Approximate Weightage of Different Subjects

AAE (Mechanical)

Sr. No	Subject	Marks
1	Fundamentals of Electrical Engineering	10
2	Elements of Civil Engineering	10
3	Engineering Drawing	10
4	Engineering Mechanics	10
5	Strength of Material	10
6	Material Science & Metullargy	15
7	Theory of Machines & Tool Engineering	15
8	Manufacturing Engineering	20
9	Fluid Mechanics & Hydraulic Machines	25
10	Metrology & Instrumentation	15
11	Industrial Engineering & Management	10
12	Plant Maintenance & Safetly	10
13	Thermodynamics	15
14	Thermal Engineering	10
15	Estimating Costing & Contracting	15
	Total Marks...	**200**

TOPICS FOR THE EXAM OF AAE (MECH)

1. FUNDAMENTALS OF ELECTRICAL ENGINEERING

FUNDAMENTALS OF ELECTRIC AND MAGNETIC CIRCUITS

- Definitions of EMF, Current, Potential Difference, Power and Energy.
- Comparison of magnetic and electric circuit.

ELECTROMAGNETIC INDUCTION

- State Faraday's laws of electromagnetic induction.
- Dynamically induced emf.
- Statically induced emf.-(a) Self induced emf (b) Mutually induced emf.

A.C. FUNDAMENTALS

- Define cycle, frequency, periodic time, amplitude, angular velocity or Frequency with reference to alternating emf & current.
- Definitions of RMS value, average value, form factor & peak factor.
- Vector representation of an alternating emf and current.

A.C. CIRCUITS

- A.C. through pure a) resistors, b) inductors and c) capacitors.
- Definitions of impedance, phase angle, and power factor.
- Power in A. C. Circuits. Concept of power triangle.
- Voltage and Current relationship in Star and Delta connections.

TRANSFORMER

- General construction and principle of transformers.
- Emf equation and transformation ratio of transformers.
- List various losses in transformers and equation of efficiency.
- Applications of Transformers.
- Construction and uses of auto transformers.

ELECTRICAL MACHINES

- Construction, working principle, types and applications of D.C. generator.
- Construction, working principle, types and applications of D.C. motor.
- Construction, working principle, types and applications of single phase and three phase Induction motor.
- Necessity of Starter (DOL and Star-Delta)

2. ELEMENTS OF CIVIL ENGINEERING

LEVELLING

- Define : Temp.bench mark, Back, Intermediate & fore sight, collimation plane, Line of collimation, Hight of instrument, Reduced level.
- Types of levels e.g. Dumpy, Tilting, Wye.

INTERPRETATION OF CIVIL ENGG. DRG.

- Define : Building plan, map & distinguish them.
- Abbriviations, conventions, symbols etc. used for different building components in the drawings.

SITE SELECTION FOR FACTORY BUILDINGS:

- Various considerations in selecting site for factory building/industrial sheds.
- Sources from where the maps & plans are available
- Various factors influencing location of sites for industrial sheds.
- Soil data for sound foundation of structures.
- Application of Government bye-laws & regulations.

BUILDING BYE-LAWS FOR INDUSTRIAL SHEDS/BUILDINGS

- Define : Bye-law
- Application of bye-laws as per IS-1256 explaining the purpose of each bye-law

LAYOUT OF INDUSTRIAL - SHEDS

- Planning a layout
- Factors affecting planning
- Various considerations like north light, orientation, margins, storages incoming & outgoing materials despatch etc.
- Factors in designing industrial sheds like internal roads, light & ventilation, margins, set back, water and sanitory rooms, recreation & retiring rooms, tool room, tiffin room store room etc.
- Rules for showing details in layout like margins, road width, compound walls and gates, north line, machine foundations, trees, electric and telephone poles etc.

MACHINE FOUNDATIONS

- Procedure of designing machine foundations.
- its purpose
- Factors to be considered while designing machine foundations like
  - Shear settlement
  - Vibrations, resonance
  - Operating frequency
  - Dead load etc.
- Various types of failures of machine foundations
- Selection of appropriate types of machine foundation identifying governing factor causing failure
- Types of dynamic loads & their effects on foundations

CONSTRUCTION MATERIALS

- Various types of construction materials commonly used like :
    - Bricks
    - Water
    - Steel (bars and sections)
    - Cements
    - Aggregates
- Properties of each material & their acceptable standards
- Where they are most suitably used
- Select most suitable construction materials for industrial structures with respect to durability, appearance, economy etc.

STRENGTH OF CEMENT CONCRETE

- Ingredients of cement concerte
- Water cement ratio & its effect on the strength of cement concrete
- Influence of other parameters on the strength of concrete Parameters like :
    - Aggregate cement ratio
    - Size & shape of aggregates
    - Strength & type of aggregates
    - Compaction
    - Curing method & curing period
    - Workmanship & handling of concerte (mixing,Transporting)
    - Property of cement used

3. ENGINEERING DRAWING

USES OF DRAWING AIDS :

- Drawing equipment instruments and materials
- Construction of Polygons.

PLANNING & LAYOUT OF DRAWING :

- I.S. codes for planning & layout
- Dimensioning methods–aligned method & unilateral with chain, parallel, progressive & combined dimensioning.

ENGINEERING CURVES :

- Various types of curves like Ellipse, parabola, hyperbola, cycloid, epicycloid, hypocycloid, Involute & spiral.

PROJECTIONS OF POINTS, LINES & PLANES :

- Reference planes, orthographic projections
- 1st Angle and 3rd Angle
- Projections of points
- Projections of Lines–determination of true lengths & inclinations.
- Projections of plane–determination of true shape.

ORTHOGRAPHIC PROJECTIONS :

- Front view, Top view, Side view, Bottom view & rear view

ISOMETRIC PROJECTIONS :

- Difference between isometric projections & isometric drawing.
- Isometric views & isometric projections.

FASTENERS :

- Detachable & permanent fasteners–difference
- Lead & pitch

GRAPHS & CHARTS :

- Advantages–types (Bar, Pie, Percentage bar, Logarithmic)
- Preparation & interpretation of the graphs and charts

4. ENGINEERING MECHANICS

INTRODUCTION

- Scalar and Vector quantities.
- Scope of Engg. Mechanics.
  - Static
  - Dynamics (a) Kinetics (b) Kinematics
- Different systems of units-Conversions-, Abbreviations.

COPLANAR CONCURRENT FORCES :

- Forces, Units of Force, elements, Principles of superposition, Principle of transmissibility.
- Composition and resolution of forces, Resultant conditions of equilibrium, Analytical and graphical method, Law of parallelogram of forces, law of triangle of forces,law of polygon of forces, Lami's theorem-problems.

COPLANER, PARALLEL AND NON-CONCURRENT FORCES

- Moment, Couple, Principal of moment, application, properties of couple, numerical problems
- Conditions of Equilibrium
- Reaction of beams by **analytical method only**
  1. Statically determinate beams
  2. Types of supports
  3. Types of loading

CENTROID & CENTRE OF GRAVITY

- Centroid, Axis of symmetry, Centroid of standard shape Sections like I, L, T, Channel etc.
- State formula to find centroid of plane sections
- Centre of Gravity (C.G), Axis of symmetry, C.G. standard solids
- State formula to find C.G. of solid sections

FRICTION

- Friction, law of friction, coefficient of friction, angle of friction, angle of repose, Types of friction
- Application of Lami's theorem and theory of resolution of forces
- Problems on Friction for a block resting on horizontal plane & inclined plane.

RECTILINEAR MOTION , MOTION OF PROJECTILES , CURVILINEAR MOTION

WORK-POWER- ENERGY

- Work: Workdone, force-displacement diagram Workdone in stretching the compound spring Torque, workdone by torque.
- Power: I.H.P., B.H.P. of engine, Equation of H.P. in terms of torque and R.P.M., Engineering Problems on it.

SIMPLE MACHINES :

- Mechanical Advantage, V.R., Efficiency, line sketch of
- different systems of pulley blocks, simple and compound
- levers, simple machines, problems.
- Laws of Machines.
- Reversible, Non-reversible machines.

5. STRENGTH OF MATERIALS

Direct Stress and Strain :

- Types of stresses and strains with suitable examples implied to mechanical engineering.
- Relationship between stress and strain with various concepts associated with it
- Hooke's law and Modulus of Elasticity.
- Effect of temperature on a material properties and strength.
- Type of loading and strain energy concept.

Shear Force (SF) and Bending Moment (BM) :

- Terms associated with SF and BM.
- SF and BM diagrams with typical loads

Stresses in Beams :

- Moment of Inertia: Concept

Deflections of Beams :

- Concept and effect of slope and deflection.
- Slope and deflection for
    a. Simply supported Beam
    b. Cantilever Beam

Combined Direct and Bending Stresses :

- Effect of combined direct and bending stresses.
- Maximum and minimum stress diagram.
- Limit of eccentricity

Columns and Struts :

- Classifications, end conditions and various terms associated with Columns and Struts.
- Euler's formula to determine critical loads.

Riveted and Welded Connections :

- Type of Connections.
- Differentiate between Riveted and Welded connection.
- Concept of Joint for Riveted Connection.
- Efficiency of Joint.
- Type of welded connection.
- Welded connection for typical standard sections.

Study of Materials :

- List of the materials used as machine elements with BIS,ASME,JIS,EN standard designations.
- Tabulation of typical strengths of different materials.
- Study of standard tests as per B.I.S.

6. MATERIALS SCIENCE AND METALLURGY

INTRODUCTION AND PROPERTIES OF ENGINEERING MATERIAL

- Introduction, need, classification of metals and non-metals.
- Materials Properties.
    i. Mechanical
    ii. Chemical Properties
    iii. Thermal Properties
    iv. Electrical / Electromagnetic
- Stress and strain-concept, relationship

METALLURGICAL CONSIDERATION OF METALS :

- Equilibrium diagrams
- TTT Curve, applications. TTT curve for stainless steel
- Iron-carbon equilibrium diagram and its characteristic

FERROUS METALS AND ITS ALLOYS :

- Introduction and classification of ferrous metals.
- Flow diagram for production of Iron and steel.
- Ferrous metals – standards & designations (According to BIS, EN, ASME , JISDIN)
- Alloying of metals-properties and effect

NON FERROUS METALS AND ITS ALLOYS

- Role of non ferrous metals and its alloys related to engineering field.
- Types, properties, capabilities, designations (According to BIS, EN, ASME, JISDIN), composition, and industrial applications of :
    - copper alloys.
    - aluminum alloys.
    - bearing metals.

HEAT TREATMENT :

- Introduction to heat treatment
- Types, method /process, process parameters and applications of various heat treatment processes/methods
- Study of quenching medias and their properties.

NON-DESTRUCTIVE TESTING

- Working principle, working, equipment, parameters ,procedure , and applications of various non- destructive testing methods.

7. (A) THEORY OF MACHINE

INTRODUCTION

- Need, Scope & importance of Theory of Machine in Design and Analysis.
- Need of developing analytical attitude, Knowledge & skill required for design and analysis.
- Basic terminology related to machines and mechanisms.
- Development of different mechanisms.
  - i. Four bar mechanism.
  - ii. Slider crank mechanisms.
  - iii. Inversion.

CAMS AND CAM PROFILES

- Introduction, function and types of cams and cam followers.
- Types of motions and displacement for different types of cam and cam followers.
- Construction of different types of cam profile for given data.

POWER TRANSMISSION

- Introduction, need, modes and applications.
- Rope –types, applications.
- Belt drive-types, terminology, ratio of tensions, effect of centrifugal forces and initial tension
- Gear trains- types and application

FLY WHEEL AND GOVERNOR

- Turning moment diagram, Use, T.M. diag. for different machines and torque determination.
- Coefficient of fluctuation of speed and energy .
- Flywheel : Functions , types and moment of inertia and weight calculation.
- Governor : functions, types and terminology associated.

BALANCING AND VIBRATION

- Concept, types of balancing, balancing of masses revolving in the same plane.(only description),basic concept of balancing reciprocating masses.
- Terminology of vibration, causes and remedies of vibration.

(B) TOOL ENGINEERING

TOOL ENGINEERING

- Concept, meaning and definitions of various terminology used, including tool, tool design, tool engineering, etc.
- Tool engineering-functions, services and assistance, organizational structure, intra and interrelationship in an organization.
- Comparison of the materials with their utility point of view

PROCESS PLANNING, ECONOMY AND ESTIMATION IN TOOL ENGINEERING:

- Information required for process planning and information available from process planning.
- Process planning-concept, meaning, importance, functions procedure and forms used.
- Applications of process & tool plans in a given situation.

INTRODUCTION TO TOOL DESIGN:

- Define, compare and differentiate tool, cutting tool and machine tool.
- Tools-types, classification, features & applications
- Tool materials-types, classification, composition, properties, cutting parameters (for various work piece materials), applications and selection criteria.
- Heat treatment-types, necessity, process, selection criteria and applications for various tool components.
- Tooldesign-importance,elements,steps,procedure examples.

CUTTING TOOLS SELECTION:

- Cutting tools-types, classification and applications.
- Criteria for selection of cutting tools for given /situation.

DESIGN OF JIGS AND FIXTURES:

- Introduction - concept, purpose, definitions, principles and difference of jigs and fixtures.
- Location and clamping- principles, types, features, working, importance and applications.
- Jig- concept, meaning, types, applications, working, components design steps, design
- Fixture-concept, meaning, types, applications, selection criteria, components, design steps, design and selection criteria.

8. MANUFACTURING ENGINEERING

INTRODUCTION TO MANUFACTURING PROCESSES :

- Nature, role and scope of manufacturing processes.
- Basic principle of mechanical working and its Terminology.
- Role of metal working, metal casting and metal joining processes.

METAL WORKING PROCESSES :

- Hot and cold working processes.
- Working principles, equipments used and their specifications, process and applications of:
  - Rolling, Forging, Drawing, Extrusion, Forming, Embossing Bending
  - Spinning, Shot peening, Coining, Swaging, Sand blasting

METAL CASTING :

- Types of foundries
- Pattern making-process and importance
- Cores– Types, Core making materials and its properties, Testing, sintering and applications
- Type of castings- i.e centrifugal , die , investment , shell moulding , special castings, etc.
- casting defects-types, causes, effects, remedies
- Recent trends in casting including Magnetic and Vacuum.
- Metal melting and pouring-process, temperatures, precautions.
- Finishing of casting-need and methods
- I.S. grade of casting and its uses.
- Casting materials-types, standards in BIS, EN, ASME, JIS, compositions, Application

METAL JOINING PROCESSES :

- Introduction and classification.
- Welding-working principle, specifications of equipment, functions of each element, process parameters for various materials
- Soldering-working principle, specifications of equipment-tools and consumables, functions of each element, process parameters for various materials and safety precautions.
- Brazing-working principle, specifications of equipment-tools and consumables, functions of each element, process parameters for various materials and safety precautions.
- Adhesive joining-process, applications
- Recent trends in metal joining
  - **i.** Electron beam welding
  - **ii.** Laser beam welding
  - **iii.** Ultrasonic welding
- Welding Techniques / methods of joining non-homogeneous metals

9. FLUID MECHANICS AND HYDRAULIC MACHINES

FLUID AND FLUID PROPERTIES

- Concept and classification
- Properties of fluid

FLUID KINEMATICS

- Fluid flow : types and equations including ideal, laminar, turbulent and compressible

FLUID DYNAMICS

- Basic equations.
- Bernoulli's equation and its applications.
- Euler's equation and its applications.

FLOW MEASUREMENT:

- Notches, Venturimeter, Orifice meter, Nozzles, Rota meters.
- Selection criteria for flow measuring devices.

FLOW THROUGH PIPES:

- Reynolds's experiment, friction factor, Darcy's equation Moody's chart.
- Water hammer effect.
- Selection criteria for pipes and pipe sizes

PUMPS:

- Concepts, classification and application of pumps.
- Detailed study (construction, working) of
  (1) Centrifugal pump
  (2) Reciprocating pump
  (3) Turbine pump
  (4) Submersible pump
  (5) Rotary positive displacement type pumps
  (6) Gear pump
- Performance of pumps, importance of efficiency, discharge, head and power consumption
- Selection and Maintenance of pumps.
- Faults, remedies and safety precaution for pumps.
- Specific speed for pumps.
- Characteristic curves of submersible and centrifugal pumps.

HYDRAULIC DEVICES:

- Flow control valves- types, construction, working and applications.
- Hydraulic control valves- types, construction, working and applications.
- Hydraulic motors- types, construction, working and applications.
- Fluid couplings-construction, working, applications.
- Advantages and limitations of hydraulic systems

PNEUMATIC DEVICES :

- Introduction to pneumatics as power transmission device.
- Pneumatic elements used in pneumatic circuits -types, construction, working, applications and common troubles and remedies in working of them, precautions in installations and assembly.
- Working principle, working and applications of pressure regulators.

10. METROLOGY AND INSTRUMENTATION

INTRODUCTION

- Need, Scope & importance of metrology and instrumentation in industries.
- Elements of measurement and factors affecting it.
- Concept, need and importance of standard and specification.
- Relationship between interchangeability and selective assembly.
- Concepts of computer aided inspection, working system and applications,
- coordinate measuring machine.

LINEAR MEASUREMENT

- Least count, accuracy, precision, error.
- Selection of instrument for given situation.

TESTING OF STRAIGHTNESS, FLATNESS AND SQUARENESS

- Concept of straightness, flatness, squareness and roundness
- Testing of straightness, flatness, squareness and roundness.

SCREW THREAD MEASUREMENT

- Terminology associated with screw thread measurement.
- Measurement methods of external and internal thread elements.
- Study of all type of thread measuring instruments.

GEAR MEASUREMENT

- Terminology associated with gear measurements.
- Various methods of measuring and deriving gear elements.
- Gear tooth vernier caliper, Parkinson's gear tester, David Brown gear tooth form testing.
- Tool room microscope as projection method for small gear.
- Involute curve checking.

LIMITS GAUGES

- Concept of gauging types and uses of gauges.
- Use of various gauges .

TEMPERATURE MEASUREMENT

- Principles of temp. measuring devices.
- Bimetal thermometer, pressure spring thermometer, resistance thermometer, thermister, thermocouple, pyrometer.
- Errors in temperature measurement.

PRESSURE MEASUREMENT

- Pressure measuring devices - types, applications, and its constructional details including vacuum.
- Use of manometers, elastic gauges, tactile sensor and pressure transducers.

FLOW MEASUREMENT

- Classification of flow measuring devices.
- Use of various volumetric meters.
- Special methods of flow measurements.

AUTOMATIC CONTROLS

- Meaning, general aspects and application of automatic control.
- Automatic control system such as open loop control, feed back control, on-off control and proportional control.

CALIBRATION OF INSTRUMENTS

- Need of calibration.
- Standards.
- Various standard procedures for calibration of instruments.

11. (A) INDUSTRIAL ENGINEERING

INTROUCTION TO INDUSTRIAL ENGINEERING.

- Know the objectives of learning this subject.
- Need, Scope & importance of Industrial Engineering in industries.

TECHNIQUE OF WORK STUDY.

- Objectives and Steps in method study.
- Motion economy and its importance.
- Design of efficient work place layout using motion economy.
- Chart used for analyzing work place layout.
- Presentation of work elements into therbligs.
- Preparation and use of SIMO chart.
- Plant layout
- Work measurement

JOB EVALUATION, ENRICHMENT, WAGES AND INCENTIVES.

INTRODUCTION TO QUALITY ASSURANCE (Q.A)

- Definition of quality, quality control(QC),quality assurance(QA), statistical quality control (SQC) and reliability.

RELIABILITY

- Concept, definition, difference between reliability and quality control.
- Factors affecting and improving reliability.

EMERGING TRENDS IN INDUSTRIAL ENGINEERING.

- ISO 9000-Concept, series, features, importance and applications.
- Six sigma-Concept, importance, calculation and applications.

(B) INDUSTRIAL MANAGEMENT

INTRODUCTION TO INDUSTRIAL MANAGEMENT.

- Need, Scope & importance of Industrial Management in Industries.

ORGANISATION STRUCTURE AND ORGANISATIONAL DYNAMICS

MATERIALS MANAGEMENT.

- Material management-definition, functions, importance, relationship with other departments.
- Purchase - objectives, purchasing systems, purchase procedure, terms and forms used in purchase department.
- Storekeeping- functions , classification of stores as centralized and decentralised with their advantages, disadvantages and application in actual practice.
- Definition of inventory control, objectives of inventory control, derivation for expression for Economic Order Quantity (EOQ), ABC analysis, other modern methods of analysis, various types of inventory models such as Willson's inventory model, replenishment model and two bin model.

PRODUCTION, PLANNING AND CONTROL (PPC):

- PPC-meaning, phases, importance and objectives.
- Explain in detail the functions of PPC along with necessary forms used in it, softwares available in market and their features.

CRITICAL PATH METHO AND PRE EVALUATION REVIEW TECHNIQUE (CPM/PERT).

- CPM & PERT-meaning, features, difference, applications.
- Understand different terms used in network diagram.
- Draw network diagram for a real life project containing 10-15
- activities, computation of LPO and EPO.
- Determination of critical path on network.
- Floats, its types and determination of floats.

VALUE ANALYSIS (VA) :

- VA-definition, terms used, process, importance and methods.
- VA flow diagram.

12. PLANT MAINTENANCE AND SAFETY

INTRODUCTION TO MAINTENANCE ENGINEERING

- Need, Scope & importance of plant maintenance and safety in industries.
- Need of attitude, knowledge & skill required for shop floor maintenance tasks in industries.
- Definition and aims of maintenance engineering.
- Primary and secondary functions and responsibilities of maintenance department.
- Types of maintenance.
- Maintenance cost and its relation with replacement economy.
- Service life of equipment

TRIBOLOGY

- Friction and its effect.
- Wear reduction methods.
- Lubricants and Lubrication procedure.
- Bearing types and application.

CORROSION AND ITS PREVENTION

- Corrosion, factors affecting the corrosion.
- Types of corrosion.
- Corrosion prevention methods.

INTRODUCTION TO MAINTENANCE ENGINEERING, BREAKDOWN MAINTENANCE

- Types of fault in Machine tools.
- Periodic inspection.
- Degreasing, cleaning and repairing scheme.
- Overhauling of components.
- Repair complexities and its use.
- Breakdown maintenance-causes, strategies to attend, remedial actions, types of spares to be stored , examples.
- Maintenance of pumps, compressors and D.G. sets.

PREVENTIVE MAINTENANCE

- Preventive maintenance.
- Steps and need of preventive maintenance.
- Advantages.
- Two major divisions of activities.
- Frequency cycle.
- Program and schedule of preventive maintenance.
- Repair complexity.
- Aids to a good preventive maintenance, its type and effect on
- preventive maintenance.

INDUSTRIAL SAFETY

- Accident : causes, types, results and control.
- Safety awareness.
- Mechanical and electrical hazards.
- Methods of safe guarding the machine and equipment.
- Fire prevention and fire fighting methods.

INSTALLATION AND TESTING OF INDUSTRIAL EQUIPMENT

- Foundation :effect and design, foundation materials, size and plan of foundation
- Erection and application of erection equipment.
- Testing and aligning methods used for industrial equipment.

13. THERMODYNAMICS

BASIC CONCEPTS OF THERMODYNAMICS :

- Thermodynamic systems, properties and classification.
- Zeroth law and temperature measurement.
- Thermodynamic process (reversible-irreversible) and cycle.

FIRST LAW OF THERMODYNAMICS :

- Law of conservation of energy.
- First law for closed cycle.
- First law applied to system undergoing a change of state.
- First law applied to open system-steady flow energy equation.(S F E E)
- Application of first law of thermodynamics.

SECOND LAW OF THERMODYNAMICS :

- Limitation of first law.
- Concepts of heat reservoir, source, sink, heat engine, heat pump and refrigerator.
- Kelvin-Plank statement and Clausius statement.
- Concept of thermal efficiency and Coefficient of performance.
- Carnot cycle and Carnot theorem - corollary.
- Concept of entropy.

IDEAL GASES AND PROCESSES :

- Specific heats and its relationship.
- Different thermodynamics processes, its representation on P-V, T-S and H-S diagrams.
- Equations for PVT relationship, work transfer, heat transfer for all above processes.

THERMODYNAMIC CYCLES :

- Concept of air Standard efficiency.
- Classification of cycles
    i. Carnot (only gas) cycle.
    ii. Otto, Diesel and Dual Combustion cycle.
    iii. Brayton cycle
    iv. Refrigeration cycles:
- Limitations and applications of above cycles.
- Expression for thermal efficiency of above cycles (Examples)
- Comparision between the above cycles

14. THERMAL ENGINEERING

STEAM PRIME-MOVERS:

- Concept of steam prime mover.
- Brief description about heat engine.
- Steam turbine - concept and classification.
- Steam nozzles-types, working and applications.
- Impulse and reaction turbines(constructional and materials details).

STEAM CONDENSERS AND COOLING TOWERS:

- Classification and working of condensers.
- Classification and working of cooling towers.

AIR COMPRESSORS:

- Concepts, functions and classification.
- Working of reciprocating air compress or and rotary air compressor.
- Single stage, multistage and inter-cooling in compressors.
- Power required and efficiency of reciprocating air Compressors-single and two stage.

INTERNAL COMBUSTION (I. C.) ENGINES:

- Concepts and classification.
- I.C. engines parts and their functions.
- Working of two stroke and four stroke cycle Spark Ignition (SI) and Compression Ignition (CI) engines.
- Valve timing of I.C. engine and its explanation on PV diagram.
- Various systems of I.C.engines.
- Carburetion, fuel pump and fuel injectors including Multi Point
- Fuel Injectors(MPFI).
- Scavenging and Turbocharger.
- Concept of octane and cetane numbers.

ECHO-FRIENDLY FUELS:

- Alternatives fuel-types, properties, compositions, advantages, disadvantages,Compressed Natural Gas(CNG), Liquefied Petroleum Gas(LPG), and Biodiesel).National and International emission norms.
- Systems required for CNG and LPG supply in vehicle.
- Compatibility needs-vaporizer for fuel compatibility, piping and allied needs.

REFRIGERATION AND AIR-CONDITIONING:

- Introduction , working on PV and TS diagrams and applications of Vapour Compression Refrigeration System (VCRS)and Vapour Absorption Refrigeration System(VARS).
- Properties and applications of commonly used refrigerants including R22,R134a and R717(Ammonia).
- Air conditioning- types and its applications.

HEAT TRANSFER:

- Various mode of heat transfer.
- Conduction heat transfer, Fourier's law, thermal conductivity and heat transfer through composite wall and cylinders.
- FreeConvection heat transfer , Newton's law of convection and force convection, coefficient of convection.
- Radiation heat transfer, Stefan and Boltzmann's law, Black body concept, emissivity, refractivity, absorptivity

15. ESTIMATING, COSTING AND CONTRACTING (ECC)

INTRODUCTION TO ECC:

- Need, Scope & importance of ECC in industries.
- Difference between costing and estimating.

ELEMENTS OF COST AND OVERHEAD ALLOCATION:

- Terminology associated with various cost elements and their Classification etc
- Determination of selling price and catalogue price.
- Depreciation and obsolescence : Definition, Types Different methods of calculating depreciation.
- Determination of cost of production.
- Concept of Machine Hour Rate (MHR).

COST ESTIMATION OF WELDING:

- Elements of cost in welding.
- Factors effecting welding cost.

COST ESTIMATION OF FORGING, CASTING, MACHINING AND PRESS TOOLS:

- Cost terminology associated with each shop(i.e. forging shop, machine shops(Turning,Milling,Drilling,Cylindricalgrinding,Keyway milling/Slotting/Broaching and Gear cutting), foundary shop and press shop(Punching and bending).
- The procedure of calculating material cost of a product
- Determine selling price of given parts made by forging, casting, pattern making, machining and sheet metal process.

BREAK EVEN ANALYSIS:

- Classification of costs, Fixed and variable costs, Classification of given set of costs as fixed and variable, Relationship between the costs and quantity of production.
- Break Even Chart :
    i. Definition of Break Even Point (BEP) and its needs in industry.
    ii. Procedure of construction of Break Even Chart.
    iii. Assumptions made in constructing Break even chart.
    iv. Calculation of B.E.P. analytically and graphically.
    v. Margin of safety, its importance and its derivation.
    vi. Effect of changing various parameters on B.E.P.
    vii. Define and derive profit/volume ratio.

PROBLEMS AND SOLUTION OF COST REDUCTION:

BUDGETING AND INDUSTRIAL ACCOUNTING:

- Define Budget and Budgetary control.
- Purpose of budget.
- Explain various accounting terminology like book value, Net Present Value, Work in progress, Gross Domestic Product (GDP),balance sheet terminology etc