पुण्यश्लोक अहिल्यादेवी होळकर सोलापूर विद्यापीठ ।। विद्यया संपन्नता ।।	**SKILL DEVELOPMENT COURSE**	

DIPLOMA COURSE
IN
RAILWAY SIGNALING AND TELECOMMUNICATION

A Programme under

Department of Electronics and Telecommunication Engineering
MIT College of Railway Engineering & Research, Barshi

In association with

Skill development center
Punyashlok Ahilyadevi Holkar Solapur University, Solapur

1	**Name of Course**	Diploma in Railway Signaling and Telecommunication
2	**Max. no. of Students**	25
3	**Duration**	1 Year
4	**CourseType**	Part Time
5	**No.of Days perweek**	2 Days
6	**No. of hours per day**	2 Hrs
7	**Spacerequire**	66 m^2 classroom and 66 m^2 Laboratory
8	**Entryqualification**	Diploma / FE- Electronics and Telecommunication Engg , Electrical Engg, Electronics Engg , Instrumentation and control Engg, Biomedical Electronics, Bsc/Msc. Electronics ,
9	**Objective of syllabus**	1. To make student realize different types of signals and signaling plan. 2. To make student understand principles of signals. 3. To make student understand work of different components and devices used in signaling and telecommunication. 4. To introduce to student concepts of data preparation and Various communication systems used in railways
10	**Employment opportunities**	Students will get jobs in government as well as Private Railway Engineering companies.
11	**Teachers Qualification**	ME/ M.Tech/PhD
12	**One month Internship is Compulsory.**	
13	**Teaching Scheme :**	

Sr.No	**Subject**	**Subject Code**	**Clock Hour/ Week**	
			Theory	**Practical**
1	System Engineering	RST01	2	2
2	Principles of Signal Engineering	RST02	2	2
3	Application Engineering	RST03	2	2
4	Modern, Emerging and Telecommunication technologies	RST04	2	2
5	Reliability, Availability, Maintainability and Safety (RAMS) in Railway	RST05	2	2
6	Railway Project work	RST06	2	2

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

Paper	Subject	Subject Code	Theory			Practical			Total	
			Duration (Hr.)	Max	Min	Duration (Hr.)	Max	Min	Min	Max
1	System Engineering	RST01	3	70	28	3	30	12	40	100
2	Principles of Signal Engineering	RST02	3	70	28	3	30	12	40	100
3	Application engineering	RST03	3	70	28	3	30	12	40	100
4	Modern, Emerging & Telecommunication technologies	RST04	3	70	28	3	30	12	40	100
5	Reliability, Availability, Maintainability and Safety (RAMS) in Railway	RST05	3	70	28	3	30	12	40	100
6	Railway Project Work	RST06	3	70	28	3	30	12	40	100
Total										600

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

SYLLABUS

Sr.No	Course Name	Diploma in Railway Signaling and Telecommunication		
1	Paper Title	System Engineering		
2	Paper Number	RST01		
3	Objective of Paper	To make student realize different types of signals and signaling		
		To make students understand preparation of signaling plans for single line and double line.		
		To introduce to students concept of block systems used on Indian Railways.		
4	Expected Outcome from Paper	At the end of this course, Students will be able to,		
		Student can describe different types of signals.		
		Student can plan signaling in railway signaling.		
		Student can describe signaling plan for single line and double line.		
		Student can describe about block system used in Indian Railways.		
5	Content	**Unit**	**Content**	**Hour**
		Unit-I	Role of Signalling in Railway operation , Signalling Concepts , Fixed Signals, Kinds, Aspects & Indications , Designation of Signals , Location of Signals ,Types of signals, Engineering plan, Signaling plan, Symbols	**8**
		Unit-II	Subsidiary Signals, Repeaters, Indicators, Markers & Back Lights, Breaking Distance, Sighting Distance & Visibility of Signals, Isolation, Overlaps, Auto CAD basics, Simultaneous Reception and Despatch of Trains,	**8**
		Unit-III	Systems of working, Absolute Block System, Automatic Block System ,Classification of Stations – Comparison of A, B & C. Comparision Of Class A, B And C Stations With Mauq & Mlq Operation Preparation of signaling, plans for single line and double line.	**8**
		Unit-IV	Inter Cabin control , Principles of Slotting, The purpose of slotting is twofold ,Types of Controls Slots , Section capacity ,Block systems used on Indian Railways	**6**
6	Reference Book	1. Railway Signalling, edited by O.S. Nock, A & C Black Publishers Ltd, 1981. 2. Hand Book on Railway Signalling in Indian Railways, by Vikas Srivastav, 2009 3. An Introduction to Railway Signalling & Equipment Andy Lawrence – 2011		

Practical List
***Any five experiments**

Sr. No	Name of the Practical	Hrs
1	Study Of Double Line Block Instruments	**2**
2	Study Of Double Line Block Instrument And Its Circuits	**2**
3	Identify The Following External Parts Of The Frequency Modulated Token Less Single Line Block Instrument And Fill In The Brackets With The Identification Numbers On The Part	**2**
4	Study of Intermediate Block Signaling	**2**
5	Study of Axle Counter Block working (Block Proving Axle Counter with Block Panel)	**2**
6	Study of Automatic Block signaling	**2**

Sr.No	Course Name	Diploma in Railway Signaling and Telecommunication		
1	Paper Title	Principles of Signal Engineering		
2	Paper Number	RST02		
3	Objective of Paper	To make Students realize concepts of points.		
		To make Students understand level crossing gates and classification.		
		To make students understand the principles of interlocking.		
		To introduce to students advantages, disadvantages and application of principles of signal engineering.		
4	Expected Outcome from Paper	At the end of this course, Students will be able to,		
		Student can describe concepts of points.		
		Student can describes level crossing gates and classification.		
		Student can describe the principles of interlocking.		
		Student can describe about advantages, disadvantages and application of principles of signal engineering..		
5	Content	**Unit**	**Content**	**Hour**
		Unit-I	Principles of Signaling, Concepts of points. Location of point and range of operation Level crossing gates and classification, Location Of Lc Gate , Protection of level crossing inside the station Limits, Level Crossings At Class `A' And `C' Stations, Level crossing located within station limits in MAS signaling, Control of level crossings in Automatic Signaling sections	**8**
		Unit-II	Numbering of signaling plan, , Standards of Interlocking, Minimum Equipment For Previous Standards Of Interlocking, Parameter for setting of switches ,Speed of train over point Standard wise, Principles of interlocking,	**8**
		Unit-III	Essentials of Interlocking, Essentials of Interlocking ,Layouts for Locking Table practice, Locking Diagrams , Testing of locking -Single wire lever frame , Application of interlocking principles Route holding	**7**
		Unit-IV	Advantages, Disadvantages and application of Principles of Signal Engineering, Signal Aspect Control Circuit, Signal Indication Circuits, Triple Pole Lamps , Inner Distant Signal , LED Signal Units , Automatic Colour Light Signalling	**7**
6	Reference Book	1. Railway Signalling, edited by O.S. Nock, A & C Black Publishers Ltd, 1981. 2. Hand Book on Railway Signalling in Indian Railways, by Vikas Srivastav, 2009 3. An Introduction to Railway Signalling & Equipment Andy Lawrence – 2011		

Practical List

Sr. No	Name of Experiment	Hrs
1	Study of Q- Series Plug In Type D.C. Relays (Non Proved Type)	**2**
2	Route Setting Type Relay Interlocking	**2**
3	Study Of Route Setting Type Relay Interlocking (British)	**2**
4	Study Of Microlok-II Electronic Interlocking System	**2**
5	Case study on signaling operations at solapur railway station	**2**

Sr.No	Course Name	Diploma in Railway Signaling and Telecommunication		
1	**Paper Title**	**Application Engineering**		
2	**Paper Number**	**RST03**		
3	**Objective of Paper**	To make Students realize Relay concepts and its types used in signaling.		
		To make Students understand the concept of signaling circuits and track detecting devices.		
		To make students understand the various locking on signals and concept of table of control.		
		To introduce to students power supply arrangement for signaling.		
4	**Expected Outcome from Paper**	At the end of this course, Students will be able to,		
		Student can describe Relay concepts and its types used in signaling.		
		Student can describes the concept of signaling circuits and track detecting devices.		
		Student can describe the various locking on signals and concept of table of control.		
		Student can describe about power supply arrangement for signaling.		
5	**Content**	**Unit**	**Content**	**Hour**
		Unit-I	Relays conceptsTypes of relays used in signalling., Various symbols ,Concepts of signalling circuits, Track detecting devices , Introduction to Relay interlocking, Sequence of Operations on Panel, Signalling Plan-Control Table	**7**
		Unit-II	Signaling Plan- Control Table, Characteristics OF Electro-Magnetic Relay , Classification Of Signaling Relay, marking of track circuits, Point control circuits. Point machines and their working.	**7**
		Unit-III	Track locking, Various locking on signals, Various logic circuits, Signal control circuits, Concept of table of control Preparation and practice of table of control	**8**
		Unit-IV	Power supply arrangements for signaling,Various cables and wires used for signaling, Concepts of relay room and cable layouts ,Cable laying practices, Concepts of location boxes.Signalling in railway electrified area.Effects of electrification	**8**
6	**Reference Book**	1. Railway Signalling, edited by O.S. Nock, A & C Black Publishers Ltd, 1981. 2. Hand Book on Railway Signalling in Indian Railways, by Vikas Srivastav, 2009 3. An Introduction to Railway Signalling & Equipment Andy Lawrence – 2011		

Practical List

Sr. No	Name of the Experiment	Hrs
1	Study Of Integrated Power Supply System	**2**
2	Study of Different Relays	**2**
3	Study of Track detecting devices	**2**
4	Study Of Microlok-Ii EI Rack Layout And Relay Rack Layout	**2**
5	Industrial visit near by railway station (Kurdwadi,Secunderabad)	**2**

Sr.No	Course Name	Diploma in Railway Signaling and Telecommunication		
1	Paper Title	Modern, Emerging Telecommunication Technologies		
2	Paper Number	**RST04**		
3	Objective of Paper	To make Students realize concepts of Electronic interlocking, software and Data preparation.		
		To make Students understand the Train control system and various communication systems.		
		To make students understand the auxiliary warning systems and axel counter block working.		
		To introduce to students the Train collision avoidance system.		
4	Expected Outcome from Paper	At the end of this course, Students will be able to,		
		Students can describe concepts of Electronic interlocking, software and Data preparation.		
		Students can describe the Train control system and various communication systems..		
		Students can describe the auxiliary warning systems and axel counter block working..		
		Students can describe train collision avoidance systems.		
5	Content	**Unit**	**Content**	**Hour**
		Unit-I	Electronic interlocking, Purpose, Role, Necessity Of Electronic interlocking, Limitation of Relay interlocking , Advantages Of Electronic Interlocking System Over Relay Interlocking, Electronic Interlocking System , Configuration Of Electronic Interlocking System , Installation Of Electronic Interlocking System, Maintenance Of Electronic Interlocking System.	**8**
		Unit-II	Hardware and software, Data preparation ,Concept of application program Train control system., Various communication systems used in railways, Cables and use of cables, Radio communication and software there off , Indoor Cables, Outdoor Cables , Power Cables, Difference between Screened cable and unscreened cable, Telecom Cables, Testing of cables before and after laying	**8**
		Unit-III	Intermediate Block Signaling , Axle Counter Block working, Block Proving Axle counter with Block Instrument , Auxiliary warning system, Axle counter block working, Block proving through axle counter Train protection and warning system.	**7**
		Unit-IV	Train collision avoidance system, ERTMS- European rail transport management system Metro Technology-CBTC- Communication Based Train Control system.	**7**
6	Reference Book	1. Development of Railway Signal & Telecom Systems on IR M C Yadav WM/Signal/SWS Sabarmati/Western Railway 2. Indian Railways Telecommunication Manual		

		3. Train Collision Avoidance System (TCAS). Government of India Ministry of Railways

Practical List

*Any five Experiments

Sr. No	Name of the Experiment	Hrs
1	Study of Efftronics Datalogger	2
2	Study on MICROLOK-II EI system Application Software and its uploading using Maintenance tool	2
3	Study of Synchronization board and Ethernet Communication board	2
4	Study of Pimary Digital Multiplexing equipment (Make PUNCOM, Model VMX-0100)	2
5	Study of OTDR	2
6	Study of Fusion Splicing.	2

Sr.No	Course Name	Diploma in Railway Signaling and Telecommunication		
1	Paper Title	Reliability, Availability, Maintainability and Safety (RAMS) in Railway		
2	Paper Number	**RST05**		
3	Objective of Paper	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.		
4	Expected Outcome from Paper	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.		
5	Content	**Unit**	**Content**	**Hour**
		Unit-I	Introduction of RAMS : 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**
		Unit-II	System Engineering Principles: 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.	**6**
		Unit-III	Safety Engineering and Technique, Railway Standards**:**	**6**

			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	
		Unit-IV	**System Assurance process:** 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&M- process, Delivering efficiency through reliability centered maintenance	**8**
6	**Reference Book**	1. Handbook of RAMS in Railway Systems Theory and Practice,Qamar Mahboob Enrico Zio,CRC Press,Taylor and Francis Group. 2. RAMS and LCC Engineering for Railway Industry: Analysis, Modelling and Optimization by Eduardo Calixto. 3. .Advances in RAMS Engineering,Karanki, Durga Rao, Vinod, Gopika, Srividya, Ajit,Spinger		

Practical List

Sr. No	Name of the Experiment	Hrs
1	Case Study RAM Management, Apportionment of RAMS to railway System.	2
2	Designing for RAM in Railway Systems: An Application to the Railway Signaling Subsystem.	2
3	Case study outline and system assurance regime- CBTC	2
4	Case study- System Engineering	2
6	Case study- RAM	2

Sr. No	**Course Name**	Diploma in Railway Signaling and Telecommunication

1	**Paper Title**	Railway Project work	
2	**Paper Number**	RST06	
3	**Objective of Paper**	To carry out a thematic design project in one of the specializations of Railway Signaling and telecommunication.	
		To carry out a project that will make the students aware of the different facets of Railway Signaling and telecommunication.	
		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. The topic for the Project Work may be from Electronics and telecommunication Engineering, Railway Signaling, Modern communication technologies used in railway, Interlocking and inter-disciplinary area related to Railway Engineering. **Guidelines for Project contents:** **a) Project Report:** Project report should be of 25 to 50 pages (More pages can be used if needed). Entire Report has to be segmented chapter wise as per the requirement. 1. Introduction (History, Importance of Project Area, Problem identification, Objective of the Project) 2. Literature Review 3. Design/ Experimentation/ Model/Actual work carried out for the same. 4. Observation/ Analysis/ Findings/Results 5. Discussion on Results and Conclusion **b) Presentation:** 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. 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	**Hour** **40**