

R16 B.TECH AUTOMOBILE ENGG.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
**B.TECH. AUTOMOBILE ENGINEERING
 III YEAR COURSE STRUCTURE & SYLLABUS (R16)**
Applicable From 2016-17 Admitted Batch
III YEAR I SEMESTER

| S. No. | Course Code | Course Title | L | T | P | Credits |
|--------|-------------|---|-----------|----------|----------|-----------|
| 1 | AM501PC | Automobile Engineering | 4 | 0 | 0 | 4 |
| 2 | ME502PC | Thermal Engineering - I | 4 | 0 | 0 | 4 |
| 3 | AM503PC | Dynamics of Machinery | 4 | 0 | 0 | 4 |
| 4 | SM504MS | Fundamentals of Management | 3 | 0 | 0 | 3 |
| 5 | | Open Elective – I | 3 | 0 | 0 | 3 |
| 6 | ME505PC | Thermal Engineering Lab | 0 | 0 | 3 | 2 |
| 7 | AM506PC | Kinematics of Machinery & Dynamics of Machinery Lab | 0 | 0 | 3 | 2 |
| 8 | AM507PC | Automobile Engineering Lab | 0 | 0 | 3 | 2 |
| 9 | *MC500HS | Professional Ethics | 3 | 0 | 0 | 0 |
| | | Total Credits | 21 | 0 | 9 | 24 |

III YEAR II SEMESTER

| S. No. | Course Code | Course Title | L | T | P | Credits |
|--------|-------------|--|-----------|----------|----------|-----------|
| 1 | ME601PC | Thermal Engineering - II | 4 | 0 | 0 | 4 |
| 2 | AM602PC | Mechanics of Fluids and Hydraulics Machinery | 4 | 0 | 0 | 4 |
| 3 | AM603PC | Design of Machine Members - I | 4 | 0 | 0 | 4 |
| 4 | | Open Elective-II | 3 | 0 | 0 | 3 |
| 5 | | Professional Elective - I | 3 | 0 | 0 | 3 |
| 6 | AM604PC | Mechanics of Fluids and Hydraulics Machinery Lab | 0 | 0 | 3 | 2 |
| 7 | AM605PC | Automobile Systems Lab | 0 | 0 | 3 | 2 |
| 8 | EN606HS | Advanced English Communication Skills Lab | 0 | 0 | 3 | 2 |
| | | Total Credits | 18 | 0 | 9 | 24 |

During Summer Vacation between III and IV Years: Industry Oriented Mini Project

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Professional Elective – I

| | |
|---------|-----------------------------------|
| AM611PE | CAD/CAM |
| AM612PE | Automobile Air Conditioning |
| AM613PE | Automotive Chassis and Suspension |
| AM614PE | Vehicle Dynamics |

***Open Elective** subjects' syllabus is provided in a separate document.

***Open Elective** – Students should take Open Electives from the List of Open Electives Offered by Other Departments/Branches Only.

Ex: - A Student of Mechanical Engineering can take Open Electives from all other departments/branches except Open Electives offered by Mechanical Engineering Dept.

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AUTOMOBILE ENGINEERING**B.Tech. III Year I Sem.**
Course Code: AM501PC

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UNIT - I

Introduction: Layout of automobile – introduction chassis and body components. Types of Automobile engines. – Power unit – Introduction to engine lubrication – engine servicing

Fuel System: S.I. Engine: Fuel supply systems, Mechanical and electrical fuel pump – filters – carburetor – types – air filters – petrol injection. Introduction to MPFI and GDI Systems.

C.I. Engines: Requirements of diesel injection systems, types of injection systems, DI Systems IDI systems. Fuel pump, nozzle, spray formation, injection timing, testing of fuel pumps. Introduction to CRDI and TDI Systems.

UNIT - II

Cooling System: Cooling Requirements, Air Cooling, Liquid Cooling, Thermo, water and Forced Circulation System – Radiators – Types – Cooling Fan - water pump, thermostat, evaporative cooling – pressure sealed cooling – antifreeze solutions.

Ignition System: Function of an ignition system, battery ignition system, constructional features of storage, battery, auto transformer, contact breaker points, condenser, and spark plug – Magneto coil ignition system, electronic ignition system using contact breaker, electronic ignition using contact triggers – spark advance and retard mechanism.

Electrical System: Charging circuit, generator, current – voltage regulator – starting system, bendix drive mechanism solenoid switch, lighting systems, Horn, wiper, fuel gauge – oil pressure gauge, engine temperature indicator etc.

UNIT - III

Transmission System: Clutches, principle, types, cone clutch, single plate clutch, multi plate clutch, magnetic and centrifugal clutches, fluid fly wheel – gear boxes, types, sliding mesh, constant mesh, synchro mesh gear boxes, epicyclic gear box, over drive torque converter. Propeller shaft – Hotch – Kiss drive, Torque tube drive, universal joint, differential rear axles – types – wheels and tyres.

Suspension System: Objects of suspension systems – rigid axle suspension system, torsion bar, shock absorber, Independent suspension system.

UNIT - IV

Braking System: Mechanical brake system, Hydraulic brake system, Master cylinder, wheel cylinder tandem master cylinder Requirement of brake fluid, Pneumatic and vacuum brakes.

Steering System: Steering geometry – camber, castor, king pin rake, combined angle toe in, center point steering. Types of steering mechanism – Ackerman steering mechanism, Davis steering mechanism, steering gears – types, steering linkages.

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UNIT - V

Emissions from Automobiles – Pollution standards National and international – Pollution Control – Techniques – Multipoint fuel injection for SI Engines. Common rail diesel injection Energy alternatives – Solar, Photo-voltaic, hydrogen, Biomass, alcohols, LPG, CNG, liquid Fuels and gaseous fuels, Hydrogen as a fuel for IC Engines. - Their merits and demerits. Standard Vehicle maintenance practice.

TEXT BOOKS:

1. Automobile Engineering / William H Crouse
2. A Text Book Automobile Engineering–Manzoor,. Nawazish Mehdi & .Yosuf Ali, Frontline Publications.

REFERENCES:

1. A Text Book of Automobile Engineering by R K Rajput. Laxmi Publications.
2. Automotive Mechanics / Heitner
3. Automotive Engineering / Newton Steeds & Garrett
4. Automotive Engines / Srinivasan
5. A Text Book of Automobile Engineering By Khalil U Siddiqui New Age International

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THERMAL ENGINEERING – I**B.Tech. III Year I Sem.**
Course Code: ME502PC

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Pre-requisite: Thermodynamics

Course Objective: To apply the laws of Thermodynamics to analyze air standard cycles and to understand and evaluate the perform analysis of the major components and systems of IC engines, refrigeration cycles and their applications.

Course Outcomes: At the end of the course, the student should be able to evaluate the performance of IC engines and compressors under the given operating conditions. Apply the laws of Thermodynamics to evaluate the performance of Refrigeration and air-conditioning cycles. Understand the functionality of the major components of the IC Engines and effects of operating conditions on their performance

UNIT – I

I.C. Engines: Classification - Working principles of Four & Two stroke engine, SI & CI engines, Valve and Port Timing Diagrams, Air – Standard, air-fuel and actual cycles - Engine systems – Carburetor and Fuel Injection Systems for SI engines, Fuel injection systems for CI engines, Ignition, Cooling and Lubrication system, Fuel properties and Combustion Stoichiometry.

UNIT – II

Normal Combustion and abnormal combustion in SI engines – Importance of flame speed and effect of engine variables – Abnormal combustion, pre-ignition and knocking in SI Engines – Fuel requirements and fuel rating, anti knock additives – combustion chamber – requirements, types of SI engines.

Four stages of combustion in CI engines – Delay period and its importance – Effect of engine variables – Diesel Knock– Need for air movement, suction, compression and combustion induced turbulence in Diesel engine – open and divided combustion chambers and fuel injection– Diesel fuel requirements and fuel rating

UNIT - III

Testing and Performance: Parameters of performance - measurement of cylinder pressure, fuel consumption, air intake, exhaust gas composition, Brake power – Determination of frictional losses and indicated power – Performance test – Heat balance sheet and chart

Classification of compressors – Fans, blowers and compressors – positive displacement and dynamic types – reciprocating and rotary types.

Reciprocating Compressors: Principle of operation, work required, Isothermal efficiency volumetric efficiency and effect of clearance volume, staged compression, under cooling, saving of work, minimum work condition for staged compression

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UNIT – IV

Rotary Compressor (Positive displacement type): Roots Blower, vane sealed compressor, Lysholm compressor – mechanical details and principle of working – efficiency considerations.

Dynamic Compressors: Centrifugal compressors: Mechanical details and principle of operation – velocity and pressure variation. Energy transfer-impeller blade shape-losses, slip factor, power input factor, pressure coefficient and adiabatic coefficient – velocity diagrams – power.

Axial Flow Compressors: Mechanical details and principle of operation – velocity triangles and energy transfer per stage degree of reaction, work done factor - isentropic efficiency-pressure rise calculations – Polytropic efficiency.

UNIT – V

Refrigeration: Mechanical Refrigeration and types – units of refrigeration – Air Refrigeration system, details and principle of operation – applications of air refrigeration, Vapour compression refrigeration systems – calculation of COP – effect of superheating and sub cooling, desired properties of refrigerants and common refrigerants- Vapour absorption system – mechanical details – working principle, Use of p-h charts for calculations

Air-Conditioning: Concepts of Psychrometry – Properties of moist air – Usage of Psychrometric Chart – Calculation of moist air properties.

Types of air – conditioning systems – Requirements - schematic layout of a typical plant.

TEXT BOOKS:

1. I.C. Engines / V. Ganesan / Mc Graw Hill
2. Thermal Engineering / Mahesh M Rathore / Mc Graw Hill

REFERENCE BOOKS:

1. Applied Thermodynamics for Engineering Technologists / Eastop / Pearson
2. Fundamentals of Classical Thermodynamics / Vanwylen G.J., Sonntag R.E. / Wiley Eastern

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DYNAMICS OF MACHINERY**B.Tech. III Year I Sem.**
Course Code: AM503PC

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Pre-requisite: Kinematics of Machinery

Course Objectives: The objective is to introduce some of the components mainly used in IC Engines and make analysis of various forces involved. Subjects deals with topics like inertia forces in slider crank mechanism; IC Engine components & the analysis like governors is introduced. It also deals with balancing of rotating & reciprocating parts. Studies are made about balancing of multi cylinder engines, Radial engines etc. study of primary & secondary forces are considered while balancing. Finally they are introduced to the topic of vibrations. The study deals with linear, longitudinal, & torsional vibrations. The idea is to introduce the concept of natural frequency and the importance of resonance and critical speeds.

Course Outcome: the study of KOM & DOM are necessary to have an idea while designing the various machine members like shafts, bearings, gears, belts & chains and various I.C. Engine Components & Machine tool parts.

UNIT – I

Precession: Gyroscopes – effect of precession – motion on the stability of moving vehicles such as motorcycle – motorcar – aeroplanes and ships.

Static and Dynamic Force Analysis: Static force analysis of planar mechanisms – Analytical Method – Dynamic Force Analysis – D'Alembert's principle, Dynamic Analysis of 4-link mechanism, Slider Crank Mechanism.

UNIT – II

Turning Moment Diagram And Flywheels: Engine Force Analysis – Piston Effort, Crank Effort, etc., Inertia Force in Reciprocating Engine – Graphical Method - Turning moment diagram – fluctuation of energy – flywheels and their design - Inertia of connecting rod – inertia force in reciprocating engines – crank effort and torque diagrams.-.

UNIT – III

Friction: pivots and collars – uniform pressure, uniform wear – friction circle and friction axis: lubricated surfaces – boundary friction – film lubrication. Clutches – Types – Single plate, multi-plate and cone clutches.

Brakes And Dynamometers: Types of brakes: Simple block brake, band and block brake-internal expanding shoe brake-effect of braking of a vehicle. Dynamometers – absorption and transmission types. General description and methods of operation.

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UNIT – IV

Governors: Types of governors - Watt, Porter and Proell governors. Spring loaded governors – Hartnell and Hartung with auxiliary springs. Sensitiveness, isochronisms and hunting – stability – effort and power of the governors.

Balancing: Balancing of rotating masses- Primary, Secondary, and higher balancing of reciprocating masses. Analytical and graphical methods. Unbalanced forces and couples.

Examination of “V” and multi cylinder in-line and radial engines for primary and secondary balancing- locomotive balancing – Hammer blow – Swaying couple – variation of tractive effort.

UNIT – V

Vibrations: Free Vibration of mass attached to vertical spring – Transverse loads – vibrations of beams with concentrated and distributed loads. Dunkerly’s method – Raleigh’s method. Whirling of shafts – critical speed – torsional vibrations – one, two and three rotor systems.

TEXT BOOKS:

1. Theory of Machines /S.S.Rattan / Mc Graw Hill.
2. Theory of Machines /Sadhu Singh/ Pearson

REFERENCE BOOKS:

1. Theory of Machines and Mechanisms/Joseph E. Shigley / Oxford
2. Theory of Machines / Rao,J.S / New Age

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FUNDAMENTALS OF MANAGEMENT**B.Tech. III Year I Sem.****Course Code: SM504MS****L T P C****3 0 0 3**

Course Objective: To understand the Management Concepts, applications of Concepts in Practical aspects of business and development of Managerial Skills.

Course Outcome: The students understand the significance of Management in their Profession. The various Management Functions like Planning, Organizing, Staffing, Leading, Motivation and Control aspects are learnt in this course. The students can explore the Management Practices in their domain area.

UNIT - I

Introduction to Management: Definition, Nature and Scope, Functions, Managerial Roles, Levels of Management, Managerial Skills, Challenges of Management; Evolution of Management- Classical Approach- Scientific and Administrative Management; The Behavioral approach; The Quantitative approach; The Systems Approach; Contingency Approach, IT Approach.

UNIT - II

Planning and Decision Making: General Framework for Planning - Planning Process, Types of Plans, Management by Objectives; Development of Business Strategy. Decision making and Problem Solving - Programmed and Non Programmed Decisions, Steps in Problem Solving and Decision Making; Bounded Rationality and Influences on Decision Making; Group Problem Solving and Decision Making, Creativity and Innovation in Managerial Work.

UNIT - III

Organization and HRM: Principles of Organization: Organizational Design & Organizational Structures; Departmentalization, Delegation; Empowerment, Centralization, Decentralization, Recentralization; Organizational Culture; Organizational Climate and Organizational Change.

Human Resource Management & Business Strategy: Talent Management, Talent Management Models and Strategic Human Resource Planning; Recruitment and Selection; Training and Development; Performance Appraisal.

UNIT - IV

Leading and Motivation: Leadership, Power and Authority, Leadership Styles; Behavioral Leadership, Situational Leadership, Leadership Skills, Leader as Mentor and Coach, Leadership during adversity and Crisis; Handling Employee and Customer Complaints, Team Leadership.

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Motivation - Types of Motivation; Relationship between Motivation, Performance and Engagement, Content Motivational Theories - Needs Hierarchy Theory, Two Factor Theory, Theory X and Theory Y.

UNIT - V

Controlling: Control, Types and Strategies for Control, Steps in Control Process, Budgetary and Non- Budgetary Controls. Characteristics of Effective Controls, Establishing control systems, Control frequency and Methods.

TEXT BOOKS:

1. Management Fundamentals, Robert N Lussier, 5e, Cengage Learning, 2013.
2. Fundamentals of Management, Stephen P. Robbins, Pearson Education, 2009.

REFERENCES:

1. Essentials of Management, Koontz Kleihrich, Tata McGraw Hill.
2. Management Essentials, Andrew DuBrin, 9e, Cengage Learning, 2012.

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THERMAL ENGINEERING LAB**B.Tech. III Year I Sem.**
Course Code: ME505PC

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Pre-Requisite: Thermodynamics & Thermal Engineering - I**Objective:** To understand the working principles of IC Engines, Compressors.**List of Experiments**

1. I.C. Engines Valve / Port Timing Diagrams
2. I.C. Engines Performance Test for 4 Stroke SI engines
3. I.C. Engines Performance Test for 2 Stroke SI engines
4. I.C. Engines Morse, Retardation, Motoring Tests
5. I.C. Engine Heat Balance – CI/SI Engines
6. I.C. Engines Economical speed Test on a SI engine
7. I.C. Engines effect of A/F Ratio in a SI engine
8. Performance Test on Variable Compression Ratio Engine
9. IC engine Performance Test on a 4S CI Engine at constant speed
10. Volumetric efficiency of Air – Compressor Unit
11. Dis-assembly / Assembly of Engines
12. Study of Boilers

Note: Perform any 10 out of the 12 exercises.

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KINEMATICS OF MACHINERY AND DYNAMICS OF MACHINERY LAB**B.Tech. III Year I Sem.****Course Code: AM506PC****L T P C****0 0 3 2****List of Experiments:**

1. Cam Analysis – Cam Profile and Jump-speed Characteristics
2. Determination of Critical Speed
3. Determination of Gyroscopic Couple
4. Determination of Natural Frequency-spring mass system
5. Determination of Natural Frequency-free transverse system
6. Determination of Radius of Gyration and Moment of Inertia-compound pendulum
7. Determination of Radius of Gyration and Moment of Inertia-bifilar system
8. Balancing of Rotating Masses-static
9. Balancing of Rotating Masses-dynamic
10. Speed Ratio of Epi-cyclic Gear Train
11. To study various types of Kinematic links, pairs, chains and Mechanisms.
12. To study various types of gear trains – simple, compound, reverted, epicyclic and
1. Differential
13. To generate spur gear involute tooth profile using simulated gear shaping process.
14. Governor apparatus with differential attachments
15. To study various type of cam and follower arrangements

Note: Any 12 experiments need to be performed.

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AUTOMOBILE ENGINEERING LAB**B.Tech. III Year I Sem.****Course Code: AM507PC****L T P C****0 0 3 2****List of Experiments:**

1. Study of Hand power and measuring tools -sketching, materials used and their uses.
2. Writing technical specifications and descriptions of all types of automobile engines (petrol and diesel) -materials, functions with sketches.
3. Petrol and Diesel engines dismantling, Inspection for wear and tear, crack, material breakdown of different engines components.
4. Servicing of engines by paraffin and degreasing methods, decarburizing procedure, Dismantling, Inspection and Assembly of different parts of two wheelers
5. Servicing of engines by paraffin and degreasing methods, decarburizing procedure, Dismantling, Inspection and Assembly of different parts of 3 wheelers
6. Servicing of engines by paraffin and degreasing methods, decarburizing procedure, Dismantling, Inspection and Assembly of different parts of 4 wheelers like Tractor & Heavy duty engines covering 2-stroke and 4 stroke, SI and CI engines using the concepts of torque and assembly diagrams.
7. Measurement of dimensions of different components of the above engines and compare the same with standard specifications.
8. Assembling the engines with using special tools, necessary adjustments of the engine components.
9. Valve spring testing, connecting rod alignment, piston ring testing procedure for dismantling and assembling.
10. Wheel alignment, wheel balancing, tyre change and repair (with tube and tubeless).

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PROFESSIONAL ETHICS**B.Tech. III Year I Sem.****Course Code: MC500HS****L T P C****3 0 0 0**

Course Objective: To enable the students to imbibe and internalize the Values and Ethical Behaviour in the personal and Professional lives.

Course Outcome: The students will understand the importance of Values and Ethics in their personal lives and professional careers. The students will learn the rights and responsibilities as an employee, team member and a global citizen.

UNIT - I

Introduction to Professional Ethics: Basic Concepts, Governing Ethics, Personal & Professional Ethics, Ethical Dilemmas, Life Skills, Emotional Intelligence, Thoughts of Ethics, Value Education, Dimensions of Ethics, Profession and professionalism, Professional Associations, Professional Risks, Professional Accountabilities, Professional Success, Ethics and Profession.

UNIT - II

Basic Theories: Basic Ethical Principles, Moral Developments, Deontology, Utilitarianism, Virtue Theory, Rights Theory, Casuist Theory, Moral Absolution, Moral Rationalism, Moral Pluralism, Ethical Egoism, Feminist Consequentialism, Moral Issues, Moral Dilemmas, Moral Autonomy.

UNIT - III

Professional Practices in Engineering: Professions and Norms of Professional Conduct, Norms of Professional Conduct vs. Profession; Responsibilities, Obligations and Moral Values in Professional Ethics, Professional codes of ethics, the limits of predictability and responsibilities of the engineering profession.

Central Responsibilities of Engineers - The Centrality of Responsibilities of Professional Ethics; lessons from 1979 American Airlines DC-10 Crash and Kansas City Hyatt Regency Walk away Collapse.

UNIT - IV

Work Place Rights & Responsibilities, Ethics in changing domains of Research, Engineers and Managers; Organizational Complaint Procedure, difference of Professional Judgment within the Nuclear Regulatory Commission (NRC), the Hanford Nuclear Reservation.

Ethics in changing domains of research - The US government wide definition of research misconduct, research misconduct distinguished from mistakes and errors, recent history of attention to research misconduct, the emerging emphasis on understanding and fostering responsible conduct, responsible authorship, reviewing & editing.

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UNIT - V

Global issues in Professional Ethics: Introduction – Current Scenario, Technology Globalization of MNCs, International Trade, World Summits, Issues, Business Ethics and Corporate Governance, Sustainable Development Ecosystem, Energy Concerns, Ozone Deflection, Pollution, Ethics in Manufacturing and Marketing, Media Ethics; War Ethics; Bio Ethics, Intellectual Property Rights.

TEXT BOOKS:

1. Professional Ethics: R. Subramanian, Oxford University Press, 2015.
2. Ethics in Engineering Practice & Research, Caroline Whitbeck, 2e, Cambridge University Press 2015.

REFERENCES

1. Engineering Ethics, Concepts Cases: Charles E Harris Jr., Michael S Pritchard, Michael J Rabins, 4e, Cengage learning, 2015.
2. Business Ethics concepts & Cases: Manuel G Velasquez, 6e, PHI, 2008.

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THERMAL ENGINEERING – II**B.Tech. III Year II Sem.****Course Code: ME601PC****L T P C****4 0 0 4****Note:** Steam Table book Permitted.**Pre-requisite:** Thermodynamics

Course Objective: To apply the laws of Thermodynamics to analyze steam and gas turbine cycles and to perform analysis of the major components of steam and gas turbine plants and their applications.

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

- Develop state – space diagrams based on the schematic diagrams of process flow of steam and gas turbine plants
- Apply the laws of Thermodynamics to analyze thermodynamic cycles
- Differentiate between vapour power cycles and gas power cycles
- Infer from property charts and tables and to apply the data for the evaluation of performance parameters of the steam and gas turbine plants
- Understand the functionality of major components of steam and gas turbine plants and to do the analysis of these components

UNIT – I

Steam Power Plant: Rankine cycle - Schematic layout, Thermodynamic Analysis, Concept of Mean Temperature of Heat addition, Methods to improve cycle performance – Regeneration & reheating.

Boilers – Classification – Working principles with sketches including H.P.Boilers – Mountings and Accessories – Working principles- Boiler horse power, Equivalent Evaporation, Efficiency and Heat balance – Draught- Classification – Height of chimney for given draught and discharge- Condition for maximum discharge- Efficiency of chimney.

UNIT – II

Steam Nozzles : Stagnation Properties- Function of nozzle – Applications and Types- Flow through nozzles- Thermodynamic analysis – Assumptions -Velocity of nozzle at exit-Ideal and actual expansion in nozzle- Velocity coefficient- Condition for maximum discharge- Critical pressure ratio- Criteria to decide nozzle shape- Super saturated flow, its effects, Degree of super saturation and Degree of under cooling - Wilson line.

UNIT – III

Steam Turbines: Classification – Impulse turbine; Mechanical details – Velocity diagram – Effect of friction – Power developed, Axial thrust, Blade or diagram efficiency – Condition for maximum efficiency. De-Laval Turbine - its features- Methods to reduce rotor speed-

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Velocity compounding and Pressure compounding- Velocity and Pressure variation along the flow – Combined velocity diagram for a velocity compounded impulse turbine.

Reaction Turbine: Mechanical details – Principle of operation, Thermodynamic analysis of a stage, Degree of reaction – Velocity diagram – Parson's reaction turbine – Condition for maximum efficiency.

UNIT - IV

Steam Condensers: Requirements of steam condensing plant – Classification of condensers – Working principle of different types – Vacuum efficiency and Condenser efficiency – Air leakage, sources and its affects, Air pump- Cooling water requirement.

Gas Turbines: Simple gas turbine plant – Ideal cycle, essential components – Parameters of performance – Actual cycle – Regeneration, Inter cooling and Reheating – Closed and Semi-closed cycles – Merits and Demerits- Combustion chambers and turbines of Gas Turbine Plant- Brief Concepts.

UNIT – V

Jet Propulsion : Principle of Operation – Classification of jet propulsive engines – Working Principles with schematic diagrams and representation on T-S diagram - Thrust, Thrust Power and Propulsion Efficiency – Turbo jet engines – Needs and Demands met by Turbo jet – Schematic Diagram, Thermodynamic Cycle, Performance Evaluation Thrust Augmentation – Methods.

Rockets: Application – Working Principle – Classification – Propellant Type – Thrust, Propulsive Efficiency – Specific Impulse – Solid and Liquid propellant Rocket Engines.

TEXT BOOKS:

1. Thermal Engineering / Mahesh M Rathore/ Mc Graw Hill
2. Gas Turbines – V.Ganesan /Mc Graw Hill

REFERENCE BOOKS:

1. Gas Turbine Theory/ Saravanamuttoo, Cohen, Rogers/ Pearson
2. Fundamentals of Engineering Thermodynamics / Rathakrishnan/ PHI

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MECHANICS OF FLUIDS AND HYDRAULICS MACHINERY

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UNIT - I

Fluid statics: Dimensions and units: physical properties of fluids- specific gravity, viscosity, and surface tension - vapour pressure and their influence on fluid motion- atmospheric, gauge and vacuum pressures – measurement of pressure- Piezometer, U-tube and differential manometers.

UNIT - II

Fluid kinematics: Stream line, path line and streak lines and stream tube, classification of flows-steady & unsteady, uniform & non uniform, laminar & turbulent, rotational & irrotational flows-equation of continuity for one dimensional flow and three dimensional flows.

Fluid dynamics: Surface and body forces –Euler's and Bernoulli's equations for flow along a stream line, momentum equation and its application on force on pipe bend.

UNIT - III

Boundary Layer Concepts: Definition, thicknesses, characteristics along thin plate, laminar and turbulent boundary layers (No derivation) boundary layer in transition, separation of boundary layer, submerged objects – drag and lift.

Closed conduit flow: Reynold's experiment- Darcy Weisbach equation- Minor losses in pipes- pipes in series and pipes in parallel- total energy line-hydraulic gradient line. Measurement of flow: Pitot tube, venturi meter, and orifice meter, Flow nozzle

UNIT - IV

Basics of turbo machinery : Hydrodynamic force of jets on stationary and moving flat, inclined, and curved vanes, jet striking centrally and at tip, velocity diagrams, work done and efficiency, flow over radial vanes.

Hydraulic Turbines : Classification of turbines, Heads and efficiencies, impulse and reaction turbines, Pelton wheel, Francis turbine and Kaplan turbine-working proportions, work done, efficiencies , hydraulic design –draft tube theory- functions and efficiency.

Performance of hydraulic turbines: Geometric similarity, Unit and specific quantities, characteristic curves, governing of turbines, selection of type of turbine, cavitation, surge tank, water hammer.

UNIT - V

Centrifugal pumps: Classification, working, work done – barometric head- losses and efficiencies specific speed- performance characteristic curves, NPSH.

Reciprocating pumps: Working, Discharge, slip, indicator diagrams.

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TEXT BOOKS:

1. Hydraulics, fluid mechanics and Hydraulic machinery MODI and SETH.
2. Fluid Mechanics and Hydraulic Machines by Rajput.

REFERENCES:

1. Fluid Mechanics and Fluid Power Engineering by D.S. Kumar, Kotaria & Sons.
2. Fluid Mechanics and Machinery by D. Rama Durgaiah, New Age International.
3. Hydraulic Machines by Banga & Sharma, Khanna Publishers.

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DESIGN OF MACHINE MEMBERS – I**B.Tech. III Year II Sem.****Course Code: AM603PC**

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Note: Design Data books are not permitted in the Examinations. The design must not only satisfy strength criteria but also rigidity criteria.

Pre-requisites: Engineering mechanics, mechanics of solids, manufacturing processes, metallurgy and material science.

Course Objectives:

- To understand the general design procedures and principles in the design of machine elements.
- To study different materials of construction and their properties and factors determining the selection of material for various applications.
- To determine stresses under different loading conditions.
- To learn the design procedure of different fasteners, joints, shafts and couplings.

Course Outcomes:

- The student acquires the knowledge about the principles of design, material selection, component behavior subjected to loads, and criteria of failure.
- Understands the concepts of principal stresses, stress concentration in machine members and fatigue loading.
- Design on the basis of strength and rigidity and analyze the stresses and strains induced in a machine element.

UNIT – I

Introduction: General considerations in the design of Engineering Materials and their properties – selection –Manufacturing consideration in design. Tolerances and fits –BIS codes of steels.

Design for Static Strength: Simple stresses – Combined stresses – Torsional and Bending stresses – Impact stresses – Stress strain relation – Various theories of failure – Factor of safety – Design for strength and rigidity – preferred numbers. The concept of stiffness in tension, bending, torsion and combined situations.

UNIT – II

Design for Fatigue Strength: Stress concentration–Theoretical stress Concentration factor– Fatigue stress concentration factor- Notch Sensitivity – Design for fluctuating stresses – Endurance limit – Estimation of Endurance strength – Gerber's curve– Modified Goodman's line– Soderberg's line.

UNIT – III

Riveted, Welded and Bolted Joints: Riveted joints- methods of failure of riveted joints- strength equations-efficiency of riveted joints-eccentrically loaded riveted joints.

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Welded joints-Design of fillet welds-axial loads-circular fillet welds under bending, torsion.
Welded joints under eccentric loading.

Bolted joints – Design of bolts with pre-stresses – Design of joints under eccentric loading –
locking devices – bolts of uniform strength.

UNIT – IV

Keys, Cotters and Knuckle Joints: Design of keys-stresses in keys-cottered joints-spigot and socket, sleeve and cotter, jib and cotter joints-Knuckle joints.

UNIT – V

Shafts: Design of solid and hollow shafts for strength and rigidity – Design of shafts for combined bending and axial loads – Shaft sizes – BIS code. Use of internal and external circlips, Gaskets and seals (stationary & rotary)

Shaft Couplings: Rigid couplings – Muff, Split muff and Flange couplings. Flexible couplings – Flange coupling (Modified).

TEXT BOOKS:

1. Design of Machine Elements / V. Bhandari / Mc Graw Hill
2. Machine Design / Jindal / Pearson

REFERENCE BOOKS:

1. Design of Machine Elements / V. M. Faires / Macmillan
2. Design of Machine Elements-I / Annaiah, M.H / New Age

R16 B.TECH AUTOMOBILE ENGG.

CAD/CAM
(Professional Elective - I)

B.Tech. III Year II Sem.
Course Code: AM611PE

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Pre-requisites: To learn the importance and use of computer in design and manufacture

Course objectives: To provide an overview of how computers are being used in design, development of manufacturing plans and manufacture. To understand the need for integration of CAD and CAM

Course Outcomes: Understand geometric transformation techniques in CAD. Develop mathematical models to represent curves and surfaces .Model engineering components using solid modeling techniques. Develop programs for CNC to manufacture industrial components. To understand the application of computers in various aspects of Manufacturing viz., Design, Proper planning, Manufacturing cost, Layout & Material Handling system.

UNIT – I

Fundamentals of CAD/CAM, Automation , design process, Application of computers for design, Benefits of CAD, Computer configuration for CAD applications, Computer peripherals for CAD, Design workstation, Graphic terminal, CAD software- definition of system software and application software ,CAD database and structure.

Geometric Modeling: 3-D wire frame modeling, wire frame entities and their definitions, Interpolation and approximation of curves, Concept of parametric and non-parametric representation of curves, Curve fitting techniques, definitions of cubic spline, Bezier, and B-spline.

UNIT - II

Surface modeling: Algebraic and geometric form, Parametric space of surface, Blending functions, parameterization of surface patch, Subdividing, Cylindrical surface, Ruled surface, Surface of revolution Spherical surface, Composite surface, Bezier surface. B-spline surface, Regenerative surface and pathological conditions.

Solid Modelling: Definition of cell composition and spatial occupancy enumeration, Sweep representation, Constructive solid geometry, Boundary representations.

UNIT – III

NC Control Production Systems: Numerical control, Elements of NC system, NC part programming: Methods of NC part programming, Manual part programming, Computer assisted part programming, Post Processor, Computerized part program, SPPL (A Simple Programming Language). CNC, DNC, and Adaptive Control Systems.

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UNIT – IV

Group Technology: Part families, Parts classification, and coding. Production flow analysis, Machine cell design.

Computer aided process planning: Difficulties in traditional process planning, Computer aided process planning: retrieval type and generative type, Machinability data systems.

Computer aided manufacturing resource planning: Material resource planning, inputs to MRP, MRP output records, Benefits of MRP, Enterprise resource planning, Capacity requirements planning.

UNIT – V

Flexible manufacturing system: F.M.S equipment, FMS layouts, Analysis methods for FMS benefits of FMS.

Computer aided quality control: Automated inspection- Off-line, On-line, contact, Non-contact; Coordinate measuring machines, Machine vision.

Computer Integrated Manufacturing: CIM system, Benefits of CIM, Benefits of CIM

TEXT BOOKS:

1. CAD/CAM /Groover M.P./ Pearson education
2. CAD/CAM Concepts and Applications/ Alavala/ PHI

REFERENCE BOOKS:

1. CAD/CAM Principles and Applications/P.N.Rao/ TMH
2. CAD / CAM Theory and Practice/ Ibrahim Zeid/TMH
3. CAD / CAM / CIM/Radhakrishnan and Subramanian/ New Age
4. Principles of Computer Aided Design and Manufacturing/ Farid Amirouche/ Pearson
5. Computer Numerical Control Concepts and programming/Warren S Seames/ Thomson

R16 B.TECH AUTOMOBILE ENGG.

AUTOMOBILE AIR CONDITIONING
(Professional Elective - I)**B.Tech. III Year II Sem.**
Course Code: AM612PE

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UNIT-I

Fundamentals of Refrigeration vapour compressors refrigeration - working principle, cycle COP - refrigeration cycle in T-s and P-h coordinates, Effect of sub cooling & super heating and cycle analysis and problems using P-h charts.

Vehicle cooling, load estimation, capacity requirements of Air Conditioning System, refrigerants used in Automobiles – properties.

UNIT-II

Introduction to Air Conditioning – Psychrometric properties and processes, sensible and latent heat loads, characterization and SHF load for ventilation and filtration, concepts of RSHF & SHF ESHF and ADP, concepts of human comfort and effective temperature.

Components of Air conditioners: Air-conditioning Components: Compressor-Evaporator-Condenser- Expansion valve-Receiver Drier- Filters-Mufflers -special features-compressor protection Anti freezing relay.

UNIT-III

Operation of an Air-conditioning System: Type of Air conditioners. Heaters-Vehicle ventilation-combination heater and air conditioner-manually controlled air conditioner and heater system- automatically controlled air conditioner and heater systems.

Air Heating equipment, Ducts, Registers and Grills, blowers, filters

UNIT-IV

Trouble Shooting and Services: Servicing of heating Systems, Causes of air conditioner Failure, leak testing guide, discharging the system- Evacuating the system-charging the System-trouble shooting air conditioner heater Systems.

UNIT-V

Servicing of Air Conditioners - Heating Systems: Air conditioner maintenance and service. Compressor trouble shooting and service, clutch service- shaft seal leakage compressor. Seal removal checking oil level-oil addition, repairs on compressors.

TEXT BOOK:

1. Automotive Air-conditioning - By William H. Grouse & Donald L. Angtin. MH
2. Automotive Air-conditioning and climate control system, by Steven Daly, Elsevier, Distributed by Yes Dee Publishing Pvt. Ltd.

REFERENCES:

1. Automotive Air-conditioning- By Lesile F.Gomgs. McGraw Hill
2. Automotive Air-conditioning- By Boyce H. Dwiggin. Reston Pub.

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3. Automotive Technology Heating and Air conditioning by Russell Carrigan, John Eichelberger. Cengage Learning, Distributed by Yes Dee Publishing Pvt. Ltd.
4. Refrigeration & Air Conditioning by CP Arora

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R16 B.TECH AUTOMOBILE ENGG.

AUTOMOTIVE CHASSIS AND SUSPENSION
(Professional Elective - I)**B.Tech. III Year II Sem.**
Course Code: AM613PE

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UNIT-I

Introduction to Chassis System: Introduction: Requirements of an automobile with types of automobiles, layout of an automobile with reference to power plant, power required for propulsion, various resistances to motion of the automobile.

Frames: Types of frames, materials, calculation of stresses on sections, constructional details, loading points. Testing of frames. **Wheels and tyres:** Types of wheels, construction. Structure and function of tyres, static and function of tyres.

UNIT-II

Two and three wheelers: construction details of frames and forks, suspension systems and shock absorbers, different arrangement of cylinders.

Steering systems: types of steering gears, front axle. Under steer and over steer, wheel alignment. Power steering, steering geometry, wheel balancing.

UNIT-III

Brakes: Types of brakes, stopping distance, and time. Brake efficiency, weight transfer, brake shoe theory, determination of braking torque, braking systems -mechanical, hydraulic, disc, parking and emergency brakes, servo and electrical brakes, details of hydraulic system, mechanical system and components. Types of master cylinders, factors influencing operation of brakes such as operating temperature, lining, brake clearance, pedal pressure, linkages etc.

UNIT-IV

Suspension: Types of suspension, leaf springs, materials, independent suspension, torsion bar, air bellows or pneumatic, suspension, hydraulic suspension, constructional details of telescopic shock absorbers. Types, vibrations and riding comfort, role axis of spring suspension.

UNIT- V

Engine Mounting: Front Wheel Mounting, Rear Wheel Mounting, Engine mounting, various types of springs used in suspension system. Requirements and various types. Material.

Testing: Testing procedures, types of tests and chassis components, equipment for lab and road tests, preparation of test reports.

TEXTBOOK:

1. Automotive chassis and body - P. L. Kohli, TMH
2. The Automotive Chassis Vol 1, and Vol. 2, By Giancarlo, Lorenzo, Springer, Distributed by Yes Dee Publishing Pvt. Ltd.

R16 B.TECH AUTOMOBILE ENGG.

REFERENCE BOOKS

1. Road Vehicle Accident Reconstruction by Rao V Dukkupati, New Age International Publishers.
2. The Automotive Body By. Lorenzo Morellol, Springer Distributed by Yes Dee Publishing Pvt. Ltd.
3. Introduction to automobile engineering -N.R. Khatawate. Khanna pub.
4. Automotive mechanics -Joseph I heitner. Affiliated East West Press
5. Problems in Automobile Engineering -N.K.Giri, Khanna Pub
6. Automotive Chassis -P.M. Heldt, Chilton & Co.

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R16 B.TECH AUTOMOBILE ENGG.

VEHICLE DYNAMICS
(Professional Elective - I)**B.Tech. III Year II Sem.**
Course Code: AM614PE

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UNIT-I**Tire and Rim Fundamentals:** Tires and Sidewall Information, Tire components, Radial and Non-Radial Tires, Tread, Wheel and Rim, Vehicle Classifications**Tire Dynamics:** Tire Coordinate Frame and Tire force system, tire Stiffness, tire print forces, effective radius, rolling resistance, Longitudinal, Lateral, Gamber, and Tire Forces.**UNIT-II****One-Dimensional Vehicle Dynamics:** Parked Car on a Level and an Inclined Road, Accelerating car on a Level and an inclined Road, Parked car on a Banked Road, Optimal Drive and Brake Force Distribution, Vehicles With More Than Two Axles.**Driveline Dynamics:** Engine Dynamics, Driveline and Efficiency, Gearbox and Clutch Dynamics, Gearbox Design.**UNIT-III****Vehicle Dynamics: Applied Dynamics:** Force and Moment, Rigid Body Translational and Rotational Dynamics, Mass Moment of Inertia Matrix, Lagrange's Form of Newton's Equations of Motion, Lagrangian Mechanics**Vehicle Planar Dynamics:** Vehicle Coordinate Frame, Rigid Vehicle Newton-Euler Dynamics, Force System Acting on a Rigid Vehicle, Two-wheel Rigid Vehicle Dynamics, Steady-State Turning.**UNIT-IV****Vehicle Roll Dynamics:** Vehicle Coordinate and DOF, Equations of Motion, Vehicle Force System, Two wheel Rigid Vehicle Dynamics, Steady state motion, Time Response**UNIT-V****Applied Vibrations:** Mechanical Vibration Elements, Newton's Method and Vibrations, Frequency Response of Vibrating Systems, Time Response of Vibrating Systems**Vehicle Vibrations:** Lagrange Method and Dissipation Function, Natural Frequencies and Mode Shapes, Bicycle Car and Body Pitch Mode, Half Car and Body Roll Mode, Full Car Vibrating Model

Natural frequencies using sweeping matrix and orthogonality principle, Holzer's method for systems with free, fixed free and fixed ends.

TEXTBOOKS:

1. Vehicle Dynamics Theory and Application by Reza N. Jazar, Springer Int. Edition.
2. Mechanical Vibration -By G. K. Grover, Nernchand & Brothers

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REFERENCES:

1. Vehicle Refinement Controlling Noise and Vibration in Road Vehicle By. Matthew Harrison Elsevier, Distributed by Yes Dee Publishing Pvt. Ltd.
2. Theory & Problems of Mechanical Vibration -By William W. Seto, McGraw Hill
3. Problems in Automobile Mechanics-By N.K.Giri, Khanna Pub.
4. Mechanics of Pneumatic Tyre -By S. K. Clark, Prentice Hall
5. Mechanical Vibration Analysis -By P Srinivasan, TMH
6. Mechanical Vibration -By Church. Wife International
7. Vibration Theory & Applications -By William I Thomson, Prentice Hall

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R16 B.TECH AUTOMOBILE ENGG.

MECHANICS OF FLUIDS AND HYDRAULICS MACHINERY LAB**B.Tech. III Year II Sem.****Course Code: AM604PC****L T P C****0 0 3 2****LIST OF EXPERIMENTS**

1. Impact of jets on Vanes.
2. Performance Test on Pelton Wheel.
3. Performance Test on Francis Turbine.
4. Performance Test on Kaplan Turbine.
5. Performance Test on Single Stage Centrifugal Pump.
6. Performance Test on Multi Stage Centrifugal Pump.
7. Performance Test on Reciprocating Pump.
8. Calibration of Venturimeter.
9. Calibration of Orifice meter.
10. Determination of friction factor for a given pipe line.
11. Determination of loss of head due to sudden contraction in a pipeline.
12. Verification of Bernoulli's Theorems

Note: Any 10 of the above 12 experiments are to be conducted

R16 B.TECH AUTOMOBILE ENGG.

AUTOMOBILE SYSTEMS LAB**B.Tech. III Year II Sem.****Course Code: AM605PC****L T P C****0 0 3 2****List of Experiments:**

1. Study, dismantling assembling of Front axle
2. Study, dismantling assembling of rear axle
3. Study, dismantling assembling of Differential
4. Study, dismantling assembling of Steering systems along with any two types of steering gear Box
5. Study, dismantling assembling of braking system-hydraulic servo vacuum, compressed air Power brakes.
6. Study of oil filter, fuel filter, fuel injection system, carburetor, MPFI
7. Study of ignition system components-coil, magneto and electronic ignition systems
8. Study of engine cooling system components.
9. Study of engine lubrication system components
10. Study of automobile electrical wiring system

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R16 B.TECH AUTOMOBILE ENGG.

ADVANCED ENGLISH COMMUNICATION SKILLS (AECS) LAB**B.Tech. III Year II Sem.**
Course Code: EN606HS

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Introduction:

A course on *Advanced English Communication Skills (AECS) Lab* is considered essential at the third year level of B.Tech and B.Pharmacy courses. At this stage, the students need to prepare themselves for their career which requires them to listen to, read, speak and write in English both for their professional and interpersonal communication. The main purpose of this course is to prepare the students of Engineering for their placements.

Course Objectives

This Lab focuses on using multi-media instruction for language development to meet the following targets:

- To improve students' fluency in spoken English
- To enable them to listen to English spoken at normal conversational speed
- To help students develop their vocabulary
- To read and comprehend texts in different contexts
- To communicate their ideas relevantly and coherently in writing
- To make students industry-ready
- To help students acquire behavioural skills for their personal and professional life
- To respond appropriately in different socio-cultural and professional contexts

Course Outcomes: Students will be able to:

- Acquire vocabulary and use it contextually
- Listen and speak effectively
- Develop proficiency in academic reading and writing
- Increase possibilities of job prospects
- Communicate confidently in formal and informal contexts

Syllabus

The following course activities will be conducted as part of the Advanced English Communication Skills (AECS) Lab:

1. **Inter-personal Communication and Building Vocabulary** - Starting a Conversation – Responding Appropriately and Relevantly – Using Appropriate Body Language – Role Play in Different Situations - Synonyms and Antonyms, One-word Substitutes, Prefixes and Suffixes, Idioms and Phrases and Collocations.
2. **Reading Comprehension** –General Vs Local Comprehension, Reading for Facts, Guessing Meanings from Context, , Skimming, Scanning, Inferring Meaning.

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3. **Writing Skills** – Structure and Presentation of Different Types of Writing – Letter Writing/Resume Writing/ e-correspondence/ Technical Report Writing.
4. **Presentation Skills** – Oral Presentations (individual or group) through JAM Sessions/Seminars/PPTs and Written Presentations through Posters/Projects/Reports/ e-mails/Assignments... etc.,
5. **Group Discussion and Interview Skills** – Dynamics of Group Discussion, Intervention, Summarizing, Modulation of Voice, Body Language, Relevance, Fluency and Organization of Ideas and Rubrics of Evaluation- Concept and Process, Pre-interview Planning, Opening Strategies, Answering Strategies, Interview through Tele-conference & Video-conference and Mock Interviews.

Minimum Hardware Requirement

Advanced English Communication Skills (AECS) Laboratory shall have the following infrastructural facilities to accommodate at least 35 students in the lab:

- Spacious room with appropriate acoustics
- Eight round tables with five movable chairs for each table.
- Audio-visual aids
- LCD Projector
- Public Address system
- Computer with suitable configuration

Suggested Software: The software consisting of the prescribed topics elaborated above should be procured and used.

- Oxford Advanced Learner's Compass, 8th Edition
- DELTA's key to the Next Generation TOEFL Test: Advanced Skill Practice.

References:

1. Kumar, Sanjay and Pushp Lata. English for Effective Communication, Oxford University Press, 2015.
2. Konar, Nira. English Language Laboratories – A Comprehensive Manual, PHI Learning Pvt. Ltd., 2011.