



RAILWAY ENGINEERING



By
Rangwala

Edition : 27th Edition : 2017
ISBN : 9789385039249
Size : 170 mm × 235 mm
Binding : Paperback
Pages : 432 + 16 = 448

**Best
Seller**



₹ 225.00 **BUY**

ABOUT THE BOOK

In the subject of *Transportation Engineering*, study of *Railway Engineering* is essential. This well-known text-book now in its *Twenty Sixth Thoroughly Revised and Enlarged Edition*, provides an up-to-date account of the basic principles on various functions and working of Railways. Its excellent material fills a significant void in the literature of *Railway Engineering*.

The entire subject is systematically arranged in chapters like: Introduction; Railway Track Gauges; Surveys and Alignment of Railway Lines; Railway Traction; Rails; Ballast; Earthwork and Drainage for Railway Track; Plate-laying; Track Fittings; Geometric Design of a Track; Resistance to Traction; Points and Crossings; Railway Stations and Yards; Railway Station Machinery; Signalling; Interlocking; Maintenance of Track; Tunnelling; Rapid Transit System (Metro Rail System); Materials Management.

Appendix I : Units Of The Indian Railway;

Appendix II : Training Institutions of the Indian Railways;

Appendix III : Famous Indian Trains;

Appendix IV : Abbreviated Terms; and

Appendix V : Multiple Choice Questions.

The topics of the subject are covered in 21 well-arranged chapters and 5 appendices; it now contains:

- * 242 Self-explanatory and Neatly Drawn Diagrams
- * 26 Useful Tables
- * 29 Solved Illustrative Problems
- * 191 Multiple Choice Questions
- * 394 Questions at the end of the chapters.

The book should prove to be extremely useful to the Civil Engineering students preparing for the Degree Examinations of all the Indian Universities, Diploma Examinations conducted by various Boards of Technical Education, Certificate Courses as well as for the A.M.I.E., U.P.S.C., G.A.T.E., I.E.S. and other similar competitive and professional examinations. It should also prove of interest to the practising professionals.

CONTENT

- 1: INTRODUCTION
 - 2: RAILWAY TRACK GAUGES
 - 3: SURVEYS AND ALIGNMENT OF RAILWAY LINES
 - 4: RAILWAY TRACTION
 - 5: RAILS
 - 6: SLEEPERS
 - 7: BALLAST
 - 8: EARTHWORK AND DRAINAGE FOR RAILWAY TRACK
 - 9: PLATE-LAYING
 - 10: TRACK FITTINGS
 - 11: GEOMETRIC DESIGN OF A TRACK
 - 12: RESISTANCE TO TRACTION
 - 13: POINTS AND CROSSINGS
 - 14: RAILWAY STATIONS AND YARDS
 - 15: RAILWAY STATION MACHINERY
 - 16: SIGNALLING
 - 17: INTERLOCKING
 - 18: MAINTENANCE OF TRACK
 - 19: TUNNELLING
 - 20: RAPID TRANSIT SYSTEM (METRO RAIL SYSTEM)
 - 21: MATERIALS MANAGEMENT
- APPENDIX I : UNITS OF THE INDIAN RAILWAY
APPENDIX II : TRAINING INSTITUTIONS OF THE INDIAN RAILWAYS
APPENDIX III : FAMOUS INDIAN TRAINS
APPENDIX IV : ABBREVIATED TERMS
APPENDIX V : MULTIPLE CHOICE QUESTIONS
BIBLIOGRAPHY
INDEX

Catalogue Checklist

RAILWAY ENGINEERING
DETAILED CONTENTS

Chapter 1 INTRODUCTION

- 1-1. Brief history of railways
 - 1-2. Importance of railways
 - (1) General
 - (2) Characteristics of railways
 - (3) Advantages of railways
 - 1-3. Trends in modern railways
 - 1-4. Trains of tomorrow (Maglev Trains)
 - 1-5. Automatic train operation
 - 1-6. Indian railways
 - 1-7. Development of the Indian railway
 - (1) The old guarantee system (1849-1869)
 - (2) State construction and ownership (1869-1882)
 - (3) The modified guarantee system (1882-1924)
 - (4) Nationalisation (1924-1944)
 - (5) Integration and regrouping (1944-1966)
 - 1-8. Classification of Indian Railways
 - (1) Trunk routes
 - (2) Main lines
 - (3) Branch Lines
 - 1-9. Achievements of Indian Railways
 - 1-10. Future plan of Indian Railways
- QUESTIONS 1

Chapter 2 RAILWAY TRACK GAUGES

- 2-1. Definition of gauge of track
 - 2-2. Factors affecting the choice of a gauge
 - (1) Traffic condition
 - (2) Development of poor areas
 - (3) Cost of track
 - (4) Speed of movement
 - (5) Nature of country
 - 2-3. Types of gauges
 - (1) Broad gauge
 - (2) Standard gauge
 - (3) Metre gauge
 - (4) Narrow gauge
 - 2-4. Uniformity in gauges
 - (1) Problems caused by change of gauge
 - (2) Advantages of uniform gauge
 - 2-5. Uniguage project of Indian Railways
 - 2-6. Loading gauge
 - 2-7. Construction gauge
 - 2-8. Track capacity
 - 2-9. Electrification of the Indian Railways
- QUESTIONS 2

Chapter 3 SURVEYS AND ALIGNMENT OF RAILWAY LINES

- 3-1. Reasons for laying a new railway line
 - (1) Strategic consideration
 - (2) Linking of trade centres
 - (3) Connecting port with the interior of the country
 - (4) Shortening existing route
 - (5) Laying of a branch line
 - (6) Undeveloped area
- 3-2. Factors influencing the proposed route
 - (1) Cost
 - (2) Safety
 - (3) Speed
- 3-3. Railway surveys
 - 3-3-1. Reconnaissance survey
 - (1) Objects of reconnaissance survey
 - (2) Importance of reconnaissance survey
 - (3) Information gathered in reconnaissance survey
 - (4) Factors to be kept in view during reconnaissance survey
 - (5) Instruments for reconnaissance survey
 - 3-3-2. Preliminary survey
 - (1) Object of preliminary survey
 - (2) Importance of preliminary survey
 - (3) Work of preliminary survey
 - (4) Instruments for preliminary survey
 - 3-3-3. Location survey
 - (1) Object of location survey
 - (2) Importance of location survey
 - (3) Work of location survey
 - (4) Instruments for location survey

- 3-3-4. Railway Electrification Survey
 - (1) Cost cum feasibility survey
 - (2) Foot by foot survey
 - 3-4. Project report and drawings
 - 3-5. Construction of new lines
- QUESTIONS 3

Chapter 4 RAILWAY TRACTION

- 4-1. Tractive effort of a locomotive
 - 4-2. Track stresses
 - (1) Elastic theory
 - (2) Procedure for determining track stresses
- QUESTIONS 4

Chapter 5 RAILS

- 5-1. Permanent way and its requirements
- 5-2. Functions of rails
- 5-3. Requirements of an ideal rail
- 5-4. Types of rails
 - (1) Double headed rails
 - (2) Bull headed rails
 - (3) Flat footed rails
- 5-5. Steel for rails
 - (1) Medium manganese steel
 - (2) High manganese steel
 - (3) Chromium steel
- 5-6. Weight and section of rails
 - (1) Cost
 - (2) Durability of track
 - (3) Waste of power
- 5-7. Marking on rails
- 5-8. Corrugated or roaring rails
 - (1) Meaning
 - (2) Causes
 - (3) Occurrence
 - (4) Effects
 - (5) Types
 - (6) Peculiar properties
 - (7) Remedy
- 5-9. Corrosion of rails
 - (1) Quality of rail
 - (2) Surface treatment
- 5-10. Length of rail
- 5-11. Welding of rails
 - (1) Theory
 - (2) Purposes
 - (3) Advantages of welding of rails
 - (4) Methods of welding
- 5-12. Wear of rails
 - (1) Wear of rails on top or head of rail
 - (2) Wear of rails at ends of rails
 - (3) Wear of rail on the sides of the head of rail
- 5-13. Methods adopted to reduce wear of rails
 - (1) Use of special alloy steel
 - (2) Good maintenance of track
 - (3) Reduction of expansion gap
 - (4) Exchange of inner and outer rails on curves
 - (5) Introducing check rails
 - (6) Use of lubricating oil
 - (7) Head hardened rails
- 5-14. Measuring wear of rails
- 5-15. Renewal of rails
 - (1) Wear of rails
 - (2) Use of heavier locomotives
 - (3) Construction of branch lines
 - (4) Bending of rails
- 5-16. Failure of rails
 - (1) Crushed head
 - (2) Transverse fissure
 - (3) Split head
 - (4) Horizontal fissure
 - (5) Square or angular breaks
- 5-17. Coning of wheels
- 5-18. Hogged rails
- 5-19. Buckling of rails
- 5-20. Creep of rails
 - 5-20-1. Causes of creep
 - (1) Brakes
 - (2) Wave action or wave theory
 - (3) Percussion theory
 - (4) Changes in temperature

RAILWAY ENGINEERING
DETAILED CONTENTS

- 5-20-2. Factors determining magnitude of creep
(1) Alignment of track
(2) Gradient of track
(3) Direction of motion of trains
(4) Embankments
(5) Weight and type of rail
- 5-20-3. Results of creep
- 5-20-4. Method of measuring the creep
- 5-20-5. Methods of correcting the creep
(1) Pulling back of rails method
(2) Use of creep anchors
(3) Use of steel sleepers
- QUESTIONS 5

Chapter 6 SLEEPERS

- 6-1. Functions of sleepers
- 6-2. Types of sleepers
(1) Longitudinal sleepers (2) Transverse sleepers
- 6-3. Requirements of an ideal material for sleeper
- 6-4. Materials for cross-sleepers
(1) Timber or wooden sleepers
(2) Steel sleepers
(3) Cast-iron (C. I.) sleepers
(4) Concrete sleepers
- 6-5. Sleeper density
- QUESTIONS 6

Chapter 7 BALLAST

- 7-1. Functions of ballast
- 7-2. Requirements of an ideal material for ballast
- 7-3. Materials used as ballast
(1) Broken stone (5) Kankar
(2) Gravel (6) Moorum
(3) Ashes or cinders (7) Brickbats
(4) Sand (8) Selected earth
- 7-4. Size and quantity of ballast
- 7-5. Screening of ballast
- QUESTIONS 7

Chapter 8 EARTHWORK AND DRAINAGE FOR RAILWAY TRACK

- 8-1. General
- 8-2. Usual forms of cross-sections
- 8-3. Features of railroad bed level
(1) Width of formation (3) Drains
(2) Slopes of sides (4) Method of construction
- 8-4. Drainage
(1) Action of water
(2) Importance of drainage
(3) Requirements of drainage system
- 8-5. Stabilization of track on poor soil
(1) Layer or blanket of moorum or sand
(2) Cement grouting
(3) Sand piles
(4) Use of chemicals
(5) By providing capillary break or cut-off
- QUESTIONS 8

Chapter 9 PLATE-LAYING

- 9-1. Meaning of the term
- 9-2. Methods of plate-laying
(1) Tram line or side method
(2) Telescopic method
(3) American method
- 9-3. Materials required per unit length of track
- 9-4. Ballast trains
- 9-5. Relaying of track
- QUESTIONS 9

Chapter 10 TRACK FITTINGS

- 10-1. Rail joints
- 10-2. Avoidance of rail joints
- 10-3. Types of rail joints

- (1) Types according to position of joints
(2) Types according to position of sleepers
- 10-4. Requirements of an ideal fastening
- 10-5. Fastenings for rails
- 10-6. Fish-plates
(1) Purpose (4) Compound or junction
(2) Design of fish-plates fish-plates
(3) Details (5) Failures of fish-plates
- 10-7. Spikes, fang-bolts and hook-bolts
- 10-7-1. Spikes
(1) Purpose of spikes (3) Types of spikes
(2) Requirements of a good spike
- 10-7-2. Fang-bolts
- 10-7-3. Hook-bolts
- 10-8. Chairs and keys
- 10-9. Bearing-plates
(1) Bearing area (5) Wear of spikes
(2) Rail-cutting (6) Maintenance
(3) Soil cutting on curves (7) Cost
(4) Stability
- QUESTIONS 10

Chapter 11 GEOMETRIC DESIGN OF A TRACK

- 11-1. Objections to curvature of track
- 11-2. Designation of a curve
- 11-3. Types of curves and limiting radius or degree of curvature
- 11-4. Transition curves
(1) Requirements of transition curve
(2) Forms of transition curve
(3) Length of transition curve
(4) Shift
- 11-5. Super-elevation or cant
- 11-6. Factors affecting super-elevation
(1) Frictional resistance (3) Body of the vehicle
(2) Coning of wheels (4) Weighted average
- 11-7. Speed of trains on curves
- 11-8. Cant Deficiency and Negative super-elevation
- 11-9. Cant Excess
- 11-10. Grade compensation on curves
- 11-11. Bending of rails on curves
- 11-12. Cutting of rails on curves
- 11-13. Widening gauge on curves
- 11-14. Spirals for mountain railways
- 11-15. Switch-backs
- 11-16. Rack railways
- 11-17. String-lining of curves
- 11-18. Tilting train
(1) The Italian Pendolino (4) Advanced passenger train
(2) The Spanish Talgo (5) X-2000
(3) United aircraft turbo train (6) Inter City Neigezug
- QUESTIONS 11

Chapter 12 RESISTANCE TO TRACTION

- 12-1. Train resistances
(1) Resistance due to friction
(2) Resistance due to wave action
(3) Resistance due to curves
(4) Resistance due to gradients
(5) Resistance due to speed of the train
- 12-2. Rolling stock
- 12-2-1. Locomotives
(1) Definition (4) Design of locomotive
(2) Types of locomotives (5) Classification
(3) Essential parts of a (6) Power of locomotive locomotive
- 12-2-2. Coaches
(1) Earlier coaches (3) Double decker coaches
(2) Modern coaches
- 12-2-3. Wagons
(1) Timber truck wagon (3) Oil tank wagon
(2) Cattle wagon (4) Petrol tank wagon

RAILWAY ENGINEERING
DETAILED CONTENTS

- (5) Hopper wagon
- (6) Powder wagon
- (7) Well wagon
- 12-3. Train-brakes
 - (1) Compressed air brakes
 - (2) Vacuum brakes
- 12-4. Dynamometer car
 - (1) General
 - (2) Mechanisms
- QUESTIONS 12

Chapter 13 POINTS AND CROSSINGS

- 13-1. Purpose
- 13-2. Some definitions
- 13-3. Sleepers laid for points and crossings
 - (1) Through sleepers
 - (2) Interlaced sleepers
- 13-4. Steel for points and crossings
- 13-5. Switches
 - (1) Stub switch
 - (2) Split switch
- 13-6. Shapes of switches
 - (1) Undercut switches
 - (2) Straight cut switches
 - (3) Over-riding switches
 - (4) or composite switches
- 13-7. Lengths of stock rails and tongue rails
- 13-8. Heel divergence or heel clearance
- 13-9. Switch angle
- 13-10. Throw of switch
- 13-11. Crossings
- 13-12. Types of crossings
 - (1) Ordinary or acute crossing
 - (2) Double or obtuse crossing
- 13-13. Theoretical nose of crossing (T.N.c.) and actual nose of crossing (A.N.c.)
- 13-14. Crossing clearance
- 13-15. Crossing number
- 13-16. Crossing angle
 - (1) Right angle or Cole's method
 - (2) Centre-line method
 - (3) Isosceles triangle method
- 13-17. Different types of leads and their calculations
- 13-18. Laying of points and crossings
 - (1) Where there is no traffic interruption as in case of a new turnout
 - (2) Under traffic where the line is available for a few hours only
- 13-19. Maintenance of points and crossings
- 13-20. Combinations of points and crossings
 - 13-20-1. Cross-overs
 - 13-20-2. Scissors cross-overs
 - 13-20-3. Slips
 - 13-20-4. Fixed point
 - 13-20-5. Three throws
 - 13-20-6. Tandems or double turnouts
 - 13-20-7. Gathering lines or ladder tracks
 - 13-20-8. Gauntlet tracks
 - 13-20-9. Double junctions
- QUESTIONS 13

Chapter 14 RAILWAY STATIONS AND YARDS

- 14-1. General
- 14-2. Definition of a station
- 14-3. Purposes of a railway station
- 14-4. Selection of site for a railway station
- 14-5. Facilities required at railway stations
 - (1) Public requirements
 - (2) Traffic requirements
 - (3) Requirements of locomotive department
 - (4) General requirements
- 14-6. Classification of stations
 - 14-6-1. Operational classification
 - (1) Block stations
 - (2) Non-block or D class stations
 - (3) Special class stations

- 14-6-2. Functional classification
 - (1) Wayside stations
 - (2) Junctions
 - (3) Terminals
- 14-7. Platforms
 - (1) Passenger platforms
 - (2) Goods platforms
- 14-8. Staff quarters
- 14-9. Goods traffic at wayside stations
- 14-10. Catch sidings
- 14-11. Definition of a yard
- 14-12. Types of yards
 - 14-12-1. Passenger yards
 - 14-12-2. Goods yards
 - 14-12-3. Marshalling yards
 - (1) General
 - (2) Design of marshalling yards
 - (3) Features of marshalling yards
 - (4) Types of marshalling yards
 - 14-12-4. Locomotive yards
- 14-13. Level-crossing
- QUESTIONS 14

Chapter 15 RAILWAY STATION MACHINERY

- 15-1. Meaning of the term
- 15-2. Engine sheds
 - (1) Rectangular type engine shed
 - (2) Circular type engine shed
- 15-3. Ash-pits, ash-pans and examination pits
- 15-4. Drop pits
- 15-5. Water columns
- 15-6. Triangles
- 15-7. Turntables
- 15-8. Traversers
- 15-9. Cranes
 - (1) Fixed-jib crane
 - (2) Mobile crane
 - (3) Gantry consisting of two parallel beams
 - (4) Goliath
- 15-10. Weigh-bridges
- 15-11. Scotch blocks
- 15-12. Bufferstops
- 15-13. Derailing switch or trap switch
- 15-14. Sand hump on snag dead-end
- 15-15. Cow catcher
- QUESTIONS 15

Chapter 16 SIGNALLING

- 16-1. General
- 16-2. Objects of signalling
- 16-3. Classification of signals
 - 16-3-1. Classification according to function
 - (1) Stop signals or semaphore type signals
 - (2) Warner signals
 - (3) Disc or ground signals
 - (4) Coloured light signals
 - 16-3-2. Classification according to location
 - (1) Outer signal
 - (2) Home signal
 - (3) Starter signal
 - (4) Advance starter signal
 - 16-3-3. Special signals
 - (1) Routing signals
 - (2) Repeating signals
 - (3) Co-acting signals
 - (4) Calling-on signals
 - (5) Indicators
 - (6) Miscellaneous signals
- 16-4. Typical layouts
 - (1) Signalling at diverging junction
 - (2) Signalling at converging junction
 - (3) Signalling at a junction of two main lines and two branch lines with a siding
- 16-5. Control of movements of trains
 - (1) Following trains system
 - (2) Absolute block system
 - (3) Automatic signalling
 - (4) Pilot guard system
 - (5) Centralized traffic control system
 - (6) Cab signalling system

- 16-6. Telecommunication
 - 16-7. Compensators
 - 16-8. Fouling marks
- QUESTIONS 16

Chapter 17 INTERLOCKING

- 17-1. Definition
 - 17-2. Essential principles of interlocking
 - 17-3. Methods of interlocking
 - (1) Tappets and locks system
 - (2) Key system
 - (3) Route relay system (RRS)
 - 17-4. Slotting of signals
 - (1) Meaning of the term
 - (2) Principles
 - (3) Purposes
 - (4) Methods
 - 17-5. Detectors
 - 17-6. Point lock and treadle or lock bar
 - 17-7. Interlocking of level-crossings
 - 17-8. Interlocking standards
 - (1) Automatic signalling
 - (2) Grouping of levers
 - (3) Interlocking
 - (4) Isolation of main line
 - (5) Large stations
 - 17-9. Improvements in interlocking and signalling
- QUESTIONS 17

Chapter 18 MAINTENANCE OF TRACK

- 18-1. General
 - (1) Foundations
 - (2) Nature of structure
 - 18-2. Necessity for maintenance of track
 - (1) New track
 - (2) Constant use
 - 18-2-1. Maintenance of track proper
 - (1) Duties of a gangmate or a ganger
 - (2) Duties of a keyman
 - (3) Duties of a Permanent Way Inspector (P.W.I.)
 - 18-2-2. Maintenance of railway bridges
 - 18-2-3. Maintenance of rolling stock
 - 18-3. Accidents
 - (1) General
 - (2) Causes of accidents
 - (3) Points to be observed at the time of accident
 - (4) Preventive measures
 - 18-4. Signalling during maintenance
 - 18-5. Estimating speed of a running train
 - (1) Counting the rail joints passed
 - (2) Counting the telegraph posts
 - 18-6. Speed restriction
 - 18-7. Tools required during maintenance
 - 18-8. Packing
 - 18-9. Rail inspection
 - 18-10. Track inspection
 - 18-11. Maintenance and boxing of ballast
 - 18-12. Track imprest
 - 18-13. Trackwork for high speeds
 - 18-14. Speeds on the Indian railways
 - (1) Brakes and signals
 - (2) Cattle and trespassers
 - (3) Curves
 - (4) Deterioration of track and rolling stock
 - (5) Dust nuisance
 - (6) Energy consumption
 - (7) Level-crossings
 - (8) Locomotives
 - (9) On-board facilities in trains
 - (10) Sharing of routes
 - 18-15. Emergency measures
 - (1) Diversions
 - (2) Ash or selected earth
 - (3) Temporary supports
 - (4) Scouring
 - (5) Wagons with rubble
 - (6) Breakdown vans
- QUESTIONS 18

Chapter 19 TUNNELLING

- 19-1. General
 - 19-2. Definition of a tunnel
 - 19-3. Advantages and disadvantages of tunnels and open cuts
 - (1) Advantages of tunnels
 - (2) Disadvantages of tunnels
 - (1) Advantages of open cuts
 - (2) Disadvantages of open cuts
 - 19-4. Classification of tunnels
 - (1) Classification according to alignment
 - (2) Classification according to purpose
 - (3) Classification according to type of material used in the construction
 - 19-5. Shape of tunnels
 - (1) Circular section
 - (2) D-section or segmental roof section
 - (3) Egg-shaped section
 - (4) Elliptical section
 - (5) Horse-shoe section
 - 19-6. Size of tunnels
 - 19-7. Problems in tunnelling
 - 19-8. Investigations for tunnel site
 - (1) Investigations before planning
 - (2) Investigations at the time of planning
 - (3) Investigations at the time of construction
 - 19-9. Setting out of tunnel
 - (1) Setting out tunnel on ground surface
 - (2) Transfer of centre line from surface to underground
 - (3) Underground setting out
 - (4) Underground levelling
 - 19-10. Tunnelling through rock
 - (1) Full face method
 - (2) Heading and bench system
 - (3) Cantilever car dump method
 - (4) Drift system
 - (5) Pilot tunnel method
 - 19-11. Tunnelling through soft ground
 - (1) Forepoling method
 - (2) Needle beam method
 - (3) Five-piece set method
 - (4) Liner plates method
 - (5) Other methods
 - 19-12. Methods of tunnelling through sub-aqueous strata
 - (1) Shield tunnelling
 - (2) Plenum process or compressed air tunnelling
 - 19-13. Drainage of tunnels
 - 19-14. Pre-drainage
 - 19-15. Dewatering (Temporary drainage)
 - 19-16. Pumping (Temporary drainage)
 - 19-17. Permanent drainage
 - 19-18. Tunnel Lighting
 - (1) Spacing of lights
 - (2) Types of tunnel lights
 - 19-19. Ventilation in tunnels
 - (1) Objects of tunnel ventilation
 - (2) Requirements of tunnel ventilation
 - (3) Volume of air required
 - (4) Methods of ventilation
 - (5) Equipments for ventilation
 - (6) Permanent ventilation
 - (1) Semi-lateral system
 - (2) Permanent ventilation
 - 19-20. Dust Control in Tunnels
 - 19-21. Shafts
 - (1) Drilling
 - (2) Raising
 - (3) Gloryholing
 - 19-22. Portals
 - 19-23. Mucking
 - (1) Manual labour
 - (2) Power shovels
 - (3) Mucking machines
 - (4) Tractor loaders
 - 19-24. Hauling
 - 19-25. Lining of tunnels
 - 19-26. Maintenance of railway tunnels
 - 19-27. Safety precautions in tunnelling
- QUESTIONS 19

Chapter 20 RAPID TRANSIT SYSTEM (METRO RAIL SYSTEM)

- 20-1. General
- 20-2. Underground railways
- 20-3. KOLKATA Metro
- 20-4. Delhi Metro
- 20-5. Dubai Metro
 - (1) Phase 1 (Red Line)
 - (2) Phase 2 (Green Line)
 - (3) Future plans
- 20-6. Tube railways
- 20-7. Ahmedabad Metro Rail Project
- 20-8. Ten Largest Metro Rail Systems In The World
 - (1) New York City (NYC) Subway
 - (2) Paris Metro
 - (3) Madrid Metro
 - (4) Seoul Subway
 - (5) London Underground
 - (6) Shanghai Metro
 - (7) Beijing Subway
 - (8) Mexico City Metro
 - (9) Moscow Metro
 - (10) Tokyo Metro

QUESTIONS 20

Chapter 21 MATERIALS MANAGEMENT

- 21-1. Meaning of the term
- 21-2. Necessity in railways
- 21-3. Stores
 - (1) Codification
 - (2) Divisions
 - (3) Internal transport
 - (4) Layout
 - (5) Location
 - (6) Material chart
 - (7) Sectionalization
 - (8) Storage of materials
 - (9) Storage of tools
 - (10) Usual facilities
 - (11) Valuable articles
- 21-4. Purchasing department
 - (1) Co-operation with other departments
 - (2) Market trends
 - (3) Organization
 - (4) Procedure for purchasing
 - (5) Records
- 21-5. Store keeping
 - (1) Accounting
 - (2) Checking
 - (3) Golden rule
 - (4) Issuing materials
 - (5) Maxima and minima
 - (6) Surplus materials
 - (7) Tools
- 21-6. Stock control
 - (1) ABC analysis
 - (2) VED analysis
- 21-7. Spare parts management
 - (1) Classification
 - (2) Codification
 - (3) Initial provisioning
 - (4) Selective control
- 21-8. Importance

QUESTIONS 21

Appendix I UNITS OF THE INDIAN RAILWAY

- A-I-1. Chittaranjan Locomotive Works
- A-I-2. Integral Coach Factory
- A-I-3. Diesel Locomotive Works
- A-I-4. Rail Coach Factory (RCF), Kapurthala

- A-I-5. Research, Designs and Standards Organization
 - (1) Architectural services
 - (2) Bridges
 - (3) Consultancy service
 - (4) Electrification
 - (5) Locomotives
 - (6) Maintenance of track
 - (7) Permanent way
 - (8) Psycho-technical cell
 - (9) Rolling stock
 - (10) Signalling and telecommunication
 - (11) Testing of materials
- A-I-6. Rail India Technical and Economic Services Limited (RITES)
- A-I-7. Indian Railway Construction Company Limited (IRCON)

Appendix II TRAINING INSTITUTIONS OF THE INDIAN RAILWAYS

- A-II-1. The Railway Staff College, Vadodara
- A-II-2. Indian Railways Institute of Civil Engineering (IRICEN), Pune
- A-II-3. Indian Railways Institute of Signal Engineering and Tele-communications (IRISET), Secunderabad
- A-II-4. Indian Railways Institute of Mechanical and Electrical Engineering, Jamalpur
- A-II-5. Institute for Signal and Civil Engineering Officers at South Lallaguda, Secunderabad
- A-II-6. Indian Railways Institute of Electrical Engineering (IRIEEN), Nasik
- A-II-7. Indian Railways Institute of Transport Management (IRITM), Lucknow
- A-II-8. Jagjivan Ram Railway Protection Force Academy, Lucknow
- A-II-9. Railway University, Vadodara

Appendix III FAMOUS INDIAN TRAINS

- A-III-1. Palace on Wheels
- A-III-2. Royal Orient
- A-III-3. Fairy Queen
- A-III-4. Kangra Queen
- A-III-5. Desert Queen
- A-III-6. Deccan Odyssey
- A-III-7. Darjeeling Himalayan Railway (DHR)
- A-III-8. Nilgiri Mountain Railway (or Ooty Rack Railway)
- A-III-9. Toy Trains
- A-III-10. Rajdhani Trains
- A-III-11. Shatabdi Express Trains
- A-III-12. Frontier Mail
- A-III-13. Flying Raneer
- A-III-14. Deccan Queen
- A-III-15. Boat Mail
- A-III-16. Janata Express, Jansewa Express, Matrubhumi Express, Jana Shatabdi Express, Garib Rath trains
- A-III-17. Samjhauta Express
- A-III-18. Lifeline Express
- A-III-19. Patiala State Monorail
- A-III-20. The Presidential Saloon
- A-III-21. DEMU, MEMU, EMU trains

Appendix IV ABBREVIATED TERMS

Appendix V MULTIPLE CHOICE QUESTIONS

BIBLIOGRAPHY

Index