SEMESTER 3rd		Contact Hrs			Marks			Credits
Subject Code	**Subject Name**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
BMEE3- 301	Mechanics of Materials	3	1	0	40	60	100	4
BMEE3-302	Applied Thermodynamics	3	1	0	40	60	100	4
BMEE3-303	Internal Combustion Engines	3	0	0	40	60	100	3
BMEE3-304	Manufacturing Processes	3	1	0	40	60	100	4
BMEE3-305	Automotive Materials	3	0	0	40	60	100	3
BHUM0-F91	Soft Skill - I	0	0	2	60	40	100	1
BMEE3-306	Machine Drawing	1	0	4	60	40	100	3
BMEE3-307	Mechanics of Materials Lab.	0	0	2	60	40	100	1
BMEE3-308	Internal Combustion Engine Lab.	0	0	2	60	40	100	1
BMEE3-309	Manufacturing Processes Lab.	0	0	2	60	40	100	1
BMEE3-310	*Workshop Training	0	0	4	60	40	100	2
Total		**16**	**3**	**16**	**560**	**540**	**1100**	**27**

*Workshop training will be imparted in the institution at the end of 2nd semester for four-week duration (Minimum 36 hrs. per week). Industrial tour will also from the part of this training.

SEMESTER 4th		Contact Hrs			Marks			Credits
Subject Code	**Subject Name**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
BMEE3- 411	Automotive Chassis Systems	3	1	0	40	60	100	4
BMEE3- 412	Mechanics of Machines	3	1	0	40	60	100	4
BMEE3- 413	Fluid Mechanics and Machinery	3	1	0	40	60	100	4
BMEE3- 414	Automotive Electrical Systems	3	1	0	40	60	100	4
BMEE3- 415	Automotive Fuels & Emissions	3	1	0	40	60	100	4
BHUM0 – F92	Soft Skill – II	0	0	2	60	40	100	1
BMEE3- 416	Automotive Chassis Systems Lab.	0	0	2	60	40	100	1
BMEE3- 417	Fluid Mechanics and Machinery Lab	0	0	2	60	40	100	1
BMEE3- 418	Automotive Electrical Systems Lab.	0	0	2	60	40	100	1
Total		**15**	**5**	**8**	**540**	**560**	**1100**	**24**

SEMESTER 5th		Contact Hrs			Marks			Credits
Subject Code	**Subject Name**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
BMEE3- 519	Vehicle Body Engineering	3	1	0	40	60	100	4
BMEE3- 520	Automotive Transmissions	3	1	0	40	60	100	4
BMEE3- 521	Heat Transfer	3	1	0	40	60	100	4
BMEE3- 522	Design of Automotive Components	3	1	0	40	60	100	4
BMEE3- 523	Measurements and Instrumentation	3	1	0	40	60	100	4
BHUM0 –F93	Soft Skill – III	0	0	2	60	40	100	1
BMEE1- 524	Measurements and Instrumentation Lab.	0	0	2	60	40	100	1
BMEE1- 525	Automotive Transmissions Lab.	0	0	2	60	40	100	1
BMEE1- 526	Vehicle Body Engineering Lab.	0	0	2	60	40	100	1
BMEE1- 527	*Industrial Training	0	0	0	60	40	100	2
Total		**15**	**5**	**8**	**500**	**500**	**1000**	**26**

*Industrial training to be imparted at the end of 4th semester for six weeks

SEMESTER 6th		Contact Hrs			Marks			Credits
Subject Code	**Subject Name**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
BMEE3- 628	Computer Aided Automotive Design	3	1	0	40	60	100	4
BMEE3- 629	Automotive Heating, Ventilation & Air Conditioning	3	1	0	40	60	100	4
BMEE3- 630	Vehicle Dynamics	3	1	0	40	60	100	4
BMEE3- 631	Automotive Aerodynamics	3	1	0	40	60	100	4
BMEE3- 632	Vehicle Safety Engineering	3	1	0	40	60	100	4
BHUM0 – F94	Soft Skill - IV	0	0	2	60	40	100	1
BMEE3- 633	Computer Aided Automotive Design Lab.	0	0	2	60	40	100	1
BMEE3- 634	Automotive Heating, Ventilation & Air Conditioning Lab.	0	0	2	60	40	100	1
BMEE3- 635	Minor Project*	0	0	2	60	40	100	1
Department Elective – I (Select any one)		3	1	0	40	60	100	4
BMEE3-656	Servo Mechanism and Automatic Controls							
BMEE3-657	Design of Energy Systems							
BMEE3-658	Special Purpose Vehicles							
BMEE3-659	Tractor and Earth Moving Machinery							
BMEE3-660	Finite Element Analysis							
Total		**18**	**6**	**8**	**480**	**520**	**1000**	**28**

MECHANICS OF MATERIALS

Subject Code: BMEE3-301 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

UNIT-I

Simple, Compound Stresses and Strains: Stress and Strain and their types, Hook's law, longitudinal and lateral strain, Poisson's ratio, stress-strain diagram for ductile and brittle materials, Stress in a bar, Analysis of bars of varying sections, composite section, elastic constants and their significance, Temperature stress and strain calculation due to axial load and variation of temperature in single and compound bars. Two dimensional stress system, stress at a point on a plane, principal stresses and principal planes, Mohr's circle of stress.

UNIT-II

Bending Moment (B.M) and Shear Force (S.F) Diagrams: S.F and B.M definitions; relation between load, shear force and bending moment; B.M and S.F diagrams for cantilevers, simply supported beams with or without overhangs, and calculation of maximum B.M and S.F and the point of contra flexure under the following loads: a) Concentrated loads b) Uniformity distributed loads over the whole span or part of span c) Combination of concentrated and uniformly distributed load.

Bending Stresses in Beams: Pure Bending or simple bending, Neutral axis and moment of resistance, Assumptions in the simple bending theory; derivation of formula and its application to beams of rectangular and circular section. Section modulus, section modulus for circular and rectangular section beam, combined direct and bending stresses, bending stress of composite / flitched beams.

UNIT-III

Shear Stresses in Beams: Shear stress at a section, Shear stress distribution in rectangular and circular sections.

Torsion: Derivation of torsion equation, assumptions and its application to the hollow and solid circular shafts, Torsional rigidity, Power transmitted by the shaft, Modulus of rupture, comparison of solid and hollow shafts, principal stress and maximum shear stresses under combined loading of bending and torsion of circular shaft.

UNIT-IV

Columns and Struts: Introduction, failure of columns, Euler's formula and assumptions, different end conditions, Limitations of Euler's formula. Rankine-Gordon's formula. Theories of failure: Strain energy in tension, compression, shear, bending and torsion Maximum principal stress theory, maximum shear stress theory, maximum principal strain theory, total strain energy theory, shear strain energy theory. Graphical representation and derivation of equation for these theories and their application to problems related to two dimensional stress systems.

Thin Cylinders: Calculation of Hoop stress, longitudinal stress in a thin cylinder, effect of internal pressure on the change in diameter, length and internal volume.

Recommended Books

1. R.K. Bansal, 'A text Book of Strength of Materials', Laxmi Publications.
2. Kirpal Singh, 'Mechanics of Materials', Standard Publishers and Distributors.
3. D.S. Bedi, 'Strength of Materials', Khanna Book Publishing Company.
4. E.P. Popov, 'Mechanics of Materials', Prentice Hall India.
5. S.S. Rattan, 'Strength of Materials', Tata McGraw Hill.

APPLIED THERMODYNAMICS

Subject Code: BMEE3-302 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

UNIT-I

Air Compressors: Introduction; Classification; Application of compressors and use of compressed air in industry and other places; Complete representation of compression process on P-v and T-s coordinates with detailed description of areas representing total work done and polytropic work done; Areas representing energy lost in internal friction, energy carried away by cooling water and extra flow work on T-s coordinates for un-cooled and cooled compression; Definitions of isentropic, polytropic and isothermal efficiencies and their representation in terms of ratio of areas representing various energy transfers on T-s coordinates.

UNIT-II

Reciprocating Air Compressors: Single stage single acting reciprocating compressor (with and without clearance volume): construction, operation, work input and best value of index of compression, heat rejected to cooling medium, isothermal, overall thermal, isentropic, polytropic, mechanical, and clearance volumetric efficiency, overall volumetric efficiency, effect of various parameters on volumetric efficiency, free air delivery; Multistage compressors: purpose and advantages, construction and operation, work input, heat rejected in intercoolers, minimum work input, optimum pressure ratio, isothermal, overall thermal, isentropic, polytropic and mechanical efficiency.

Positive Displacement Rotary Compressors: Introduction; Classification; Comparison of rotary compressors with reciprocating compressors; Construction, operation, work input and efficiency of rotary compressors like roots blower, Lysholm compressor and Vane Type Blower.

UNIT-III

Centrifugal Compressors: Construction and operation; Applications of Steady Flow Energy Equation and thermodynamics of dynamic compressors; Stagnation and static values of pressure, Temperature and enthalpy for flow through dynamic machines; Complete thermodynamic analysis of centrifugal compressor stage; Polytropic, isentropic and isothermal efficiencies; Complete representation of compression process starting from ambient air flow through suction pipe, Impeller, Diffuser and finally to delivery pipe on T-S coordinates; Pre-guide vanes and pre-whirl; Slip factor; Power input factor; Various modes of energy transfer in impeller and diffuser; Energy transfer in backward, forward and radial vanes; Pressure coefficient as a function of slip factor; Efficiency and out-coming velocity profile from the impeller; Derivation of non-dimensional parameters for plotting compressor characteristics; Centrifugal compressor characteristic curves; Surging and choking in centrifugal compressors.

Axial Flow Compressors: Different components of axial flow compressor and their arrangement; Working; Discussion on flow passages and simple theory of aerofoil blading; Angle of attack; coefficients of lift and drag; Turbine versus compressor blades; Velocity vector; Vector diagrams; Thermodynamic analysis and power calculations; Modes of energy transfer in rotor and stator blade flow passages; Detailed discussion on work done factor, degree of reaction, blade efficiency and their derivations; Isentropic, polytropic and isothermal efficiencies; Surging, Choking and Stalling in axial flow compressors; Comparison of axial flow compressor with centrifugal compressor; Field of application of axial flow compressors.

UNIT-IV

Gas Turbines: Classification on the basis of system of operation (open and closed cycles) and on the basis of combustion (at constant volume or constant pressure); Comparison of open and closed cycles; Comparison of gas turbine with IC engine; Fields of application of gas turbines; Position of gas turbine in power industry; Thermodynamics of constant pressure gas turbine cycle (Brayton cycle); Calculation of net output, work ratio and thermal efficiency of ideal and actual cycles; Cycle air rate, temperature ratio; Effect of changes in specific heat and that of mass of fuel on power and efficiency; Multistage compression and expansion; Dual Turbine system; Series and parallel arrangements; Closed and semi-closed gas turbine cycle; Requirements of a gas turbine combustion chamber; Gas turbine fuels.

Jet Propulsion: Principle of jet propulsion; Description of different types of jet propulsion system like rockets and thermal jet engines like (i) Athodyds (ramjet and pulsejet), (ii) Turbojet engine, (iii) Turboprop engine. Thermodynamics of turbojet engine components; Types of rocket motors (e.g. solid propellant and liquid propellant systems); Various common propellant combinations (i.e. fuels) used in rocket motors; Cooling of rockets; Advantages and disadvantages of jet propulsion over propulsion systems.

Recommended Books

1. R. Yadav and Rajay, 'Applied Thermodynamics', Central Publishing House.
2. P.K. Nag, 'Basic and Applied Thermodynamics', Tata McGraw Hill.
3. D.S. Kumar and V.P. Vasandani, 'Heat Engineering', Metropolitan Book Co. Pvt. Ltd.
4. D.G. Shephered, 'Principles of Turbo machinery', Macmillan.
5. G.F.C. Rogers and M. Sarvan, 'Gas Turbine Theory', Longmans.
6. S.M. Yahya, 'Elementary Gas Dynamics', Satya Prakashan.

INTERNAL COMBUSTION ENGINES

Subject Code: BMEE3-303 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

UNIT-I

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

Constructional Details: Cylinder block, Engine cylinder, Cylinder liner, Cylinder Head and cover, Piston for C.I. and S.I. engine, Piston rings, Piston pin, connecting rod, Crank shaft, Main bearings, Cam shaft, Oil pan, Engine mountings and Engine balancing, Vibration Damper, Cam shafts & drives, Inlet and exhaust valves, Valve actuating mechanism including variable control system, Air cleaner, Manifold & gasket – intake and exhaust, silencer, tail pipe.

UNIT-II

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

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

UNIT-III

Petrol Engine Fuel Supply System: Methods of fuel supply system- gravity system, pressure system, Vacuum system, pump system, Components of fuel supply system –Fuel tank, fuel pump (Mechanical and Electrical) Vapor return line, Air cleaner, Fuel filters, Carburetion, Functions of carburetor, simple carburetor, Limitations of simple carburetor, Types of Carburetor-Solex and SU carburetor, Special features of modern carburetor. Benefits of electronic fuel injection system.

Diesel Engine Fuel Supply System: Comparison of diesel engine with petrol engine, Requirements of diesel injection system, Fuel feed pump, Types of injection system, fuel injection pump, and fuel injectors. Fuel filter, air cleaner, Phasing and calibration of fuel injection pump, Injector Testing (pressure test, leak test) Electronic control of fuel injection system

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

UNIT-IV

Engine Cooling System: Distribution of heat supplied to engine, Necessity of engine cooling, Piston and engine Cylinder temperatures, Factors affecting on piston temperature, Types of cooling system, Air cooling system, Water cooling system, Thermosiphon cooling, Cooling with thermostatic regulator. Components of water cooling System-Radiator, Pressure Cap, Expansion Reservoir, Coolants, Thermostat, Water Pump, Viscous coupling, Comparison between water cooling and air cooling. Effects of over and under cooling.

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

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

Recommended Books

1. V. Ganesan, 'Internal Combustion Engines ', Tata McGraw Hill.
2. K.K. Ramalingam, 'Internal Combustion Engines Theory and Practice', Scitech Publications, India.
3. H.N. Gupta, 'Fundamentals of Internal Combustion Engines', PHI Learning.

4. Willard W. Pulkrabek, 'Engineering Fundamentals of the Internal Combustion Engine', Pearson Prentice Hall.
5. V.M. Maleev, 'Diesel Engine Operation and Maintenance', McGraw Hill.
6. William H. Crouse, 'Automotive Engines', McGraw Hill.

MANUFACTURING PROCESSES

Subject Code: BMEE3-304 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

UNIT-I

Casting: Introduction to metal casting, types of patterns, their materials and allowances. Moulding materials: Moulding sand compositions and moulding sand properties, types of moulds, moulding machines cores, core sands, types of cores, core banking, elements of gating system, and risers. Casting processes: sand casting, shell mould casting, investment casting, permanent mould casting, full mould casting, and vacuum casting. Die casting, Centrifugal casting and continuous casting. Casting defects, their causes and remedies.

UNIT-II

Welding: Introduction and classification of welding processes, welding terminology, welding positions, filler metals. Flame cutting. Electric arc welding. Principle, equipment, types- MIG, TIG, submerged arc welding. Welding electrodes, classification and selection of electrodes, welding arc and its characteristics. Thermal effects on weldment Resistance welding- principle and their types i.e. spot, seam, projection, upset and flash thermit welding, electro slag welding, friction welding, plasma arc welding, electron beam welding. Welding defects, their causes and remedies.

UNIT-III

Metal Forming: Classification, Process Principles, Description, Applications and Products of the Following: Rolling, Drawing, Forging, Extrusion, Sheet Metal, Spinning, Deep Drawing, Bending, Press working, Plastic moulding machines and extruders.
Metal Cutting and Machine Tools: Cutting tool materials and geometry, Coolants: Classification, purpose and their effects, Introduction to broaching machine, milling machine and its classification, indexing: Simple compound and differential, Boring Operation and their machines, Jig Boring, Slotting Machine, Grinding: Cylindrical, surface and centreless grinding.

UNIT-IV

Introduction to Non Traditional Machining: Working Principle and applications of the following: Electric Discharge Machining, Laser Beam Machining, Abrasive Water Jet Machining, Abrasive Flow Machining, Electro Chemical Machining, Chemical Machining.

Recommended Books

1. R.W. Heine and P.C. Rosenthal, 'Principles of Metal Casting', McGraw Hill.
2. R.S. Parmar, 'Welding Technology', Khanna Publishers.
3. J.S. Campbell, 'Principles of Manufacturing Materials and Processes', Tata McGraw Hill.
4. T. Alton, 'Metal Forming Fundamentals and Applications', Addison-Wesley.
5. P.C. Sharma, 'Production Technology', S. Chand Publisher.

AUTOMOTIVE MATERIALS

Subject Code: BMEE3-305 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

UNIT-I

Introduction: Engineering materials, material classifications, mechanical, thermal, electrical, magnetic, chemical, optical and physical properties of materials, effects of alloying elements on properties of steel, carbon steel, low alloy steels, stainless steel, tool steels and die steels. Alloys of Ni, Al, Cu, Mg; properties and their applications. Recrystallization temperature, their effect on the properties of materials.
Ceramic Materials: Introduction, nature of ceramic materials, types, products, properties developments in ceramics.
Glass: Introduction, composition, structure, types of glass and their properties, use of glass, fracture in glass.
Rubber: Introduction, characteristics of rubbers, structure of elastomers, types of elastomers, vulcanization of rubber, uses of rubber and applications.
Plastics Materials: Introduction, definition and concept, properties of plastics, thermoplastics, thermosetting plastics, deformation of plastics, plastic alloys.

UNIT-II

Fundamentals of Composites: Need for composites – Enhancement of properties -classification of composites – Matrix-Polymer matrix composites (PMC), Metal matrix composites (MMC), Fibre reinforced composites, Applications of various types of composites.
Polymer Matrix Composites: Polymer matrix resins – Thermosetting resins, thermoplastic resins – Reinforcement fibres – various types of fibres. Fibre reinforced plastics (FRP), Glass fibre reinforced plastics (GRP).
Ceramic Matrix Composites: Engineering ceramic materials – properties – advantages – limitations – Monolithic ceramics -Need for CMC – Ceramic matrix - Various types of Ceramic Matrix composites- oxide ceramics – non oxide ceramics – aluminium oxide – silicon nitride – reinforcements – particles- fibreswhiskers. Sintering - Hot pressing – Cold isostatic pressing (CIPing) – Hot isostatic pressing (HIPing).

UNIT-III

Advances in Composites: Carbon / carbon composites – Advantages of carbon matrix – limitations of carbon matrix Carbon f ibre.
Heat Treatment and Surface Treatment: Heat treatment of steel – Annealing, Normalizing, Hardening and tempering with their types and application to automotive components.
Surface Hardening Techniques: Induction, flame and chemical hardening, coating of wear and corrosion resistance, Electroplating, Phosphating, Anodizing, hot dipping, thermal spraying, hard facing and thin film coatings.

UNIT-IV

Selection of Materials: Factors affecting the selection of materials, Cryogenic wear, corrosion, fatigue, creep and oxidation resistance application. Criteria of selecting materials for automotive components viz. cylinder block, Cylinder head, piston, piston ring, Gudgeon pin, connecting rod, crank shaft, crank case, cam, cam shaft, engine valve, gear wheel, clutch plate, axle, bearings, chassis, spring, body panel - radiator, brake lining etc. Materials for heavy duty vehicles: special alloys, plastics, seat fabrics and materials for bumpers.

Recommended Books

1. O.P. Khanna, 'Material Science and Metallurgy', Dhanpat Rai and Sons.
2. B.K. Agarwal, 'Introduction to Engineering Materials', Tata McGraw Hill.
3. Rakesh Dogra, 'Advances in Material Science', Katson Books.
4. F.L. Mathews and R.D. Rawlings, 'Composite Materials', 1st Edn., Chapman and Hall, London, England, **1994**.
5. K.K. Chawla, 'Composite Materials', Springer – Verlag, **1987**.
6. A.B. Strong, 'Fundamentals of Composite Manufacturing', SME, **1989**.
7. S.C. Sharma, 'Composite Materials', Narosa Publications, **2000**.

SOFT SKILLS-I

Subject Code: **BHUM0-F91** **L T P C** **Duration: 26 Hrs.**
0 0 2 1

Course Objectives

The course aims to cause a basic awareness about the significance of soft skills in professional and interpersonal communications and facilitate an all-round development of personality.

Course Outcomes

At the end of the course, the student will be able to develop his/her personal traits and expose their personality effectively.

UNIT-1

SOFT SKILLS- Introduction to Soft Skills, Aspects of Soft Skills, Identifying your Soft Skills, Negotiation skills, Importance of Soft Skills, Concept of effective communication.
SELF-DISCOVERY- Self-Assessment, Process, Identifying strengths and limitations, SWOT Analysis Grid.

UNIT-2

FORMING VALUES- Values and Attitudes, Importance of Values, Self-Discipline, Personal Values - Cultural Values-Social Values-some examples, Recognition of one's own limits and deficiencies.

UNIT-3

ART OF LISTENING- Proxemics, Haptics: The Language of Touch, Meta Communication, Listening Skills, Types of Listening, Listening tips.

UNIT-4

ETIQUETTE AND MANNERS- ETIQUETTE- Introduction, Modern Etiquette, Benefits of Etiquette, Taboo topics, Do's and Don'ts for Men and Women. MANNERS- Introduction, Importance of manners at various occasions, Professional manners, Mobile manners. CORPORATE GROOMING TIPS- Dressing for Office: Do's and Don'ts for Men and Women, Annoying Office Habits.

Recommended Books

1. K. Alex, S. Chand Publishers.
2. Butterfield, Jeff, 'Soft Skills for Everyone', Cengage Course, New Delhi, **2010**.
3. G.S. Chauhan and Sangeeta Sharma, 'Soft Skills', Wiley, New Delhi, **2016**.
4. Klaus, Peggy, Jane Rohman & Molly Hamaker, 'The Hard Truth About Soft Skills', Harper Collins E-books, London, **2007**.
5. S.J. Petes, Francis, 'Soft Skills and Professional Communication', Tata McGraw Hill Education, New Delhi, **2011**.

MACHINE DRAWING

Subject Code: BMEE3-306 **L T P C**
1 0 4 3

Principles of Drawing: Requirements of production drawing, sectioning and conventional representation, dimensioning, symbols of standard tolerances, machining symbols, Introduction and familiarization of the code IS: 296.
Fasteners: Various types of screw threads, types of nuts and bolts, screwed fasteners, welding joints and riveted joints.
Assembly and Disassembly of the following manually and using computer aided drafting:
a) **Couplings:** Solid or rigid Coupling, protected type flange coupling, Pin type flexible coupling, muff coupling, Oldham, universal coupling, claw coupling, cone friction clutch, free hand sketch of single plate friction clutch.
b) **Knuckle and Cotter Joints.**
c) **Pipe and Pipe Fittings:** Flanged joints, spigot a socket joint, union joint, hydraulic an expansion joint.
d) **IC Engine Parts:** Piston, connecting rod.
e) **Boiler Mountings:** Steam stop valve, feed check valve, safety valve, blow off cock.
f) **Bearings:** Swivel bearing, thrust bearing, Plummer and angular plumber block.
g) **Miscellaneous:** Screw Jack, Drill Press Vice, Crane hook. Drafting of simple mechanical components on computer.
NOTE: Drawing Practice is to be done as per IS: 296 code. First angle projection to be used. Drawings should contain bill of materials and should illustrate finish. The syllabus given above indicates the broad outlines and the scope of the subject to be covered. It is not necessary to cover all the drawing exercises of the types of machine tools mentioned above.

Recommended Books
1. Ajit Singh, 'Machine Drawing', Tata McGraw Hill.
2. N.D. Bhatt, 'Machine Drawing', Charotar Publications.
3. N. Sidheshwar, 'Machine Drawing', Tata McGraw Hill.
4. P.S. Gill, 'Machine Drawing', B.D. Kataria and Sons.
5. V. Lakshmi Narayanan and Mathur, 'Text-Book of Machine Drawing', Jain Brothers.
6. R.K. Dhawan, 'Machine Drawing', S. Chand.

MECHANICS OF MATERIALS LAB.

Subject Code: BMEE3-307 **L T P C**
0 0 2 1

EXPERIMENTS

1. To perform tensile test in ductile and brittle materials and to draw stress-strain curve and to determine various mechanical properties.
2. To perform compression test on C.I. and to determine ultimate compressive strength.
3. To perform shear test on different materials and determine ultimate shear strength.
4. To perform any one hardness test (Rockwell, Brinell & Vicker's test) and determine hardness of materials.
5. To perform impact test to determine impact strength.

6. To perform torsion test and to determine various mechanical properties.
7. Study of performance of Fatigue & Creep tests.
8. To perform bending test on beam (wooden or any other material) and to determine the Young's modulus and Modulus of rupture.
9. To perform Torsion test on helical springs in tension and compression and to determine modulus of rigidity/stiffness.

INTERNAL COMBUSTION ENGINES LAB.

Subject Code: BMEE3-308 **L T P C**
0 0 2 1

EXPERIMENTS

1. Study of layout of different components in an IC Engine.
2. Study and draw a valve timing diagram for a 4-stroke multi cylinder engine.
3. Study of valve actuating mechanisms of a multi cylinder engine.
4. Study of different carburetors in Indian make of vehicles.
5. Study of different fuel injection system in Indian make of vehicles.
6. Trouble shooting in an IC engine.
7. Morse test on petrol and diesel engines.
8. Heat balance test on an automotive engine.
9. Performance study of IC engine at full throttle and part throttle conditions with alternative fuels and their comparisons.
10. Exhaust emission analysis of an SI and CI engine.
11. Study of emission control systems on a vehicle.

MANUFACTURING PROCESSES LAB.

Subject Code: BMEE3-309 **L T P C**
0 0 2 1

EXPERIMENTS

Welding Practicals:

1. Study of Arc welding equipment and making a weld joint by this process.
2. Study of MIG welding equipment and making a weld joint by this process.
3. Study of Spot welding and preparing a weld joint by this process.

Machining Practicals:

1. Study of constructional features of following machines through drawings/ sketches and an exercise based on them:
   a) Universal milling machine.
   b) Grinding machines (Surface, cylindrical)
   c) c) Hydraulic Press.

Industrial Visit to demonstration of Machines.

AUTOMOTIVE CHASSIS SYSTEMS

Subject Code: BMEE3-411 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

UNIT-I

Introduction: Types of chassis layout with reference to power plant locations and drive, Vehicle frames. Load acting on vehicle frame due to different systems.

Front Axle & Steering System: Types of front axles, Constructional details, materials. Front wheel geometry viz. Castor, Camber, King pin inclination, Toe. Wheel Alignment. Steering geometry. Ackerman and Davis steering system. Different types of steering gear boxes. Steering linkages and their layouts. Power and power assisted steering. Steering of crawler tractors. Multi axle steering systems.

UNIT-II

Driveline and Differential: Effects of driving thrust and torque reactions. Hotch kiss drive, torque tube drive and radius rods. Transverse rods. Propeller shaft, Universal joints. Constant velocity universal joints. Drive Shaft. Front wheel drive. Different types of final drives. Spiral bevel gear and hypoid gear final drives. Double reduction and twin speed final drives. Differential principles. Constructional details of a differential gear unit. Non-slip and Limited slip differential. Differential locks - Differential housings. Comparison of front wheel, rear wheel and all-wheel drive arrangement.

Drive Axles: Construction of rear axles. Types of loads acting on rear axles. Fully floating, three quarter floating and semi floating rear axles. Rear axle housing. Construction of different types of axle housing, multi axled vehicles. Construction details of multi drive axle vehicles. Dead axles.

UNIT-III

Suspension System: Need of suspension system, Types of suspension, Suspension springs, Constructional details and characteristics of leaf, coil and torsion bar springs, Independent suspension, Types: Mc Pherson strut, Double wishbone, Five link type, etc, Rubber suspension, Pneumatic suspension, Shock absorbers.

Wheels and Tires: Types of wheels – wire spoke, disc – solid and split type, alloy type, offset, onset & zero set, denomination of rim. Tires, materials, construction, structure, denomination and function of tires, types of tires, comparison of radial and bias ply tires. Tubes – construction and types, Tubeless tires. Tire inflation, effects of tire pressure on tire performance. Tire wears patterns and their causes. Rolling Resistance and self-aligning torque, Wheel Balancing – need, procedure. All-season tires, tire quality grading, changing tire sizes. Run flat tires (RFT), new heat resistant tires for better mileage, fuel efficient handling and safety.

UNIT-IV

Braking System: Weight transfer during braking and stopping distances. Classification of brakes - drum brakes and disc brakes. Constructional details. Theory of braking, Brake split and proportioning. Mechanical, hydraulic and pneumatic brakes - Servo brake, power and power-assisted brakes -Different types of brake retarders like eddy current and hydraulic retarder. Skidding of wheels on braking and remedies, Anti-lock braking systems: types, system components, operations, fluids. Power Brakes and Parking Brakes, Additive, self-energizing brakes, regenerative and emergency braking system.

Recommended Books

1. Reimpell and Betzler, 'The Automotive Chassis: Engineering Principles', 2nd Edn., Butterworth Heinemann, London.
2. Giancarlo Genta, 'The Automotive Chassis', vol. I and II, Springer.
3. Heinz Heisler, 'Advanced Vehicle Technology', 2nd Edn., Butterworth Heinemann, London.
4. T. Gilles, 'Automotive Chassis Brakes Steering and Suspension', Thomson USA.
5. Newton Steeds and Garrot, 'Motor Vehicles', Butterworths, London.
6. A.W. Judge, 'Mechanism of the Car', Chapman and Halls Ltd., London.

MECHANICS OF MACHINES

Subject Code: BMEE3-412 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

UNIT-I

Basic Concept of Machines: Link mechanism kinematic pair and chain, principles of inversion, inversion of a four bar chain, slider-crank-chain, double slider-crank chain and their inversions, kinematic pairs. Determination of forces and couples for a crank, inertia of reciprocating parts, dynamically equivalent system, analytical and graphical method, inertia force analysis of basic engine mechanism torque required to overcome inertia and gravitational force of a four bar linkage.

UNIT-II

Belts, Ropes and Chains: Material, types of drives, idle pulley, intermediate or counter shaft pulley, angle and right angle drive, quarter turn drive, velocity ratio, crowning shaft pulley, loose and fast pulley, stepped or cone pulleys, ratio of tension on tight and slack sided of belts, HP transmitted by belts including consideration of creep and slip, centrifugal tensions and its effect on HP transmitted. Use of gravity, idle, flat, V-belts and rope materials. Length of belt, rope and chain drives, type and cone type.

UNIT-III

Cams: Types of cams and follower, definitions of terms connected with cams, displacement velocity and acceleration diagrams for cam followers. Analytical and Graphical design of cam profiles with various motions (SHM, uniform acceleration and retardation).

Flywheels: Turning moment and crank effort diagrams for reciprocating machines Fluctuations of speed, coefficient of fluctuation of speed and energy, Determination of flywheel mass and dimensions for engines and Punching Machines.

UNIT-IV

Governors: Function, types and characteristics of governors, Watt, Porter and Proell governor. Hartnell and Willson Hartnell, spring loaded governors, Simple numerical problems on these governors. Sensitivity, stability, isochronisms and hunting of governors, Governor Effort and power controlling force curve, effect of sleeve friction.

Balancing: Classifications, need for balancing, balancing of single and multiple rotating masses, static and dynamic balancing, primary and secondary balancing for reciprocating masses, partial balancing of locomotives, swaying couple, hammer blow, variation in tractive effort, balancing of V-engine, concept of direct and reverse crank, balancing of machines, rotors, reversible rotors.

Recommended Books

1. Jagdish Lal, 'Theory of Mechanisms and Machines', Metropolitan Book Co. Pvt. Ltd. New Delhi.

2. S.S. Rattan, 'Theory of Machines', Tata McGraw Hill, New Delhi.
3. Thomas Beven, 'Theory of Machines', Longman's Green & Co., London.
4. W.G. Green, 'Theory of Machines', Blackie and Sons, London.
5. I.E. Shigley and J.R. Uicker, 'Theory of Machines', McGraw Hill, New York.

FLUID MECHANICS AND MACHINERY

Subject Code: BMEE3-413 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

UNIT-I

Fluid and their Properties: Concept of fluid, difference between solids, liquids and gases; ideal and real fluids; capillarity, vapors pressure, compressibility and bulk modulus; Newtonian and non- Newtonian fluids.

Fluid Statics: Concept of pressure, Pascal's law and its engineering applications, Hydrostatic paradox. Action of fluid pressure on a plane (horizontal, vertical and inclined) submerged surface, resultant force and center of pressure, force on a curved surface due to hydrostatic pressure. Buoyancy and flotation, stability of floating and submerged bodies, metacentric height and its determination.

UNIT-II

Fluid Kinematics: Classification of fluid flows, velocity and acceleration of fluid particle, local and convective acceleration, normal and tangential acceleration, streamline, path line and streak line, flow rate and discharge mean velocity, continuity equation in Cartesian and cylindrical, polar coordinates. Rotational flows, rotation velocity and circulation, stream and velocity potential functions, flow net.

Fluid Dynamics: Euler's equation, Bernoulli's equation and steady flow energy equation; representation of energy changes in fluid system, impulse momentum equation, kinetic energy and momentum correction factors, flow along a curved streamline.

UNIT-III

Dimensional Analysis and Similitude: Fundamental and derived units and dimensions, dimensional homogeneity. Rayleigh's and Buckingham's Pi method for dimensional analysis. Dimensionless numbers and their significance, geometric, kinematic and dynamic similarity, model studies.

Introduction to Laminar and Turbulent Flows: Flow in circular cross- section pipes. Turbulent flows and flow losses in pipes, Darcy equation, minor head losses in pipes and pipe fittings, hydraulic and energy gradient lines.

UNIT-IV

Fluid Flow Measurements: Manometers, pitot tubes, ventui meter and orifice meters, orifice, mouthpieces, notches and weirs, rotameter.

Fluid Machinery: Basic components of a turbo machine and its classification on the basis of purpose, fluid dynamic action, operating principle, geometrical features, path followed by the fluid. Classification, Principle of operation of centrifugal and axial pumps, Construction, operation and utility of simple accumulator, intensifier, gear, vane and piston pumps.

Recommended Books

1. D.S. Kumar, 'Fluid Mechanics and Fluid Power Engineering', Kataria and Sons Publishers.
2. B.S. Massey, 'Mechanics of Fluids', Van Nostrand Reinhold Co.
3. J.F. Douglas, 'Fluid Mechanics', Pitman.

4. V.L. Streetes and E.B. Wylie, 'Fluid Mechanics', McGraw Hill Book Co.
5. Jagdish Lal, 'Hydraulic Machines', Metropolitan Book Co Pvt. Ltd.

AUTOMOTIVE ELECTRICAL SYSTEMS

Subject Code: BMEE3-414 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

UNIT-I

Introduction: Earth returns and insulated return systems, 6, 12, and 24-volt systems. Positive & negative earth systems, fusing of circuits, relays, switches, low and high voltage automotive cables, wiring diagram for typical automotive wiring systems, maintenance and servicing.
Batteries: Principles of lead acid cells and their characteristics - construction and working of lead acid battery, types of batteries, testing of batteries, effect of temperature on: capacity and voltage, battery capacity, voltage, efficiency, charging of batteries, sulphation and desulphation, maintenance and servicing, Battery failures & checking, Maintenance free Batteries, High energy and power density batteries for electric vehicles.

UNIT-II

Charging System: Principle of generation of direct current. Shunt generator characteristics. Armature reaction. Third brush regulation. Cut-out. Voltage & current regulators, compensated voltage regulator. Alternators - principle, constructional and working aspects, bridge rectifiers. Principle of Magneto, Flywheel Magneto, Maintenance and servicing. Trouble shooting in charging systems.
Starting System: Condition at Starting – starting torque and power requirements, behavior of starter during starting. Series motor and its characteristics. Principle & construction of starter motor. Working of different starter drive units, care & maintenance of starter motor. Starter switches. Safety mechanism. Maintenance, servicing and trouble shooting.

UNIT-III

Ignition System: Types, construction & working of battery & coil and magneto ignition systems. Relative merits, Ballast Resistor, Ignition coil, Distributor, Contact breaker Point, centrifugal and vacuum advance mechanisms, Limitations of conventional ignition systems, Transistorized Ignition systems, Spark plugs - construction, different types, plug fouling, maintenance, servicing and fault diagnosis, Electronic Ignition system. Programmed ignition, distributor less ignition.
Lighting System: Principle of automobile illumination, headlamp construction and wiring, reflectors – types, signaling devices flashers, stop lights, fog lamps, auxiliary lighting-engine, passenger, reading lamp. Regn-plate lamps. Automatic illumination system. Head light levelling devices. Study of a modern headlight system with improved night vision.
Electrical Equipment and Accessories: Oil pressure gauge, fuel level gauge, engine temperature gauge, electrical fuel pump, speedometer, odometer, trip meter, engine rpm meter, Headlamp & Windshield washer and wiper, heaters and defrosters, horns, stereo/radio, power antennae. Central locking, power window winding. Sun/Moon Roof. Motorized rear view mirrors, reverse warning, Bumper collision warning. Other accessories in modern vehicles.

UNIT-IV

Fuel Cells: Thermodynamic aspects; types-hydrogen and methanol, power rating and performance. Various components and working of fuel cell, Heat dissipation.

Drive Motors and Controllers: Drive arrangements in Hybrid and Electric vehicles. Drive motors: types and construction. Controlling of motor operations. Motor-generator in hybrid vehicles and its controls.

Recommended Books

1. P.L. Kohli, 'Automotive Electrical Equipment', Tata McGraw Hill.
2. Chapman, 'Principles of Electricity and Electronics for the Automotive Technician', Thomson Asia, **2000**.
3. A.W. Judge, 'Modern Electrical Equipment of Automobiles', Chapman & Hall, London.
4. G.W. Vinal, 'Storage Batteries', John Wiley & Sons Inc.
5. W.H. Crouse, 'Automobile Electrical Equipment', McGraw Hill Book Co. Inc.
6. F.G. Spreadbury, 'Electrical Ignition Equipment', Constable & Co Ltd.

AUTOMOTIVE FUELS & EMISSIONS

Subject Code: BMEE3-415 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

UNIT-I

Introduction to Fuels: Classification of automotive fuels and drivetrains, Scenario of conventional auto fuels, Oil reserves of the world fuel quality aspects related to emissions, technological up gradations required, Need for alternate fuel, business driving factors for alternative fuels, roadmap for alternative fuels, alternate fuel development worldwide. Automotive Fuels: Properties, production, storage, handling, performance and safety aspects, advantages and disadvantages, Emissions, Engine modifications of the following o Gaseous Automotive Fuels: Hydrogen, compressed natural gas, Liquefied petroleum gas: o Bio –Fuels o Biogas, Biodiesel: o Alcohols o Methanol, Ethanol, DEE, DME: o Synthetic alternate Fuels o Wood Gas, Tire Pyrolysis Oil: o Reformulated Conventional Fuels o Emulsified Fuels:

UNIT-II

Future Alternative Fuels: Ammonia: properties, ammonia in nature, hazards, carrier for hydrogen, storage, stationary engine application, ammonia for fuel cell vehicles. Boron: properties, overview of the boron – water process, features, analysis. Water: Japanese water car, water fuel cell, hydrogen boosters, water to gas technology.

UNIT-III

Introduction to Emission: Pollutants, sources, formation of HC and CO in SI engines, NO formation in SI and CI engines, Particulate emission from SI and CI engines, Smoke Emission in CI engines. Effect of operating variables on Emission formation, Transient operational effects on pollution SI Engine & CI Engines Combustion and Pollutant Formation Basic Chemistry combustion - HC and CO formation in 4-stoke and 2-stroke SI engines - NO formation, - Particulate emissions, - Effects of operating variables on emission formation. Smoke emissions, Color and aldehyde emissions. Photochemical smog, Sulphur, Phosphorus emissions.

UNIT-IV

Post Combustion Treatment: Introduction, physical conditions and exhaust gas compositions before treatment, catalytic mechanism. Thermal reactions, installation of catalyst in exhaust lines, NOx treatment in diesel engines. Diesel trap oxidizers Control Techniques Engine Emission Reduction Design changes - Optimization of operating factors - Exhaust gas recirculation - Fumigation - Air injection PCV system - Exhaust treatment in SI engines - Thermal reactors - Catalytic converters - Catalysts - Use of unleaded petrol. Test Procedure &

Instrumentation for Emission Measurement Test procedures, NDIR analyzer, thermal conductivity and flame ionization detectors, Chemiluminescent analyzer, analyzers for NOx, Gas chromatograph - Orsat apparatus -Smoke meters, spot sampling and continuous indication types like Bosch, Hart ridge.

Recommended Books

1. S.S. Thipse, 'Alternative Fuels', Jaico Publications.
2. B.P. Pundir, 'Engine Emissions: Pollutant Formation and Advances in Control Technology', Narosa Publications.
3. E.F. Oberts, 'Internal Combustion Engine and Air Pollution', Harper and Row Publisher.
4. H.H. Willard, 'Instrumental Method of Analysis', CBS Publishers and Distributors.
5. J.B. Heywood, 'Internal Combustion Engine Fundamentals', McGraw Hill.
6. 'Motor Vehicles Act / Emission Norms', Govt of India Publications.

AUTOMOTIVE CHASSIS SYSTEMS LAB.

Subject Code: BMEE3-416 **L T P C**
0 0 2 1

EXPERIMENTS

1. Study of layout of a chassis and its different components, of a vehicle.
2. Trouble shooting in different types of steering systems - mechanical and power and various steering linkages.
3. Measurement of steering geometry angles – Wheel Alignment.
4. Study of impact of steering geometry angles on vehicle.
5. Study of different types of wheels (rims) and tires and their defects.
6. Conducting Wheel balancing of a given wheel assy.
7. Trouble shooting in Propeller Shafts and Drive shafts including constant velocity joints.
8. Trouble shooting in different types of dead axles (front or rear).
9. Trouble shooting in different types of live axles and Differential systems.
10. Trouble shooting in suspensions of following types:
    a) Leaf Spring
    b) Double Wishbone with Torsion Bar or Coil Spring
    c) McPherson Strut Type
    d) Five Bar Link type
    e) Air Suspension system
    f) A shock absorber (damper).

Trouble shooting in braking system in master and wheel cylinder, drum and disc brakes, overhauling and adjusting of system and its testing on brake tester.

FLUID MECHANICS AND MACHINERY LAB.

Subject Code: BMEE3-417 **L T P C**
0 0 2 1

EXPERIMENTS

1. To study the flow through a variable area duct and verify Bernoulli's energy equation.
2. To determine the coefficient of discharge for an obstruction flow meter (venturi meter/ orifice meter).

3. To study the transition from laminar to turbulent flow and to ascertain the lower critical Reynolds number.
4. To determine the hydraulic coefficients for flow through an orifice.
5. To determine the friction coefficients for pipes of different diameters.
6. To determine the head loss in a pipe line due to sudden expansion/ sudden contraction/ bend.
7. To determine the velocity distribution for pipeline flow with a pitot static probe.
8. To study the constructional features of reciprocating pump and to perform test on it for determination of pump performance.
9. To draw the various characteristics of Centrifugal pump.

AUTOMOTIVE ELECTRICAL SYSTEMS LAB.

Subject Code: BMEE3-418 **L T P C**
0 0 2 1

EXPERIMENTS

1. To understand the layout of complete wiring system of an automobile.
2. Perform the various tests for checking the battery condition.
3. To understand and test the charging circuit and charging motor.
4. To conduct performance test on a dynamo, alternator & starter motor.
5. To understand & test the starting circuit and trouble shooting in it.
6. Understand and test the conventional ignition system, setting of contact breaker points and spark plug gap.
7. Understand the working and testing of an Electronic Ignition system.
8. Understand and test the lighting circuit of a car.
9. Conduct headlamp focusing as per the procedure.
10. Study the working of different accessories of a modern car.
11. To study the layout / working of a Fuel Cell powered electric car.

VEHICLE BODY ENGINEERING

Subject Code: BMEE3-519 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

UNIT-I

Introduction: Classification of automobiles on different basis, Types of vehicle bodies, requirements of automobile body, constructional details.

Car Body Details: Types: Saloon, hatchback, convertibles, Limousine, Estate Van, racing and sports car, etc. Car body construction types – frame and unitary (monocoque), various body panels and their constructional details.

UNIT-II

Bus Body Details: Types: Mini bus, single and double Decker, split level and articulated bus, Bus body lay out, Floor height, Engine location, Entrance and exit location, Seating dimensions, Constructional details: Frame construction, Double skin construction, Types of metal section used, Regulations, Conventional and integral type construction.

Commercial Vehicle Details: Types of commercial vehicles. Commercial vehicle body details, flat platform, drop side, fixed side, tipper body, tanker body, tractor trailer.

UNIT-III

Body Loads: Idealized structure, structural surface, shear panel method, symmetric and asymmetric vertical loads in a car, longitudinal load, and different loading situations.

Body Materials, Trim and Mechanisms: Carbon fibers, plastics, timber, GRP; ferrous and non-ferrous materials used in vehicle. Corrosion and anticorrosion method. Paint and painting process, Corrosion, Anticorrosion methods, Body trim items, Body mechanisms.

UNIT-IV

Special Purpose Vehicle Details: Various types, Needs and constructional details - Fire station vehicle, tankers, pumping vehicles, ladder vehicle, Concrete mixer transport vehicles; Ambulance, Towing vehicle, Road trains, Off road vehicles, cement trucks.

Safety in Vehicle Design: Basics of impacts protection, design for crashworthiness, front impact and side impact analysis, bumper system, energy absorbent forms. Indian Motor acts and its application- The motors vehicle acts 1988, Driving license, Registration of vehicles, Rules of the road, Motor Insurance.

Recommended Books

1. J. Powloski, 'Vehicle Body Engineering', Business Books Ltd., London.
2. Kirpal Singh, 'Automobile Engineering', Vol-1., Standard Publishers Distributor's.
3. J.B. Braithwaite, 'Vehicle Body Building and Drawing', Heinemann Educational Books Ltd., London.
4. Sydney F. Page, 'Body Engineering', Chapman & Hill Ltd., London.
5. John Fenton, 'Handbook of Automotive Body and Systems Design', Wiley.
6. Heinz Hezler, 'Advance Vehicle Technology'.

AUTOMOTIVE TRANSMISSIONS

Subject Code: BMEE3-520 **L T P C** **3 1 0 4** **Duration: 45 Hrs.**

UNIT-I

Introduction: Need for Transmission system, Tractive effort and resistances to Motion of a Vehicle, Requirements of transmission system, Classification of Transmission systems, Different Wheel drive systems (Single, Two and Four), Drives (Belt, Chain, Shaft, Hydraulic and Electric drives), Multi-axle drives, Location of transmission system, Different Transmissions units in scooter, car, MUVs and different transport vehicles of Indian make.

UNIT-II

Clutch: Principle of operation, Constructional details, torque capacity and design aspects of different types of clutches, Operation of single plate: helical spring and diaphragm type, and multi-plate clutch, Centrifugal and Automatic Clutches, Dry and Wet type of clutch, Friction lining materials, Over-running clutches, Modes of Operating clutch – mechanical, hydraulic and electric, Dual Clutch transmission.

Gear Box: Determination of gear ratios for vehicles, Different types of gearboxes – sliding, constant and synchromesh type, need for double declutching and working of synchronizing unit, Power and economy modes in gearbox, transfer box, Transaxles, Overdrives, Gear shifting mechanisms – mechanical link and wire types, Paddle shift.

UNIT-III

Hydrodynamic Drive: Fluid coupling- principle of operation, constructional details, Torque capacity, Performance characteristics, Reduction of drag torque, Torque converter, converter coupling- Principle of operation, constructional details & performance characteristics.

Hydrostatic Drive: Hydrostatic drive, various types of hydrostatic systems, Principles of hydrostatic drive system, Advantages and limitations, Comparison of hydrostatic drive with hydrodynamic drive, Construction and working of typical Janny hydrostatic drive.

UNIT-IV

Electric Drive: Electric drive, Principle of early and modified Ward Leonard Control system, Advantage & limitations, Performance characteristics.

Automatic Transmission & Applications: Block diagrams of- Chevrolet "Turbo-glide" Transmission, Power-glide Transmission & Clutch Hydraulic Actuation system, Introduction to Toyota "ECT-i" Automatic Transmission with Intelligent Electronic controls system.

Recommended Books

1. Kirpal Singh, 'Automobile Engineering', Vol-1., Standard Publishers Distributor's.
2. S. Jaiganesh, 'Automotive Transmissions', (moallemy.persiangig.com/.../AUTOMOTIVE TRANSMISSION.pdf).
3. Newton and Steeds, 'Motor vehicles', llliffe Publishers.
4. A.W. Judge, 'Modern Transmission Systems', Chapman and Hall Ltd.
5. W.H. Crouse, D.L. Anglin, 'Automotive Transmission and Power Trains Construction', McGraw Hill.

HEAT TRANSFER

Subject Code: BMEE3-521 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

UNIT-I

Introduction: Concept of heat transfer, Difference between the subject of "Heat Transfer" and its parent subject "Thermodynamics", Different modes of heat transfer - conduction, convection, radiation and Combine mode, Basic laws of conduction, convection & radiation, Effect of temperature and pressure on thermal conductivity of solids, liquids and gases and its measurement, Thermal diffusivity and its significance, Newtonian heating and cooling of solids.

UNIT-II

Conduction: Fourier's law of heat conduction, Three-dimensional general conduction equation in rectangular, cylindrical and spherical coordinates involving internal heat generation and unsteady state conditions. Derivation of equations for simple one dimensional steady state heat conduction from three dimensional equations for heat conduction though walls, cylinders and spherical shells (simple and composite), critical thickness of insulation layers on pipes carrying hot fluids. Internal generation cases along with some practical cases of heat conduction. Influence of variable thermal conductivity on conduction through simple cases of walls / cylinders and spheres.

UNIT-III

Theory of Fins: Fins, Types of Fins, Straight rod type of fins of uniform cross-section e.g. circular, rectangular or any other cross-section. Heat dissipation from an infinitely long fin, heat dissipation from a fin insulated at tip and loosing at tip. Optimum design of straight find of

rectangular and triangular profile cross-sections; fin effectiveness and fin efficiency for straight rod fins of rectangular and circular cross-section.

Heat Exchanger: Function of heat Exchanger, Classification, types and applications of heat Exchangers, elements of heat exchanger and Overall coefficient of heat transfer, Different design criterion for heat exchangers, Log mean temperature difference for evaporator and condenser tubes, Parallel and counter flow heat exchangers, NTU, Calculation of number and length of tubes in a heat exchanger.

UNIT-IV

Radiation: Process of heat flow in radiation, Definition of Emissivity, Absorptivity, reflectivity and transmissivity, Concept of black and grey bodies, Kirchoff's law and Stefan Boltzmann's law.

Convection Process and Properties: Free and forced convection, laminar and turbulent flow, Newton Rikhman Law, Nusselt Number, significance of dimensionless numbers.

Heat Transfer in IC Engines: Heat transfer and Engine energy balance, Temperature distribution and thermal stresses in piston, cylinder linear, cylinder head, and valves.

Recommended Books

1. D.S. Kumar, 'Fundamentals of Heat and Mass Transfer', S.K. Kataria and Sons.
2. S. Domkundwar, 'A Course in Heat and Mass Transfer', Dhanpat Rai and Sons.
3. J.P. Holmans, 'Heat Transfer', Tata McGraw Hill Publishing Company Ltd.
4. Vijay Gupta, 'Elements of Heat and Mass Transfer', New Age International Ltd.
5. J. Heywood, 'Fundamental of I.C. Engine', Tata McGraw Hill.
6. V. Ganesan, 'Internal Combustion Engines', Tata McGraw Hill.

DESIGN OF AUTOMOTIVE COMPONENTS

Subject Code: BMEE3-522 **L T P C** **3 1 0 4** **Duration: 45 Hrs.**

UNIT-I

Meaning of Design: Definition and understanding of various types of design, Elaborated Design process.

Design and Creativity: Systematic design conceptualization, product design definition & manufacturing considerations in design, underlying principles of design in Aesthetics and ergonomics, free body diagram for components design.

UNIT-II

General Design Considerations: Theory of Failure, Selection of materials, Basic criteria of selection of material for automotive parts like piston, cylinder, connecting rod, crankshaft and camshaft, mechanical properties of those materials in brief. Study of Stress concentration, factor of safety under different loading conditions,

UNIT-III

Design Against Static Loading: Bolted Joints- Understanding the various stresses/ failure in bolted joints, basic and eccentrically loaded bolts, Welded Joints- Design for various loading conditions in torsion, shear or direct loads.

Design Against Fluctuating Loading: Design of automobile coupling & Springs, Flywheel, Braking Systems, self-energizing brakes, shoe brakes - internal & external expanding, band brakes and disc brakes.

UNIT-IV

Transmission: Clutch-Design considerations for single plate clutch, centrifugal clutch, cone clutch, energy dissipated, torque transmission capacity of clutch. Gears - Design of spur, helical and straight bevel gears, Final Drive- Design consideration for different types of propeller shafts & rear axles. Bearing - Basics of bearings, their types, nomenclature and Selection criteria.

Recommended Books

1. Kirpal Singh, 'Automobile Engineering', Vol-1', Standard Publishers Distributor's.
2. N.K. Giri, 'Automotive Mechanics', Khanna Publisher.
3. R.C. Juvenal, 'Fundamental of Machine Component Design', John Wiley.
4. 'PSG Design Data', PSG College of Technology.
5. J.A. Charles, 'Selection & Use of Engineering Materials', Butterworth – Heinemann.
6. V.B. Bhandari, 'Design of Machine Elements', McGraw Hill, ED.
7. Joseph Edward, 'Mechanical Engg. Design', Shigley.

MEASUREMENTS AND INSTRUMENTATION

Subject Code: BMEE3-523 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

UNIT-I

Basic Statistical Concepts: Types of Measured Quantities (Discrete and Continuous), Central Tendency of Data, Mode, Median, Arithmetic Mean, Range, Deviation, Variance, Standard Deviation.

Instruments and their Representation: Introduction, Typical Applications of Instrument Systems, Functional Elements of a Measurement System, Classification of Instruments, Standards and Calibration Static and Dynamic Characteristics of Instruments: Range and span, accuracy and precision, calibration, hysteresis and dead zone, sensitivity and linearity, threshold and resolution; speed of response, lag, fidelity and dynamic error, dead time and dead zone. Zero, ramp and sinusoidal input signals.

UNIT-II

Errors in Measurement: Sources of errors, systematic and random errors; statistical analysis of test-data, probable error and probability tables, ejection of test data; curve fitting, error propagation; Design and planning of experiments and report writing.

Sensors and Transducers: Introduction, Analog and Digital Transducers, Electromechanical; Potentiometric, Inductive and reluctance type, Electromagnetic, Electrodynamics, Eddy Current, Magnetostrictive, Variable Inductance, Linearly Variable Differential Transformer, Variable Capacitance, Piezo-Electric Transducer and Associated Circuits, Unbonded and Bonded Resistance Strain Gages. Strain Gage Bridge circuits, Temperature Compensation, Balancing and Calibration, Opto-Electrical Transducers, Photo Conductive Transducers, Photovoltaic Transducers, Digital Transducers, Frequency domain transducer, Vibrating string transducer, Data, Acquisition Systems, Data processing, Data Display and Storage, Modern Automotive Instrumentation, Study of automotive sensors and actuators.

UNIT-III

Position, Displacement, and Velocity Measurement: Introduction, Relative motion Measuring Devices, Electromechanical, Optical, Photo Electric, Moire-Fringe, Pneumatic, Absolute Motion Devices.

Force, Acceleration and Torque Measurement: Seismic Devices, Spring Mass & Force Balance Type, Calibration, Hydraulic Load Cell, Pneumatic Load Cell, Elastic Force Devices, Separation of Force Components, Electro Mechanical Methods, Strain Gage, Torque Transducer, Toque Meter.

Pressure Measurement: Moderate Pressure Measurement, Monometers, Piezo Transducer, Dynamic Effects of Connecting Tubing, High Pressure Transducer, Low Pressure Measurement, Calibration and Testing.

UNIT-IV

Flow Measurement: Quantity Meters, Positive Displacement Meters, Flow Rate Meters, Variable Head Meters, Variable Area Meters, Rotameters, Pitot - static tube Meter, Drag Force Flow Meter, Turbine Flow Meter, Electronic Flow Meter, Electro Magnetic Flow meter. Hot-Wire Anemometer.

Temperature Measurement: Introduction, Measurement of Temperature, Non Electrical Methods, Solid Rod Thermometer, Bimetallic Thermometer, Liquid-in -Glass thermometer, Pressure Thermometer, Electrical Methods, Electrical Resistance Thermometers, Semiconductor Resistance Sensors (Thermistors), Thermo–Electric Sensors, Thermocouple Materials, Radiation Methods (Pyrometry), Total Radiation Pyrometer, Selective Radiation Pyrometer.

Recommended Books

1. D.S. Kumar, 'Mechanical Measurements', Kataria & Sons.
2. Doebelin, 'Measurement Systems Application and Design', Tata McGraw Hill, **2002**.
3. Francis S. Tse, Ivan E. Morse and Marcel Dekker, 'Measurement and Instrumentation in Engineering', CRC Publishers.
4. Alan S. Morris, 'Principles of Measurement and Instrumentation', Prentice Hall of India.
5. B.C. Nakra and K.K. Chaudhary, 'Instrumentation, Measurement and Analysis', Tata McGraw Hill.
6. 'Mechanical Measurements and Control', 4th Revised & Englarged Edn., Metropolitan Book Co. Pvt. Ltd., **2009**.

SOFT SKILLS-III

Subject Code: **BHUM0-F93** **L T P C** **0 0 2 1** **Duration: 26 Hrs.**

Course Objectives

The course aims to equip the students with effective writing skills in English. Also, to make the students understand their role as team players in organizations.

Course Outcomes

At the completion of the course, the student will become well –versed with the behavioural skills. They will also understand the role of body language and non-verbal communication during the interview process.

UNIT-1

ART OF WRITING - Introduction, Importance of Writing Creative Writing, Writing tips, Drawback of written communication.

ART OF BUSINESS WRITING - Introduction, Business Writing, Business Letter, Format and Styles, Types of business letters, Art of writing correct and precise mails, Understand netiquette.

UNIT-2

BODY LANGUAGE - Introduction- Body Talk, Forms of body language, uses of body language, Body language in understanding Intra and Inter-Personal Relations, Types of body language, Gender differences, Gaining confidence with knowledge of Kinesics.

UNIT-3

TEAM BUILDING AND TEAM WORK - Introduction, Meaning, Characteristics of an effective team, Role of a Team Leader, Role of Team Members, inter group Collaboration-Advantages, Difficulties faced, Group Exercises-Team Tasks and Role-Play, Importance of Group Dynamics.

UNIT-4

TIME MANAGEMENT - Introduction, the 80-20 Rule, three secrets of Time Management, Time Management Matrix, Effective Scheduling, Time Wasters, Time Savers, Time Circle Planner, Difficulties in Time Management, Overcoming Procastination.

RECOMMENDED BOOKS

1. K. Alex, S. Chand Publishers.
2. R.C. Sharma and Krishna Mohan, 'Business Correspondence and Report Writing', TMH, New Delhi, **2016.**
3. N. Krishnaswami and T. Sriraman, 'Creative English for Communication', Macmillan.
4. Penrose, John M., et al., 'Business Communication for Managers', Thomson South Western, New Delhi, **2007**.
5. Holtz, Shel, 'Corporate Conversations', PHI, New Delhi, **2007**.

MEASUREMENTS AND INSTRUMENTATION LAB.

Subject Code: BMEE3-524 **L T P C**
0 0 2 1

EXPERIMENTS

1. Measurement with the help of Vernier caliper and micrometer.
2. Measurement of an angle with the help of sine bar.
3. Measurement of surface roughness.
4. Measurement of speed and torque of an engine.
5. Measurement of acceleration and vibrations of the vehicle.
6. Calibration of a pressure gauge with the help of a dead weight gauge tester.
7. Measurement of temperature using RTD / thermocouple.
8. Determination of frequency & phase angle using C.R.O.
9. Measurement of Inductance by Maxwell's Bridge.
10. Measurement of flow rate and quantity of air passing in the petrol.

AUTOMOTIVE TRANSMISSIONS LAB.

Subject Code: BMEE3-525 **L T P C**
0 0 2 1

EXPERIMENTS

1. Study of a layout of transmission system for a front wheel drive, rear wheel drive and a four-wheel drive arrangement.
2. Trouble shooting in different types of friction clutches.

3. Study of layout of gears and shafts in a manual type gearbox and a transaxle & their troubleshooting.
4. Study of layout in a manual & automatic gearbox for a two wheeler & its troubleshooting.
5. Study of layout of an automatic gearbox.
6. Study of gear shifting controls in an automatic gearbox & its troubleshooting.
7. Study of a manual and electric transfer case & its troubleshooting.
8. Study of an electric drive in an Electric vehicle.

VEHICLE BODY ENGINEERING LAB.

Subject Code: BMEE3-526 **L T P C**
0 0 2 1

EXPERIMENTS

1. Study of typical car body construction and propose new design sketches.
2. Study driver's seat position, passenger seat position, its requirement and construction of typical truck/bus body and propose new design sketches.
3. To prepare the analysis of the vehicle body weight and the weight distribution in different conditions and its effect on tractive performance.
4. Measurement of drag, lift force of a scaled model in wind tunnel.
5. Study the anti-corrosion and body painting and repainting procedures.
6. Study the construction of a special purpose vehicle.
7. To prepare the analysis of the vehicle body weight and the weight distribution in different conditions and its effect on steering performance.

COMPUTER AIDED AUTOMOTIVE DESIGN

Subject Code: BMEE3-628 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

UNIT-I

Introduction: Study and selection of vehicle specifications - Choice of Cycle, fuel, speed, cylinder arrangement, number of cylinders, method of cooling, material, design variables and operating variables affecting performance and emission.

Bearing, Belts and Chains Systems: Design of sliding and rolling type of bearings, Details of design of bearing housings, Design for the selection of V-belt, toothed belt and chains, Design of pulley for belt, sprocket for chain.

UNIT-II

Engine Design: Design of Engine Components, Cylinder and Cylinder Liner, Piston, Piston Head or Crown, Piston Rings, Piston Skirt, Piston Pin, Connecting Rod, Crankshaft, Bearing Pressure and Stresses in Crankshafts, Design for Centre Crankshaft, Valve Gear Mechanism, Valves, Rocker Arm.

UNIT-III

Axle and Steering System: Study of loads, moments & stresses in different sections of front axle, king pin bearing and wheel spindle bearing, optimizing sizes of steering linkages, final drive design considerations in different types of propeller shafts, final drive & rear axle.

Resistance to Vehicle Motion: Calculation and plotting the curves of air, rolling and gradient resistances, driving force – Engine power, speed, rear axle ratio, Torque and mechanical efficiency at different vehicle speeds.

UNIT-IV

Performance Curves: Resistance, Power and torque curve, driving force against vehicle speed – Acceleration and grad-ability in different gears for a typical car or truck plotted from specifications.

Gear Ratios: Determination of Gear Ratios, Acceleration and grad-ability - typical problems.

Recommended Books

1. N.K. Giri, 'Automobile Mechanics', Khanna Publishers, New Delhi.
2. P.M. Heldt, 'High Speed Combustion Engine', Oxford & IBH Publishing Co., Calcutta.
3. 'Design Data Book', PSG College of Technology, Coimbatore.
4. R.C. Juvenal, 'Fundamental of Machine Component Design', John Wiley.
5. Kevin L. Hoag, 'Vehicular Engine Design', SAE Publication.
6. J.E. Shigley, 'Mechanical Engg. Design', McGraw Hill.

AUTOMOTIVE HEATING, VENTILATION AND AIR CONDITIONING

Subject Code: BMEE3-629 **L T P C** **Duration: 45 Hrs.**

3 1 0 4

UNIT-I

Air Conditioning Fundamentals: Fundamentals of refrigeration, basics of vehicle air conditioning system, location of air conditioning component in a car – schematic layout of a refrigeration system, component like compressor, condenser, fan blower, expansion device – expansion valve calibration, evaporator pressure regulator, low and high pressure switch.

UNIT-II

Air Conditioning Heating System: Automotive heaters – manually controlled air conditioner – heater system –automatically control air conditioner – air conditioning protection with heater diagnosis chart.

Refrigerants: Introduction, classification, properties, selection criteria, commonly used refrigerants, eco-friendly refrigerants, global warming and ozone forming potential of refrigerants, containers, handling of refrigerants.

UNIT-III

Psychometry: Introduction, Psychometric properties, Inside and outside design conditions of air conditioning system. Air distribution: introduction, factors affecting design of air distribution system, types of air distribution system, air flow through the dashboard recalculating unit, duct system, ventilation, vacuum reserve.

UNIT-IV

Air Conditioning Maintenance and Service: Cause of air conditioner failure, trouble shooting of air conditioning system, servicing heater system, removing and replacing components, leak testing, compressor service, charging and discharging, performance testing.

Recommended Books

1. William H. Crouse, 'Automotive Air Conditioning', Tata McGraw Hill Publication.
2. 'Automotive Air Conditioning', Mitchell Information Service, PHI.
3. W.H. Hucho, 'Aerodynamic of Road Vehicles, Butterworths Co.

VEHICLE DYNAMICS

Subject Code: BMEE3-630 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

UNIT-I

Introduction: Fundamental of vibration, Mechanical vibrating systems, Modeling and Simulation - Model of an automobile -Single, two and multi degrees of freedom systems – Free, forced and damped vibrations, Magnification factor -Transmissibility - Vibration absorber.

UNIT-II

Multi Degree of Freedom Systems: Closed coupled system - Eigen valve problems - Far coupled Systems - Orthogonality of mode shapes – Modal analysis - Forced vibration by matrix inversion. Approximate methods for fundamental frequency - Dunkerley's lower bound - Rayleigh's upper bound - Hozler method for close coupled and branched systems.

UNIT-III

Suspension and Tires: Requirements, Sprung mass frequency, Wheel hop, wheel wobble, wheel shimmy, Choice of suspension spring rate, Calculation of effective spring rate, Vehicle suspension in fore and apt directions. Ride characteristics of tire - Effect of driving and braking torque - Gough's tire characteristics.

UNIT-IV

Vehicle Handling: Over steer, under steer, steady state cornering, Effect of braking, driving torques on steering, Effect of camber, transient effects in cornering, Directional stability of vehicles.

Stability of Vehicles: Load distribution, Calculation of Tractive effort and reactions for different drives - Stability of a vehicle on a slope, on a curve and a banked road.

Recommended Books

1. T.D. Gillespie, ‘Fundamental of Vehicle Dynamics’, Society of Automotive Engineers, USA.
2. P.M. Heldt, ‘Automotive Chassis’, Chilton Co., New York.
3. Giles J.G. Steering, ‘Suspension and Tires’, llliffe Books Ltd., London.
4. N.K. Giri, ‘Automobile Mechanics’, Khanna Publishers, New Delhi.
5. J.S. Rao & K. Gupta, ‘Theory and Practice of Mechanical Vibrations’, Wiley Eastern Ltd., New Delhi.

AUTOMOTVE AERODYNAMICS

Subject Code: BMEE3-631 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

UNIT-I

Introduction: Scope, historical developments, fundamental of fluid mechanics, flow phenomenon related to vehicles, external and Internal flow problem, resistance to vehicle motion, performance, fuel consumption and performance potential of vehicle aerodynamics, engine cooling requirement, air flow to passenger compartment, duct for air conditioning, cooling of transverse engine and rear engine.

UNIT-II

Aerodynamic Drag of Cars: Cars as a bluff body, flow field around car, drag force, types of drag force, analysis of aerodynamic drag, drag coefficient of cars, strategies for aerodynamic development, low drag profiles.

Shape Optimization of Cars: Front end modification, front and rear wind shield angle, boat tailing, hatch back, fast back and square back, dust flow patterns at the rear, effects of gap configuration, effect of fasteners.

UNIT-III

Vehicle Handling: The origin of forces and moments on a vehicle, lateral stability problems, methods to calculate forces and moments – vehicle dynamics under side winds, the effects of forces and moments, characteristics of forces and moments, dirt accumulation on the vehicle, wind noise, drag reduction in commercial vehicles.

UNIT-IV

Wind Tunnels for Automotive Aerodynamics: Introduction, principle of wind tunnel technology, limitation of simulation, stress with scale models, full scale wind tunnels, measurement techniques, equipment and transducers, road testing methods, numerical methods.

Recommended Books

1. W.H. Hucho, 'Aerodynamic of Road Vehicles', Butterworths Co., Ltd.
2. A. Pope, 'Wind Tunnel Testing', 2nd Edn., John Wiley & Sons, New York.
3. 'Automotive Aerodynamic: Update SP-706', SAE.
4. Vehicle Aerodynamics - SP-1145', SAE.

VEHICLE SAFETY ENGINEERING

Subject Code: BMEE3-632 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

UNIT-I

Introduction: Design of the body for safety, engine location, deceleration of vehicle inside passenger compartment, deceleration on impact with stationary and movable obstacle, concept of crumple zone, safety sandwich construction, monocoque chassis construction.

UNIT-II

Safety Concepts: Active safety: driving safety, conditional safety, perceptibility safety, operating safety, passive safety: exterior safety, interior safety, deformation behavior of vehicle body, and speed, stopping distance.

Safety Equipment: Seat belt, regulations, automatic seat belt tightening system, collapsible steering column, tilt-able steering wheel, air bags, electronic system for activating air bags, bumper design for safety, Anti-lock Braking System (ABS), introduction to Electronic Stability Programme (ESP) & Electronic Brake Force Distribution (EBD).

UNIT-III

Collision Warning and Avoidance: Collision warning system, causes of rear end collision, frontal object d etection, rear vehicle object detection system, object detection system with braking system interactions, pedestrian detection.

UNIT-IV

Comfort and Convenience System: Steering and mirror adjustment, central locking system, Garage door opening system, tire pressure control system, rain sensor system, environment information system.

Recommended Books

1. Bosch, 'Automotive Handbook'. 5th Edn., SAE Publication, **2000**.
2. J. Powloski, 'Vehicle Body Engineering', Business books Ltd., London, **1969**.
3. Ronald. K. Jurgen, 'Automotive Electronics Handbook', 2nd Edn., McGraw Hill Inc., **1999**.
4. W.H. Hucho, 'Aerodynamic of Road Vehicles', Butterworths Co., Ltd., **1997**.

SOFT SKILLS-IV

Subject Code: **BHUM0-F94** **L T P C** **Duration: 26 Hrs.**

0 0 2 1

Course Objectives

The course aims at the key areas like conversation skills, group skills and persuasion skills required during the interview process in an organization.

Course Outcomes

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

1. Demonstrate soft skills required for business situations.
2. Analyze the value of soft skills for career enhancement.
3. Apply soft skills to workplace environment.
4. Confidently participate in GD and interview process.

UNIT-1

ART OF SPEAKING- Introduction. Communication process. Importance of communication, channels of communication. Formal and informal communication. Barriers to communication. Tips for effective communication. tips for conversation. Presentation skills. Effective multi-media presentation skills. Speeches and debates. Combating nervousness. Patterns and methods of presentation. Oral presentation, planning and preparation.

UNIT-2

GROUP DISCUSSION- Introduction. Importance of GD. Characters tested in a GD. Tips on GD. Essential elements of GD. Traits tested in a GD .GD etiquette. Initiating a GD. Non-verbal communication in GD. Movement and gestures to be avoided in a GD. Some topics for GD.

UNIT-3

PREPARING CV/RESUME-Introduction – meaning – difference among bio-data, CV and resume. CV writing tips. Do's and don'ts of resume preparation. Vocabulary for resume, common resume mistakes, cover letters, tips for writing cover letters.

UNIT-4

INTERVIEW SKILLS - Introduction. Types of interview. Types of question asked. Reasons for rejections. Post-interview etiquette. Telephonic interview. Dress code at interview. Mistakes during interview. Tips to crack on interview. Contextual questions in interview skills. Emotional crack an interview. Emotional intelligence and critical thinking during interview process.

RECOMMENDED BOOKS

1. K. Alex, S. Chand Publishers.
2. Lucas, Stephen E., 'The Art of Public Speaking', 11th Edn., International Edn., McGraw Hill Book Co., **2014**.
3. Goleman, Daniel, 'Working with Emotional Intelligence', Banton Books, London, **1998**.
4. Thrope, Edgar and Showick Trope, 'Winning at Interviews', Pearson Education, **2004.**
5. Turk, Christopher, 'Effective Speaking', South Asia Division: Taylor & Francis, 1**985**.

COMPUTER AIDED DESIGN AND MANUFACTURING LAB.

Subject Code: **BMEE3-633** **L T P C**
0 0 2 1

EXPERIMENTS

A: Introduction to Modeling (using any CAD software):

1. 2D drawing using sketcher – 2 Drawings 2 Hrs.
2. 3D modeling using 3D features (Modeling of Screw Jack, Brake Pedal, Clutch, Steering Linkage, Carburettor, F. I. P., any four components) 6 Hrs.
3. Assembling and drafting (any 2 above mentioned assemblies) with proper mating conditions and interference checking. 6 Hrs.
4. Surface modeling – (Any two of above assemblies) 4 Hrs.

B: Computer Aided Manufacturing:

1. Manual part programming on CNC Lathe and CNC Milling – (4 programs, 2 for each) 4 hrs.
2. Computer Aided part programming for CNC Lathe and CNC Milling to generate tool path, NC code, and Optimization of tool path (to reduce machining time) using any CAM software. 4 Hrs.

AUTOMOTIVE HEATING, VENTILATION AND AIR CONDITIONING LAB.

Subject Code: **BMEE3-634** **L T P C**
0 0 2 1

EXPERIMENTS

1. Study of various elements of a vapour compression refrigeration system.
2. Study and performance testing of an automobile refrigerator system.
3. Study and performance testing of an automobile heating system.
4. Calculation/ Estimation of cooling load for a Vehicle.
5. Calculation/ Estimation of heating load for a Vehicle.
6. Study the performance of air-conditioning, heating and ventilation of two vehicles.

TRACTORS & EARTH MOVING MACHINERY

Subject Code: BMEE3-659 **L T P C** **Duration: 45 Hrs.**
3 1 0 4

UNIT-I

Introduction: Classification of special purpose vehicles, wheel type, track type & their applications.

Working Principles: Study of working principles & design considerations of different systems like power system, lubrication, electrical, braking, steering system.

UNIT-II

Transmissions & Final Drive: Auxiliary transmission, compound transmission, twin & triple countershaft transmissions and planetary transmission, Final drives: types of reductions like single reduction, double reduction final drives and planetary final drives, PTO shaft. Earth Moving Machinery: Constructional & working features of Bull Dozer, Front end loader, ripper, shovel, excavator, dumper, forklift, scraper, compactors.

UNIT-III

Tractors & Agricultural Implements: Classification of tractors, main tractor assemblies, functions of farm tractors, types of engine & transmissions used, braking system, Specifications of wheels and tires, dual versus tandem tires, applications of tractors, forces acting on a tractor on move, parallel pull and rolling resistance, tractor stability and weight distribution, maintenance and operation of tractors, differential lock.

UNIT-IV

Mobile Cranes: Basic characteristics of truck cranes, stability & design features, control systems & safety devices.

Miscellaneous Topics: Tracked vehicles, articulated vehicles, multi-axle vehicles.

Recommended Books

1. C.P. Nakra, 'Farm Machines and Equipment', Dhanpat Rai Publications, New Delhi.
2. J. Konard, 'Manual of Tractors', Asia Publishing House.
3. Jain and Roy, 'Tractors and Agriculture Equipment'.
4. David A. Day, Neal B.H. Benjamin, 'Construction Equipment Guide', Wiley.