

Subject : Industrial Engineering & Management (Common Paper)

Subject Code : 601

Full Marks : 80+20= 100

1. Productivity : 02 Hrs

Production and productivity, importance of productivity, factors affecting productivity, means of increasing productivity.

2. Plant Layout and Material Handling : 02 Hrs

Definition of plant layout, objectives of good plant layout, principles of plant layout, types of plant layout, flow pattern, steps in planning the layout for a new enterprise, definition of material handling, functions and principles of material handling, material handling devices.

3. Work Study : 04 Hrs

Definition, concept and need for work study, objectives of method study and work measurement, basic procedure/steps in method study, recording technique, critical examination, principles of motion economy, stop watch procedure for collecting time study data, including performance rating and allowances, work sampling.

4. Production Planning and Control (PPC) : 04 Hrs

Definition and objectives of PPC, functions of PPC, routing, scheduling, loading, dispatching, production control definition and objectives, principle of sound production control system.

5. Material, Purchase and Stores Management : 04 Hrs

Definition, functions& objectives of materials management, inventory control, economic order quantity (EOQ), ABC analysis. Objectives of purchasing department, buying techniques, purchasing procedure (steps involved in one complete purchasing cycle); functions of stores department, location and layout of stores, receipt and issue of materials.

6. Quality Control and TQM : 04 Hrs

Meaning of quality and quality control, dimensions of quality, quality circle, concept and definition of TQM, elements of TQM, Kaizen, 5 'S' and six sigma.

7. Management : 04 Hrs

Various definition, concept of management, levels of management, administration and management, scientific management by F. W. Taylor. Principles of management (14 principles of Henry Fayol). Functions of management - planning, organizing, coordinating, directing, controlling, decision making.

8. Organizational Management : 04 Hrs

Organization - definition, steps in forming organization. Types of organization. Types of organization -line, line and staff, functions, project type. Departmentation- Organized and decentralized, authority and responsibility, span of control (management). Forms of ownership - proprietorship, partnership, joint stock company, co-operative society, govt. sector.

9. Human Resource Management : 06 Hrs

Personnel Management – Introduction, definition, function. Staffing – Introduction to HR, Introduction to HR Planning, Recruitment procedure. Personnel- Training & Development – Types of training, Induction, Skill enhancement. Leadership & Motivation – Leadership- Styles & types, Motivation- Definition, Intrinsic, &Extrinsic, Moslow's theory of Motivation and its significance. Safety Management – Causes of accident, Safety Procedures. Introduction, Objectives & feature of Industrial Legislation such as – Factory act, ESI act, Workman compensation act, Industrial dispute act and salary & wages.

10. Financial Management : 04 Hrs

Financial Management- Objectives & Functions. Capital Generation & Management- Types of capitals, Sources of finance. Budgets and accounts- Types of budgets, Production budget (including variance report), Labour budget, Introduction to Profit & Loss Accounts (Only concept), Balance sheet etc.

11. Entrepreneurship : 04 Hrs

Concept and definition of entrepreneur and entrepreneurship, factors influencing entrepreneurship, entrepreneurial characteristics, need for promotion of entrepreneurship and small scale industries, steps in setting up a small scale industrial enterprise.

Subject : Power Electronics

Subject Code : ECE504

Full Marks : 80 + 20 = 100

1. Power semiconductor devices PNP diodes, DIACS Thyristors, TRIACS, G.T.O. devices. Power Transistors, Power MOSFET, Rating, Losses and Cooling. Triggering circuits for SCR's, UJT, Blocking Oscillators, Schmitt trigger circuits – Power MOS gate drive circuits. **10 hours**

2. Uncontrolled and controlled Rectifiers : Single phase and poly phase Bridge rectifiers. Transformer ratings. Inductive load, free wheeling diodes. Converter operation: Overlap, power factor, inversion, regulation, P-pulse converters, power factor control via PWM converters. **06 hours**

3. D.C. line commutation : Series and parallel capacitor turn off, resonant turn off, impulse commutation. D.C. Choppers : Principles, classification, use. **06 hours**

4. Frequency conversion : Cycloconverter single and three phase circuits, blocked group operation, circulating current mode. Single phase and three phase inverters, constant voltage source and constant current source inverters, HF inverters for heating. **12 hours**

5. Application: D.C. and A.C. drives, S.M.P.S., Resonant converters, A.C. Line Filters, ratio, interference suppression. HDVC transmission. **08 hours**

Subject : Utilization of Electrical Energy**Subject Code : ELE604****Full Marks : 80+20=100****1. Illumination: 05 hours**

1.1 Definitions of Terms Used in Illumination: Light, Luminous Flux, Luminous Intensity, Lumen, Candle Power, Illumination, Lux or Meter Candle, Mean Horizontal Candle Power (MHCP), Mean Spherical Candle Power (MSCP), Mean Hemi-spherical Candle Power (MHSCP), Reduction Factor, Lamp Efficiency, Specific Consumption, Glare, Space-Height Ratio, Utilisation Factor, Maintenance Factor, Depreciation Factor, Waste Light Factor, Absorption Factor, Reflection Factor, Solid Angle.

1.2 Laws of Illumination:

- Law of Inverse Squares
- Lambert's Cosine Law. (No Numerical)

1.3 Sources of Light: Construction, Working and Applications of Following Lamps:

- Incandescent Lamps.
- Halogen Lamps.
- Low Pressure Mercury Vapour Lamps (Fluorescent Tube).
- High Pressure Mercury Vapour Lamps.
- Sodium Vapour Lamps.
- Compact Fluorescent Lamps (C.F.L.).
- Metal Halide Lamps
- LED Lamps
- Neon Signs.

1.4 Basic Principles of Light Control.

1.5 Types of Lighting Schemes.

Direct, Semi-direct, Semi-indirect, Indirect, General Lighting.

1.6 Design of Lighting Scheme: Objectives of Lighting Scheme. Factors to be considered While Designing the Lighting Scheme. (Simple Numericals)

1.7 Factory Lighting:

- General Requirements
- Types of Installations: General Lighting, Local Lighting, Emergency

Lighting.

1.8 Lumen or Light Flux Method of Lighting Calculations. (Simple Numericals).

1.9 Flood Lighting

- Flood Lighting Purposes.
- Classification of Projectors.
- Location and Mounting of Projectors. (Simple Numericals) [no numerical].

2. Electric Heating and Welding: 05+05=10 hours**2.1 Electric Heating:**

2.1.1 Advantages of Electric Heating.

2.1.2 Modes of Transfer of Heat:

- Conduction, Convection and Radiation.

2.1.3 Classification of Electric Heating Methods:

2.1.4 Resistance Heating:(Construction & Operation)

- Direct Resistance Heating: Salt Bath Furnace.
- Indirect Resistance Heating: Resistance Ovens, Requirements of Heating Element Material, Causes of Failure of Heating Elements, Methods of Temperature Control.
- Applications of Resistance Heating.

2.1.5 Arc Heating: (Construction & Operation)

- Direct Arc Furnace:
- Indirect Arc Furnace.
- Applications of Arc Heating.

2.1.6 –Induction Heating: (Construction & Operation)

- Core Type Induction Furnaces: Ajax Wyatt Furnace.
- Coreless Induction Furnace.
- Applications of Induction Heating. (Simple Numericals on Melting Furnaces)

2.1.7 – Dielectric Heating:

- Principle of Dielectric Heating.
- Advantages of Dielectric Heating
- Limitations of Dielectric Heating.
- Applications of Dielectric Heating. (Simple Numericals on Dielectric Heating)

2.1.8 Eddy current heating Principle, advantages and applications

2.2 Electric Welding:

2.2.1 – Methods of Electric Welding: Electric Arc Welding, Resistance Welding.

2.2.2 – Resistance Welding:

- Principle of Resistance Welding.
- Advantages of Resistance Welding.
- Types of Resistance Welding - (Only List).

2.2.3 – Spot Welding Machine.

2.2.4 – Electric Arc Welding:

- Formation and Characteristics of Electric Arc.
- Effect of Arc Length.
- Arc Blow.

2.2.5 – Polarity in DC Welding:

2.2.6 – Electrodes for Metal Arc Welding:

2.2.7 – V-I Characteristics of Arc Welding DC Machines.

2.2.8 – Arc Welding Machines:[only list]

- DC Welding Machines – MG Set, AC Rectified Welding Unit.
- AC Welding Machines – Welding Transformer.

3. Elevators: 04 hours

- 3.1 Types of electric elevators
- 3.2 Size and shape of elevator car
- 3.3 Speed of elevators
- 3.4 Location of elevator machine
- 3.5 Types of elevator machines, elevator motors
- 3.6 Power transmission gears braking
- 3.7 Safety in elevators.

4. Electric Drives: 07 hours

- 4.1 Introduction:
 - What is drive?
 - Drives
 - Mechanical Drive and Electric Drive.
- 4.2 Advantages and Disadvantages of Electric Drive.
- 4.3 Factors Governing Selection of Electric Motors.
- 4.4 Nature of Electric Supply: 3 ϕ & 1 ϕ AC and DC.
- 4.5 Type of Drive: Group Drive & Individual Drive.
- 4.6 Nature of Load: Nature of the Mechanical Load, Matching of the Speed Torque Characteristics of the Motor with that of the Load, and Starting Conditions of the Load.
- 4.7 Electrical Characteristics: (Only DC Series, Three Phase and Single Phase Induction Motors are to be dealt)
 - Running Characteristics: Three Typical Speed Torque Characteristics Inverse, Constant Speed and Drooping.
 - Starting Characteristics: Starting Torque only. (No Starters).
 - Speed Control: Suitability to Economic and Efficient Speed Control Methods (Above and Below Normal Speed).
 - Braking Characteristics: Plugging, Rheostatic Braking and Regenerative Braking, as Applied to DC Series and Three Phase Induction Motor. Only characteristics and applications of following motors D.C. Series, 1phase A.C. Series, 1phase I.M., 3phase I.M., Universal motor, Stepper motor. Requirements of Motors used in following applications, stone crushing, textile industry, paper manufacturing industry, rolling mill, chemical industry.
- 4.8 Mechanical Features:
 - Type of Enclosure as per IS
 - Type of Bearings
 - Type of Transmission for Drive
 - Noise Level.
- 4.9 Size and Rating of Motor:
 - Load Cycles for

– Continuous Loads, Short Time Loads, Intermittent Loads, Continuous Operation with Short Time Loads and Continuous Operation with Intermittent Loads.

- Duty Cycles.
- Standard Ratings for Motors as per ISS.
- Estimation of Rating of a Motor. (Simple Numericals on Estimating Size of Continuously Rated Motor).
- Load Equalisation. (No Calculations)
- 4.10 Cost:
 - Capital Cost
 - Running Cost (Losses, p. f., Maintenance).
- 5. Electric Traction: 10 hours**
- 5.1 Requirements of an Ideal Traction System.
- 5.2 Traction Systems:
 - Non-electric Traction Systems.
 - Electric Traction Systems: Straight Electric Traction, Its advantages and Disadvantages. Diesel Electric Traction, Its advantages and Disadvantages.
- 5.3 Systems of Track Electrification: DC System, Composite System – Single Phase to Three Phase System and Single Phase AC to DC System (Kando System). Advantages and Disadvantages of Single Phase 25 KV AC System Over DC System.
- 5.4 Traction Mechanics:
 - Units Used in Traction Mechanics.
 - Types of Services.
 - Speed Time Curve.
 - Simplified Speed Time Curve (No Derivation)
 - Average Speed and Schedule Speed.
 - Factors Affecting The Schedule Speed.
 - Tractive Effort [No Derivation]
 - Specific Energy Consumption [No Derivation]
 - Factors Affecting Specific Energy Consumption.
 - Coefficient of Adhesion. (Simple Numerical on Simplified Speed Time Curves and Specific Energy Consumption)
- 5.5 Traction Motors:
 - Desirable Characteristics of Traction Motors, Special features of traction motor. Only advantages, disadvantages and applications of following motors
 - Suitability of DC Series Motor for Traction.
 - Suitability of Three Phase Induction Motor for Traction. , LIM, 1phase ac series motor.
- 5.6 Traction Motor Control:
 - Requirements.

- Traction Control of DC Locomotives and EMUs: Series Parallel Control Combined with Rheostatic Control, Transition from Series to Parallel Combination (Open Circuit Transition, Shunt Transition and Bridge Transition), Energy Efficiency and Limitations of Series Parallel cum Rheostatic Control, Chopper Control of Motors in DC Traction Systems.
 - Traction Control System of AC Locomotives: Tap Changer, Step less Voltage Control through Use of Thyristors, PWM Control of Induction Motors.
- 5.7 Braking:
- Requirements of a Braking System.
 - Mechanical Braking: Vacuum Braking, Com- pressed Air Braking, Hand Brake for Parking.
 - Electric Braking: Rheostatic Braking and Regenerative Braking. (No Derivation and No Numericals).
 - Sequence of Braking
 - Dead Man's Handle
- 6. Economic Aspects of Utilising Electrical Energy: 06 hours**
- 6.1 Economic Aspects of Utilising Electrical Energy.
- 6.2 Costing of Electrical Energy: Fixed Charges, Semi Fixed Charges and Running Charges.
- 6.3 Formulation of Electrical Tariffs.
- 6.4 Various Types of Tariffs: Tariffs in force for Domestic, Commercial and Industrial Consumers. Simple Block rate, Two part, Three part, KVA, MD, P.F. Tariffs.
- 6.5 Power Factor Improvement: Causes of Low Power Factor, Disadvantages of Low Power Factor, Power Factor Improvement by using Static Capacitors, Location of Capacitors for Power Factor Improvement, Most Economical Power Factor. Automatic Power Factor Controller (Derivation and Simple Numericals)
- 6.6 Energy Conservation: Importance and need of Energy Conservation, Measures for Energy Conservation in (i) Electric Drives (ii) Electric Traction (iii) Electric Heating (iv) Refrigeration and Air Conditioning (v) Illumination.

Subject : Renewable Energy Sources (Elective III)

Subject Code : ELE606

Full Marks : 80+20=100

INTRODUCTION

[8 hours]

World Energy Use – Reserves of Energy Resources – Environmental Aspects of Energy Utilisation – Renewable Energy Scenario in Jharkhand, India and around the World – Potentials – Achievements / Applications –Economics of renewable energy systems.

SOLAR ENERGY

[8 hours]

Solar Radiation – Measurements of Solar Radiation – Flat Plate and Concentrating Collectors – Solar direct Thermal Applications – Solar thermal Power Generation – Fundamentals of Solar Photo Voltaic Conversion –Solar Cells – Solar PV Power Generation – Solar PV Applications.

WIND ENERGY

[8 hours]

Wind Data and Energy Estimation – Types of Wind Energy Systems – Performance – Site Selection – Details of Wind Turbine Generator – Safety and Environmental Aspects

BIO-ENERGY

[9 hours]

Biomass direct combustion – Biomass gasifiers – Biogas plants – Digesters – Ethanol production – Bio diesel –Cogeneration – Biomass Applications

OTHER RENEWABLE ENERGY SOURCES

[9 hours]

Tidal energy – Wave Energy – Open and Closed OTEC Cycles – Small Hydro-Geothermal Energy – MSD, Hydrogen and Storage – Fuel Cell Systems – Hybrid Systems.

Subject : Smart Grid (Elective IV)

Subject Code : ELE608

Full Marks : 80+20=100

1. Introduction to Smart Grid, Architecture of Smart Grid System, Standards for Smart Grid System, Elements and Technologies of Smart Grid System **06 Hours**
2. Communication Technologies for Power System: Fiber Optical Networks, WAN based on Fiber Optical Networks, IP based Real Time data Transmission, Substation communication network, Zigbee Information System for Control Centers (ICCS): ICCS Configuration, ICCS communication Network, ICCS Time Synchronization. E-Commerce of Electricity, GIS, GPS **08 Hours**
3. Integration, Control and Operation of Distributed Generation: Distributed Generation Technologies and its benefits, Distributed Generation Utilization Barriers, Distributed Generation integration to power grid. **10 Hours**
4. Monitoring the smart grid: Load dispatch centers, wide-area monitoring control and protection of Micro **10 Hours**
5. Micro grid: Integration of distributed energy sources; concept, operation, control and protection of Micro **08 Hours**