Diploma in Mechanical

Programme Contents :-

First Year	
Sr. No.	**Name of Subject**
1	English-I
2	Applied Mathematics
3	Applied Physics
4	Applied Chemistry
5	Applied Mechanics
6	Basics of Mechanical Engineering
7	Engineering Drawing
8	Concepts in Information Technology
9	Workshop Technology
10	Business Communication
11	Study Through ICT* Technology
12	Assignment Work
13	Extra-Curricular Activities & Project Work

Second Year	
Sr. No.	**Name of Subject**
1	English-II
2	Applied Mathematics-II
3	Workshop Technology - II
4	Thermodynamics
5	Engineering Materials & Material Science
6	Machine Design & Drawing - I
7	Computer Application for Engineering
8	Industrial Management
9	Strength of Materials
10	Mechanical Engineering Drawing
11	Study Through ICT* Technology
12	Assignment Work
13	Extra-Curricular Activities & Project Work

Third Year	
Sr. No.	**Name of Subject**
1	English-III / Hindi-III
2	Theory of Machines
3	CNC Machines & Automation

4	Hydraulics & Hydraulic Machines
5	Machine Design & Drawing – II
6	Workshop Technology – III
7	Entrepreneurship Development & Management
8	Industrial Engineering
9	Project Work
10	Study Through ICT* Technology
11	Assignment Work
12	Extra-Curricular Activities & Project Work
Total	

Detailed syllabus: -

First Year:

First Year	
Sr. No.	**Name of Subject**
1	English-I
2	Applied Mathematics
3	Applied Physics
4	Applied Chemistry
5	Applied Mechanics
6	Basics of Mechanical Engineering
7	Engineering Drawing
8	Concepts in Information Technology
9	Workshop Technology
10	Business Communication
11	Study Through ICT* Technology
12	Assignment Work
13	Extra-Curricular Activities & Project Work

Subject Name: English-I

1. **Functional Grammar:** Patterns & Parts of speech Subject, Predicate, Noun, Pronoun, Adjective, Adverb, Verb, Verb phrases, Conjunction, Interjection.
2. **Vocabulary:** Word formation, Prefix, Suffix, Compound words, Conversion, Synonyms, Antonyms, Homophones and Homonyms, How to look up a dictionary.
3. **Communication:** Meaning & importance of communication, Barriers to effective communication, Channels of communication, Language as a tool of communication.
4. **Requisites of Sentence writing:** Fragmented sentences, A good sentence, expletives, Garbled sentences, Rambling sentences, Loaded sentences, Parallel Comparison, Squinting construction, Loose & periodic sentences.

Subject Name: Applied Mathematics

1. Quadratic Equations
2. Arithmetic Progressions
3. Geometric Progressions
4. Partial Fractions
5. Permutations
6. Combinations
7. Binomial Theorem (For Positive Integral Index)
8. Binomial Theorem (For Fractional Index)
9. Measurement of Angles
10. Trigonometric Functions
11. Trigonometric Functions of Sum and Difference of Two Angles
12. Transformation Formulae
13. Trigonometric Functions of Multiple and Sub-Multiple Angles
14. Relations Between the Sides and the Trigonometric Ratios of the Angles of a Triangle
15. Area of a Triangle
16. Solution of Triangles
17. Cartesian Coordinates (Two Dimensions)
18. Locus
19. Straight Lines
20. Circles
21. Plotting of Curves
22. Translation of Axes
23. Parabolas
24. Ellipses
25. Hyperbolas
26. Polar Coordinates

Subject Name: Applied Physics

1. **Units and Dimensions:** Fundamental and Derived Units in SI System, Dimensions of Physical Quantities, Principle of Homogeneity Dimensional Equation, Applications of Dimensional Analysis: Checking the Correctness of Physical Equations, Derivation of Simple Physical Relations, Limitation of Dimensional Analysis, Significant Figures and Error Analysis.
2. **Force and Motion:** Scalars and Vectors, Velocity & acceleration, Equations of Motion, Newton's Law of Motion, Force & its Derivation from Newton's Laws of Motion, Composition and resolution of forces, Parabolic Motion Horizontal Projection and Projection at an angle, Time of Flight, Horizontal Range and Maximum Horizontal Range, Simple Problems, Centripetal Acceleration, Centripetal and Centrifugal Forces, Concept of Friction and its Application, Application to Banking of roads.
3. **Work, Power and Energy:** Work and its Units, Work Done on Bodies Moving on Horizontal and Inclined Planes (Consider Frictional Forces Also). Concept of Power and its Units, Calculations of Power (Simple Cases), Concept of Kinetic Energy and Potential Energy Expressions for P.E and K.E, Conservation of Energy in the Case of Freely Falling Bodies, Principle of Conservation of Energy.

4. **Rotational and Simple Harmonic Motions:** Definition of Moment of Inertia, Moment of Inertia of Disc, Ring, & Sphere, Torque and Angular Momentum and Their Inter Relation, Principles of Conservation (Angular Momentum and its Applications). Kinetic Energy of Rolling Body, S.H.M – Derivation of Displacement, Velocity, Acceleration, Time Period and Frequency, Motion of Cantilever, Free, Forced and Resonant Vibrations (No Derivation).
5. **Heat- Temperature and its Measurement:** Concept of Heat and Temperature on the Basis of K.E. of Molecules, Unit of Heat Basic Principles of Measurement of Temperature, Thermocouple, Bimetallic and Resistance, Pyrometers and Thermometers Criteria for the Selection of Thermometers.
6. **Expansion of Solids:** Coefficient of Linear, Surface and Cubical Expansions and Relation Amongst Them, Thermal Stresses (Qualitative Only) and their Applications.
7. **Heat Transfer:** Three Modes of Transfer of Heat, Coefficient of Thermal Conductivity, its Determination by Searle's Method and Lee's Disc Method, Conduction Through Compound Media (Series and Parallel for Two Materials Only), Heat Radiation, Characteristics of Heat Radiations, Prevost's Theory of Heat Exchange, Black Body Radiations, Emissivity and Absorptivity Kirchhoff's Law and Stefan's Law of Radiation.

Subject Name: Applied Chemistry

1. **Structure of Atom:** Chemistry as Important Branch of Science, Basic Concept of Elements Mixture and Compound, Chemical Equation, its Balancing, Implications and Limitations, Recapitulation of Fundamental Particles of Atom i.e., Electron, Proton and Neutron, Bohr's Model of Atom, Line Spectrum of Hydrogen, Modern Concept of Atom-Four Quantum Numbers, Shells, Subshells, Orbital (Shapes of s & p Orbital), Pauli's Exclusion Principle, Aufbau Energy Ranking Rule, Orbital Concept Types of bonds co-valency, formation of s-s, s-p, p-p, bonding with examples, Hybridization sp, sp^2, sp^3, (Consider BeF_2, BF_3, CH_4) molecules, Brief Concept of Modern Periodic Table of Elements.
2. **Chemical Equation, Oxidation & Reduction:** Concept of Oxidation & Reduction, Electronic Concept of Oxidation & Reduction, Redox Reactions (Direct and Indirect), Oxidation Number Balancing of Simple Redox Reactions by Oxidation Number.
3. **Ionic Equilibrium:** Ionization, Degree of Ionization, Focus Effecting Ionization, Ionization of Water, Ionization Equilibrium in Aqueous Solutions, Common Ion Effect.
4. **Acids and Bases:** Concept of Acids and Bases, Their Strength in Ionization Constant, PH Value, Acid Base Titration, Choice of Indicators, Hydrolysis, Buffer Solution.
5. **Electrolysis:** Concept of Electrolysis, Faraday's Law of Electrolysis, Engineering Applications (Electro-Metallurgy, Electroplating & Electro-Refining)
6. **Water:** Hard and Soft Water, Removal of Hardness by: Soda Lime Process, Permutit's Process, Ion Exchange Method., Disadvantages of Hard Water in Industrial User, Boiler Scales, Priming, Foaming Corrosion and Caustic Embrittlement, Expressing the Degree of Hardness of Water in (With Simple Problems): Clark's Degree, O' Hener's Method, Determination of Degree of Hardness by (With Simple Problems): Soap Titration Method, O' Hener's Method: Water for Drinking Purposes.
7. **Solutions & Colloids:** Solute, Solvent, Solution & Colloids, Particle Size and Colloidal State, Tyndell Effect, Brownian Movement, Coagulation.

Subject Name: Applied Mechanics

1. **Introduction:** Concept of Mechanics and Applied Mechanics, Explanation of Mechanics and Applied Mechanics, Its Importance and Necessity, Giving Suitable Examples on Bodies at Rest and in Motion, Explanation of Branches of this Subject, Concept of Rigid Bodies.
2. **Laws of Forces:** Force and its Effects, Units and Measurement of Force, Characteristics of Force Vector Representation, Bow's Notation, Types of Forces, Action and Reaction, Tension, Thrust and Shear Force, Force Systems: Coplanar and Space Force Systems, Coplanar Concurrent and Non-Concurrent Forces, Free Body Diagrams, Resultant and Components Concept of Equilibrium, Parallelogram Law of Forces, Equilibrium of Two Forces, Superposition and Transmissibility of Forces, Newton's Third Law, Triangle of Forces, Different Cases of Concurrent Coplanar, Two Force Systems, Extension of Parallelogram Law and Triangle Law to Many Forces Acting at One Point-Polygon Law of Forces, Method of Resolution into Orthogonal Components for Finding the Resultant, Graphical Methods, Special Case of Three Concurrent, Coplanar Forces, Lami's Theorem.
3. **Moments:** Concept of Moment, Varigon's Theorem- Statement Only, Principle of Moments- Application of Moments to Simple Mechanism, Parallel Forces, Calculation of their Resultant, Concept of Couple Properties and Effect, Moving a Force Parallel to its Line of Action, General Cases of Coplanar Force System, General Conditions of Equilibrium of Bodies Under Coplanar Forces.
4. **Friction:** Concept of Friction, Laws of Friction, Limiting Friction and Coefficient of Friction, Sliding Friction.
5. **Centre of Gravity:** Concept of Gravity, Gravitational Force, Centroid and Center of Gravity, Centroid for Regular Lamina and Center of Gravity for Regular Solids, Position of Center of Gravity of Compound Bodies and Centroid of Composition Area, CG of Bodies with Portions Removed.
6. **Laws of Motion:** Concept of Momentum, Newton's Laws of Motion, Their Application, Derivation of Force Equation from Second Law of Motion, Numerical Problems on Second Law of Motion, Piles, Lifts, Bodies Tied with String, Newton's Third Law of Motion and Numerical Problems Based on it, Conservation of Momentum, Impulsive Force (Definition Only).
7. **Simple Machines:** Concept of Machine, Mechanical Advantage, Velocity Ratio and Efficiency of a Machine, their Relationship, Law of Machine, Simple Machines (Lever, Wheel and Axle, Pulleys, Jacks Winch Crabs Only).

Subject Name: Basics of Mechanical Engineering

1. **Source of Energy:** Introduction, Types of Energy.
2. **Steam and its Properties:** Introduction to Steam, Terms Related to Steam Formation.
3. **Boiler:** Classification of Boilers, Merits and Demerits, Boiler Mounting.
4. **Prime Movers:** Definition of Prime Movers, Impulse and Reaction Turbines, Open and Close Cycle Gas Turbine.
5. **Internal Combustion Engines:** Heat Engine, External and Internal Combustion Engine, Classification of IC Engines, Principle Parts of IC Engines.
6. **Refrigeration and Air Conditioning:** Types of Refrigeration System, VCRS, Air Conditioning.
7. **Welding, Soldering and Brazing:** Welding, Classification of Plastic and Fussion Welding, Arc Welding, Types of Electrode, Brazing and Soldering.

8. **Machine Tools:** Introduction, Classification of Lathes, Major Parts of a Lathe, Specification of Lathe, Drilling Machine Operations, Milling and Down Milling, Grinding Machines.
9. **Lubrication and Bearings:** Introduction to Lubrication, Function and Properties of Lubricants Classification of Bearings.
10. **Power Transmission:** Belt Drives, Belt Material, Gear Train, Types of Gears, Compound Gear Train.
11. **Mechatronics:** Concept of Mechatronics System, Elements of Measurement System, Types of Control Systems, Microprocessor Based Controllers.

Subject Name: Engineering Drawing

1. **Drawing Office Practice:** Importance of Engineering Drawing, Importance of Legible Lettering and Numbering, Dimensioning, Scales, Geometrical Construction, Conics, Geometric Curves.
2. **Orthographic Projections, Projection of Simple Objects in three views.**
3. **Projection of Solids and Section of Solids:** Projection of Simple Solids, Sectional View.
4. **Pictorial Drawing:** Isometric Drawings.
5. **Development of Surfaces.**
6. **Practice on AutoCAD:** AutoCAD Commands, Exercise.

Subject Name: Concepts in Information Technology

1. **Information Concepts & Processing:** Definition of Information, Data VS Information, Introduction to Information System, Information Representation Digital Media, Images, Graphics, Animation, Audio, Video etc. Need a Value & Quality of Information the concept of Information entropy & Numerical.
2. **Computer Appreciation:** Definition of electronic Computer, History, Generation, Characteristics & Application of Computers, Classification of Computers, RAM, ROM, Computer Hardware, CPU, Various I/O Devices, Peripherals, Storage Media, Software Definition and Concepts.
3. **Data Communication & Networks:** Computer Networks, Networking of Computers, Introduction to LAN, WAN, MAN, Network Topologies, Basic Concepts in Computer Networks, Introduction to GPRS, CDMA, GSM & FM Technologies.
4. **Introduction to Internet Technologies:** HTML, DHTML, WWW, FTP, TELNET, Web Browser, Net Surfing, Search Engines, E-Mail, ISP, E-Commerce, Public Key, Private Key, Safety of Business Transaction on Web.
5. **Concepts in Operating System:** Elementary Concepts in Operating System, GUI, Introduction to DOS, MS Windows.

Subject Name: Workshop Technology

1. **Carpentry and Painting Shop:** Introduction to Wood Work, Preparation of Dovetail Joint, Preparation of Mitre Joint, Preparation of Lengthening Joint etc…
2. **Fitting Shop:** Drill, Taps and Dies, Using a Hand Tap, Care and Maintenance of Measuring Tools, Height Gauge, Files, Preparation of Job Involving Threads, Using a Pipe Threading Set, Care of Pipe Cutters and Threading Sets.

3. **Welding Shop:** Gas Welding, Operation and Maintenance of Oxygas Equipment, Equipment Setup, Maintaining the Equipment, Oxygas Welding Techniques, Common Welding Joints Generally Made by Gas Welding, Proper Edge Preparation and Fit Up, Welding Procedure.
4. **Electric Shop:** Importance of Three Phase Wiring and Its Effectiveness, Two-Wattmeter Method of Power Measurement in a Three Phase Circuit, Connecting Single Energy Meter and testing it, Reading and Working out the Power and costing of Energy in a Single Phase Circuit.
5. **Electronic Shop:** Wire Rope, Various Types of Plugs, Sockets, Connectors Suitable for General Purpose Audio Video Use, Demonstrate the skill to make Facilities Solder Joint, Installation and Soldering of Printed Circuit Components, Soldering of PCB Components, Application of Solder and Soldering Iron Tip.

Subject Name: Business Communication

1. **Corresponding: (Official, Business and Personal):** One Letter from Each Category.
2. **Grammar:** Tenses, Narration, Punctuation.
3. **Essay.**
4. Reports.
5. Notices.
6. Note-Making and Summarizing.
7. Business Correspondence.

Second Year

Second Year	
Sr. No.	**Name of Subject**
1	English-II
2	Applied Mathematics-II
3	Workshop Technology - II
4	Thermodynamics
5	Engineering Materials & Material Science
6	Machine Design & Drawing - I
7	Computer Application for Engineering
8	Industrial Management
9	Strength of Materials
10	Mechanical Engineering Drawing
11	Study Through ICT* Technology
12	Assignment Work
13	Extra-Curricular Activities & Project Work

Subject Name: English-II

1. **Functional Grammar:** Articles, Preposition, Tenses: Functions, Synthesis, Transformation, Spotting errors and correction of sentences.

2. **Pre- Requisites of Technical written Communication:** One word substitution, Spelling rules, Words often confused & misused, Phrases.
3. **The Structure of sentences/ clauses:** Adverb clause, Adjective clause, Noun clause. Sentences: Simple, Double, Multiple and complex, Transformation of sentences: simple to complex & vice versa, simple to compound & vice-versa, Interrogative to assertive & to negative & vice-versa.
4. **Technical Communication:** Nature, Origin and Development, Salient features, Scope & Significance, Forms of Technical Communication, Difference between Technical Communication & General writing, Objective Style vs. Literary Composition.

Subject Name: Applied Mathematics-II

1. **Complex Numbers:** Complex Numbers, phasor and Application of Complex Number in R.L.C. Circuits
2. **Differential Calculus:** Functions and Limits, Differentiation, Approximation of Errors by Differentials.
3. **Integral Calculus:** Indefinite Integral, Definite Integrals, Area Bounded by a Curve and Axes, Average Value and Root Mean Square Value of a function, Finite Differences and Numerical.
4. **Partial Differentiation:** Partial Differentiation.
5. **Solution of Ordinary Differential Equations:** Differential Equations, Linear Differential Equations, Applications of Differential Equations to R-L-C Electric Circuits.

Subject Name: Workshop Technology-II

1. Turning

- Principles of Turning.
- Description and function of main parts of lathe.
- Specification of lathe.
- Drives and Transmission.
- Work holding tools.
- Lathe tools.
- Lathe operations-plan and step turning , Facing, parting off, taper Turning, eccentric turning, drilling, reaming, boring, threading and knurling.
- Cutting Parameters-speed, feed and depth of out.
- Speed ratio, preferred number of speed selection.
- Cutting fluid-its purpose and types.
- Lathe accessories (Steady rset, taper turning attachment, tool post grinder).
- Types of lather :(a) Brief description of capstan and turret lathes. (b) High Performance lathes.

2. Drilling :

- Principle of drilling.
- Classification of drilling machines and their description.
- Operations performed on drilling machines-drilling, reaming, counter boring, counter sinking, hole milling, tapping.
- Speed and feeds during drilling.
- Types of drills and their features.
- Drill holding device.

3. Boring

- Principle of boring.
- Classification of boring machines and their description.
- Specification of boring machine.
- Boring tools.
- Boring bars and boring heads.
- Alignment of bores and its importance.

4. Shaping, Planning and Slotting

- Working principle of shaper, Planer and slotter.
- Quick return mechanism applied to them.
- Types of tools used and their geometry.
- specifications of shaper, planer and slotting machine.
- Speed and feeds in above processes.

Subject Name: Thermodynamics

1. **Basic Concept and First Law:** Basic Concepts of Continuum, macroscopic approach, Thermodynamic systems-closed, open and isolated. Property, state, path and process, quasi-static process, work, modes of work, Concepts of ideal and real gases. First law of thermodynamic -application to closed and open systems, internal energy , specific heat capacities, enthalpy, steady flow process with reference to various thermal equipment.
2. **Second Law:** Second law of thermodynamics-Kelvin's and Clausius statements of second law. Reversibility and irreversibility. cannot theorem, cannot cycle, reversed cannot cycle, efficiency, COP. Thermodynamic temperature scale, Clausius inequality, Concept of entropy, entropy of ideal gas, Principle of increase of entropy- availability.
3. **Properties of Pure Substance and Steam Power Cycle:** Properties of Pure Substance- Thermodynamic properties of pure substances in solid, Liquid and vapour phases, Phases rule P-V, P-T, T-V, T-S, H-S diagrams, PVT surfaces, thermodynamic properties of steam. Calculations of Work done and heart transfer in non flow and flow processes. Standard Rankin cycle, Reheat and Regenerative cycle.
4. **Ideal and real Gases and Thermodynamic Relations:** Gas mixtures- Properties ideal and real gases, Equation of state, Compressibility factor, exact differential, T-D relations, Maxwell's relations, Clausius Chaperon Equations, Joule- Thomson Coefficient.
5. **Psychrometry:** Psychrometry and psychrometric charts, Property Calculations of air Vapour Mixtures. Psychrometric Process - Sensible heat exchange Processes. Latent Heat exchange Processes. Adiabatic Mixing, Evaporative Cooling(Use of Standard Thermodynamic tables, Mollier diagram, Psychometric chart and Refrigerant property tables are permitted).

Subject Name: Engineering Materials & Material Science

1. **General**
   - Introduction to engineering Materials.
   - Classification of Materials.
   - Thermal, chemical, electrical, Mechanical Properties of Various Materials.
   - Selection criteria for use in Industry.
2. **Structure of Metal and Their Deformation**
   - Metal Structure.
   - Relation of Metal structure to its properties
   - Arrangement of atoms in metal (Basic Idea).
   - Crystalline Structure of metals.
   - Crystal imperfections.
   - Deformation of Metal.
   - impact of Cold and Hot working on metal Structure.
   - Corrosion, its Cause and Prevention
3. **Ferrous Materials**
   - Classification of Iron and Steel.
   - Sources of iron ore and its availability.
   - manufacture of pig iron, wrought iron, Cast iron and Steel (Flow Diagrams Only).
   - Types of Cast iron, White, malleable, grey, Mottled, Modular and alloy and their usage.
   - Steels and alloy steels.
   - Classification of steels.
   - Different manufacturing method of Steel-open hearth, Bessemer, electric arc.
   - Availability, Properties and Usage of Steels.
   - Specification as per BIS and equivalent standards.
   - Effect of Various alloying element like Cr, Ni, Co, Va, W, Mo, Si, Mn, S onmechanical properties of Sheet.
   - Use of alloy steels(high speed steel, stainless steel, spring, steel, Silicon steel)
4. **Non-Ferrous Materials**
   - Important ores and Properties of aluminum, Copper, Zinc, tin, Lead.
   - Properties and User of Al alloys, Copper alloys, Bearing metals, Solders.
5. **Engineering Plastic and Fibers**
   - Important Source of plastics.
   - Classification- Thermoplastic and Thermoset.
   - Various trade names of engg. Plastics.
   - plastic Coasting.
   - Fibers and Their Classification, Inorganic and organic Fibers.
   - Usage of Fibers.
6. **Insulating Materials**
   - Various Heat insulating material and Their usage like asbestos, glass wool, thermocole, Cork, puf, China clay.
   - Various electrical insulating material and Their use like China clay, leather, Bakelite, ebonite, glass wool, rubber, felt.

Subject Name: Machine Design and Drawing - I

1. **Introduction to Design**
   - Basic Requirement for machine elements
   - General Design Process
   - Mechanical Properties
   - General Design Consideration like Fating, Creep, Fabrication methods, economic Considerations for Strength
   - Designing for Strength
2. **Riveted and Welded Joint**
   - Types of Riveted joints
   - Possible failure of riveted Joints
   - Strength and efficiency of Riveted joints
   - Common Types of Welded Joints
   - Simple Design for V Butt welded Joints
   - Transverse Fillet and Parallel fillet welded joints
3. **Screwed Joints**
   - Introduction to term Screw and Various definition of Screw threads
   - Advantage and Disadvantages of Screwed joints
   - Form of Screw Threads
   - Common types of Screw fastening: through bolt, tap bolt, Stud, cap Screw, Machine Screw and Set Screws
   - Designation of Screw threads
   - Stresses in Screw fastening
   - Design of bolts for cylinder Cover
4. **Keys and Couplings**
   - Definition of Term Key; its various Types
   - Splines
   - Forces acting on Sunk keys
   - shaft coupling and its various types
   - Design of flangs coupling
5. **Shafts**
   - Various types of shafts
   - Stresses in shafts
   - Design of shafts(Solid and hollow) Subjected to torque and bending moment
6. **Design of Cotter Joint for Round Rod**
   - Design of Cotter
   - Design of Socket
   - Design of Spigot
7. **Design of Knuckle Joint**
   - Design of rod
   - Design of Pin

Subject Name: Computer Application for Engineering

1. **Information Storage and Retrieval**
   - Need for Information storage and retrieval.
   - Creating database file.
   - Querying database file on Single and Multiple Keys.
   - Ordering the data on a selected key.
   - Programming a very simple application.
2. **Programming in 'C'**
   - Basic Structure of C Programs.
   - Executing C programs.
   - Constants, variables and Data Types.
   - Operators and expressions.
   - Managing Input-Output operations like reading a character, writing a character, formatted input, Output through Print, Scan getch, putch statements etc.
   - Decision making and branching using IF.....else, switch go to statements.
   - Decision Masking and looping using do-while and for statements.
   - Array-one dimensional and two dimensional.
   - File
3. **Computer Application Overview**
   - Commercial and Business data Processing application.
   - Engineering Computation.
   - CAD, CAM, CAE, CAI
4. **Typical Applications**
   - Use of Various application Software available in the field of Electronics Engineering.

Subject Name: Industrial Management

1. **Meaning, Nature and Significance of Management:** Concept of Management, Nature and Characteristics, Significance, role and Importance of Management, Scope, Level of Management.
2. **Management Process:** Element of the Process, Qualities of Successful Manager.
3. **Evolution of Management Thought:** School of Management Thought, Contribution of Elton Mayo to Management Science/Human relations Approach/ Hawthorne Experiments, Contribution of Max Weber to Management Science/ science, Management Science.
4. **Factors of Individual (Human) Behavior:** Concept and Important, factor influencing individual Behaviors.
5. **Perception:** Concept and Important, factor influencing individual Behavior, Stereo typing, Projection, Perceptual Change and Organization, Sensation.
6. **Learning:** Concept, Nature and Characteristics of Learning, Learning Procedure, Theories of Learning, Principles of Learning.
7. **Personality:** Concepts, Determinants of individual Personality, Measuring the Personality, Theories, Personality Traits, Personality and organizational behavior.

8. **Interpersonal Relationship and Group Behaviors :**Features and Characteristics of a group, Function of a group, Reasons of Group formation, Group development Process, types of Group, Theories of group Formation, Group Norms, group Cohesiveness.

Subject Name: Strength of Materials

1. **Stresses and Strains**
   - Concept of Load, Stresses and strain
   - Tensile Compressive and shear stresses and strain
   - Concept of elasticity, Elastic Limit of Proportionality.
   - Hook's Law.
   - Young modulus of Elasticity.
   - Nominal Stress.
   - Yield Point, plastic stage.
   - strain hardening.
   - Ultimate strength and Breaking stress.
   - Proof stress and Working stress.
   - Factor of safety.
   - shear modulus.
   - Longitudinal and Circumferential stresses in seamless thin walled Cylindrical shells(Derivation of these formulae not required).
2. **Moment of Inertia**
   - Concept of moment of Inertia and Second moment of area.
   - Radius of gyration.
   - Second moment of area of Common Geometrical Sections: Rectangle, Triangle, Circle(Without derivation)Second moment of area for L,T and I Section.
   - Section Modulus.
3. **Beams and Bending Stress**
   - **Concept of beam and form of loading.**
     concept of end supports, Roller, Hinged and fixed.
     concept of Bending moment and shearing force.
     B.M and S.F Diagram for cantilever and simply Supported beams with and without overhang subjected to concentrated and U.D.L.
   - **Bending stresses**
     Concept of Bending stresses.
     Theory of Simple bending.
     Use of the equation f/y=M/I+E/R.
     Concept of Moment of resistance.
     Bending stress diagram.
     Calculation of maximum bending stress in beams of rectangular, Circular, I and T Section.
     Permissible Bending stress Section modulus for rectangular, Circular and Symmetrical I Section.
   - **Laminated Spring(Semi elliptical type only)**
     Determination of number of Plates.

Maximum bending stress and deflection.

- **Combined direct and bending stresses.**
  Simple Cases of Short column of uniform Section Subject to eccentric loading with stress diagram.

Subject Name: Mechanical Engineering Drawing

1. **Basic Principles:** Introduction, Engineering Drawing Instruments, Materials and Their Use, General Instructions, Types of Lines, Lettering, Dimensioning.
2. **Geometrical Construction:** Lines, Divide a Line into a Given Number of Equal parts, Angles, Triangles, Circles, Determine the Diameter of a Circle whose Circumference is Known, Curves, Bisect a Given Arc, Construction, Inscription and Circumscription of Polygons.
3. **Conic Sections and Special Curves:** Introduction, Ellipse, Parabola, Hyperbola, Special Curves, Involutes.
4. **Free Hand Sketching:** Introduction, Techniques of Lines, Straight Lines, hidden Lines, Circle and Arcs, multi-view Projection, One-view Drawing, Isometric Sketching, Oblique Sketching.
5. **Screw Thread and Fasteners :**Screw Threads, Internal and External , Threads, Pitch, Lead and Multistate threads, Components of a Screw Thread, Types of Thread, bolts, various Types of Bolts, Types of Nuts, Washer, Assembly of Bolt, Nut and Washer, Stud, Cap Screw, Set Screws, pins, Foundation bolts.
6. **Welded Joints, Pipes and pipe Joints:** Welded joints, Additional weld Symbol, Pipe and Pipe Joints, joints Steam pipes, Joints for Copper Steam Pipes.
7. **Bearings:** Introduction Types of Bearings
8. **Pulleys and fly wheel:** Pulley, fly Wheel.
9. **IC Engine Parts:** Introduction, Pistons, Connecting Roads, Crankshaft.

Third Year

Third Year	
Sr. No.	**Name of Subject**
1	English-III / Hindi-III
2	Theory of Machines
3	CNC Machines & Automation
4	Hydraulics & Hydraulic Machines
5	Machine Design & Drawing – II
6	Workshop Technology – III
7	Entrepreneurship Development & Management
8	Industrial Engineering
9	Project Work
10	Study Through ICT* Technology
11	Assignment Work
12	Extra-Curricular Activities & Project Work
Total	

Subject Name: English-III

1. **The Seven C's of the Effective Communication:** Completeness, Conciseness, Consideration, Concreteness, Clarity, Courtesy, Correctness.

2. **Communication:** Its interpretation: Basics, Nonverbal Communication, Barriers to Communication.
3. **Business Communication at Work Place:** Letter Components and Layouts, Planning a letter, Process of Letter writing, Email Communication, Memo and Memo Reports, Employment Communication, Notice Agenda and Minutes of Meeting, Brochures.
4. **Report Writing:** Effective Writing, Types of Business Reports, Structure of Reports, Gathering Information**,** Organization of the Material, Writing Abstracts and Summaries, Writing Definitions, Visual Aids, User Instruction Manual.
5. **Required Skills:** Reading Skills, Note-making, Précis Writing, Audio Visual Aids, Oral Communication.
6. **Mechanics of Writing:** Transitions, Spelling Rules, Hyphenation, Transcribing Numbers, Abbreviating Technical and Non-Technical Terms, Proof Reading.

Subject Name: Theory of Machines

1. **Simple Machines:** Introduction to Link, Kinematic Pair, Lower and Higher Pair, Kinematic Chain, Mechanism, Inversions, Different Types of Mechanisms (with Examples), Mechanical Advantage of a Linkage, Cams and Followers: Terminology and Classification.
2. **Friction:** Definition and its Necessity, Horizontal Force Required to Move a Body on an Inclined Plane Both Upward and Downward, Frictional Torque in Screws, Both for Square and V Threads, Screw Jack (Simple Numerical Only), Frictional Clutches Bearing, Friction in Journal Bearing, Different Types of Bearing and Their Application.
3. **Power Transmission:** Transmission Screw: Power Transmitted and Frequency, Flat and V Belt Drive: Ratio of Tensions, H.P. Transmitted, Centrifugal Tension, Condition for Maximum Horse Power, Power Transmitted by Chains: Different Types of Chains and Their Terminology, Gear Terminology, Types of Gears and their Applications, Simple and Compound Gear Trains, Power Transmitted by Simple Spur Gear.
4. **Flywheel:** Principles and Applications of Flywheel, Turning- Moment Diagram of Flywheel for Different Engine (No Numerical), Fluctuation of Speed and Fluctuation of Energy.
5. **Governor:** Principal of Governor, Simple Description and Working of Watt, Porter and Hartnel Governor (No Numerical).
6. **Balancing:** Concept of Balancing, Introduction to Balancing.
7. **Vibrations:** Causes of Vibrations in Machines, their Harmful Effects and Remedies.

Subject Name: CNC Machines and Automation

1. **Introduction to CNC Machines:** Introduction, Applications of CNC Machine, Types of CNC Machines, CNC Router Machine, CNC Milling, Lathes, Major Cutting Tools for CNC Machines, CNC Controller, CAD/CAM, CNC Machines- Advantages/Disadvantages.
2. **Transmission Systems and Motors:** Introduction, Power Screws, Lead Screw and Nut, Ball Bearing Power Screws, Rotating Nut, Rack and Pinion, Reducers, Timing Belt and Pulleys, Motors, Stepper Motor, Servo Motors, Stepper Versus Servo: Pros and Cons, Encoders.
3. **The CNC Controls System:** Introduction, Classification of CNC System, Open and Closed Loop Control, Elements of CNC System, Developments in CNC System, CNC Controller Hardware, Control Software.

4. **An Overview of CAM/CAD:** Introduction, Flow of a Computer Aided Manufacturing System, CAM System, Benefits of CAM, CAM Software, What is CAD?, Raster to Vector Conversion Utilities, Difference Between 2D and 3D, Listing of CAD Vendors, CAD/CAM Implementation.
5. **Fundamentals of CNC Part Programming:** Introduction, Manual Part Programming Methods, A Foreword on Computer Operating Systems and Applications, G-Code Editors, G-Code, M Codes.
6. **Items Produced on a CNC Router and Advanced Part Programming:** Introduction, Important Examples of Items Produced on a CNC Router, Factors Affecting the Buying Decision of CNC Router, Advanced Part Programming, APT Language Structure, Motion Commands.

Subject Name: Hydraulics and Hydraulic Machines

1. **Introduction:** Fluid: Real Fluid, Ideal Fluid, Fluid Mechanics, Hydraulics, Hydrostatics, Hydrokinematics and Hydrodynamics.
2. **Properties of Fluids:** Mass Density, Specific Weight, Specific Gravity, Cohesion, Adhesion, Viscosity, Surface Tension, Capillary, Vapour Pressure and Compressibility, Units of Measurement.
3. **Hydrostatic Pressure:** Pressure, Intensity of Pressure, Pressure Head, Pascal's Law and its Applications, Total Pressure, Resultant Pressure, and Center of Pressure, Total Pressure and Center of Pressure on Vertical and Inclined Plane Surfaces: Rectangular, Triangular, Trapezoidal, Circular, Total Pressure on Dams and Lock Gates.
4. **Measurement of Pressure:** Atmospheric Pressure, Gauge Pressure, Vacuum Pressure and Absolute Pressure, Piezometers, Simple Manometer, Different Manometer and Mechanical Gauges, Measurement of Pressure by Manometers and Pressure Gauges.
5. **Fundamentals of Fluid Flow:** Types of Flow: Steady and Unsteady Flow, Laminar and Turbulent Flow, Uniform and Non Uniform Flow, Discharge and Continuity Equation (Flow Equation), Types of Hydraulic Energy: Potential Energy, Kinetic Energy, Pressure Energy, Bernoulli's Theorem: Statement and Description (without Proof of Theorem).
6. **Orifice:** Definition of Orifice, and Types of Orifice, Hydraulic Coefficients, Large Vertical Orifices and Small Orifices, Free Drowned and Partially Drowned Orifice, Time of Emptying a Rectangular/Circular Tanks with Flat Bottom.
7. **Flow Through Pipes:** Definition, Laminar and Turbulent Flow, Explain Through Reynolds Experiment, Reynolds Number, Critical Velocity and Velocity Distribution, Head Lose in Pipelines Due to Friction, Sudden Expansion and Sudden Contraction, Entrance, Exit, Obstruction and Change of Direction (No Derivation of Formulae), Flow From One Reservoir to Another Through Long Pipe of Uniform and Composite Section, Water Hammer Phenomenon and its Effects (Only Elementary Treatment), Pipes in Series and Parallel, Syphon.
8. **Flow Through Open Channels:** Definition of a Channel, Uniform Flow and Open Channel Flow, Discharge Through Channels Using: (a) Chezy's Formulae (No Derivation), (b) Manning's Formulae, Most Economical Sections: (a) Rectangular, (b) Trapezoidal, (c) Circular.
9. **Flow Measurements:** Measurement of Velocity by Pitot-Tube, Current Meter, Surface Float, Velocity Rods, Measurement of Discharge by a Notch: (a) Difference between Notches and Orifices, (b) Discharge Formulae for Rectangular Notch, Triangular Notch, Trapezoidal Notch and Conditions for their use (No Derivation), Measurement of Discharge by Weirs: (a) Difference between Notch and Weir, (b) Discharge Formulae for Free Drowned and Broad Crested Weir With and Without end Contraction, Velocity of

Approach and Condition of Their Use, (c) Venturi Fumes to Measure Flow, Measurement of Discharge by Velocity Area- Method.

10. **Hydraulic Machines:** Reciprocating Pumps, Centrifugal Pumps, Impulse Turbines, Reaction Turbines, Sketching and Description of Principles of Working of Above Mentioned Machines.

Subject Name: Machine Design and Drawing-II

1. **Linkages:** Introduction, Basic Linkage Concepts, Mobility Criterion, Establishing Precision Positions, Plane Four- Bar Linkage, Plane Offset Slider- Crank Linkage, Kinematic Analysis of the Planar Four- Bar Linkage, Dimensional Synthesis of the Planer Four- Bar Linkage: Crank- Angle Coordination, Pole- Force Method.
2. **Springs:** Selection of Spring Materials, Heat Treatment of Springs, Helical Compression Springs, Helical Extension Springs, Helical Torsion Springs, Belleville Spring Washer, Special Spring Washers, Flat Springs, Constant- Force Springs, Torsion Bars, Power Springs, Hot- Wound Springs.
3. **Gearing: Gear Trains:** General Gear Trains, Gear Type Selection, Planetary Gear Trains, Differential Trains, Spur Gears, Force Analysis, Helical Gears, Types, Advantages, Geometry, Bevel and Hypoid Gears, Gear Manufacturing, Worm Gearing, Kinematics, Force Analysis, Strength and Power Rating, Heat Dissipation, Design Standards.
4. **Flywheels and Power Screws:** Flywheel Usage, Sizing the Flywheel, Stress, Flywheels for Energy Storage, Strength and Safety, Power Screws.
5. **Clutches and Brakes:** Types, Uses, Advantages and Characteristics, Torque and Energy, Temperature Considerations, Friction Materials, Torque and Force Analysis of Rim, Band and Cone Brakes and Clutches.
6. **Belt Drives:** Basic Concept of Belt Drives, Flat Belts, V-Belts, Synchronous-Belt Drive.

Subject Name: Workshop Technology-III

1. **Foundry Practices:** Pattern Making: Types of Patterns, Pattern Material, Pattern Allowances, Coloring of Patterns, Introduction to Cores, Core Materials and Types of Cores.
2. **Molding:** Introduction to Molding, Types of Molding Sand and Their Properties, Sand Mixing and Mold Preparation, Molding Defects.
3. **Melting and Pouring:** Types of Melting Furnaces (Pit, Titing, Cupola) Used, Closing and Pouring of Mold.
4. **Special Casting Methods:** Introduction to Die Casting, Investment, Centrifugal Casting.

Subject Name: Entrepreneurship Development and Management

1. **Entrepreneurship:** Definition of Entrepreneur, Internal and External Factors, Functions of an Entrepreneur, Entrepreneurial Motivation and Barriers, Classification of Entrepreneurship, Theory of Entrepreneurship, Concept of Entrepreneurship, Development of Entrepreneurship, Culture, Stages in Entrepreneurial Process.
2. **Creativity and Entrepreneurship Plan:** Idea Generation, Screening and Project Identification, Creative Performance, Feasibility Analysis: Economic, Marketing, Financial and Technical, Project Planning: Evaluation, Monitoring and Control Segmentation, Creative Problem Solving: Heuristics, Brainstorming, Synectics, Value Analysis, Innovation.

3. **International Entrepreneurship Opportunities:** The Nature of International Entrepreneurship, Importance of International Business to the Firm, International Versus Domestics' Entrepreneurship, Stages of Economic Development, Institutional Support for New Ventures: Supporting Organizations, Incentives and Facilities, Financial Institutions and Small Scale Industries, Govt. Policies for SSIs.
4. **The Personal Enterprise Environment:** Family and Non Family Entrepreneur, Role of Professionals, Professionalism Vs Family Entrepreneurs, Role of Woman Entrepreneur, Venture Capital, Nature and Overview, Venture Capital Process, Locating Venture Capitalists.

Subject Name: Industrial Engineering

1. **Industrial Engineering and Scientific Management:** Application of Industrial Engineering, Nature of Industrial Engineering, Scientific Management Techniques.
2. **Production, Productivity and the Standard of Living:** The Standard of Living, Requirements for a Minimum Satisfactory Standard Living, Production, Productivity, Factors Influencing Productivity, Work Contents.
3. **Work Study and Human Factors:** Techniques of Work Study, Basic Steps of Work Study, Work Study and Top Management, Work Study and Middle Management, Work Study and the Workers.
4. **Working Environment and Safety:** Occupational Accidents, Industrial Accidents, Good Housekeeping, Lighting and Noise, Environment, Ergonomics, Fatigue in Industry.
5. **Plant Layout and Materials Handling:** The Plant Layout, Types of Layout, Product Layout, Process Layout, Mixed or Grouped Layout, Group Technology Layout, Materials Handling.
6. **Work Simplification:** Selection of Work to be Studied, Recording the Facts, Process Charts, Operation Process Chart, Flow Process Chart, Procedure for Examine Critically.
7. **Movement of Workers in the Plant:** The String Diagram, Procedure of Constructing String Diagram, The Travel Chart, Weighted Travel Chart, Multiple Activity Chart, Man and Machine Process Chart, Multiple Activity Chart, (Gang Process Chart).
8. **Movement at the Work Place:** The Principles of Motion Economy, Summary on Work Place Layout and Simplification of Movements, The Two Handed Process Chart, Example of a Two Handed Process Chart, Micro Motion Study, Simultaneous Motion Chart.
9. **Work Measurement:** Objectives and Uses of Time Study, Techniques of Work Measurement, Basic Procedure of Time Study, Techniques of Work Measurement, Time Study Equipment, Breaking an Operation Into Elements, Types of Elements, Rules for Breaking a Jon into Elements, Sample Size (Statistical Method), Performance Rating, Scales of Rating, Allowances.
10. **Time Study Techniques:** Production Study, Work Sampling, Determination of Sample Size, Procedure for Making a Work Sampling Study, Estimation of Standard Time, Synthesis Techniques of Work Measurement, Predetermined Time Standards (PTS), Work Factor System, Methods Time Measurement (MTM) System, Basic Motion Time Study (BMT), Advantages of PTS System.
11. **Incentives:** Need of Incentive Planes, Day Work Incentive Scheme, Piece Rate Incentive Scheme, Premium Bonus Incentive Scheme, Group Incentives, Special Forums of Incentive Plans.
12. **Statistical Quality Control:** Statistical Tools is Quality Control, Statistical Concept and Variability, Mean and Spreads, Normal Distribution, Control Charts for Variables (X and R-Charts), Control Limits, Control Charts for Range, Control Charts for Attributes, Number Defective (NP Chart) Chart, Control Chart for Defects, Acceptance Sampling, Operating Characteristic Curve, Design of an Acceptance Plan.

Note:-

The Normal Rule and Regulation pertaining to the Examination and other issues will be applicable in Faculty of Engineering & Technology as per Arunachal University of Studies Act 2012, Subsequent Statute and Rules & Regulations