# RAILWAY ENGINEERING SKILL DEVELOPMENT COURSE

# DIPLOMA COURSE

# IN

# RAILWAY TRACK TECHNOLOGY

A Programme under

**Department of Civil Engineering**

**MIT College of Railway Engineering & Research, Barshi**

In association with

**Skill development centre**

**Punyashlok Ahilyadevi Holkar Solapur University, Solapur**

| | | |
|---|---|---|
| 1 | **Name of Course** | Diploma in Railway Track Technology |
| 2 | **Max no. of Students** | 30 |
| 3 | **Duration** | 1 Year |
| 4 | **Course Type** | Part Time |
| 5 | **No. of Days per week** | 3 Days |
| 6 | **No. of hours per day** | 2 Hrs |
| 7 | **Space require** | 66 sq. m classroom and 66 sq. m Laboratory |
| 8 | **Entry qualification** | Diploma Civil / FE- Civil |
| 9 | **Objective of syllabus** | To get Knowledge of Railway track,<br>To Understanding Railways Curves, Railway Turnout, P&C and Railway Defects |
| 10 | **Employment opportunities** | Government and Private sector associated with Railways |
| 11 | **Teachers Qualification** | ME/ M.Tech/ PhD |
| 12 | **Fifteen day Summer Internship is Compulsory.** | |

**13 Teaching Scheme :**

| Sr.No | Subject | Subject Code | Clock Hour/ Week | | Total (Hour/ Week) |
|---|---|---|---|---|---|
| | | | Theory | Practical | |
| 1 | **Survey and Construction of Railway Lines** | RT001 | 2 | 2 | 4 |
| 2 | **Track Structure** | RT002 | 2 | 2 | 4 |
| 3 | **Track Maintenance** | RT003 | 2 | 2 | 4 |
| 4 | **Track Modernisation** | RT004 | 2 | 2 | 4 |
| 5 | **Investigation of derailments** | RT005 | 2 | 2 | 4 |
| 6 | **Railway Project work** | RT006 | 0 | 4 | 4 |

**14 Examination Scheme – Final Examination will be based on a syllabus of One years.**

| Paper No | Subject | Subject Code | Theory | | | Practical | | | Total | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Duration (Hr.) | Max | Min | Duration (Hr.) | Max | Min | Min | Max |
| **1** | **Survey and Construction of Railway Lines** | RT001 | 3 | 80 | 32 | 2 | 20 | 8 | 40 | 100 |
| **2** | **Track Structure** | RT002 | 3 | 80 | 32 | 2 | 20 | 8 | 40 | 100 |
| **3** | **Track Maintenance** | RT003 | 3 | 80 | 32 | 2 | 20 | 8 | 40 | 100 |
| **4** | **Track Modernisation** | RT004 | 3 | 80 | 32 | 2 | 20 | 8 | 40 | 100 |
| **5** | **Investigation of derailments** | RT005 | 3 | 80 | 32 | 2 | 20 | 8 | 40 | 100 |
| **6** | **Railway Project work** | RT006 | 0 | 0 | 0 | 2 | 100 | 40 | 40 | 100 |
| **Total** | | | | 400 | 160 | | 200 | 80 | 240 | 600 |

**NOTE :-** ***COMBINE PASSING (BOTH THEORY & PRACTICAL )***

# SYLLABUS

| Sr.No | Course Name | Diploma in Railway Track Technology | | |
|---|---|---|---|---|
| 1 | Paper Title | **Survey and Construction of Railway Lines** | | |
| 2 | Paper Number | RT001 | | |
| 3 | Objective of Paper | To introduce to the students the surveying technique and its significance in construction of railway line. | | |
| | | To introduce to the students various types of gauge. | | |
| | | To introduce to the students various types of joints in track structure. | | |
| | | To introduce to the students with types of turnouts and crossings | | |
| 4 | Expected Outcome from Paper | To analyses the survey required for Railways | | |
| | | To illustrate Location requirement in Railway Surveying | | |
| | | To develop surveys for Railway Electrification | | |
| | | Be conversant with basics of designing geometric of railway track | | |
| 5 | Content | **Unit** | **Content** | **Hour** |
| | | **Unit-I** | **Construction of New Railway Lines and Track Linking** Construction of New Lines, Requirement of Track Material for BG Track, Doubling of Railway Lines, Gauge Conversion | **5** |
| | | **Unit-II** | **Reconnaissance Survey, Preliminary and Location Survey for Railway** Objective of reconnaissance survey, Importance of reconnaissance survey, Information gathered in reconnaissance survey, Instruments used in reconnaissance survey. Reconnaissance Survey for New Railway Line- strategic consideration, linking of trade routes, laying of branch line, factors affecting proposed route. Objective of Preliminary survey, Importance of Preliminary survey, Information gathered in Preliminary survey, Instruments used in Preliminary survey. Objective of Location survey, Importance of Location survey, Information gathered in Location survey, Instruments used in Location survey. | **5** |
| | | **Unit-III** | **Railway Electrification Survey** Electrification survey, cost and feasibility survey, foot by foot survey, project report preparation and drawing with construction of new lines. | **5** |
| | | **Unit-IV** | **Railway Curves** Necessity of curves, Classification of curves, Setting Out of curves, Degree of curves, Simple curves, | **8** |

| | | | | |
|---|---|---|---|---|
| | | | Compound curves, Transition curves, Permissible speed on a curve. | |
| | | **Unit-V** | **Geometric Design of Railway Curves and Superelevation** Necessity of curves, Classification of curves, Setting Out of curves, Degree of curves, Simple curves, Compound curves, Transition curves, Permissible speed on a curve. | **7** |
| | **Practical** | **Practical -1** | Reconnaissance Survey using GIS | 2 |
| | | **Practical -2** | Railway Electrification & Planning Using CAD | 2 |
| | | **Practical -3** | Simple and Compound curve | 2 |
| | | **Practical -4** | super elevation and Transition curve | 2 |
| | | **Practical -5** | Geometric Design | 2 |
| **6** | **Reference Book** | 1. Railway Engineering- S. C. Rangwala, Charotar Publications, Anand, Gujarat.<br>2. Indian Railway Tracks- M. M. Agarwal, Prabha & Co., New Delhi.<br>3. Surveying Vol-II- Dr. B. C. Punmia, Laxmi Publications Pvt. Ltd., New Delhi.<br>4. Railway Monographs | | |

| Sr.No | Course Name | Diploma in Railway Track Technology | | |
|---|---|---|---|---|
| 1 | **Paper Title** | **Track Structure** | | |
| 2 | **Paper Number** | RT002 | | |
| 3 | **Objective of Paper** | To acquaint students with Rails and Type of Rails | | |
| | | To introduce students to sleepers | | |
| | | To educate students about ballast and testing | | |
| | | To impart knowledge of various methods of concrete mix design. | | |
| | | To educate students about testing of various construction materials. | | |
| 4 | **Expected Outcome from Paper** | To Evaluate the property of ballast | | |
| | | To Execute earthwork in embankment | | |
| | | To Select appropriate rail fastening | | |
| | | | | |
| 5 | **Content** | **Unit** | **Content** | **Hour** |
| | | **Unit-I** | **Rails**<br>Function of Rails, Types of Rails , Requirements for an Ideal Rail Section , Rail Manufacture , Rail Wear , Other Defects in Rails , Rail Failure , Rail Flaw Detection | 6 |
| | | **Unit-II** | **Sleepers**<br>Functions and Requirements of Sleepers, Sleeper Density and Spacing of Sleepers , Types of Sleepers , Wooden Sleepers , Steel Channel Sleepers , Steel Trough Sleeper , Cast Iron Sleepers , Concrete Sleepers | 6 |
| | | **Unit-III** | **Ballast**<br>Functions of Ballast , Types of Ballast , Sizes of Ballast, Requirements of a Good Ballast , Design of Ballast Section , Specifications for Track Ballast , Collection and Transportation of Ballasts , Methods of Measurement , Laboratory Tests for Physical Properties of Ballast , Assessment of Ballast Requirements ,<br>Guidelines for Provision of Sub-ballast | 6 |
| | | **Unit-IV** | Formation Slopes of Formation , Execution of Earthwork in Embankments and Cuttings , Blanket and Blanketing Material , Failure of Railway Embankment, Site Investigations | 6 |
| | | **Unit-V** | **Rail Fastening**<br>Rail-to-Rail Fastenings , Fittings for Wooden Sleepers , Fittings of Steel Trough Sleepers , | 6 |

| | | | | |
|---|---|---|---|---|
| | | | Fittings of CI Sleepers , Elastic Fastenings , Other Fittings and Fastenings , Testing of Fastenings | |
| | **Practical** | **Practical -1** | Specific Gravity of Aggregate | 2 |
| | | **Practical -2** | Aggregate Crushing Value | 2 |
| | | **Practical -3** | Los Angeles Abrasion Value of Aggregate | 2 |
| | | **Practical -4** | Impact Value of Aggregate | 2 |
| | | **Practical -5** | Water Absorption Test on Aggregate | 2 |
| **6** | **Reference Book** | 1. Railway Engineering- S. C. Rangwala, Charotar Publications, Anand, Gujarat.<br>2. Indian Railway Tracks- M. M. Agarwal, Prabha & Co., New Delhi.<br>3. Surveying Vol-II- Dr. B. C. Punmia, Laxmi Publications Pvt. Ltd., New Delhi.<br>4. Railway Monographs | | |

| Sr.No | Course Name | Diploma in Railway Track Technology | | |
|---|---|---|---|---|
| 1 | Paper Title | **Track Maintenance** | | |
| 2 | Paper Number | RT003 | | |
| 3 | Objective of Paper | To understand the Maintenance Works required for Railway Track | | |
| | | To analyze the different structure of Track Maintenance | | |
| 4 | Expected Outcome from Paper | To examine Maintenance Requirement | | |
| | | To illustrate various Drainage system and Crossing system | | |
| | | To demonstrate renewal methodologies. | | |
| 5 | Content | **Unit** | | |
| | | **Unit-I** | **Points and Switches**-Important Terms, Switches, Design of Tongue Rails, Crossing, Number and Angle of Crossing, Reconditioning of Worn Out Crossings, Turnouts, Turnout with Curved Switches, Layout of Turnout, Trends in Turnout Design on Indian Railways, Inspection and Maintenance of Points and Crossings. | **5** |
| | | **Unit-II** | **CROSSING**- Importance, Necessity, Classification of Level Crossings Dimensions of Level Crossings, Accidents at Level Crossings and Remedial Measures, Maintenance of Level Crossings, Inspection of Level Crossings | **5** |
| | | **Unit-III** | **LEVEL CROSSING**-Classification of Level Crossings, Dimensions of Level Crossings, Accidents at Level Crossings and Remedial Measures, Maintenance of Level Crossings, Inspection of Level Crossings by PWI and AEN | **5** |
| | | **Unit-IV** | **Track Drainage-**<br>Need for Proper Track Drainage, Sources of Percolated Water in the Track, Requirements of a Good Track Drainage System, Practical Tips for Good Surface Drainage, Track Drainage Systems, Sub-surface Drainage, | **7** |
| | | **Unit-V** | **Track Maintenance** Necessity and Advantages of Track Maintenance, Essentials of Track Maintenance, Measuring Equipment and Maintenance Tools for Tracks, Maintenance of Rail Surface, Deep Screening of Ballast, Maintenance of Track in Track Circuited Lengths, Organization Structure for Track Maintenance, | |

| | | | | |
|---|---|---|---|---|
| | | | Protection of Track for Engineering Work, Patrolling of Railway Tracks, Track Tolerances | |
| | **Practical** | **Practical -1** | Site Visit-1 | **2** |
| | | **Practical -2** | Site Visit-2 | **2** |
| | | **Practical -3** | Case Study-1 | **2** |
| | | **Practical -4** | Case Study-2 | **2** |
| | | **Practical -5** | Preparation of Model for Track Maintenance | **2** |
| **6** | **Reference Book** | 1. Railway Engineering- S. C. Rangwala, Charotar Publications, Anand, Gujarat.<br>2. Indian Railway Tracks- M. M. Agarwal, Prabha & Co., New Delhi.<br>3. Surveying Vol-II- Dr. B. C. Punmia, Laxmi Publications Pvt. Ltd., New Delhi.<br>4. Railway Monographs | | |

| Sr. No | Course Name | Diploma in Railway Track Technology | | |
|---|---|---|---|---|
| 1 | Paper Title | **Track Modernization** | | |
| 2 | Paper Number | RT004 | | |
| 3 | Objective of Paper | To make the students understand about mechanized methods of track maintenance | | |
| | | To make the students understand quality control in Track linking | | |
| | | To understand track relaying and greasing of fish plates, Ballast cleaning machine. | | |
| 4 | Expected Outcome from Paper | To prepare Quality Control Measures in Track Maintenance | | |
| | | To Illustrate various Modern Mechanized Track Maintenance | | |
| | | To differentiate with conventional and modern methodologies of track maintenance | | |
| | | To demonstrate standards of track geometry along with track relaying. | | |
| 5 | Content | **Unit** | **Content** | **Hour** |
| | | **Unit-I** | **Mechanized Methods of Track Maintenance** Mechanized Methods of Track Maintenance, Off-track Tampers, On-track Tampers, Future of Track Machines on Indian Railways, Measured Shovel Packing, Directed Track | **5** |
| | | **Unit-II** | **Track Tolerances for New Work** Track Tolerances for New Work, Prerequisites for Ensuring Quality, Standards of Track Geometry, Prescribed Standards of Track Geometry, | **5** |
| | | **Unit-III** | **Quality Control in Track linking** Quality Control in Track linking, Primary survey of rail level and deciding final rail level, Unloading and stacking of rail panels, Drilling of holes & chamfering, Use of 1 M long fish plate, Position and Location of Joints, Staggering of Joints on curves, Expansion Gaps at Joints, Greasing of fishing planes and oiling of fish bolts | **5** |
| | | **Unit-IV** | **Mechanized Track Relaying** Introduction to Mechanized Track Relaying, System of Mechanized Renewal, PQRS, Activities at Base depot, Quality Control at Base Depot, Activities at site, Track Relaying Train (TRT), Advantage of | **7** |

| | | | | |
|---|---|---|---|---|
| | | | TRT, Activities of TRT, Modes of operation of TRT, Ballast Cleaning Machine (BCM). | |
| | | **Unit-V** | **Precautions during Rail handling and Quality Control** Precautions during Rail Handling, Quality control in thermit welding, Use of rail free fastening on girder bridges, Provision of SWR on un-ballasted bridges, Provision of LWR/CWR on bridges, Bridges with ballasted deck without bearing, Bridges with or without ballasted deck with bearing, Track structure for new line and track renewal, Proposed Rail section, Minimum Sleeper density, Recommended depth of Ballast cushion | **8** |
| | **Practical** | **Practical -1** | Site Visit-1 | **2** |
| | | **Practical -2** | Site Visit-2 | **2** |
| | | **Practical -3** | Case Study-1 | **2** |
| | | **Practical -4** | Case Study-2 | **2** |
| | | **Practical -5** | Preparation of Model | **2** |
| **6** | **Reference Book** | 1. Railway Engineering- S. C. Rangwala, Charotar Publications, Anand, Gujarat.<br>2. Indian Railway Tracks- M. M. Agarwal, Prabha & Co., New Delhi.<br>3. Surveying Vol-II- Dr. B. C. Punmia, Laxmi Publications Pvt. Ltd., New Delhi<br>4. Railway Monographs | | |

| Sr.No | Course Name | Diploma in Railway Track Technology | | |
|---|---|---|---|---|
| 1 | Paper Title | **Investigation of derailments** | | |
| 2 | Paper Number | RT005 | | |
| 3 | Objective of Paper | To prepare the students to analyze the situations involved in derailment. | | |
| | | To make students identify the track failure defects during derailment. | | |
| | | To develop an investigative approach in the students with the help of case studies. | | |
| 4 | Expected Outcome from Paper | Understand the mechanism behind derailments. | | |
| | | Illustrate derailment with data from site investigation. | | |
| | | Identify the track defects and failure. | | |
| | | Develop preventive measures using case studies with reference. | | |
| 5 | Content | **Unit** | **Content** | **Hour** |
| | | **Unit-I** | **Theoretical Background**<br>Derailment Mechanism, Mechanism of flange climbing derailment and Nadal's Formula, Application of Nadal's Formula in derailment investigation, Stability analysis by rail-wheel interaction forces, Track-Train Dynamics and its relation to rail-wheel interaction, Vehicle Oscillations, Self-excited oscillations and effect of wheel conicity, Critical Speed, Cyclic track irregularities and resonance, Effect of track or vehicle twist on wheel off-loading, Lateral stability of Track, Determination of Safe Permissible maximum speed of rolling stock | **8** |
| | | **Unit-II** | **Site Investigation**<br>Sudden Derailment**,** Gradual derailment by flange climbing**,** Preservation of clues**,** Accident Sketch | **4** |
| | | **Unit-III** | **Rolling Stock features and Defects**<br>Wheel set, Suspension System, Vehicle Body, Defects in Wheel sets, Journal, Axle boxes, Springs, Damping, Bogie rotation, Break gear, Twist in underframe, Buffer & draft gear | **5** |
| | | **Unit-IV** | **Track Defects**<br>Failure of track components, Failure of formation, Failure of Ballast, Failure of sleepers & fastenings, Failure of rails, Track Geometry, Gauge, Cross levels, Twist, Variation in | **7** |

| | | | | |
|---|---|---|---|---|
| | | | Alignment, Buckling/Distortion in track, Unevenness and low joints, Curves, Check rails and curves, Points & Crossings, Girder bridge (unballasted) and level crossing Approaches, Safety at worksites | |
| | | **Unit-V** | **Operating Features** Slacks**,** Train Brake Application**,** Wheel off Loading due to Braking and Tractive Forces**,** Effect of Curvature**,** Marshalling of The Train**,** Movement of 3 - Axled Bogie on Sags and Humps**,** Wheel Slips on Diamond Crossing | **6** |
| | **Practical** | **Practical -1** | Case study -1 | **2** |
| | | **Practical -2** | Case Study -2 | **2** |
| | | **Practical -3** | Case Study -3 | **2** |
| | | **Practical -4** | Case Study -4 | **2** |
| | | **Practical -5** | Case Study -5 | **2** |
| **6** | **Reference Book** | 1. Railway Engineering- S. C. Rangwala, Charotar Publications, Anand, Gujarat.<br>2. Indian Railway Tracks- M. M. Agarwal, Prabha & Co., New Delhi.<br>3. Surveying Vol-II- Dr. B. C. Punmia, Laxmi Publications Pvt. Ltd., New Delhi.<br>4. Railway Monographs | | |

| Sr. No | Course Name | Diploma in Railway Track Technology | |
|---|---|---|---|
| 1 | Paper Title | **Railway Project wor**k | |
| 2 | Paper Number | RT006 | |
| 3 | Objective of Paper | To carry out a thematic design project in one of the specializations of Railway track | |
| | | To carry out a project that will make the students aware of the different facets of Railway track | |
| | | To explore the skill and abilities of student to work in team | |
| 4 | Expected Outcome from Paper | Develop an ability to apply the basic knowledge of mathematics, science and engineering to real-life problems | |
| | | Identify the real life problem and present the solution by conducting experimental/ analytical study and in and off the laboratory | |
| | | Apply modern tools such as different application software, modern instrumentation for the most precise study of the project undertaken | |
| | | Demonstrate a commitment to teamwork while working with other students of diverse culture and different intellectual backgrounds | |
| 5 | Content Practical | Student shall submit the report and prepare presentation for defense.<br>The topic for the Project Work may be from any Civil Engineering and inter-disciplinary area related to Railway Engineering.<br>**Guidelines for Project contents:**<br>**a) Project Report:**<br>Project report should be of 25 to 50 pages (More pages can be used if needed).<br>Entire Report has to be segmented chapter wise as per the requirement.<br>1. Introduction (History, Importance of Project Area, Problem identification, Objective of the Project)<br>2. Literature Review<br>3. Design/ Experimentation/ Model/Actual work carried out for the same.<br>4. Observation/ Analysis/ Findings/Results<br>5. Discussion on Results and Conclusion<br>**b) Presentation:**<br>The group has to prepare a power point presentation on project report and present it in front of the faculty of department along with the demonstration of the project. | **Hour**<br>**40** |

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|---|---|---|---|
| | | One copy of the report should be submitted to Institute/ Department, One copy to Guide and one copy should remain with each student of the project group | |