Corrosion and Anti corrosion methods. Body panel tools for repairing, tinkering and soldering. Surface finish: Painting processes – Electroplating of components, Vacuum coating and Electrostatic painting.

TEXT BOOK

2. Powloski J, Vehicle Body Engineering, Business Books Ltd, 1989.

REFERENCES

3. Giles G.J. Body Construction & Design Illiffe Books Butter worth & co., 1971.
4. John Fenton Vehicle Body Layout and Analysis, Mechanical Engineering Publication Ltd., London, 1980.

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CORE COURSE-XIV (CC) - AUTOMOBILE TRANSMISSION

UNIT – I GEAR BOX AND FLUID COUPLING

Gear Box: method of calculation of gear ratios for vehicles, performance characteristics in different speeds, different types of gear boxes, speed synchronizing devices, gear materials, lubrication. Fluid coupling: advantages and limitations, construction details, torque capacity, slip in fluid coupling, performance characteristics. Means used to reduce drag torque in fluid coupling.

UNIT – II PLANETARY GEAR BOX

All spur and internal gear type planetary gearboxes, Ford T-model, Cotal and Wilson Gear box, determination of gear ratios, automatic overdrives.

UNIT – III TORQUE CONVERTORS

Principal of torque conversion, single, multi stage and polyphase torque converters, performance characteristics, constructional and operational details of typical hydraulic transmission drives (e.g.) Leyland, White Hydro torque drives.

UNIT – IV AUTOMATIC TRANSMISSION

Automatic transmission: relative merits and demerits when compared to conventional transmission, automatic control of gears, study of typical automatic transmissions, Ford and Chevrolet drive, automatic control of gear box.

UNIT – V HYDROSTATIC AND ELECTRIC DRIVES

Hydrostatic drives: advantages and disadvantages, principles of hydrostatic drive systems, construction and working of typical hydrostatic drives, Janney Hydrostatic drive.Electrical drives: advantages and limitations, principles of Ward Leonard system of control Modern electric drive for buses and performance characteristics.

TEXT BOOKS

- Heldt P.M - Torque converters- Chilton Book Co.-1992
- Newton and Steeds - Motor Vehicle- Illiffee Publisher- 2000

REFERENCE

1. Design Practices, passenger Car Automotive Transmissions- SAE Hand book- 1994

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MAJOR BASED ELECTIVE II

ALTERNATIVE FUELS AND ENERGY SYSTEMS

UNIT I INTRODUCTION

Need for alternate fuel, availability and properties of alternate fuels, general use of alcohols, LPG, hydrogen, ammonia, CNG and LNG, vegetable oils and biogas, merits and demerits of various alternate fuels, introduction to alternate energy sources. Like EV, hybrid, fuel cell and solar cars.

UNIT II ALCOHOLS

Properties as engine fuel, alcohols and gasoline blends, performance in SI engine, methanol and gasoline blends, combustion characteristics in CI engines, emission characteristics, DME, DEE properties performance analysis, performance in SI & CI Engines.

UNIT III NATURAL GAS, LPG, HYDROGEN AND BIOGAS

Availability of CNG, properties, modification required to use in engines, performance and emission characteristics of CNG using LPG in SI & CI engines, performance and emission of LPG. Hydrogen; storage and handling, performance and safety aspects.

UNIT IV VEGETABLE OILS

Various vegetable oils for engines, esterification, performance in engines, performance and emission characteristics, bio diesel and its characteristics

UNIT V ELECTRIC, HYBRID, FUEL CELL AND SOLAR CARS

Layout of an electric vehicle, advantage and limitations, specifications, system components, electronic control system, high energy and power density batteries, hybrid vehicle, fuel cell vehicles, solar powered vehicles.

TEXT BOOK

1. Richard.L.Bechfold – Alternative Fuels Guide Book - SAE International Warrendale - 1997.

REFERENCES

1. Maheswar Dayal - "Energy today & tomorrow" - I & B Horishr India - 1982.
2. Nagpal - "Power Plant Engineering" - Khanna Publishers - 1991.
3. "Alcohols as motor fuels progress in technology" - Series No.19 - SAE Publication USE - 1980.
4. SAE paper nos. 840367, 841333, 841334, 841156, Transactions, SAE, USA.

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MAJOR BASED ELECTIVE III

VEHICLE STEERING AND BRAKING SYSTEM

UNIT I BASIC OF STEERING SYSTEM

Condition for true rolling motion of road wheels during steering. Ackerman and Davis Steering. Front wheel geometry – Camber, Caster, King Pin inclination, Included angle, Toe in, Toe out. Wheel wobble & shimmy. Constructional details of steering linkages.

UNIT II STEERING GEAR BOXES

Types – Rack & Pinion, Recirculating ball, Worm & Nut, Worm & Roller and others. Over steer, Under steer, Reversibility. Power steering system and types- Linkage , Integral. Front axle and types. Four wheel steering system.

UNIT III BASICS OF BRAKING SYSTEM

Types – Drum & Disc – Hydraulic, Pneumatic. Hydraulic braking system –working principle, Details of Master cylinder, Wheel cylinder. Pneumatic braking system- working Principle, Details of Brake valve, Safety valve. Working principle of Disc brake.

UNIT IV BRAKES FOR SPECIAL APPLICATIONS

Engine exhaust brake, Electric brake, Power brake, Diagonal brake. Anti Lock braking system- principle, Stopping distance- Pumping of brake.

UNIT V SERVICING OF STEERING AND BRAKING SYSTEM

Trouble shooting of Steering and Braking system of automobile vehicle.

TEXT BOOK

1.Kirpal Singh "Automobile Engineering Vol. 1& 2", Standard Publishers, New Delhi.

REFERENCS

1. Newton, Steeds & Garret, Motor Vehicle, Illiffe Books Ltd., London, 1969.
2. Crouse and Anglin "Automotive Mechanism", 9th Edition. Tata McGraw-Hill,2003.

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