FUNDAMENTALS OF DESIGN AND MANUFACTURING

Group A

Engineering design process and its structure. Identification and analysis of need, product design specifications, standards of performance and constraints.

Searching for design concepts; morphological analysis, brainstorming. Evaluation of design concepts for physical reliability, economic feasibility and utility.

Detailed design; design for manufacture, assembly, shipping, maintenance, use, and recyclability.

Design checks for clarity, simplicity, modularity and safety. Standardization and size ranges. Reliability and robust design. Design organisation and communication, . technical reports, drawings, presentations and models.

Concept of manufacturing; classification of manufacturing processes. Fundamentals of casting. Basic understanding of commonly used casting processes (sand casting, investment casting and permanent mould casting processes).

Fundamentals of metal forming; hot and cold working; basic understanding of primary metal forming processes (rolling, forging, extrusion and drawing processes, punching and blanking).

Group B

Fundamentals of metal cutting; tool-work interaction for production of machined surfaces. Classification of machining processes. Basic machining operations (turning, shaping, planning, drilling and milling processes).

Fundamentals of grinding and finishing; overview of unconventional machining processes; fundamentals of welding processes; introduction to primary welding and allied processes; selection of manufacturing processes. Design for manufacturability.

Need for integration-commercial, economic and technological perspective; basic tools of integration; concept of a system. introduction to information technology and its elements.

Introduction to group technology; introduction to simulation and database management systems.

Elements of integration:-eontrol1ers, sensors, robots, automated machines; AGVs, AS, RS, etc.

Product and process design- for integration; design for economic manufacturing; design for manufacturing integration.

Introduction to computer aided process planning; selection of machine tools.

MATERIAL SCIENCE AND ENGINEERING

Group A

Introduction to materials . Metal and alloys, ceramics, polymers and semi conducting materials-introduction and application as engineering materials.

Defects in solids . Point, line and surface defects. Diffusion in solids.

Phase diagrams . Mono-component and binary systems, non-equilibrium system, phase diagram and. application in crystalline and non-crystalline solids.

Mechanical properties . Tensile strength, yield strength, elastic and viscoelastic properties, creep, stress relaxation and impact. Fracture behaviour. Ductile fracture, Griffith theory, effect of heat treatment and temperature on properties of metals.

Deformation of metals. Elastic and plastic deformation, slip, twin, dislocation theory, critical resolved shear stress, deformation in polycrystalline materials; season cracking, Bachinger's effect, strengthening mechanics; work hardening recovery, crystallization and grain growth, cold and hot working. .

Group B

Heat treatment . Iron-carbon system. Annealing, normalising, hardening,. critical cooling rate, hardenability, age hardening, surface hardening, tempering.

Thermal properties . High temperature materials; materials for cryogenic application, thermally insulating materials. (Specific heat, thermal conductivity, thermal expansion).

Ceramic materials and polymers . Silicon structures, polymerism . in glass, electrical properties of ceramic phases, rocks, building stones, refractories.

Polymerisation mechanism , structural properties of polymer, thermoplastics, thermosets, elastomer, resins, composites, particles and fibre reinforced composite. Composite material including nano material.

Electronic properties . Magnetism, diamagnetism, paramagnetism, ferromagnetism, magnetic energy, zone theory of solids, zones in conductors and insulators.

COMPUTING AND INFORMATICS

Group A

Programming languages . C including C++; Languages-declarations, expressions, control statements, arrays, functions, pointers and structures; Algorithms and flow charts. Introduction to Pascal.

Informatics . Information systems for decision making; Data management and database management technology; Office automation system-LAN, WAN, electronic mail, electronic .data interchange; client server technology; overview of TCP/IP; Information systems for business; Strategic information systems; Information resources management.

Group B

Computer basics . History, generations and classification of computers; Number systems; Boolean algebra.

Hardware . Introduction to logic gates an flip flops; components of a computer input/output devices, CPU unit and memory unit, secondary storage.

Software . System software; application software; compilers and translators

Operating systems . Introduction to operating systems;' types of operating systems and their functions; popular operating systems-MS-DOS, UNIX and Windows; file. management.

SOCIETY AND ENVIRONMENT

Group A

Societal Structures and Dynamics : An analysis of basic sociological concepts and the applications to contemporary society; social Stratification caste, class, cultural heritage, occupation, mobility and income distribution. Social tensions and their cause societal responsibilities and social institutions.

Development Processes : Parameters for development. Interrelationship between social, economic and scientific factors. Role of science and technology in development. Planning-its objective and assessment.

Technology Assessment : Historical development of science and technology Criteria for assessment of appropriate technology and technology adaptation.

Group B

Ecosystems : Natural ecosystems. Principles of eco-balance, Biosphere cycle, carbon dioxide. Causes for eco-imbalance - its effects and remedies.

Environmental Degradation : Causes for degradation - its effect. Control of air, water, soil and noise pollutions. Protection of ozone layer.

Waste Management : Agricultural, urban and industrial waste.

Sustainable Development : Definition and concept. Technology for sustainable energy and materials.