



# **SKILL DEVELOPMENT COURSE**



## **DIPLOMA COURSE IN RAILWAY ROLLING STOCKS AND OPERATIONS**

A Programme under

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

In association with

**Skill development center  
Punyashlok Ahilyadevi Holkar Solapur University, Solapur**

<b>1</b>	<b>Name of Course</b>	Diploma in Railway Rolling Stocks and Operations				
<b>2</b>	<b>Max no. of Students</b>	30				
<b>3</b>	<b>Duration</b>	1 Year				
<b>4</b>	<b>Course Type</b>	Part Time				
<b>5</b>	<b>No. of Days per week</b>	2 days				
<b>6</b>	<b>No. of hours per day</b>	4 Hrs.				
<b>7</b>	<b>Space require</b>	66 m <sup>2</sup> classroom and 66 m <sup>2</sup> Laboratory				
<b>8</b>	<b>Entry qualification</b>	Diploma Mechanical Engineering/Automobile Engineering/ Production Engineering / FE- Mechanical				
<b>9</b>	<b>Objective of syllabus</b>	1. To introduce students about Railway Organization, Standards and Coding's. 2. To study Construction and working of Railway Rolling Stocks and its components. 3. To analyze various Mechanisms and Systems in Railways. 4. To apply skills for advancement in Railways				
<b>10</b>	<b>Employment opportunities</b>	Students can be placed in Government and Private organizations of Railways				
<b>11</b>	<b>Teachers Qualification</b>	ME/ M.Tech/Ph.D.				
<b>12</b>	<b>One Month Internship is Compulsory.</b>					
<b>13</b>	<b>Teaching Scheme :</b>					
	<b>Sr. No.</b>	<b>Subject</b>	<b>Subject Code</b>	<b>Clock Hour/ Week</b>		<b>Total</b>
				<b>Theory</b>	<b>Practical</b>	
	1	Standards and Coding's of Indian Railway	RRS001	2 Hrs.	2 Hrs.	4 Hrs.
	2	Rolling Stocks	RRS002	2 Hrs.	2 Hrs.	4 Hrs.
	3	Systems and Mechanisms of Railway	RRS003	2 Hrs.	2 Hrs.	4 Hrs.
	4	Permanent Way, Signal System and Overhead Equipments	RRS004	2 Hrs.	2 Hrs.	4 Hrs.
	5	Reliability, Availability, Maintainability and Safety (RAMS) in Railway	RRS005	2 Hrs.	2 Hrs.	4 Hrs.
	6	Railway Project Work	RRS006	2 Hrs.	2 Hrs.	4 Hrs.
	<b>Total</b>					24 Hrs.

Paper	Subject	Subject Code	Theory			Practical			Total	
			Duration (Hr.)	Max	Min	Duration (Hr.)	Max	Min	Min	Max
1	Standards and Coding's of Indian Railway	RRS001	4	70	28	2	30	12	40	100
2	Rolling Stocks	RRS002	4	70	28	2	30	12	40	100
3	Systems and Mechanisms of Railway	RRS003	4	70	28	2	30	12	40	100
4	Permanent Way, Signal System and Overhead Equipments	RRS004	4	70	28	2	30	12	40	100
5	Reliability, Availability, Maintainability and Safety (RAMS) in Railway	RRS005	4	40	16	2	60	24	40	100
6	Railway Project Work	RRS006	4	-	-	-	100	40	40	100
<b>Total</b>										600

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

<b>Sr. No.</b>	<b>Course Name</b>	Diploma in Railway Rolling Stocks and Operations		
<b>1</b>	<b>Paper Title</b>	Standards and Coding's Of Indian Railway		
<b>2</b>	<b>Paper Number</b>	RRS001		
<b>3</b>	<b>Objective of Paper</b>	1. To introduce Railway Organization in Indian Railway		
		2. To introduce students to the Railway Standards.		
		3. To introduce students to the Railway Coding's		
<b>4</b>	<b>Expected Outcome from Paper</b>	1. Understand the different Railway Organization in Indian Railway.		
		2. Understand the Railway Standards		
		3. Become familiar with various Railway Coding's.		
<b>5</b>	<b>Content</b>	<b>Unit</b>	<b>Content</b>	<b>Hour</b>
		Unit-I	<b>Organization in Indian Railway</b> History of Indian Railway, Indian Railway organization structure, Railway Boards: Roles and responsibilities, Railway Zones, Railways technical institutes, Railways research institutes, Railway production units, Workshop Management & Production Control Organisation (PCO)	<b>10</b>
		Unit-II	<b>General Codes, Conditions of Indian Railway</b> Standards and specifications for Railway zones, Railway stations – Terminal, Centre, Junction & Station, Railway Platform- Types & Codes, Rolling stocks- Locomotive, Coaches & Wagons	<b>08</b>
		Unit-III	<b>Standards of Indian Railway</b> Signal System- Manual and Automatic Signal Systems, Horns- Types & Codes of Horns. Track side symbols. Codes of Mechanical Department (Workshop). Rail gauge- Broad Gauge, Meter gauge & Narrow gauge.	<b>08</b>
		Unit-IV	<b>Engineering Enrollment in Railways</b> PPP policy. Organizations for Metro and Mono rails, Railway recruitment Processes in Railways- RRB, RRC, UPSC, PSUs	<b>06</b>
<b>Total</b>				<b>32</b>
<b>Practical List</b>				
<b>1</b>	Assignment on Railway organization structure.			<b>02</b>
<b>2</b>	Assignment on Codes, Conditions and Standards of Indian Railway.			<b>02</b>

<b>3</b>	Assignment on Railway Rolling stocks.	<b>02</b>
<b>4</b>	Case study on Rolling Stocks	<b>02</b>
<b>Total</b>		<b>08</b>
<b>Reference Book</b>	<ol style="list-style-type: none"> <li>1. Christos N. Pyrgidis, Railway Transportation Systems: Design, Construction and Operation, Oxford, New York, Philadelphia.</li> <li>2. Principles of Railway Engineering, S.C. Rangawala, Charotar Publication, 2015.</li> <li>3. A Text Book of Railway Engineering, Dhanpat Rai &amp; Sons.</li> </ol>	

<b>Sr. No.</b>	<b>Course Name</b>	Diploma in Railway Rolling Stocks and Operations		
<b>1</b>	<b>Paper Title</b>	Rolling Stocks		
<b>2</b>	<b>Paper Number</b>	RRS002		
<b>3</b>	<b>Objective of Paper</b>	1. To introduce students to the Rolling Stocks.		
		2. To help them understand the different aspects of Railway Locomotives, Railway Coaches & Wagons		
		3. To give an introduction to components and assembly Rolling stocks.		
<b>4</b>	<b>Expected Outcome from Paper</b>	1. Understand the different components of a railway like Locomotives, Coaches, and sleepers.		
		2. Understand the physics behind Railway mechanisms.		
		3. Become familiar with various railway systems.		
<b>5</b>	<b>Content</b>	<b>Unit</b>	<b>Content</b>	<b>Hour</b>
		Unit-I	<b>Locomotives</b> History of locomotives, types of locomotives- Diesel Mechanical, Diesel Electric and Diesel Hydraulic locomotives, Working of Steam, Diesel electric and Electric Locomotive.	<b>06</b>
		Unit-II	<b>Railway Coaches &amp; Wagons</b> Types of coaches - IRS, ICF & LHB, Types of wagons - Open wagon, Covered wagon, Tank wagon, Flat wagon, Hopper wagon, components and assembly of coaches & wagons, Carriage and Wagon Bogie Maintenance in Workshops.	<b>12</b>
		Unit-III	<b>Bogies</b> Requirements from a Bogie, Types of bogies- CASNUB bogie, ICF bogie, FIAT bogie, Bogie Frame, Axle Guide Arrangement, Components and assembly of bogies.	<b>08</b>
		Unit-IV	<b>Engineering Vehicles</b> Types of Engineering Vehicle, Cranes: General Arrangements, Types of cranes, Components and assembly of Cranes.	<b>06</b>
<b>Total</b>				<b>32</b>
<b>Practical List</b>				
<b>1</b>	Assignment on Locomotives.			<b>02</b>
<b>2</b>	Assignment on Coaches and Wagons.			<b>02</b>
<b>3</b>	Assignment on Bogies.			<b>02</b>
<b>4</b>	Seminar on Rolling Stocks.			<b>02</b>
<b>Total</b>				<b>08</b>

<b>Reference Book</b>	<ol style="list-style-type: none"><li>1. Christos N. Pyrgidis, Railway Transportation Systems: Design, Construction and Operation, Oxford, New York, Philadelphia.</li><li>2. Principles of Railway Engineering, S.C. Rangawala, Charotar Publication, 2015.</li><li>3. A Text Book of Railway Engineering, Dhanpat Rai &amp; Sons.</li></ol>
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<b>Sr. No</b>	<b>Course Name</b>	Diploma in Railway Rolling Stocks and Operations		
<b>1</b>	<b>Paper Title</b>	Systems and Mechanisms of Railways		
<b>2</b>	<b>Paper Number</b>	RRS003		
<b>3</b>	<b>Objective of Paper</b>	1. To introduce students to the Rails and Slippers.		
		2. To help them understand the different aspects of Rail and Wheel Interaction.		
		3. To give an introduction to Railway Systems and Mechanisms.		
<b>4</b>	<b>Expected Outcome from Paper</b>	1. Understand the different components of a railway like Locomotives, Coaches, sleepers		
		2. Understand the physics behind Railway mechanisms.		
		3. Become familiar with various railway systems.		
<b>5</b>	<b>Content</b>	<b>Unit</b>	<b>Content</b>	<b>Hour</b>
		Unit-I	<b>Rails and Slippers</b> Rail gauges, Track fittings: Rail joints, Avoidance of rail joints, Types of rail joints- According to position of joints, According to position of sleepers, Requirements of an ideal fastening Fastenings for rails, Fish-plates- Purpose, Design of fish-plates Fish plates, Details, Compound or junction, Failures of fish-plates, Spikes, fang-bolts and hook-bolts, Spikes- Purpose of spikes, Types of spikes, Requirements of a good spike, Fang-bolts, Hook-bolts, Rail-cutting. Sleepers: Functions and Requirements of Sleepers, Sleeper Density and Spacing of Sleepers, Types of Sleepers.	<b>08</b>
		Unit-II	Rail and wheel geometry, Track train dynamics, Forces on the rail, Adhesion and friction, Fatigue and failure, Material science approach, Safety approach. Coning of Rail and wheel. Blanking of track. Track changing mechanism. Points and Crossings: Important Term, Switches, Design of Tongue Rails, Crossing,	<b>08</b>



			Number and Angle of Crossing, Reconditioning of Worn Out Crossings, Turnout, Turnout with Curved Switches, Layout of Turnouts.	
		Unit-III	<p><b>Braking and HVAC System</b></p> <p><b>Braking System:</b> Friction braking, Regenerative braking system, Utilization of generated power, roof-mounted braking resistors, electro pneumatic friction brakes outfitted with steel discs and sintered pads designed for high loads, linear eddy-current brakes. Selection of appropriate braking system. Auxiliary system including compressors, single phase to three phase converters, battery chargers etc.</p> <p><b>HVAC System:</b> HVAC system in High speed trains, minimizing heating and cooling needed, heat exchangers to preheat or precool incoming air. Saving energy.</p>	08
		Unit-IV	<p><b>Tractive, Suspension and Coupling System</b></p> <p><b>Traction System:</b> Three Phase AC-AC Locomotive Drive System, Types of drives, torque-speed requirements, design of rectifier, three phase inverters, V/F control and field vector control.</p> <p><b>Suspension System:</b> Suspension systems of Diesel locomotives and effect on tractive effort, High Adhesion Bogie.</p> <p><b>Coupling System:</b> Types- Screw, CBC and Janney coupler. Working principle of coupling systems.</p>	08
			<b>Total</b>	<b>32</b>

<b>Practical List</b>		
<b>1</b>	Study and Demonstration of Coning of Wheel.	<b>02</b>
<b>2</b>	Study and Demonstration of Rail wheel interaction at track changing mechanism.	<b>02</b>
<b>3</b>	Study and Demonstration of Braking System.	<b>02</b>
<b>4</b>	Study and Demonstration of Coupling System.	<b>02</b>
<b>Total</b>		<b>08</b>
<b>Reference Book</b>	<ol style="list-style-type: none"> <li>1. A Text Book of Railway Engineering, Dhanpat Rai &amp; Sons.</li> <li>2. Principles of Railway Engineering, S.C. Rangawala, Charotar Publication, 2015.</li> <li>3. Railway Engineering, M.M. Agrawal, Prabha &amp; Co., New Delhi.</li> <li>4. A Text Book of Railway Engineering, S.C. Saxena, S.P.Arora, Dhanpat Rai Publications (p) Ltd.-new Delhi, 2010.</li> <li>5. Christos N. Pyrgidis, Railway Transportation Systems: Design, Construction and Operation, Oxford, New York, Philadelphia.</li> <li>6. Railway Track Engineering, Fourth Edition, J. S.Mundrey, Tata McGraw Hill Publications</li> <li>7. Handbook of Railway Vehicle Dynamics, Taylor &amp; Francis Group.</li> </ol>	

<b>Sr. No</b>	<b>Course Name</b>	Diploma in Railway Rolling Stocks and Operations		
<b>1</b>	<b>Paper Title</b>	Permanent Way, Signal System and Overhead Equipments		
<b>2</b>	<b>Paper Number</b>	RRS004		
<b>3</b>	<b>Objective of Paper</b>	1. To introduce students to Permanent Way.		
		2. To help them understand the different aspects of Signal systems used in Indian Railways.		
		3. To help them understand the different aspects of Over Head Equipment systems used in Indian Railways.		
<b>4</b>	<b>Expected Outcome from Paper</b>	1. Understand the structure of Permanent Way.		
		2. Understand the Signal systems used in Railways.		
		3. Understand the Oher Head Equipments used in Railways.		
<b>5</b>	<b>Content</b>	<b>Unit</b>	<b>Content</b>	<b>Hour</b>
		Unit-I	<b>Permanent way:</b> Permanent way components – Railway Track Gauge - Cross Section of Permanent Way - Functions of various Components like Rails, Sleepers and Ballast – Rail Fastenings.	<b>08</b>
		Unit-II	<b>Creep of Rails:</b> Theories related to creep, Adzing of Sleepers, Sleeper density, Rail joints techniques. Track failure.	<b>06</b>
		Unit-III	<b>Railway Signals: Turnouts &amp; Controllers:</b> Track layouts, Switches, Design of Tongue Rails, Crossings, Turnouts, Layout of Turnout, Double Turnout, Diamond crossing, Scissors crossing. Signal Objectives, Classification, Fixed signals, Stop signals, Signaling systems, Mechanical signaling system, Electrical signaling system, System for Controlling Train Movement, Interlocking, Modern signaling Installations.	<b>10</b>
		Unit-IV	<b>Signal System and OHE:</b> Signaling and General Provisions, Description of fixed signals, Equipment of signals, Working of Signals and Points, Hand Signals and Detonating Signals, Flare Signals, Defective signals and points, Interlocking, Modern Signaling system, Overhead catenaries	<b>08</b>
			<b>Total</b>	<b>32</b>
<b>Practical List</b>				

<b>1</b>	Study and Demonstration of Structure of Permanent Way.	<b>02</b>
<b>2</b>	Study and Demonstration of Manual Signal System.	<b>02</b>
<b>3</b>	Study and Demonstration of Automatic Signal System.	<b>02</b>
<b>4</b>	Study and Demonstration of Over Head Equipment System.	<b>02</b>
<b>Total</b>		<b>08</b>
<b>Total</b>		<b>40</b>
<b>Reference Book</b>	<ol style="list-style-type: none"> <li>1. Christos N. Pyrgidis, Railway Transportation Systems: Design, Construction and Operation, Oxford, New York, Philadelphia.</li> <li>2. A Text Book of Railway Engineering, Dhanpat Rai &amp; Sons.</li> <li>3. A Text Book of Railway Engineering, S.C. Saxena, S.P.Arora, Dhanpat Rai Publications (p) Ltd.-new Delhi, 2010.</li> </ol>	

<b>Sr.No</b>	<b>Course Name</b>	Diploma in Railway Rolling Stocks and Operations		
<b>1</b>	<b>Paper Title</b>	Reliability, Availability, Maintainability and Safety (RAMS) in Railway		
<b>2</b>	<b>Paper Number</b>	RRS05		
<b>3</b>	<b>Objective of Paper</b>	To make Students realize concepts of RAMS in Railway		
		To make Students understand System Engineering concepts.		
		To make students understand Safety Engineering and Technique.		
		To introduce to students the Railway Engineering Standards		
		To make Students realize concepts of the system Assurance process.		
<b>4</b>	<b>Expected Outcome from Paper</b>	At the end of this course, Students will be able to,		
		Students can describe concepts of RAMS in Railway		
		Students can describe the System Engineering concepts.		
		Students can describe the Railway Engineering Standards.		
		Students can describe the system Assurance process.		
<b>5</b>	<b>Content</b>	<b>Unit</b>	<b>Content</b>	<b>Hour</b>
		<b>Unit-I</b>	<b>Introduction of RAMS :</b> RAM Mathematics ,Probability theory, Conditional probability, Venn Diagram ,Mutually exclusive and independent events, Boolean Algebra, Axioms and Theorems, RAM Basics, Detailed explanation of Reliability, Availability, Maintainability and associated parameters ,Relationship between different parameters, Constant failure rate model and bathtub curve, Different types of Maintenance, Different types of Availability, RAM Modeling, Reliability block diagrams, Series and parallel systems, Decomposition method of RBD solution, Markov chain analysis for repairable systems, Fault tolerance and Redundancy, Systematic and Random faults, Types of redundancy- Hardware and Software, Common cause failures, FMECA-RAM analysis, Software reliability ,Preliminary RAM analysis, RAM targets and their apportionment,Final RAM analysis,Availability Modelling.	10
		<b>Unit-II</b>	<b>System Engineering Principles:</b> Introduction of System, System engineering Elements of Systems, System Life cycle, Blackbox analysis, System engineering application to the railway, Whole life costs, Life cycle cost modelling, Value Engineering.	8
		<b>Unit-III</b>	Safety Engineering and Technique,	6

			<p><b>Railway Standards:</b></p> <p>Hazard, Hazard Analysis and Risk Acceptance, System, product safety assessment, SIL levels, CENELEC standards and Common safety methods, Safety Engineering Techniques, Hazard Log Management, FMECA- Safety analysis, Fault tree analysis, Event tree analysis, Safety targets compliance, Risk acceptance through common safety methods</p>	
		<b>Unit-IV</b>	<p><b>System Assurance process:</b></p> <p>Introduction to system assurance regime, Risk based assurance, Self assurance regime, Progressive Assurance, Planning of system assurance processes, System assurance audits, Assurance Management, System assurance attitude, System Assurance qualities- Safety consciousness, transparency, integrity, trust, Project stage based evidence maturity, Risk management through assurance, Commitment to reputation, Success through collaboration: Client, supplier and Assurance, Handover to O&amp;M- process, Delivering efficiency through reliability centered maintenance</p>	8
<b>Total</b>				<b>32</b>
<b>Reference Book</b>	<ol style="list-style-type: none"> <li>1. Handbook of RAMS in Railway Systems Theory and Practice, Qamar Mahboob Enrico Zio, CRC Press, Taylor and Francis Group.</li> <li>2. RAMS and LCC Engineering for Railway Industry: Analysis, Modelling and Optimization by Eduardo Calixto.</li> <li>3. Advances in RAMS Engineering, Karanki, Durga Rao, Vinod, Gopika, Srividya, Ajit, Spinger</li> </ol>			
<b>Practical List</b>				
<b>1</b>	Case Study RAM Management, Apportionment of RAMS to railway System			<b>04</b>
<b>2</b>	Case study on Railway Safety Systems			<b>04</b>
<b>Total</b>				<b>08</b>
<b>Reference Book</b>	<ol style="list-style-type: none"> <li>1. Christos N. Pyrgidis, Railway Transportation Systems: Design, Construction and Operation, Oxford, New York, Philadelphia.</li> <li>2. A Text Book of Railway Engineering, Dhanpat Rai &amp; Sons.</li> <li>3. A Text Book of Railway Engineering, S.C. Saxena, S.P. Arora, Dhanpat Rai Publications (p) Ltd.-new Delhi, 2010.</li> </ol>			

<b>Sr. No</b>	<b>Course Name</b>	Diploma in Railway Track Technology	
1	<b>Paper Title</b>	Railway Project work	
2	<b>Paper Number</b>	RRS006	
3	<b>Objective of Paper</b>	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	<b>Expected Outcome from Paper</b>	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	<b>Content Practical</b>	<p>Student shall submit the report and prepare presentation for defense.</p> <p>The topic for the Project Work may be from any Civil Engineering and inter-disciplinary area related to Railway Engineering.</p> <p><b>Guidelines for Project contents:</b></p> <p><b>a) Project Report:</b></p> <p>Project report should be of 25 to 50 pages (More pages can be used if needed).</p> <p>Entire Report has to be segmented chapter wise as per the requirement.</p> <ol style="list-style-type: none"> <li>1. Introduction (History, Importance of Project Area, Problem identification, Objective of the Project)</li> <li>2. Literature Review</li> <li>3. Design/ Experimentation/ Model/Actual work carried out for the same.</li> <li>4. Observation/ Analysis/ Findings/Results</li> <li>5. Discussion on Results and Conclusion</li> </ol> <p><b>b) Presentation:</b></p> <p>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.</p> <p>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</p>	<b>Hour</b>
			<b>40</b>