SYLLABUS

SEMESTER-III

Diploma in Automobile Engineering

(wef 2018 batch)

UNIVERSITY POLYTECHNIC
B.I.T., MESRA, RANCHI

Syllabus of Diploma in Engineering (Automobile Engineering)

COURSE STRUCTURE
(W.E.F. 2018 Batch Students)
(Total Credits 24.0)
Diploma in Automobile Engineering
Third Semester

Subject Code	Subject	Theory	Tutorial	Lab.	Credit
DMA 3101	Applied Mathematics	3	0	0	3
DMM 3101	Thermal Engineering	3	1	0	4
DME 3007	Manufacturing Process	3	0	0	3
DMM 3003	Applied Mechanics	3	1	0	4
DMM 3005	Mechanical Engineering Materials	3	0	0	3
DMM 3006	Machine Drawing	0	1	2	2
DME 3106	Manufacturing Process Lab.	0	0	2	1
DMM 3102	Thermal Engineering Lab.	0	0	2	1
DMM 3004	Applied Mechanics Lab.	0	0	2	1
DHU 3002	Professional Practices-II	0	0	2	1
DGA 3002/04/06/08	PT and Games/NSS/NCC/CA	0	0	3	1
	Periods per week	**15**	**3**	**13**	-
	Total credits	-	-	-	**24**
	Total periods per week	-	-	-	**31**

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DMA 3101 APPLIED MATHEMATICS

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OBJECTIVE: Students will be able to
1. Develop the essential skills of using Partial Differentiation and Multiple Integrals for applications in engineering.
2. Learn and apply Vector Analysis to solve technical problems.
3. Learn to use First order ODEs necessary for modeling engineering problems.
4. Acquire necessary ability to use second order ODEs to design engineering models.
5. Learn and appreciate basic probability and statistical methods.

Module-I: Partial Differentiation and Multiple Integrals
1.1 Functions of two or more variables. Partial derivatives of first and higher order.
1.2 Differentiation of composite functions. Jacobians and its properties.
1.3 Evaluation of double integral. Change of order of integration.
1.4 Finding area and volume using double integration. Change of variables from Cartesian to polar.

Module-II: Vector Calculus
2.1 Definition Vector functions and its derivative. Velocity and acceleration.
2.2 Concepts of Scalar and Vector Fields. Gradient of scalar field. Directional Derivative and its geometrical interpretation. Properties of Gradient.
2.3 Divergence and Curl of a vector function and their properties. Physical interpretation of divergence and curl.
2.4 Integration of vector functions. Concept of line integral. Work done by a force. Surface and volume integral.

Module-III: Ordinary Differential Equations (ODE) of First Order
3.1. Definitions of ODE and meaning of solution of ODE. Formation of ODE.
3.2. Solution of ODE of first order and first degree: Variable separable method, Homogenous equations, Equations reducible to homogenous form, Exact equations, Linear equations, Bernoulli equations.

Module-VI: Linear Differential Equations of Second and Higher Order
4.1. Definition of linear ODE. The operator 'D'. Auxiliary Equations (A.E.) and rules of finding Complementary Function (C.F.).
4.2. The inverse Operator $\frac{1}{f(D)}$. Rules for finding the Particular Integral (P.E.).

Module-V: Statistics and Probability
5.1 Measures of Central tendency (mean, median, mode) for ungrouped and grouped frequency distribution.
5.2 Measures of Dispersion such as range, mean deviation, Standard Deviation, Variance and coefficient of variation.
5.3 Definition of random experiment, sample space, event, Occurrence of event and types of events (impossible, mutually exclusive, exhaustive, equally likely). Definition of Probability, addition and multiplication theorems of Probability.

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Text Books:
1. N.P. Bali and Manish Goyal. "A Textbook of Engineering Mathematics". Laxmi Publications Pvt. Ltd.

Reference Books:
1. B. S. Grewal. Higher Engineering Mathematics. Khanna Publication, New Dehli.
2. Erwin Kreyszig. Advanced Engineering Mathematics. John Wiley & Sons, Inc.
3. Murray R Spiegel. Vector Analysis and an Introduction to Tensor Analysis. Schaum's Outline series. McGraw-Hill.

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DMM 3101 THERMAL ENGINEERING

COURSE OBJECTIVE: Students will be able to
1. Know basic concepts of thermal engineering. Significance of thermodynamic properties in order to analyse a thermodynamic system from macroscopic view point.
2. Applying first law of thermodynamics in closed and open systems involving steady flow
3. Applying second law of thermodynamics in closed and open systems involving steady flow
4. Learn about turbine, nozzle and compressor
5. Know about different laws and processes
   .

COURSE OUTCOME: After the completion of this course, students will be able to:

1. Solve the mechanical using zeroth laws and apply the concept of mechanical properties and thermodynamic system.
2. Analyze concept of first law of thermodynamics and apply their properties and applications.
3. Evaluate the heat engine and heat pump by the using second law of thermodynamics and statement of Clausius and Kelvin Planck and their application of heat engine , heat pump and refrigeration.
4. Assess the applicability of steam turbine. nozzle and applications.
5. Discuss basic concept regarding thermodynamic cycle and compressor.

Module-I:
Concepts and Terminology:
Basic Concepts, Zeroth law of Thermodynamics and its significance, Concept of heat and work. Properties of steam, Properties of Ideal gas. Macroscopic and microscopic views of study, concept of continuum Thermodynamic properties of a system (Pressure, volume, temperature and units of measurement) Intensive and extensive properties, State and Process Thermodynamic equilibrium.
Energy and Work Transfer:
Conceptual explanation of energy, work and heat, work transfer Path and point Function, Displacement work, forms of work transfer, Modes of Heat Transfer, introductory concepts of Conduction convection and Radiation, Sensible and latent heat, Specific heat, energy and its resources. Quasi static process.   [10]

Module-II:
First Law of Thermodynamics:
First Law of thermodynamics Energy as system property, forms of stored energy First law for a closed system undergoing a cyclic process First law for a closed system undergoing change of state Concept of Enthalpy, First law applied to steady flow processes, Steady Flow Energy Equation and its application to nozzle, turbine and compressor, Perpetual motion machine of first kind.   [8]

Module-III:
Second law of Thermodynamics:
Limitations of first law Thermal reservoir Concept of heat engine, heat pump and refrigerator Statement of Second law of thermodynamics (Clausius and Kelvin Planck), Perpetual motion machine of second kind, Carnot cycle Application of second law in heat engine, heat pump, refrigerator and determination of Efficiencies and C.O.P, Elementary knowledge of Entropy and

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Enthalpy and Third law of Thermodynamics. [9]

Module-IV:
Principles of Steam Turbine and Nozzle:
Types of nozzle flow of steam through nozzles, steady flow energy equation in nozzles, principle of operation of steam turbine, types of steam turbine, difference between steam turbine and steam engine, difference between impulse turbine and reaction turbine. [7]

Module-V:
Thermodynamic Cycles and Air Compressor:

Otto-cycle, Diesel-cycle, Joule/Brayton-cycle.Introduction, classification, application, construction and working of single stage compressor, calculation of power. [6]

Text Books:
1. An Introduction to Thermodynamics   P.K. Nag
2. Engineering Thermodynamics   R.K. Rajput.
3. Thermal Engineering   P.L. Ballaney.

Reference Books:

1. Engineering Thermodynamics   Arora & Domkundwar
2. Engineering. Thermodynamics   Dr. D. S. Kumar

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DME 3007 MANUFACTURING PROCESS

OBJECTIVE: Students will be able to

1. Learn basic ideas about foundry, pattern and its kinds.
2. Understand various sands, their properties, gating system.
3. Basic idea about different melting furnaces like cupola, electric arc furnace.
4. Will be able to know about special casting processes other than conventional methods.
5. Know the safety practices while working in workshop.

Module – I Foundry: Introduction to foundry, advantages and disadvantages, Pattern: pattern making, Type of patterns, pattern materials.
Sand Moulding & Core making : Introduction, mould material, sand grains, types of sand, sand properties, sand preparation, testing of moulding sand, types of mould, sand moulding techniques, conventional sand moulding, CO_2 moulding, Moulding materials, Cores: Core making materials, types of cores, Core prints. Gating System – Parts of the gating system – pouring basin, sprue, runner, riser.

Module-II Melting furnaces and casting defects: Arc furnace: types, operational features, advantages and disadvantages, Cupola: construction, different zones, working principle, advantages and disadvantages and efficiency of cupola, Cleaning of casting, Casting defects & Remedies.
Module-III Welding processes:
Concepts, principle, application, advantages and disadvantage of Oxy-acetylene gas welding, Shielded metal arc welding, Electric resistance welding, Spot, Seam, Projection and Butt welding. Defects in welding. Concept of Brazing and Soldering.

Module-IV Introduction and classification of machine tool:
Basic concept of machining, different type of tool material, Cutting fluid (Classification and purpose), Types of chip, Orthogonal and Oblique cutting. Lathe Machine: Type of Lathe machine, Specification of lathe machine, Type of accessories and attachment used, Types of operation which can be performed.

Module-V Drilling, Shaper and Milling Machine:
Classification, specification, type of operations performed in shaper, drilling and milling machine, type of work holding and tool holding mechanism, up milling and down milling, types of milling cutter.

Text Books :
1. Elements of Workshop Technology, Vol. I & II - Hazra S. K. and Chaudhary
2. Workshop Technology by Raghuwanshi B. S.

Reference Books:
1. Workshop Technology Vol. I & II by Gupta K. N. and Kaushin J. P.
2. Workshop Practice Vol. I & V by Atherton W. H.
3. Principle of Foundry Technology – K. P. Sinha
4. Manufacturing Technology Vol. I & II – O. P. Khanna
5. Welding Technology – O.P. Khanna
6. Production Technology – R. K. Jain
7. Workshop Technology-S.K.Garg

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DMM 3003 APPLIED MECHANICS

OBJECTIVE: Students will be able to:
1. Know basic concepts about force system.
2. Learn to find the resultant of given force system.
3. Find the reactions of beam.
4. Find the centre of gravity of composite solids Find M.A., V.R.
5. Efficiency and establish law of machine.
6. To know about different laws and processes.

Module-I Force System Fundamentals: - Definitions of mechanics, statics and dynamics, scalar and vector, Engineering Mechanics law, principle of transmissibility, Triangle and parallelogram and polygon law, Resolution of forces, Resultant of a forces system, Moment of a force, Definition, geometrical meaning of moment of a force, classification of moments according to direction of rotation, sign convention, law of moments Varignon's theorem of moment, Couple.

Module-II Equilibrium:
Definition, conditions of equilibrium, analytical and graphical conditions of equilibrium for concurrent, non-concurrent and parallel force system, free body and free body diagram, General condition of equilibrium, Action & reactions, Equilibrium of a particle under Three Forces.

Module-III Centroid and Moment of inertia:
Centroid**:** Definition of centroid. Moment of an area about an axis, Centroid of basic geometrical figures such as square, rectangle, triangle, circle, semicircle and quarter circle. Centroid of composite figure, Center of gravity such as cylinder, sphere, hemisphere, cone, cube, and rectangular block , Radius of Gyration, parallel and perpendicular axis of Theorem, moment of inertia of standard forms and moment of inertia of composite Materials.

Module-IV Friction:
Definition of friction, force of friction, limiting frictional force, coefficient of friction, angle of friction, angle of repose, relation between angle of friction angle of repose and coefficient of friction. Cone of friction, types of friction, and laws of friction, advantages and disadvantages of friction, Equilibrium of bodies on level plane external force applied horizontal and inclined up and down. Equilibrium of bodies on inclined plane

Module-V Simple Machines:
Definitions of simple machine, compound machine, load, effort, mechanical advantage, velocity ratio. Input on a machine, output of a machine, and efficiency of a machine, expression for mechanical advantage, velocity ratio and efficiency of a machine. Ideal machine, ideal effort and ideal load, friction in machines, effort lost in friction and frictional load. Law of machine, maximum mechanical advantage and maximum efficiency of a machine, reversibility of a machine, condition for reversibility of a machine, self-locking machine.

Text Books:
Engineering Mechanics - Beer – Johnson
Engineering Mechanics - Basu
Reference Books:
Engineering Mechanics – R K Bansal

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DMM 3005 MECHANICAL ENGINEERING MATERIALS

OBJECTIVE: Students will be able to
1. Understand the properties of engineering materials like metals and non-metals, ferrous and non - ferrous metals.
2. Know the phase diagram to find temperatures for heat treatment process.
3. Understand heat treatment process and its applications.
4. Learn non- destructive testing methods.
5. Know powder metallurgy methods and its applications.

Module –I Engineering materials and their properties:
Material classification into ferrous and non- ferrous category and alloys, Properties of Materials: Physical and Chemical Performance requirements Material reliability and safety, Elementary description of Nano Materials, Smart materials, polymer, Composite and Polymer materials.

Module-II Crystal imperfections:
Crystal defines, classification of crystals, ideal crystal and crystal imperfections, Classification of imperfection: Point defects, line defects, surface defects and volume defects, Types and causes of point defects: Vacancies, Interstitials and impurities, Types and causes of line defects: Edge dislocation and screw dislocation, Effect of imperfection on material properties, Deformation by slip and twinning, Effect of deformation on material properties

Module –III Ferrous and Non Ferrous Materials and alloys
Characteristics and application of ferrous materials Classification, composition and application of low carbon steel, medium carbon steel and High carbon steel Alloy steel: Low alloy steel, high alloy steel, tool steel and stainless steel Tool steel: Effect of various alloying elements such as Cr, Mn, Ni, V, Mo, W. Properties, applications and chemical composition of Copper alloys (naval brass, muntz metal, gun metal and bronze), Aluminum alloys (Y-alloy and duralumin).

Module –IV Iron Carbon system:
Concept of phase diagram and cooling curves Features of Iron-Carbon diagram with salient micro-constituents of Iron and Steel, Bearing and spring materials, Introduction to Corrosion, types of Corrosion, Corrosion resisting, Special Cutting Tool Materials – High speed steel, Diamond, Stellates & Tungsten Carbide

Module-V Heat Treatment:
Introduction to heat treatment process such as Annealing, normalizing, hardening, tampering- their principle, applications, advantages and limitations. Surface hardening: Different methods like case hardening, flame hardening, induction hardening, carburizing and nitriding- their principle, applications, advantages and limitations. Effect of heat treatment on properties of steel Hardenability of steel, Powder Metallurgy & Non-destructive Testing Advantages, limitations and applications of Powder Metallurgy for engineering products. Brief Description of Process of Powder Metallurgy – Powder making.

Text Books:
1. O. P. Khanna "A Textbook of Material Science and Metallurgy" Dhanpat Rai & Sons
2. R. K. Rajput "Engineering Materials and Metallurgy" S. K. Khatri & Sons.
Reference Book:
1. S. K. Hazra and Choudhary" Material Science and Processes" Indian Book Distribution Co.

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DMM 3006 MACHINE DRAWING

OBJECTIVE: Students will be able to
1. Develop ability towards recognizing significance of standardized representations
2. Understand various fastening elements and offer engineering drawing thereof in manual mode.
3. Learn geometrical constraints and function of components in assemblies such as bearings and screw jack.
4. Know functional requirement of major components and offer engineering drawing in manual mode thereof.
5. Know about different joints.

Module –I:
Conventional-presentations:
(a) Materials C.I., M.S, Brass, Bronze, Aluminum, wood, Glass, Concrete, and Rubber, (b) Long and short break in pipe, rod and shaft. (c) Ball and Roller bearing, pipe joints, cocks, valves, internal / external, threads. (d) Various sections- Half, removed, revolved, offset, partial and aligned sections. (e) Knurling, serrated shafts, splined shafts, and chain wheels. (f) Springs with square and flat ends, Gears, sprocket wheel (g) Countersunk & counter bore. (h) Tapers.

Module –II:
Limits, Fits and Tolerances:
Characteristics of surface roughness- Indication o machining symbol showing direction of lay, roughness grades, machining allowances, manufacturing methods. 2. Introduction to ISO system of tolerencing, dimensional tolerances, and elements of interchangeable system, hole & shaft based system, limits, fits & allowances. 3. Geometrical tolerances, tolerances of form and position and its geometric representation.

Module-III:
Details to Assembly:
1. Introduction. 2. Couplings – Universal couplings & Oldham's Coupling 3. Bearing – Foot Step Bearing & Pedestal Bearing, 4. Lathe tool Post, 5. Machine vice, 6. Screw Jack.

Module –IV:
Assembly to Details:
1. Introduction – 2. Pedestal Bearing, 3. Lathe Tail Stock, 4. Drilling Jig 5. Piston & connecting rod 6. Gland and Stuffing box Assembly, 7. Fast & loose pulley, Bolt, nut and threads, Screws and rivet.

Module –V:
Pipe joint:
Conventional symbols, Union joint, Nipple joint, Cotter and spigot joint, Knuckle joints and Universal joints. Pipe Vice, Valve – Not more than eight parts.

Text Books:
N.D.Bhatt   Machine Drawing
IS Code SP 46 (1988)   Code of practice for general engineering Drawing Practice
Reference Books:
L.K.Narayanan   P.Kannaich, Production Drawing

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DME 3106 MANUFACTURING PROCESS LAB.

LIST OF EXPERIMENTS

1. Identification and Specification of Lathe machine.

2. Do some lathe operations on the given job.

3. Identification and Specification of Drilling machine.

4. Do some drilling operations on the given job.

5. Identification and Specification of Shaper machine.

6. Do some shaping operations on the given job.

7. Identification and Specification of Milling machine.

8. Do some milling operations on the given job.

9. To make a job like (nut & bolt) using all the above four machines.

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DMM 3102 THERMAL ENGINEERING LAB.

LIST OF EXPERIMENTS

1. Study of Lancashire boiler.

2. Study of Babcock and Wilcox boiler.

3. Study of Reverse flue gas oil fired packaged boiler.

4. Study of Rover gas turbine, its components and instrumentation provided over it.

5. Study of Steam turbine.

6. Study of Steam Power Plant.

7. Study of Single stage and multistage compressor.

8. Study of Refrigeration and Air conditioning.

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DMM 3004 APPLIED MECHANICS LAB.

LIST OF EXPERIMENTS

a. To verify the Polygon Law of Forces, with the help of force polygon apparatus.

b. To verify the parallelogram law of forces.

c. To study Lami's theorem using universal force table apparatus.

d. To verify the forces in the different members of a jib crane.

e. To find out centre of gravity of regular laminas.

f. To find out centre of gravity of irregular laminas.

g. To find moment of inertia of flywheel.

h. Comparison of coefficient of friction of various pairs of surfaces & determination of angle of repose.

i. To find the mechanical advantage, velocity ratio and efficiency in the case of Screw Jack.

j. Deflections of a truss-horizontal deflections & vertical deflections of various joints of a pin-jointed truss.

k. To find the mechanical advantage, velocity ratio and efficiency in the case of Winch Crab Single Graphical Representation.

l. To study the performance of differential axle and wheel and find its velocity ratio, efficiency and law of machine.

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DHU 3002 PROFESSIONAL PRACTICES-II

Module-I:
Industrial visit: Industrial visit be arrange and report of the same should be submitted by the individual student, to form a part of team work. TWO industrial visits be arranged.

Module-II:
Lectures by professional /Industrial expert be organised from any one of the following areas:
    i.   Use of plastics in automobiles
    ii.   Non-ferrous metals and alloys for engineering applications
    iii.   Industrial hygiene
    iv.   Composite materials
    v.   Heat treatment processes
    vi.   Ceramics
    vii.   Safety engineering and waste elimination

Module-III:
Individual assignments:
Any two from the following lists;
    i.   Process sequence of any two machine operations
    ii.   Write material specification of any two composite jobs
    iii.   Collections of different plastic material or cutting tools with properties, applications and specifications
    iv.   List the various properties and applications of following materials-
        a) Ceramics, b) Thermoplastic plastics, c) thermo setting plastics and d) rubbers.

Module-IV:
Conduct any one of the following activities through active participation of the students and write report:
    i.   Survey for local social problems such as malnutrition, unemployment, cleanliness, illiteracy
    ii.   Conduct aptitude, general knowledge test, IQ test.

Module-V:
Seminar:
Seminar on any advanced technical topic to be presented by individual student in a batch of 5.

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SEMESTER-IV

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COURSE STRUCTURE
(W.E.F. 2018 Batch Students)
(Total Credits 26.0)

Fourth Semester

Subject Code	Subject	Theory	Tutorial	Lab.	Credit
DMM 4007	Strength of Materials	3	1	0	4
DMM 4103	Fluid Mechanics and Machines	3	1	0	4
DAE 4011	Automotive Engine	3	1	0	4
DAE 4013	Autotronics	3	1	0	4
DCS 4011	Computer Programming	3	0	0	3
DAC 4001	Environmental Science	2	0	0	2
DMM 4008	Strength of Materials Lab.	0	0	2	1
DAE 4012	Automotive Engine Lab.	0	0	2	1
DHU 4002	Professional Practices-III	0	0	2	1
DAE 4014	Autotronics Lab.	0	0	2	1
DCS 4012	Computer Programming Lab.	0	0	2	1
	Periods per week	**17**	**4**	**10**	-
	Total credits	-	-	-	**26**
	Total periods per week	-	-	-	**31**

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DMM 4007 STRENGTH OF MATERIALS

OBJECTIVE: The Student should be able to
1. Understand the fundamentals of solid mechanics.
2. Acquire elementary knowledge of stresses, strains & material properties.
3. Understand & analyse the basic principles involved in the behaviour of machine parts under load in the context of designing it.
4. Understand & analyse the mechanical properties of the various materials.

Module–I:
Basic Concepts: Definition, elastic & plastic properties of material, stress & strain diagram for ductile & brittle materials, introductory remarks on fatigue, creep & fracture .Simple stresses and strains: Stress & strain, Simple stress and strain in composite sections, Thermal stresses, relation between elastic constants.

Module –II:
Principal Planes and Stresses: Principal stresses and principal planes, Mohr's circle for biaxial stresses.

Module –III:
Bending Moment and shearing forces : Types of beams, types of support, shear force and bending moment diagram for simply supported, and cantilever subjected to point and uniformly distributed loads, relation between intensity of loading shear force and bending moment.

Module-IV:
Bending, slope and deflection of beams: Definitions, theory of simple bending, relation between slope and deflection calculations for cantilever & simply supported beams.

Module –V:
Torsion & Vibration: Concept of Pure Torsion, Torsion equation for solid and hollow circular shaft**s**, power Transmitted and stiffness of shaft. Assumptions in theory of pure Torsion, Comparison between Solid and Hollow Shafts, Theory of Failure for Brittle and Ductile material. Types of vibrations, free vibrations.

Text Books:
1. Strength of materials – Ryder

2. Strength of materials – Sadhu Singh

3. Strength of materials – Rajput

Reference Books:
4. Strength of materials – Bansal

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DMM 4103 FLUID MECHANICS AND MACHINES

OBJECTIVE: The Student should be able to

1. Measure various properties such as pressure, velocity, flow rate using various instruments.
2. Calculate different parameters such as co-efficient of friction, power, efficiency etc.of various Systems.
3. Describe the construction and working of turbines and pumps.
4. Test the performance of turbines and pumps.
5. Plot characteristics curves of turbines and pumps.

COURSE OUTCOMES: - After the completion of this course, students will able to:

1. To understand the concept of fluid and explain the effect of fluid properties on a flow system.
2. Demonstrate the applications of fluid dynamics and determine the various losses occurred in the fluid flow problems.
3. Able to identify type of fluid flow patterns and describe continuity
equation. Determine the required hydro power for a given catchment and measure the hydro static forces on plane and curved surfaces.
4. Student will understand the principles of turbo machinery and measure the performance of different types of turbines.
5. Student will calculate the performance of different types of pumps and also explain the working principles of various hydraulic systems, hydraulic control systems and fluidics and select a suitable hydraulic device for a particular application.

Module-I:
Properties of fluid:
Density, Specific gravity, Specific Weight, Specific Volume, Dynamic Viscosity, Kinematic Viscosity, Surface tension, Capillarity, Vapour Pressure, Compressibility, laws of viscosity, Hydrostatic and Pascal's law

Module-II:
Fluid Pressure & Pressure Measurement:
Introduction ,Fluid pressure, Pressure head, Pressure intensity, Concept of absolute vacuum, gauge pressure, atmospheric Pressure, absolute pressure, Simple and differential manometers, Bourdon pressure, gauge. Concept of total pressure on immersed bodies, centre of pressure, Buoyancy, center of Buoyancy, Metacentre and metacentric Height, conditions of Equilibrium of a Floating and submerged Bodies.

Module-III:
Fluid Flow and Measurement:
Types of fluid flows, Continuity equation, Bernoulli's theorem,Venturimeter – Construction, principle of working, Coefficient of discharge, Derivation for discharge through venturi meter, Orifice meter – Construction, Principle of working, hydraulic coefficients, Derivation for discharge through Orifice meter Pitot tube – Construction, Principle of Working

Module-IV:
Flow through Pipes
Laws of fluid friction (Laminar and turbulent), Darcy's equation and Chezy's equation for frictional losses. Minor losses in pipes, Hydraulic gradient and total gradient line, Hydraulic power

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transmission through pipe. Series and parallel pipes connection, siphon and Water Hammer in pipes

<u>**Module-V:**</u>
Dimensional and Model Analysis
Introduction, Dimensional homogeneity, methods of dimensional Analysis: Rayleigh Method, Buckingham's Π Theorem, model analysis, similitude- types of similarities, dimensional Numbers: Reynolds's Number, Froude's Number, Euler's Number, Weber's Number, and Mach's Number, Models testing of partial submerged Bodies, Classification of models

Text Books:
Modi P. N. and Seth   Fluid mechanics and Machinery
R.K Bansal   Fluid Mechanics and hydraulic machine

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DAE 4011 AUTOMOTIVE ENGINE

OBJECTIVE
1. To understand the various concept and basic principles of the ENGINE
2. To understand the basics components and their working principles of the Engine.
3. Combustion of S.I and CI Engine and their mechanism of the combustion process
4. Students will be enable to understand the air- fuel ratio and ignition systems.
5. Modern trends and technological trends in the Automobile sector

Module-I:
Introduction:
Basic units, major components of engine, mechanism of operation, Four- Stroke and two – Stroke Petrol and diesel engine, their applications, specification of Auto – engines, classification of automobile engine.

Module-II:
Constructional details of automotive engine :
Introduction, multi-valve overhead cam system, Crank case, Cylinder liner, piston, rings, Connecting rod, crank shaft, Main bearing, Cam shaft, Valves, Valves seats, Valve mechanism, Valve timing gears, balancing, flywheel, Vibration damper, timing order.

Module-III:
Combustion Phenomenon:
Characteristics of petrol and diesel engine fuels, additives, Combustion in S.I. and C.I. engines, flame propagation, Detonation, Pre-ignition and diesel knock, Combustion chamber of S.I. and C.I. engines, HUCR, octane and cetane number, E.G.R. system.

Module-IV:
Fuel Feed System Engine:
Petrol fuel feed system, Petrol pumps, carburettors, Air fuel ratio of combustion, electronic control of A / F ratios, Petrol injection, M.P.F.I. system, injection timing, Air cleaners, manifold, exhaust pipe, Muffler, supercharging, Turbo charger. Fuel feed system, fuel injection pump, fuel injection system testing, fuel feed pump, injector, fuel pump governor, fuel filters, devices for cold starting , emission control

Module-V:
Cooling systems & lubricating system:
Significance, types of cooling systems and their description, water pump, fan , radiator, cooling system cleaning and maintenance, anti – freeze solution. Signification, components, Oil strainer, Oil filter, Oil cooler, Oil seal, Crank case ventilation, Oil pressure gauge, Oil level indicator, properties of lubricating oil, Servicing and trouble shooting of lubrication system.

Text Books:
1. Automotive Engines   S. Srinivasan
2. Automobile Engineering   K.M. Gupta
3. Automobile Engineering   K.K. Ramalingam
References Books:
4. Internal Combustion Engines   Shyam K. Agrawal
5. Internal Combustion Engines   Feruson & Kirkpartrick

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DAE 4013 AUTOTRONICS

OBJECTIVE
Students will be able to
1. To understand about the generator, alternator, regulator and starting motor and mechanism.
2. To study about the different ignition system.
3. To learn about the lighting system and its components in the automobile vehicle.
4. To study the horn, wins screen wiper, lamps and audio systems.
5. To study the electronic devices in the automotive.

Module-I: Basic Electrical and Safety
Definitions: Electric Current, Voltage and resistance – Ohms law and Kirchhoff's law – electromagnetism (Definition only) Magnetic flux, flux density, magnetic field intensity, Magneto Motive Force (MMF) and magnetizing force permeability, reluctance, Faradays Laws of electromagnetic induction, power, power factor (definition only). Electrical safety measures – Importance of earthling - electric shock: care of shocks, precautions against shock.

Module-II: Generator, Alternator, Regulator and Starting motor

Generator, Purposes, Construction, Field winding, Armature winding, , Brushes , Alternator Purpose, Construction, Body Stator winding Rotor winding, Slip rings,. Regulator: Need for the regulator. Constant current and voltage regulator, compensated voltage regulator Trouble shooting in regulator. Dynamo principle.

Starting motor, Need, Working Principle, Construction, Body, Field coil, Armature windings, and Poles Commutator and brush gears, Solenoid switch. Starting motor drive mechanism, clutch type drive & coaxial drive mechanism in the heavy vehicles, complete electrical circuits of heavy duty starting motor First contact and second

Module-III: Ignition system

Ignition system – Charging System – Lighting system and Auxiliary system –Their needs. charging and discharging . Capacity ratings test – charging methods – trouble shooting in batteries. Battery coil ignition system. Components and its functions – Distributor, spark plug (types), Condenser ,Breaker point mechanism , Importance of ignition timing. Magneto ignition system, Advantages over battery coil ignition system to magnetic coil ignition system, transistorized ignition system , Electronic ignition system ,Heater plugs ,Cold starting devices in diesel engines.

Module-IV: Lighting, lamp, Horn, Gauges and wiring

Lighting,. Head lamps, Head Lamp Beam setting and adjustments, Halogen lamps indicator, Fog lamp Park lamp ,Rear number plate lamp, Fluorescent lamp in transport vehicles, brake light ,Brake light switch , traffic indicators (Resistance & Transistor type) panel lamps.

Horn, Construction, Horn circuit, horn turning, Troubleshooting.

Gauges, Fuel gauge, Oil pressure gauge, Coiling water temperature gauge indicator, Wind screen wipers Pneumatic type wind screen wipers.

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Wiring, Single pole and Double pole, Cable size colour code, wiring harness, Cable connection, fuses, Circuit breakers

Module-V: Electronics – Computer Applications in Automobile

Semi-conductor materials, N type and P type, PN junction forward and reverse bias. Microprocessor control systems: Concept of CPU and computer memory used in automobiles. Sensors: pressure sensor, throttle position sensor, fuel flow sensor, thermistor sensor, oxygen sensor, speed sensors, knock detecting sensors solenoid and stepper motor. Electronic dashboard instruments and warning system – ECU- principle and working of ECU

Text Books
1. Automotive electrical equipment's,   P.L.Kohli, Tata McGraw hill publications
2. Automobile Electrical and Electronics Systems, Tom Denton, Arnold, London

Reference Books
1. Automotive electrical equipment,   A.P. Young and L. Griffidis

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DCS 4011 COMPUTER PROGRAMMING

OBJECTIVE:
1. To develop programming skills using the fundamentals and basics of C language.
2. To present the syntax and semantics of the "C" language as well as data types offered by the language.
3. To study the advantages of user defined data type which provides flexibility for application development?
4. To teach the basics of pre-processors available with C compiler.
5. To impart the knowledge about pointers which is the backbone of effective memory handling?

Module-I:
Programming techniques and overview of c language:
Algorithm and Programming Development, Steps in development of a program. Flow charts, Algorithm development, Program Debugging, Program Structure. Formatted input, formatted output., assignment statements, Constants, variables and data types.

Module-II:
Operators and Expressions:
Arithmetic, Relational, Increment, increment, Assignment, logical and Conditional Operators, Operator precedence and associativity, type casting, size of () operator, Math functions sqrt ()), pow(), sin(), cos() and tan() .

Module-III:
Decision making and branching:
if statement (if, if-else, else-if ladder, nested if-else), Switch case statement, break statement, goto.
Decision making and looping:
while, do, do-while statements for loop, continue statement

Module-IV:
Arrays and Strings:
Declaration and initialization of one dimensional, two dimensional and character arrays, accessing array elements. Declaration and initialization of string variables, string handling functions from standard library (strlen (), strcpy (), strcat (),strcmp ()).

Module –V:
Functions:
Need of functions, scope and lifetime of variables, defining functions, function call (call by value, call by reference), return values, storage classes. Category of function (No argument No return value, No argument with return value, argument with return value), recursion.
Pointers:- Understanding pointers, declaring and accessing pointers, Pointers arithmetic, pointers and arrays.

Text Books:-
1. E Balagurusamy, "Programming in ANSI C" Tata McGraw-Hill, New Delhi.
Reference Books:
    1. Ashok N. Kamthane, "Programming in C" Pearson Education India, New Delhi

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SUBJECT: DAC 4001 ENVIRONMENTAL SCIENCE

OBJECTIVE
The main aim of Environmental Science is to make the students acquainted with various types of pollution hazards, which are becoming more critical every day and also acquire the knowledge to participate in solving environmental problems for green earth.
Students will be able to understand:
1. Importance of Environmental Science as well as biogeochemical cycles and food chain
2. Composition and function of various segments of environment
3. Water pollution, various pollutants, their toxic effects and water treatment process
4. Classification, toxic effects and sources of air pollutants and their control measures
5. Brief introduction to Noise Pollution, Soil Pollution and radiation pollution

Module I:
Multidisciplinary nature of Environmental Science & Ecology:
Definition & importance of Environmental Science. Ecosystem, basic structure of an ecosystem (abiotic and biotic components), nutrient and biogeochemical cycles (carbon cycle, nitrogen cycle, and hydrological cycle), food chain, food web.

Module II:
Segments of environment:
Atmosphere, hydrosphere, lithosphere, soil profile and composition of soil, biosphere.

Module III:
Water Pollution & Waste water treatment:
Water resources, sources of water pollution, various pollutants, their toxic effect, portability of water, rain water harvesting, primary and secondary waste water treatment (Trickling filter & Activated sludge process.

Module IV:
Air Pollution:
Classification of air pollutants, toxic effects, sources and their control measures like ESP, catalytic converter and bag house filter.

Module V:
A brief introduction to Noise Pollution, Soil Pollution and radiation pollution.

Text books:
1. Environmental Chemistry – A. K. Dey
2. A basic course in Environmental studies - Deswal & Deswal
Reference books:
1. Environmental pollution – B. K. Sharma
2. Environmental pollution and control - C. S. Rao
3. Essentials of ecology & environmental Sciences - S.V.S. Rana

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DMM 4008 STRENGTH OF MATERIALS LAB

LIST OF EXPERIMRNTS

1. Study of Rockwell Hardness Machine.

2. Study of Brinell hardness Machine.

3. Study of Tensile Strength of mild steel

4. Study of Young Modulus of bending.

5. Study of torsion test.

6. Study of Universal Testing Machine.

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DAE 4012 AUTOMOTIVE ENGINE LAB.

LIST OF EXPERIMRNTS

1. Small Engine Dynamometer Experiment Manual.

2. Diesel Engine Test Bed System

3. Shock Absorber Trainer

4. Brake Test hydraulic Dual circuit Breaker system

5. Wheel Alignment Trainer

6. Petrol Engine Test Bed System

7. Hydraulic Engine Dynamometer

8. Gas Turbine

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DHU 4002 PROFESSIONAL PRACTICES-III

Module-I:
Industrial visit:
Industrial visit be arranged and report of the same be submitted by the individual student, to form a part of term work. One industrial visit may be arranged in the following areas to observe material handling system, Quality control chart/ production records/ layout system/ hydraulic and pneumatic system/working of boilers and steam engineering applications.

Module –II:
Lectures by professionals/ industrial expert be organised from any one of the following areas.
- Use of plastics in automobiles
- Non-ferrous metals and alloys for engineering applications
- Industrial hygiene
- Composite materials
- Heat treatment processes
- Ceramics
- Safety engineering and waste elimination

Module –III:
Group-Discussion:
The students shall discuss in group of six to eight students and write a brief report on the same as a part of term work.

Module –IV:
Student Activities:
The students in a group of 3 or 4 will perform any two of the following activities and write a report as a part of term work.
Activity:

i. Study any one type of CNC machine centre and prepare on tooling and tool holding devices.
ii. For a given job write a sequence of operations performed by automated manufacturing system. Draw a block diagram of control system to perform above operations.
iii. For a drilling or milling operations on a simple machine component, draw a jig or fixtures showing various features like locating clamping tool.
iv. For a given job involving 3 to 4 operations suggest to prepare a report.

Module –V:
Seminar:
Seminar on any advanced technical topic to be presented by individual student.

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DAE 4014 AUTOTRONICS LAB.

LIST OF EXPERIMRNTS

1. Multipoint Injection

2. Electronic injection

3. ABS4 Channel Systems

4. Engine control and sensors

5. Car Air-Conditioning

6. Suspension simulator

7. Transmission simulator

8. Safety system simulator

9. Automotive Electrical

10. Hybrid Vehicle System.

SYLLABUS

SEMESTER-V

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COURSE STRUCTURE
(W.E.F. 2018 Batch Students)
(Total Credits 22.0)
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Fifth Semester

Subject Code	Subject	Theory	Tutorial	Lab.	Credit
DMM 5013	Theory of Machine	3	1	0	3
DME 5013	Quality Control	3	0	0	3
DAE 5011	Automotive Equipment and Maintenance	3	1	0	3
DAE 5015	Automotive Design	3	1	0	3
DAE 5017	Motor Vehicle Technology	3	0	0	3
DAE 5010	Driving Practice	0	0	3	2
DAE 5014	Theory of Machine Lab.	0	0	3	1
DAE 5016	Automotive Repair and Maintenance Lab.-I	0	0	3	1
DAE 5012	Project-I	0	0	6	3
	Periods per week	**15**	**3**	**15**	-
	Total credits	-	-	-	**22**
	Total periods per week	-	-	-	**33**

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DMM 5013 THEORY OF MACHINE

OBJECTIVE: The Student should be able to
1. To focus on understanding the concept of machines, mechanisms and their elements. Also study kinematics aspects of various links in mechanisms. To form foundation for kinematics synthesis, analysis and design of mechanism.
2. To know different machine elements and mechanisms.
3. Understand Kinematics and dynamics of different machines and mechanisms.
4. Select Suitable drives and mechanisms for a particular application,
5. Appreciate concept of balancing.
6. Develop ability to come up with innovative ideas.

Module-I:
Mechanisms: Kinematic concept of Link, Kinematic chain, Mechanism, degree of freedom, Inversions of four bar mechanism, single slider crank mechanism and double slider crank mechanisms.

Module-II:
Motion Analysis: Types of motion: Kinematic and Dynamic quantities; Vector diagrams, Velocity and acceleration diagram of plane mechanism.

Module-III:
Flywheel & Belt: Concept, function and application of flywheel with the help of Turning Moment diagram; Fluctuation of energy and speed. Types of belt, ration of tension in belt, Centrifugal tension in belt & Power transmission

Module-IV:
Gears: Fundamental laws of gearing: classification and basic terminology, involute tooth profile and its kinematic consideration, spur gears, other types of gears, standards in tooth forms. Gear trains: Simple and, compound gear trains.

Module-V:
CAM & Balancing: Balancing of Rotating masses by a single mass in same plane, Balancing of a single rotating mass by two masses rotating in different planes, Balancing of several masses rotating in same plane. Various types of cams, Displacement, velocity and acceleration of followers, Graphical determination of CAM profiles with simple followers.

Text Book:
1. Khurmi.R.S   Theory of Machine
Reference Books:
1. Singh. Sadhu   Theory of Machine

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DME 5013 QUALITY CONTROL

OBJECTIVE: Students will be able to
1. Understand the terms like quality, quality control, inspection, value of quality, cost of quality.
2. Know about reliability and statistical quality control.
3. Construct and draw control charts.
4. Understand different sampling methods and draw OC curve.
5. Understand ISO certification procedure and quality system.

COURSE OUTCOME: After the completion of this course, students will able to
1. Understand the philosophy of quality improvement, basic concept of statistical quality control.
2. Analyze the reliability of different types of equipment, machines and products as well as cad detect the reasons of failure.
3. Demonstrate the ability to draw, use and interpret control chart for attribute and variable and give the concept of process capability.
4. Prepare sampling plans and methods for attribute.
5. Understand the concept of ISO-9000 quality system and total quality management.

Module-I:
Concept of Quality: Definition of quality cost of quality, value of quality. Quality control, objectives of quality control, quality control and inspection.   [4]
Module-II:
Statistical concepts and Reliability: Definition of probability, laws of probability. Normal and Binomial probability distributions. Statistical Quality Control, Definition of reliability, basic concept. Failure patterns for complex product, designing for reliability, System reliability.   [8]

Module-III:
Control Charts for Variables and Attributes: Introduction, objectives, theories of control charts for averages, ranges, standard deviations. Process capability study, Fraction defectives and number of defects. Interpretation of control charts.   [6]

Module-IV:
Acceptance Sampling by attributes: Concepts of acceptance sampling, advantages and limitations, sampling methods, single, double and- multiple sampling plants operating characteristic curves.   [6]
Module-V:
Total Quality Management and ISO 9000 Quality System: Concept of Total Quality management, Principle objectives of TQM, History of ISO: 9000, ISO: 9000 series in general, benefits by becoming an ISO: 9000 company, steps to registration, India and ISO: 9000.   [6]

Text Books:
1. Statistical Quality Control   - M.Mahahjan
2. Quality Planning and Analysis   - J.M .Juran & Frank M Gryna

Reference Books:
1. Statistical Quality Control   by Eugune L.Grant & Richard S Leaven worth
2. Total Quality Management   by John M Kelly
3. TQM   by R.P. Mohanty & R.R. Lakhe.

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DAE 5011 AUTOMOTIVE EQUIPMENT AND MAINTENANCE

OBJECTIVE: Students will be able to
1. Understand the terminology of the Automobile components and their function
2. Know about inspection and engineering performance.
3. Constructional and Design details of the Automobile transmission and drive systems.
4. Focusing of head lamp and maintenance of electrical accessories
5. Trouble-shooting, and fault diagnosis of the Various Automobile systems

Module-I:
Inspection of cylinder
Inspection of cylinder wears Changing of ring set, Measurement of Quality & tapered ness, Cylinder boring, Honing process, changing of liners.

Module-II:
Inspections of Crankshaft
Inspections of Crankshaft for wear ovality & tapper, Crankshaft grinding procedure corresponding under sized bearing. Bearing effect of crankshaft & bearing wear on engineering performance.

Module-III:
Transmission maintenance
Transmission system maintenance, adjustment of clutch, causes & remedies of gear box faults, causes & remedies of propeller shaft, causes & remedies of differential & Rear axle, inspection & adjustment of brakes, hydraulic brake system & brake bleeding, air assisted hydraulic brakes, air brakes and their adjustment.

Module-IV:
Body Maintenance
Adjustment of doors and Locks, Frame repairs and alignments, Front wheel alignment procedures & steering linkage, care of wheels & tyres, reclaiming & re-treading of tyres, vulcanising, focusing of head lamp and maintenance of electrical accessories.

Module-V:
Carburettors Adjustment
Tuning of carburettors, adjustment of idle speed, winter & summer adjustment, float level adjustment, metering pin adjustment. Theories & Maintenance of MPFI System, trouble shooting, and fault diagnosis of MPFI engines, Testing & replacing of sensors and injectors.

Books Recommended
1. Automotive mechanics by Williams H Course and Donald
2. Car maintenance and repair by A W Judge Vol. IV
3. Maintenance of high speed diesel engine by A W Judge
4. Automotive Engineering by G B S Narang
5. Automotive Engineering by Kripal Singh
6. Service manual – Maruti, Indicia, Santro, Accent etc.

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DAE 5015 AUTOMOTIVE DESIGN

OBJECTIVE
1. To make the student get acquainted with standardize the automobile parts
2. After design the components like gear, gear box, piston, connected rod, piston pin, crank shaft, valve mechanism, cylinder liner, fly-wheel etc.
3. To select the required bearing for same by considering the different design consideration.
4. Students will learn various components and their working design consideration.
5. To Understand Engine power requirements, selection of engine types, stroke and bore, compression ratio.

Module-I Standardization in Automobile system design:
Preferred numbers- preferred series, derived series and their application in the design

Module-II Design consideration:
Manufacturing and assembly consideration, Design of components for casting, welding, forging, hot and cold working, machining etc. assembly consideration in design. Design for fatigue and creep- thermal consideration, wear consideration in design, human consideration in Design.

Module-III Design OF Bearing:
Bearing Identification/Designations, Rolling contact Bearing. Types of rolling contact bearing, static and dynamic load capacities, equivalent bearing load, Load life relationship, bearing life, load factor, selection of bearing from manufacture catalogue. Lubrication and mounting, dismounting and preloading of bearing, oils seals, and packing.
Sliding contact bearing- Bearing materials and their properties, Bearing types, and their constructional details, hydrodynamic lubrication-Basic theory, design consideration in hydrodynamic bearing.

Module IV Design of Gear box:
Design consideration of gear box, selection of proper gear ratio for an automobile gearbox, Design of shaft, splines, and gear for gear box used in automobiles.

Module-V Design of I.C Components:
Engine power requirements, selection of engine types, stroke and bore, compression ratio, clearance volume and swept volume, mean piston speed. Design of crankshaft and connecting rod-forces, materials types, Design criteria, dimension etc. Cylinder block dimension, types of liner-Dry and Wet types.
Valve Mechanism Design: Valve spring, camshaft and cam follower etc. Flywheel type and construction, criteria of design for solid and rim types. Selection of Engine layouts: design criteria of intake and Exhaust manifold**,**

Text books	Title of Books.
Bdokins.D.T	Elements of Motor Vehicle Design
Agrwal.K.M	Auto Design problems

Refernces Books

Singh. Sadhu	Machine Design

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DAE 5017 MOTOR VEHICLE TECHNOLOGY

OBJECTIVE: Students will be able to
1. To understand the transmission and Drive systems.
2. Various working principles and Mechanism of the Automobile components systems.
3. Introduction & study of front axle assemblies and Electronic controlled systems.
4. Familiarisation of Manual and Automatic control and Driving systems.
5. Knowledge Automobile Electrical Components, charging system and possible defects and remedies.

OUTCOME:
1. Students will be able to understand the transmission and gain knowledge in Drive systems.
2. Grab knowledge on various working principles and Mechanism of the Automobile components systems.
3. Students will be introduced to front axle assemblies and Electronic controlled systems & will briefly study the above.
4. Students will be given knowledge on Manual and Automatic control and Driving systems with all precautions.
5. Brief idea on Automobile Electrical Components, charging system and possible defects and remedies.

.
Module-I Clutch:
Principle, torque transmission, types of clutch, lining, friction and bonding material, single plate clutch, multiple spring single plate clutch, driven plate, multiple plate clutch, automatic clutch action, fluid flywheel.

Module-II Gear Box, Propeller and Differential Shaft:
Function, working of selective gear box - sliding mesh type, constant mesh type, synchronous type, torque converter and overdrive, propeller shaft and rear axle, universal joint, differential, automatic transmission. Function of propeller shaft, Types of propeller shaft: - Universal, Hooks, Balls & Trunion Joints. Necessity & function of final drive

Module-III Transmission System:
Requirements, live axle transmission, rear engine with live axle, dead axle and axle less transmission, four wheel drive and all-wheel drive transmission, drive line operation. Principle & necessity of suspension systems, Types of springs (leaf, Coil, Torsion Bar), Front suspension, Stabilizer bar, Rear Suspension, Air Suspension, Shock Absorber, Automatic Lever Control, Introduction of electronic controlled suspension systems

Module-IV Front Axle & Steering:
Introduction & study of front axle assemblies. Types of front Axle:- Dead, Live, Elliot & Lamoine front wheel assembly, Correct steering angle, Steering gearbox, Worm, Wheel Worm & Roller, Rack & Pinion type, Ackerman linkage, Power Steering, and Electronic controlled Power Steering System.

Module-V Miscellaneous Automobile System:
Automobile Electrical Components, charging system, starting system, lighting system.

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Speedometer, fuel gauge, Temperature gauge, RPM meter, Horn circuits, power door and windows, Introduction, Chassis lubrication, Types of body, constructional details, types of frames & frameless, materials of frames, load consideration, possible defects and remedies, Types of lubricants, their uses, properties different lubricants used in various automobile components.

BOOKS RECOMMENDED:

1. Automobile Engineering Vol.I & II By Kirpal Singh.
2. Automobile Engineering By G.B.S. Narang.
3. Automotive Mechanics By W.H. Crouse.
4. Harbans Singh Rayat.

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DAE 5010 DRIVING PRACTICE

1. **Driving Lab**: Lab demonstrates various systems and cut section models of vehicle and display models about various driving procedures.

2. **Testing Laboratory:** To assess vision, Illumination, Adaptation ,Action, Judgment,, Speed Anticipation, Depth Perception and Discriminative reaction.

3. **Driving Simulators Training** with their good scenario control modules can tech a range of cognitive skills deal with complex roadway and Traffic conditions and general driving techniques.

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DMM 5014 THEORY OF MACHINE LAB.

LIST OF EXPERIMRNTS

1. To verify the relation of simple pendulum.

2. To verify the relation of compound pendulum and determine of the radius of Gyration.

3. To determine the radius of Gyration of given bar using bifilar suspension.

4. To study the torsional vibration single rotor system

5. To study the free vibration of two rotor system and to determine natural frequency(both theoretically and experimentally)

6. To study the gyroscopic effect of a rotating disc.

7. To study the static and dynamic balancing using rigid blocks.

8. To study the effect of whirling of shaft with:

      a. both end fixed.

      b. Both end supported

      c. Fixed supported.

9. Study of cam-follower pair and to plot X-0 curve for different cam-follower pairs.

10. Balancing of masses in Machines fault-simulator

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DAE 5016 AUTOMOTIVE REPAIR AND MAINTENANCE LAB. – I

1. Introduction of tool and their uses in workshop.

2. Introduction of the different types of automobile engine parts.

3. To study of different type clutch system.

4. To study of air & water cooling system.

5. To study of ignition system.

6. To study of different type of gear box.

7. To study of Fuel system.

8. To study the differential and final drive.

9. To study the propeller shaft and universal joint.

SYLLABUS

SEMESTER-VI

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COURSE STRUCTURE
(W.E.F. 2018 Batch Students)
(Total Credits 25.0)
Sixth Semester

Subject Code	Subject	Theory	Tutorial	Lab.	Credit
DME 6011	Industrial Engineering	3	0	0	3
DAE 6009	Automotive Emission and Control System	3	0	0	3
DAE 6015	Special Purpose Vehicles and Equipment	3	0	0	3
DME 6003	Mechatronics	3	0	0	3
DMM 6013	CAD/CAM	3	0	0	3
	Elective	3	0	0	3
DAE 6008	Automotive Repair and Maintenance Lab.-II	0	1	2	2
DMM 6014	CAD Lab.	0	1	2	2
DAE 6012	Project-II	0	0	6	3
ELECTIVE(Any one)					
DME 6107	Operation Research	3	0	0	3
DME 6001	Numerical Technique	3	0	0	3
DMM 6015	Heating Ventilation and Air Conditioning	3	0	0	3
	Periods per week	**18**	**2**	**10**	**-**
	Total credits	-	-	-	**25**
	Total periods per week	-	-	-	**30**

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DME 6011 INDUSTRIAL ENGINEERING

OBJECTIVE
The student will be able to
1. Understand importance of productivity, factors affecting productivity and forecasting.
2. Find the break-even point for manufacturing a product, criteria for replacement or retention of products.
3. To give basic concept of inventory and its control, EOQ ABC analysis.
4. Know the concept of JIT, Lean manufacturing, MRP.
5. Using techniques of work measurement and method study should be able to improve the existing manufacturing method.

COURSE OUTCOME:
After the completion of this course, students will able to
1. Able to understand the functions of production system and make demand forecast using different methods.
2. Perform brake even analysis under different conditions, perform replacement or retention using different methods and estimate the cost of products/equipment.
3. Solve inventory problems and how to control and manage it.
4. Discuss about JIT, Lean manufacturing, MRP.
5. Apply the concept of work study and ergonomics to increase the productivity of industry.

Module –I:
Production Functions and Forecasting: Concept, Types and Management of production systems, Predicting markets for products, components of demands, time series forecasting methods (moving average, exponentially weighted moving average, Delphi, market survey and historical and life cycle analysis. [6]

Module-II:
Facility Layout and Engineering Economy: Process charts, line and product layout, functional process lay out, group layout, balancing technique, Concept of replacement and depreciation, Break even analysis, overhead, fixed and variable cost. [8]

Module –III:
Inventory Control : System inventories, EOQ, buffer stock, reorder point, fixed reorder quantity system, periodic reorder system, ABC analysis, Material requirement planning. [4]

Module –IV:
Concept of JIT, Lean Manufacturing & Group Technology: Production wastages and its control, Concept, classification and coding of parts, coding system, OPTIZ coding system and its application. [6]

Module –V:
Work study: Conceptual frame work of Method Study, Micro-motion study and work measurement, Principle of Motion Economy, Work sampling. [6]

Books Recommended:
1.Industrial Engineering. & Management – O. P. Khanna
2.Industrial Engineering & Production Management – Martand Telsang

Reference Books:

1.Production & Operation Management – S. N. Chary
2.Production & Operation Management – Ronald, S. Ebert
3.Production & Operation Management – S. K Sharma

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DAE 6009 AUTOMOTIVE EMISSION AND CONTROL SYSTEM

OBJECTIVE
1. This course will provide an opportunity to develop skills in measuring pollution and maintain emission control devices.it is an important
2. Use appropriate Emission Control Device & Systems as per country prevailing emission-norms.
3. Test and analyses various Emission Control Devices to reduce air pollutant.
4. Select suitable alternative fuels for controlling pollution.
5. The course content should be taught and with the aim to develop different types of skills so that students are able to acquire following competencies

Module-I: Introduction to automotive pollution
The atmosphere: Air pollutants, pollutants produced by automobiles, Emission control Norms-International and Indian Norms: Bharat standards, Noise and sound pressure, Measurement of Noise, causes of automobile noise and its reduction

Module-II: Principle of production of exhaust gases
Describe various pollutants produced under different driving conditions, Theoretical air-fuel ratio, carbon mono-oxide (CO) Gas, Hydro-carbon (HC) Gas, oxides of Nitrogen (NO_X), Driving conditions and Exhaust gases.

Module-III: Emission control systems
Describe various systems used for emission control, Explain construction & working of different Emission control systems, Emission control components layout and drawing. Necessity and operation of Positive Crankcase Ventilation (PCV) system, Necessity and operation of fuel evaporative emission control (EVAP) system for Carbureted & MPFI engines. Necessity and operation of Throttle Positioner (TP) system & Throttle Positioner sensor, Catalytic converters, Oxygen (O2) sensor. Necessity and operation of High Altitude Compensation (HAC) system, Manifold Absolute Pressure Sensor (MAPS).

Module-IV: Principle methods of exhaust gas analysis
Describe method of measuring various pollutants: Measuring CO and CO2 concentrations, Measuring HC concentrations, Measuring NOx concentrations. Prevalent Automotive emission control norms in India. Construction & working of Exhaust Gas analyzer. Construction & working of Diesel, Smoke meter.

Module-V: LPG and CNG conversion
Describe conversion, installation & maintenance of LPG & CNG kit, Merits of LPG's., LPG conversion kit, LPG kit installation. , Maintenance of LPG kit components , Merits of CNG's., CNG conversion kit., CNG kit installation, Maintenance of CNG kit components, Performance features of Petrol, LPG and CNG vis-à-vis.

Text Books	**Titles of Books**
Anil Chhikara	Automobile Engineering
Richard K. DuPuy, Steven D. Schaefer,	Fuel systems and emission controls
References Books	
Tom Denton	Automobile Electrical & Electronics System

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DAE 6015 SPECIAL PURPOSE VEHICLES AND EQUIPMENT

OBJECTIVE
The course is designed to give knowledge of
1. To present a problem oriented in depth knowledge of special purpose vehicle.
2. To address the underlying concept and method of special purpose vehicle
3. To apply the knowledge of instrumentation in special purpose vehicle.
4. Knowledge of stability, design features, control systems and safety Devices.
5. To understand the latest trends of Technology in the Automobile and Mobility sectors.

Module-I: **Introduction**
Classification of special purpose vehicles, wheel type vehicles and track type, application.

Module-II: **Tractors**
Classification of tractors-Layout of wheeled tractor- power transmission system, steering-system, accessories of wheel tractor, hydraulic control system, power take off unit.

Module-III: **Constructional Working Features and Instrumentation**
Study of Different types of Earth moving machinery such as Rippers, scrapers and shovel, loaders, Excavators, dumpers, Bulldozers, fork, lift, JCB, and Road Roller.

Module-IV: **Mobile Crane**
Basic characteristics of truck cranes, stability and Design Features and control systems and safety devices.

Module V: **Special Purpose Vehicles**
Features of oil tankers- Articulated Vehicles, working features of Ambulance, fire extinguishing vehicle and Tipper working of Hover craft

Text Books	Titles of Book
J.Y Wong	Theory of Ground Vehicles

References Books

C.P. Nakara	Farm Machines and Equipment
A. Astkhov	Trucks Cranes

Hand Book of Earth moving Machinery –Central water and Power commission (Govt of India)

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DME 6003 MECHATRONICS

OBJECTIVE: Students should be able to:
>   1. Identify various input and output devices in an automated system.
>   2. Understand and draw ladder diagrams.
>   3. Write simple programs for PLCs.
>   4. Interpret and use operations manual of a PLC manufacturer.
>   5. Use simulation software provided with the PLC.
>   6. Understand interfacing of input and output devices

Module-I:
Introduction and Mechatronics elements:
Definition of mechatronics. Mechatronics in manufacturing, products and design. Review of fundamentals of electronics. Introduction to Sensors, Transducers and Actuators Principle, working and applications of-Limit switches, proximity switches like inductive ,capacitive and optical (deflecting and through beam type) , Thumb wheel Switches magnetic reed switches , Optical encoders-displacement measurement, rotary, incremental, opto-couplers. Actuator – solenoids – on-off applications, latching, triggering

Module-II:
Processors /controllers:
Microprocessors, microcontrollers, PID controllers and PLCs.

Module-III:
Drives and mechanisms of an automated system:
Drives: stepper motors, servo drives. Ball screws, linear motion bearings, cams, systems controlled by camshafts, electronic cams, indexing mechanisms, tool magazines, and transfer systems.

Module-IV:
Hydraulic system:
Hydraulic systems: flow, pressure and direction control valves, actuators, and supporting elements, hydraulic power packs, and pumps. Design of hydraulic circuits.

Module-V:
Pneumatic system:
Pneumatics: production, distribution and conditioning of compressed air, system components and graphic representations, design of systems.

Text Books:
>   1. Bolton W. Mechatronics- Electronic control systems in Mechanical and Electrical Engineering. Pearson Education Ltd.
>   2. Histand B.H. and Alciatore D.G .Introduction to Mechatronics and Measurement systems Tata McGraw Hill Publishing
>   3. John W. Webb and Ronald Reis Programmable Logic Controllers Prentice Hall of India.
>   4. NIIT Programmable Logic Control – Principles and Applications Prentice Hall of India
>   5. Kholk R.A. and Shetty D. Mechatronics systems design Vikas Publishing, New Delhi

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DMM 6013 CAD/CAM

OBJECTIVE: Students should be able to
1. Identify various Basic Concepts of CAD and CAM
2. Understand Graphic System AND Graphic System
3. Knowledge Various Geometric modelling: Wire frame, surface & solid modelling.
4. Concept of numerical control machine and Industrial application of ROBOT. Introduction to FMS.
5. Preparatory function and G and M-code, simple program for lathe and milling.

Module-I: **Basic Concepts of CAD and CAM**
Introduction of Computer Aided Design, The Design Process, Product Cycle, CAD/CAM Developments, Definition of CAD&CAM Tools, Hardware and Software requirement of CAD, Engineering Application of CAD.

Module-II: Computer Graphics
Graphic System: CRT, Raster Scan system and Display process, Random Scan System and display, direct view storage tubes, Graphics Software configuration.   Line draw algorithm – DDA & Bresenhems, Circle Midpoint circle Algorithm, Bezier & B-Spline curves. Bezier & B-Spline surfaces. The various surface representation scheme & techniques.

Module-III: Geometric Transformations and Modelling System
2D & 3D Transformations. Translation, Rotation, Scaling, Reflection, Homogeneous co-ordinates, windowing & clipping, Orthographic projection, Isometric projection.
Geometric modelling: Wire frame, surface & solid modelling. Techniques, Boundary Representation and constructive Solid Geometry method.

Module-IV: Introduction to CAM, ROBOTICS & FMS:
Concept of numerical control machine, CNC machine and DNC machine Working principle of NC, Features of CNC machine, Construction and working principle of . Concept & Introduction of Robotics, Configuration of Robots, Industrial application of ROBOT. Introduction to FMS, components of FMS, Layout of FMS, Types of FMS.

Module-V: CAM & Part Programming
NC coordinate system, various programming technique, manual programming, conventional programming and APT, Word address format, NC coordinate system, types of motor control, preparatory function and G code, simple program for lathe and milling: linear & circular interpolation.

Text Book:
1. Groover. M.P.   CAD/CAM
Reference Books:
1. CAD/CAM – by Ibrahim Zeid ,Tata McGraw Hill Publishing Comp. Ltd., New Delhi
2. CAD/CAM – by P. N. Rao
3. CAD/CAM – by Chirs McMohan, Publication: Pearson Education Asia.
4. Computer Aided Design – by R.K. Srivastava, Umesh Publication.
5. Computer Graphics – by Hearn & Baker, Publication Prentice Hall

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DAE 6008 AUTOMOTIVE REPAIR MAINTENANCE LAB-II

<u>LAB EXPERIMENTS</u>

1. Types of steering system. Removal and refitting of steering gear box.

2. Discussion on construction and operation of rack and pinion type steering system.

3. Removal, clearing, inspecting of worm and wheel str. Gear box.

4. Removal of road spring, shock absorber, cleaning, vowing and installing, removal of torsion Bar, establisher bar.

5. Servicing of drum brake, cleaning, servicing of M/cylinder wheel cylinder.

6. Removal, dismantling inspection of dies brake.

7. Brake – bleeding procedure.

8. Removal of engine from chassis,

9. Dismantling of C.l engine and reassembly.

10. Dismantling of S.l engine and reassembly.

11. Information sharing on how to operate diagnostics equipment

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DMM 6014 CAD LAB.

1. Practice on the following commands
Units , limits , grid , line , poly-line , donut , polygon , chamfer , fillet , offset , text , de-text.

2. Practice on the following commands:
O snap , Extension , undo , redo , oops , color , line-type , layer , save , quit , end.
Hints: use layers, color, line-types)

3. Practice on the following commands:
Erase , Copy , move , array , break , trim , mirror , pedit , pan , divide , zoom

4. **Practice on the following commands:** Hatch, batch, Hatchedit, boundary and dimensioning.

5. Draw the details of the footstep bearing and also draw plan and elevation (full sectional).

6. Draw the details of connecting Rod, Crank pin, cylinder block and also draw plan and Elevation.

7. Draw all the Automobile components by using the CAD Tools.

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DME 6107 OPERATIONAL RESEARCH (ELECTIVE)

OBJECTIVE: - Students will be able to
1. Develop the essential background in Operations Research.
2. Learn to use the LPP in different fields of engineering problems.
3. Learn to use Assignment and Transportation algorithms necessary for practical problems.
4. Acquire basic skills in PERT/CPM and Queuing Theory.
5. Learn to use Sequencing Problem and Inventory Models for managing practical engineering jobs

OUTCOME: After the completion of this course, students will able to
1. Solve linear programming problems using appropriate techniques and optimization solvers, interpret the results obtained.
2. Determine optimal strategy for Minimization of Cost of shipping of products from source to Destination/ Maximization of profits of shipping products using various methods, Finding initial basic feasible and optimal solution of the Transportation problems
3. Optimize the allocation of resources to Demand points in the best possible way using various techniques and minimize the cost or time of completion of number of jobs by number of persons.
4. Formulate Network models for service and manufacturing systems, and apply operations research techniques and algorithms to solve these Network problems. Choose the appropriate queuing model for a given practical application.
5. Understand the need of inventory management and sequencing problems
    1.
Module-I:
Operation Research:
An overview, Organ and Development of OR, Nature and Features of OR, Modelling in OR, General Solution Methods for OR models, Scientific method in OR, Methodology of OR, Application, Opportunities and Shortcomings of OR.
Module-II:
Linear Programming Problem
Introduction, Mathematical Formulation of the Problem, Graphical Solution Method, Some Exceptional Cases.
General LPP, Canonical and Standard forms of LPP.
Simplex Method: Introduction, Fundamental properties of solutions, the Computational Procedure, Use of Artificial variables.
Module-III:
Assignment Problem, Transportation Problem
The transportation problem, Formulation of Transportation Problem, Initial Feasible Solution Methods, Optimality Test, Degeneracy in TP.
Assignment Problem, Balanced Assignment Problems, Hungerian Method.
Module-IV:
PERT/CPM and Queuing Theory
Network representation, Critical path (CPM) computations and PERT networks.
Queuing Models: The M/M/1/FIFO queuing systems.

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Module-V:

Sequencing Problem and Inventory Models

Sequencing Problem, Processing of n Jobs Through Two Machines and m Machines, Graphical Method of Two Jobs m Machines Problem. Deterministic Inventory Models: EOQ Model and EOQ Cost Model. Sensitivity Analysis.

Text Book

1. Kanti Swarup, P.K. Gupta, Man Mohan, "Operations Research", Sultan Chand & Sons, 2001

Reference Books

1. Hillier & Lieberman, "Operations Research", TMH
2. Sharma, J.K., "Operations Research-Theory and Applications", 4th Ed. Macmillan India, 2009.

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DME 6001 NUMERICAL TECHNIQUE (ELECTIVE)

OBJECTIVE
Students will be able to
1. Understand the importance of Error Analysis in Numerical Analysis.
2. Realize the applications of numerical methods in solving Algebraic and Transcendental Equations.
3. Learn to use Interpolation Techniques and apply it to solve Numerical Differentiation and Integration problems.
4. Solve systems of linear equations numerically.
5. Use and learn basic numerical techniques necessary for solving ODEs

Module-I:
Error and Solution of Algebraic and Transcendental Equations
Errors and Their Computations, A General Error Formula, Errors in Series Approximations.
The Bisection Method, Method of False Position, The Iteration Method, Newton-Raphson Method.

Module-II:
Finite Differences- Forward Differences, Backward Differences, Central Differences, Symbolic Relations and Separation of Symbols, Newton's Formula for Interpolation. Interpolation with

Module-III:
Numerical differentiation and Integration
Numerical Differentiation. Numerical Integration- Trapezoidal Rule, Simpson's 1/3- Rule, Simpson's 3/8- Rules, Romberg Integration, Weddle's rule.

Module-IV:
Numerical solution of linear system of equations
Direct method- Gauss elimination, Gauss-Jordan, LU decomposition methods. Iterative methods- Gauss-Jacobi & Gauss Seidel methods.

Module-V:
Numerical solution ordinary differential equations
Solution by Taylor's Series, Picard's Method, Euler's Method, Modified Euler's Method, Runge-Kutta Methods of 2nd & 4th order.

Text Book
1. Grewal and Grewal, "Numerical Methods", Khanna Publishers, 2005.

Reference Books
1. Sastry, S.S., "Introductory Methods of Numerical Analysis", PHI, 2005.

2. Vedamurthy, V.N. and Iyengar N. Ch. S.N., "Numerical Methods", Vikas Publishing House Pvt. Ltd., 2005.

3. Mollah, S.A., "Numerical Analysis and Computational Procedures". Books and Allied (P) Ltd, 2005.

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DMM 6015 HEATING VENTILATION AND AIR CONDITIONING (ELECTIVE)

OBJECTIVE
1. Estimating heating and cooling loads for low energy building in cold climates
2. Describe the design and application of suitable heating, ventilation and air conditioning system for low energy building in cold climates
3. Analyse and explain the interaction between the different technical solution with in the building and the building itself.

Module-I: Introduction
Scope, concept of air conditioning system, central air conditioning system, psychometric chart, components of AHU and its components

Module-II: Refrigerants
Refrigerants type, Evaporating and condensing, properties, refrigerant pipe sizing methods

Module-III: Cooling and Heat load Estimations
Basics of heat transfer in building, understanding of outdoor and indoor condition, sources of heat gain and heat loss condition.

Module-IV: Design of Air distribution systems
Components of air distribution system and its introduction, types of air terminal devices, TYPES of AHU,FCU,FAHU and their installation, classification of Ducts, classification and selection of Dampers restaurants and kitchen system Design, chilled water system Design.

Module-V: Ventilation and Exhaust system
Natural ventilation system, mechanical ventilation system, car park ventilation system, designing calculation of ventilation system, selection of Exhaust fans (jet fans, jet thrust)

Text Books	**Title of Books**
Arora, C.P.	Refrigeration and Air Conditioning,
Refrences Books	
Ashare Hand Books	Fundamentals, American society of Heating.
Croome, D.J and Roberts	Air conditioning and ventilation of Building