Punyashlok Ahilyadevi Holkar Solapur University, Solapur
Electronics & Telecommunication Engineering

Structure for Honors Degree – Railway Engineering
w.e.f. 2021-22

Course Code	*Semester*	*Course Name*	*Hrs./week*			*Credits*	*Examination Scheme*			
			L	*T*	*P*		*ISE*	*ESE*	*ICA*	*Total*
HET41	SY Sem II	Railway Engineering: A Beginner's Perspective	3	1		4	30	70	25	125
HET42	TY Sem I	Data Communication and Signaling in Railway	3		2	4	30	70	25	125
HET43	TY Sem II	Seminar			2*	1			25	25
HET44	TY Sem II	Applications of IT and Control Engineering in Railway	3		2	4	30	70	25	125
HET45	B Tech Sem I	Mini Project			4*	2		50	50	100
HET46	B Tech Sem I	Advanced Communication and Modern Signaling in Railway	3		2	4	30	70	25	125
	Sub Total		12	1	12	19	120	330	175	625

* indicates contact hours

Punyashlok Ahilyadevi Holkar Solapur University, Solapur

Electronics & Telecommunication Engineering

Honors in Railway Engineering

S.Y. BTech (Electronics & Telecommunication Engineering)- Part-II

HET41: Railway Engineering: A Beginner's Perspective

Teaching Scheme:	**Examination Scheme:**
Lecture : 3Hrs/Week, 3 credits	ISE:30 Marks
Tutorial: 1Hr/Week, 1 credit	ESE:70 Marks
	ICA: 25 Marks

Railway engineering is a multi-faceted engineering discipline dealing with the design, construction and operation of all types of rail transport systems. It encompasses a wide range of engineering disciplines, including civil engineering, computer engineering, electrical engineering, mechanical engineering, industrial engineering and production engineering. In this course, there is study of Railway signaling with Electronics part. This course is help for new beginners to understand the operation of railway signaling.

Course prerequisite: Prerequisite for this course is Basic electronics and Basic Electrical Engineering.

Course Objectives:

1. To make student aware of Indian Railways System
2. To summarize Railway Transportation and Its Development
3. To understand role of Electrical, Electronics, Computer, Civil, and Mechanical Engineers in Railways
4. To discuss recent trends in Indian Railways
5. To discriminate the Indian Railways as an International Perspective

Course Outcomes:

At the end of this course students will be able to,

1. Define the Indian Railways System
2. Summarize Railway Transportation and Its Development
3. Understand the role of Electrical, Electronics, Computer, Civil and Mechanical Engineers in Railways
4. Discuss the recent trends in Indian Railways
5. Discriminate the Indian Railways as an International Perspective

SECTION I

Unit1-Indian Railways - A Perspective : (05)

General Features of Indian Railways, Important Statistics of Indian Railways, Organization of Indian Railways, Indian Railway Finances and their Control, Commission of Railway Safety, Recruitment Boards of Indian Railways Different Corporations in Indian Railways, Indian Railway Information Systems, Growth of Indian Railways.

Unit2- Railway Transportation and Its Development : (07)

Terminology- Locomotive, Engine, Bogie, Coach, Freight train, Wheel Arrangement (WA), Driving Cab, Pantograph, Gauge, Transmission, Traction Motors, Coupler, Crossing, Diamond crossing, Junction, Terminal, Fishplate, Permanent way, Rolling stock

Evolution of Different Facets of the Railways

a. Rails Types of rail section: D.H. Rails, B.H. Rails and F.F. Rails, Standard rail sections, Comparison of rail types,Track structure and different gauges.

b. Sleepers , comparison of different types of sleepers and components of track

c. Bridges evolution of iron to steel, arch ,rcc, psc, steel

d. Mode of traction steam, diesel, electric

e. Locomotives evolution of locomotives of each typeVarious propulsion systems

f. Bogies and coaches

Unit 3- Role of Electrical, Electronics & Computer Engineering in Railways (09)

Introduction to Electrical Engines, Working of Locomotives, Overhead (OHE) Equipment's in Railways, Braking Systems in Railways, Power Supply System & Technology in Railways, Introduction to the Electronic System in Indian Railway, Electrical Switches and Relays used in Indian Railway, Display Control and Mechanism in Railway, Electronics Communication System in Railways, Safety Measures in Indian Railways, Software's in Indian Railways

SECTION II

Unit 4- Role of Civil and Mechanical Engineering in Railways (08)

Fundamentals of Geology, Tracking System, Layers of material on Tracks, Overview of Civil Engineering in Railway Systems, Introduction to Ballast, Rails, Sleepers, Points of Crossings, and Points of Switches, Maintenance of Railway Tracks.

Mechanical System used in Railway Engine & Bogies. Construction of Bogies, Material Used for Railing system, Mechanisms in Railway Locomotive, Study of Railway Engines, Maintenance of Railway Tracks

Unit 5- Recent Trends in Indian Railways (08)

Introduction, Modernization of traction, Speed trends, modernization of track, Trends in track vehicles, container transport service, Automation in operation, High powered locomotives, Miscellaneous development. Introduction to the Clean Energy in Indian Railways, Overview of Faster Trains in India, Overview of Bullet Trains and Metro, Concept of Anubhuti Coaches in Indian Railways, and Introduction to the Bio Toilets in Indian Railway.

Unit 6- Review of Railways - An International Perspective (05)

Overview of International Railways, Development of Railway Systems, Recent Trends in International Railways, and Overview of Maglev Technology.

Internal Continuous Assessment (ICA):

1. Case Study: Case Studies on Recent Trends in Railways (15 hrs)
2. Industrial Visits on Railway Workshops/Institutes/Industries (15 hrs)

References:

1. Satish Chandra and M.M. Agarwal, Railway Engineering, Oxford University Press, 2007.
2. Christos N. Pyrgidis, Railway Transportation Systems: Design, Construction and Operation, Oxford, New York, Philadelphia
3. M.A. Chowdhary and A. Sadek, Fundamentals of Intelligent Transportation systems planning. Artech House Inc., US, 2003
4. S.C. Rangawala, Principles of Railway Engineering, Charotar Publication, 2015.
2. V. D. Kodgire, Sushil Kodgire, Material Science and Metallurgy for Engineers, Everest Publishing House
3. Handbook of Railway Vehicle Dynamics, Taylor & Francis Group
4. J. S. Mundrey, Railway Track Engineering, McGraw Hill Publication, 2009
5. R..B. Gupte, Text Book Of Engineering Geology, Pune Vidyarthi GrihaPrakashan
6. G. Shanmugam and M. S. Palanichamy, Basic Civil and Mechanical Engineering, Tata McGraw Hill Publishing Co., New Delhi, 1996.
7. R. K. Jain, Mechanical and Industrial Measurements, Khanna Publishers, Delhi, 1999.
8. Robert Sneddon, Material Technology, Heinemann Library, 2002 12. James A. Jacobs & Thomas Kilduff, Engineering Materials Technology: Structures, Processing, Properties, and Selection, Pearson; 5th edition, 2004
9. David A. Dornfeld, Green Manufacturing: Fundamentals and Applications, Springer; 2012 edition
10. Nand K. Jha, Green Design and Manufacturing for Sustainability, CRC Press; first edition, 2015
11. John B. Heywood, Internal Combustion Engine Fundamentals, McGraw Hill Education; 1st edition, 2017
12. V. Ganeshan, Internal Combustion Engine, McGraw Hill Education; 4th edition, 2017
13. S.C. Saxena, S.P. Arora, A Text Book Of Railway Engineering, Dhanpat Rai Publications (p) Ltd.-new Delhi, 2010.

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Electronics & Telecommunication Engineering

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T.Y. BTech (Electronics & Telecommunication Engineering)- Part-I

HET42: Data Communication and Signaling in Railway

Teaching Scheme:	**Examination Scheme:**
Lecture : 3Hrs/Week, 3 credits	ISE:30 Marks
Practical: 2Hr/Week, 1 credit	ESE:70 Marks
	ICA: 25 Marks

Course Objectives:

1. To make students aware of Data communication
2. To summarize Railway Transportation and Its InternetFacility
3. To understand the role of Electrical, Electronics in Railways
4. To discuss recent trends in signalingin Indian Railways
5. To discriminate against the Indian Railways from an International Perspective

Course Outcomes:

At the end of this course, students will be able to,

1.Define theData communication

2. Summarize Railway Transportation and Its InternetFacility

3. Understand the role of Electrical, Electronics in Railways

4. Discuss the recent trends in signaling in Indian Railways

5. Discriminate the Indian Railways as an International Perspective

SECTION I

Unit 1 - Data Communication (07)

Introduction of data communication Fundamentals such as data, signals, etc., types of Transmission Medias, Types of Network cables: Twisted Pair cable, Coaxial Cable, Fiber Optic Cable,

Unit 2- Internet (07)

IP Addressing: Physical, Logical Internet & Intranet, Components of the Internet, World Wide Web, E-Mail, Telnet, FTP, Understanding the World Wide Web, Hypertext: The Motion of the Web, Retrieving Documents on the Web: The URL, Real-Time Communication.

Unit 3 - Basics of Electrical and Electronics (07)

Passive Components, Basics of AC and Electrical Cables, Cells & Batteries, Transformers, AC & DC measurements, Soldering & De-soldering and switches, Rectifiers, IC Regulators, Different Batteries, 110 DC Voltage, Electromagnetic theory, Electric Discharge Different types of fuzes

SECTION II

Unit 4- Basic Signaling in Railway (07)

Introduction to Signal, Objects of Signals, Types of Signals, Classification of Signals according to functions, Classification of Signals according to Location, Special Signals. Principles of Signaling, Concepts of points. Location of point and range of operation. Signaling Plan- Control Table, Characteristics OF Electro-Magnetic Relay, Classification Of Signaling Relay

Unit 5 - Computer Network (06)

Introduction to Computer Network, Networking Devices, Client-Server Communication, Installation & Configuration of DHCP, DNS, FTP, TELNET, Introduction to Network security & GPS

Unit 6 - Railnet (Railway Intranet) (08)

An Installation, Equipment used in Railnet, Installation of the equipment, Connectivity Diagram, IP Planning, E-Mail addressing, Software based on Railnet, Failure & Troubleshooting

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Internal Continuous Assessment (ICA):

1. ICA shall consist of minimum six to eight assignments based on entire curriculum
2. Industrial Training/Internship

References:

1. Computer Networks (Principles, Technologies and Protocols for network design) - Natalia Olifer, Victor Olifer (Wiley Publications)
2. Internetworking with TCP/IP Vol III. Client-Server Programming & Applications: Douglas E. Comer
3. Data Communication and Networking: Behrouz A. Forouzan
4. Satish Chandra and M.M. Agarwal, Railway Engineering, Oxford University Press, 2007.
5. Christos N. Pyrgidis, Railway Transportation Systems: Design, Construction and Operation, Oxford, New York, Philadelphia
6. S.C. Rangawala, Principles of Railway Engineering, Charotar Publication, 2015.
7. TCP/IP Protocol Suite: Behrouz A. Forouzan (Fourth Edition)
8. Internetworking with TCP/IP Vol III. Client-Server Programming & Applications: Douglas E. Comer

9. Engineering Circuit Analysis. Hayt W. H. &Kemmerly J. E. McGraw-Hill. 1993.
10. Circuits, Devices & Systems. Smith R. J. & Dorf R.C., John Wiley & Sons.1992.
11. Electronic Devices & Circuit Theory. Boylestad R. L. &Nashelsky L. 6th Ed. Prentice Hall India. 2001.
12. Principles of Communications: Systems, Modulation & Noise. Ziemer R. E. & Tranter W. H. 5th Ed. John Wiley & Sons. 2001.
13. Communication Systems. Haykin Simon. 4th Ed. John Wiley & Sons. 2001.
14. Digital & Analog Communication Systems. Shanmugam K. Sam. John Wiley & Sons. 1979.
15. Signals and Systems A.V. Oppenheim and A. S. Wilsky, 2nd edition [Pearson Education]
16. Signals and Systems Simon Haykin and Barry Van Veen, 2nd edition [Wiley and Sons]
17. Signals and Systems, I. Ravi Kumar, PHI

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HET43: Seminar

Teaching Scheme:	**Examination Scheme:**
Practical: 2Hr/Week, 1 credit	ICA: 25 Marks

A student shall submit the seminar report and prepare a presentation for it.
The topic for the seminar Work may be Electronics and telecommunication Engineering, Railway Signaling, Modern communication technologies used in railway, Interlocking and inter-disciplinary areas related to Railway Engineering.

Guidelines for Project contents:

a) Seminar Report: The seminar report should be 25 to 50 pages (More pages can be used if needed). The entire Report has to be segmented chapter-wise as per the requirement.

1. Introduction (History, Importance of topic, Area, Problem identification, Objective of the seminar)
2. Literature Review
3. Design/ Experimentation/ Model/Actual work carried out for the same.
4. Observation/ Analysis/ Findings/Results

b) Presentation: The group has to prepare a PowerPoint presentation on the seminar report and present it in front of the faculty of the department. One copy of the report should be submitted to Institute/ Department, and one copy should remain with each student of the project group

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HET44: Applications of IT and Control Engineering in Railway

Teaching Scheme:	**Examination Scheme:**
Lecture : 3Hrs/Week, 3 credits	ISE:30 Marks
Practical: 2Hr/Week, 1 credit	ESE:70 Marks
	ICA: 25 Marks

Course Objectives:

1. To make students aware of FOIS system
2. To understand PRS System
3. To understand the control engineering in Railways
4. To discuss recent trends in microprocessor and micro controller in Indian Railways
5. To discriminate against the Indian Railways from an International Perspective

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Course Outcomes:

At the end of this course, students will be able to,

1. Understand and analyze the FOIS system.
2. Understand and analyze the PRS system
3. Understand the control engineering in Railway.
4. Discuss the recent trends of microprocessor and micro controller in Indian Railways

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SECTION I

Unit 1- Freight Operations Information Systems (FOIS) (07)

Introduction, Mission Statement of FOIS, Composition of FOIS system, FOIS Design Architecture, Existing FOIS Network, FOIS network topology, Introduction of IOT in Indian Railways

Unit2 - Passenger Reservation System (PRS) (07)

PRS: Introduction, Main Frame Servers of PRS, Salient Features of PRS, Typical arrangement of PRS Terminals, Unreserved Ticketing System (UTS): Introduction, UTS Network, Basic requirements of UTS Network, Network Management System.

Unit3- Control Engineering (07)

System, Control system, Types of control systems, concept of feedback, Liquid level control system, Automobile driving system, Servomechanism for steering of antenna, Robotic control system. The transfer function of a closed-loop system, Data Loggers and Event Loggers, SCADA.

SECTION II

Unit4- Microcontrollers and Microprocessors in Railways (07)

Sensors, DSLR (digital single-lens reflex), Android Based Controller, Micro-controller, PIC Controller DATALOGGER, ACD, Train Protection & Warning System, Auxiliary Warning System, Application of Microprocessors and Micro-controllers.

Unit5 - Telecommunications in Railway (07)

Provisions of the Control Communication, 4 Wire/2 Wire Train Traffic Control Communication Equipment, V F Repeaters, Interruptions and Routine Tests on Control Circuits, Telephones Used In Control Working.

Unit6 - Communication in Railway (07)

Radio Propagation, Public Address System, Multiplexing (Analog &Digital), Passenger Information System, Train Information System, Train Traffic Control Data Communications and Networking, Mobile Communications (VHF, SM-R, DECT, TETRA.), TCMS(Metro)

Internal Continuous Assessment (ICA):

ICA shall consist of a minimum six to eight assignments based on the entire curriculum

References:

1. http://railwaytrainngsandt.blogspot.com/p/week.html.
2. https://iriset.indianrailways.gov.in
3. Mobile Communications – Jochen Schiller (PEARSON) (Chapters: 1, 2, 3, 5,6)
4. Qiao Jian-hua; Li Lin-sheng; Zhang Jing-gang; “Design of Rail Surface Crack-detecting System Based on Linear CCD Sensor”, IEEE Int. Conf. on Networking, Sensing and Control, 2008
5. K. Vijayakumar, S.R. Wylie, J. D. Cullen, C.C. Wright, A.I. AIShamma’a, “Non invasive rail track detection system using Microwave sensor”, Journal of App. Phy., 2009
6. White Paper- Safety on Indian Railways, April 2003, Govt. of India, Ministry of Railways.
7. Indian Railways - Safety Performance of relevant years, published by Safety Directorate of Ministry of Railways, Govt. of India
8. Development of Railway Signal & Telecom Systems on IR M C Yadav WM/Signal/SWS Sabarmati/Western Railway
9. Indian Railways Telecommunication Manual