Punyashlok Ahilyadevi Holkar Solapur University, Solapur
Electronics Engineering and
Electronics & Telecommunication Engineering

Structure for Honors Degree – 1. Artificial Intelligence and Machine Learning
w.e.f. AY 2021-22

Course Code	*Semester*	*Course Name*	*Hrs./week*			*Credits*	*Examination Scheme*			
			L	*T*	*P*		*ISE*	*ESE*	*ICA*	*Total*
HET11	SY Sem II	Computational Statistics	3	1	--	4	30	70	25	125
HET12	TY Sem I	Artificial Intelligence	3	--	2	4	30	70	25	125
HET13	TY Sem II	Seminar	--	--	2*	1	--	--	25	25
HET14	TY Sem II	Machine Learning	3	--	2	4	30	70	25	125
HET15	B Tech Sem I	Mini Project	--	--	4*	2	--	50#	50	100
HET16	B Tech Sem I	AI Applications	3	--	2	4	30	70	25	125
	Sub Total		**12**	**1**	**12**	**19**	**120**	**330**	**175**	**625**

* indicates contact hours

There will be Oral Examination of 50 marks at the end of the semester for Mini Project.

This Mini Project will be different than the Mini Project done at TY Sem-II in the regular Curriculum.

Punyashlok Ahilyadevi Holkar Solapur University, Solapur

Electronics Engineering and Electronics & Telecommunication Engineering

S.Y. B. Tech. (Electronics Engineering)- Part-II

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

HET11: Computational Statistics

Teaching Scheme:
Lecture : 3Hrs/Week, 3 credits
Tutorial: 1Hr/Week, 1 credit

Examination Scheme:
ISE:30 Marks
ESE:70 Marks
ICA: 25 Marks

The goal of this course is to provide students an introduction to a variety of modern computational statistical techniques and the role of computation as a tool of discovery.

Course Prerequisite:

Student shall have knowledge of programming language python, also some background in probability and statistical inference.

Course Objectives:

1. To make students learn efficient numerical methods for solving problems in statistical analysis.
2. To make students use computational statistics in applications like statistical machine learning.
3. To describe the Dimensionality reduction method.
4. To introduce basics of Learning theory.

Course Outcomes:

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

1. Describe fundamental aspects of efficient numerical methods for statistical analysis
2. Explore modern computational statistical techniques
3. Describe the role of computation as a tool of discovery.
4. Apply statistical methods for Machine learning applications

Section I

Unit 1: Probability Distributions (07)

Construction of a Probability Space, Discrete and Continuous Probabilities, Sum Rule, Product Rule, and Bayes' Theorem, Statistics and Independence, Gaussian distribution, Conjugacy and the Exponential Family, Change of Variables/Inverse Transform

Unit 2: Regression - linear and nonlinear (07)

Problem Formulation, Parameter Estimation, Bayesian Linear Regression, Maximum Likelihood as Orthogonal Projection

Unity 3 : Matrix fundamentals (08)

Systems of Linear Equations, Matrices, Solving Systems of Linear Equations, Vector Spaces, Linear Independence, Basis and Rank, Linear Mappings, Affine Spaces, Determinant and Trace, Eigenvalues and Eigenvectors, Cholesky Decomposition, Eigen decomposition and Diagonalization, Singular Value Decomposition, Matrix Approximation

Section II

Unit 4 : Dimensionality reduction (07)

Problem Setting, Maximum Variance Perspective, Projection Perspective, Eigenvector Computation and Low-Rank Approximations, PCA in High Dimensions, Key Steps of PCA in Practice, Latent Variable Perspective

Unit 5 : Basic learning theory (07)

- types, feasibility, training, testing, generalization, bias- variance, underfitting, overfitting etc

Unit 6: Introduction to Machine Learning (08)

Well posed learning problem, designing a learning system, perspectives and issues in machine learning, applications of machine learning, probability theory, model selection, the curse of dimensionality, decision theory, information theory

Internal Continuous Assessment:

ICA consists of minimum 8 tutorials based upon above curriculum.

Text books:

1. Peter Givens, G. H. and Hoeting, J. A. (2005) Computational Statistics, 2nd Edition, Wiley-Interscience

2. Mathematics for Machine Learning by Marc Peter Deisenroth, A. Aldo Faisal, and Cheng Soon Ong .

Reference Books:

1. Liu, J. (2001). Monte Carlo Strategies in Scienti_c Computing, Springer-Verlag.
2. Lange, K. (2002). Numerical Analysis for Statisticians, Springer-Verlag, 2nd Edition.
3. Hastie, T., Tibshirani, R. and Friedman, J. (2009). The Elements of Statistical Learning, 2nd Edition, Springer.
4. Goodfellow, I., Bengio, Y. and Courville, A. (2016). Deep Learning, MIT Press.

Punyashlok Ahilyadevi Holkar Solapur University, Solapur
Electronics Engineering and
Electronics & Telecommunication Engineering

Structure for Honors Degree – 2. Data Science
w.e.f AY 2021-22

Course Code	*Semester*	*Course Name*	*Hrs./week*			*Credits*	*Examination Scheme*			
			L	*T*	*P*		*ISE*	*ESE*	*ICA*	*Total*
HET21	SY Sem II	Database Management Systems	3	1	--	4	30	70	25	125
HET22	TYSem I	Data Processing & Feature Engineering	3	--	2	4	30	70	25	125
HET23	TY Sem II	Seminar	--	--	2*	1	--	--	25	25
HET24	TY Sem II	Machine Learning	3	--	2	4	30	70	25	125
HET25	B Tech Sem I	Mini Project	--	--	4*	2	--	50#	50	100
HET26	B Tech Sem I	Business Analytics	3	--	2	4	30	70	25	125
	Sub Total		12	1	12	19	120	330	175	625

* indicates contact hours

There will be Oral Examination of 50 marks at the end of the semester for Mini Project.

This Mini Project will be different than the Mini Project done at TY Sem-II in the regular Curriculum.

Punyashlok Ahilyadevi Holkar Solapur University, Solapur

Electronics Engineering and Electronics & Telecommunication Engineering

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

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

HET21: Database Management System

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

This course introduces a Data Base Management System, which is the system software for easy, efficient and reliable data processing and management. It covers ER Model, Relational Model, Structured Query Language, Relational Database Design and Concurrency Control techniques.

Course Objectives:

1. To understand the basics of database design, structure, implementation and applications.
2. To develop the logical design of the database using data modeling concepts such as entity relationship diagrams.
3. To understand and use Structured Query Language to query, update, and manage a database.
4. To apply normalization techniques to normalize the database.
5. To familiarize the students with the fundamentals of database transaction processing, learn techniques for concurrency control and recovery methods**.**

Course Outcomes:

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

1. Apply the basic concepts of database system to design relational model and schemas.
2. Design schema using E- R model and normalization.
3. Extract data using relational algebra and SQL.
4. Access data using Indexing and Hashing techniques.
5. Apply ACID properties for transaction processing.
6. Explain concurrency control and recovery methods.

SECTION– I

Unit 1: Introduction to DBMS (03)

Database- System Applications, Purpose of Database Systems, View of data, Database Languages, Database Architectures, Database users and administrators, history of databases system.

Unit 2: E-R model (05)

Overview of design process, E-R Model, Constraints, E-R diagrams, E-R design issues, Weak Entity Sets, Extended E-R features, Reduction to relational schema.

Unit 2: Relational Model (05)

Relational Model: Basic structure of relational databases, Database schema, keys, Schema diagrams,Relational Query languages, Relational algebra-Fundamental, Additional and Extended Relational Algebra Operations.

Unit 4: Introduction to SQL (08)

Overview, SQL data definition, SQL data types,Integrity constraints, Basic structure of SQL Queries,Types of SQL Commands: DDL, DML, DCL and TCL statements, Basic SQL clauses [select, from, where, group by, having, order by etc.].

SECTION-II

Unit 5: Intermediate SQL (06)

Additional basic operations, Set operations, NULL values, Aggregate functions, Nested sub queries, Modification of the databases. Join operations, Views, Integrity constraints, Authorization.

Unit 6: Normalization (05)

Features of good Relational Designs, Atomic Domains, First Normal Form, Keys and Functional dependencies, Second Normal Form, Boyce-Codd Normal Form, Third Normal Form, Functional dependency theory.

Unit 7: Indexing and Hashing (05)

Basic Concepts, Ordered Indices, B+ Tree Index Files, B Tree Index Files, Multiple Key Access, Introduction to Indexing, Comparison of Indexing and Hashing, Index definition in SQL.

Unit 8: Transactions and Concurrency Control (05)

Transaction concept, Transaction State, Implementation of Atomicity and Durability, Concurrent Executions. Concurrency Control - Lock based protocol: Locks, Granting of Locks, Two-Phase Locking Protocol. Time Stamp-based protocols, Deadlock handling.

Internal Continuous Assessment (ICA):
ICA shall consist of minimum 8 assignments/tutorials based on above syllabus.

Suggestive List of Assignments/tutorials:

- Write queries in SQL using DDL and DML commands.
- Write queries in SQL to demonstrate integrity constraints.
- Write nested sub queries in SQL using Joins and Set operations.
- Write queries in SQL to create Views and demonstrate Authorization.
- Identify set of functional dependencies, find canonical cover and closure of functional dependency.
- Convert the created database into 1NF, 2NF, 3NF and BCNF

Text books:

1. Database system concepts by Abraham Silberschatz, Henry F. Korth, S. Sudarshan (McGraw Hill International Edition) sixth edition.
2. Database system concepts by Peter Rob, Carlos Coronel (Cengage Learning) ninth edition.

Reference Books:

1. Fundamentals of Database systems by RamezElMasri, S. B. Navathe (Pearson Education)5thedition.
2. Database Management Systems by RamkrishnanGehreke (Tata McGraw Hill) third edition.
3. Principles of Database Systems by J. D. Ullman (Galgotia Publications)
4. Advanced Database Management System by RiniChakrabarti, ShilbhadraDasgupta (Dreamtech Press Publication).

Punyashlok Ahilyadevi Holkar Solapur University, Solapur
Electronics Engineering and
Electronics & Telecommunication Engineering

Structure for Honors Degree – 3. Internet of Things (IoT)
w.e.f AY 2021-22

Course Code	*Semester*	*Course Name*	*Hrs./week*			*Credits*	*Examination Scheme*			
			L	*T*	*P*		*ISE*	*ESE*	*ICA*	*Total*
HET31	SY Sem II	Fundamentals of IOT	3	1	--	4	30	70	25	125
HET32	TY SemI	Industrial IoT	3	--	2	4	30	70	25	125
HET33	TY SemII	Seminar	--	--	2*	1	--	--	25	25
HET34	TY SemII	IOT Cloud Platform	3	--	2	4	30	70	25	125
HET35	B Tech Sem I	Mini Project	--	--	4*	2	--	50#	50	100
HET36	B Tech Sem I	Architecting IoT Solutions	3	--	2	4	30	70	25	125
	Sub Total		12	1	12	19	120	330	175	625

* indicates contact hours

There will be Oral Examination of 50 marks at the end of the semester for Mini Project.

This Mini Project will be different than the Mini Project done at TY Sem-II in the regular Curriculum.

Punyashlok Ahilyadevi Holkar Solapur University, Solapur

Electronics Engineering and Electronics & Telecommunication Engineering

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

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

HET31: Fundamentals of IOT

Teaching Scheme:
Lecture : 3Hrs/Week, 3 credits
Tutorial: 1Hr/Week, 1 credit

Examination Scheme:
ISE:30 Marks
ESE:70 Marks
ICA: 25 Marks

The Internet of Things (IoT) refers to the system in which different devices equipped with sensors and signal processing are connected through a network to communicate with each other and/or with central servers. This course provides a thorough introduction to the different components of an IoT System. The course also introduces different communication protocols. Introduction to Raspberry Pi and its architecture is also a part of this course.

Course Objectives:

1. To make student aware of different components of an IoT System
2. To introduce to student different sensors used in IoT.
3. To make student learn usage of different sensorsin IoT.
4. To make student learn different communication technologies used in IoT.
5. To make student build simple IoT applications with Raspberry Pi.

Course Outcomes:

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

1. Define what Internet of Things is with suitable example.
2. Comprehend different components of an embedded System w.r.t. IoT.
3. Select appropriate sensor for a given IoT application with suitable justification.
4. Categorize different communication technologies used in IoT.
5. Construct a solution based on Raspberry Pi for the development of simple IoT application.

Section I

Unit 1 - Introduction to Internet of Things (06)

Introduction to IoT, different components of an IoT system: embedded system, communication systems, cloud, applications of IoT in various domains.

Unit 2 – Embedded Systems for IoT (07)

Introduction to embedded systems, different components of an embedded system, basics of Linux based embedded systems, various embedded platforms used in IoT, understanding the various IDEs used for embedded development.

Unit 3 – Sensors Fundamentals and Characteristics (08)

Sensors, Sensor Classification, Signals and Systems, Units of Measurements, SensorCharacteristics.

Section II

Unit 4 – Sensor Applications (07)

Occupancy and Motion Detectors, Position, Displacement, and Level, Velocity and Acceleration, Humidity and Moisture Sensors, Light Detectors, Temperature Sensors.

Unit 5 – Communication technologies for IoT (06)

Basics of the communication technologies (Bluetooth Low Energy (BLE), Wifi, RFID) their architecture, characteristics, limitation, power consumption parameters and applications.

Unit 6 – Development of IoT solution. (08)

Introduction to Raspberry Pi, Linux- Introduction, File System, Raspbian O.S.- Introduction, Installing Raspbian on Pi, First boot and Basic Configuration of Pi, Popular Linux Commands for shell access, remote access though Putty, features, Python programs for interfacing I/O devices like led's, switch's, LCD, etc with Raspberry Pi.

Internal Continuous Assessment (ICA):

ICA consists of minimum 8 tutorials based on above curriculum

Text Books

1. Internet of Things: Architecture and Design Principles by Raj Kamal, First edition, McGraw Hill Education
2. The Definitive Guide to the ARM Cortex-M3 by Joseph Yiu, Second Edition, Elsevier
3. Internet of Things for Architects by Perry Lea, Packt Publishing Limited
4. Analytics for the Internet of Things (IoT) by Andrew Minteer, First edition, Packt Publishing
5. Getting Started with Python for the Internet of Things by Dr. Steven Lawrence Fernandes, SaiYamanoor, and Tim Cox, First edition, Packt Publishing

6. Internet of Things Programming Projects: Build Modern IoT Solutions with the Raspberry Pi 3 and Python by Colin Dow, Packt Publishing Limited

Reference Books

1.Internet-of-Things (IoT) Systems: Architectures, Algorithms, Methodologies by DimitriosSerpanos, Marilyn Wolf, 1st ed. 2018 edition, Springer
2.Mastering Internet of Things: Design and create your own IoT applications using Raspberry Pi 3 by Peter Waher.First edition, Packt Publishing
3.Designing Embedded Systems and the Internet of Things (IoT) with the ARM mbed by Perry Xiao, 1st edition, Wiley
4.J. Fraden, Handbook of Modern Sensors: Physical, Designs, and Applications, AIP Press, Springer

Recommended Online Free Courseware /Learning Resources

1. Udemy.com
2. Introduction to ARM mbed: playlist on Youtube
3. https://www.raspberrypi.org/teach/

Punyashlok Ahilyadevi Holkar Solapur University, Solapur

Computer Science & Engineering, Information Technology, Electronics & Telecommunication Engineering

Structure for Honors Degree – 4. Cyber Security
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	Cryptography	3	1	--	4	30	70	25	125
HET42	TY SemI	Network Security and Secure Coding	3	--	2	4	30	70	25	125
HET43	TY SemII	Seminar	--	--	2*	1	--	--	25	25
HET44	TY SemII	Cyber forensic	3	--	2	4	30	70	25	125
HET45	B Tech Sem I	Mini Project	--	--	4*	2	--	50#	50	100
HET46	B Tech Sem I	Information Auditing and Monitoring	3	--	2	4	30	70	25	125
	Sub Total		12	1	12	19	120	330	175	625

* indicates contact hours

There will be Oral Examination of 50 marks at the end of the semester for Mini Project.

This Mini Project will be different than the Mini Project done at TY Sem-II in the regular Curriculum.

Punyashlok Ahilyadevi Holkar Solapur University, Solapur

Computer Science and Engineering / Information Technology/

Electronics & Telecommunication Engineering

S.Y. B.Tech. (Computer Science and Engineering)- Part-II
S.Y. B.Tech. (Information Technology)- Part-II
S.Y. B.Tech. (Electronics & Telecommunication Engineering)- Part-II

HET41 : Cryptography

Teaching Scheme	**Examination Scheme**
Lectures: 3 Hours/Week, 3 credits	ESE: 70 Marks
Tutorial: 1 Hour/Week, 1 credit	ISE: 30 marks
	ICA: 25 Marks

This course provides an introduction to modern cryptography and communication security. It focuses on how cryptographic algorithms and protocols work and how to use them. The course covers the concepts of block ciphers and message authentication codes, public key encryption, digital signatures, and key establishment, as well as common examples and uses of such schemes, including the AES, RSA, and the Digital Signature Algorithm. Basic cryptanalytic techniques and examples of practical security solutions are explored to understand how to design and evaluate modern security solutions.

Course Objective:

This course aims to give students:

1. an overview of basic cryptographic concepts and methods
2. a good knowledge of some commonly used cryptographic primitives and protocols
3. a sound understanding of theory and implementation, as well as limitations and vulnerabilities
4. an appreciation of the engineering difficulties involved in employing cryptographic tools to build secure systems

Course Outcome:

At the end of course, students will be able to

1. Apply the most common type of cryptographic algorithm ·
2. Understand the Public-Key Infrastructure ·
3. Analyze different security protocols for protecting data on networks

4. Be able to compose, build and analyze simple cryptographic solutions
5. Perform simple vulnerability assessments.

Section – I

Unit 1 : Overview (07)

Computer Security Concepts, The OSI Security Architecture, Security Attacks, Security Services, Security Mechanisms, A model for Network Security

Unit 2 : Classical Encryption Techniques (05)

Symmetric Cipher Model, Substitution Techniques, Transposition Techniques, Rotor Machines, Steganography

Unit 3 : Block Cipher and Data Encryption Standard (08)

Traditional Block Cipher Structure, The Data Encryption Standard, A DES Example, The Strength of DES, Block Cipher Design Principles

AES: Finite field arithmetic, AES structure, AES transformation function, AES key expansion, An AES example

Section – II

Unit 4 : Public Key Cryptography and RSA (07)

Principles of Public-Key Cryptosystem: Public Key Cryptosystems, Applications for Public-Key Cryptosystems, Requirements of Public-Key Cryptosystems

RSA Algorithm: Description of Algorithm, Computational aspects, The Security of RSA

Diffie Hellman Key Exchange: The Algorithm, Key Exchange Protocols, Man-in-middle Attack

Unit 5 : Cryptographic Hash Functions and Message Authentication Codes (08)

Cryptographic Hash Functions: Applications, Two Simple Hash Functions, Requirements and Security, Secure Hash Algorithm (SHA)

Message Authentication Codes: Requirements for Message Authentication Codes, Security of MACs, MACs based on Hash Functions (HMAC),Digital Signatures

Unit 6 :User Authentication (07)

Remote user authentication principles, Remote user authentication using symmetric encryption, Kerberos, Remote user authentication using asymmetric encryption, Federated Identity management, Personal identity Verification

Internal Continuous Assessment (ICA) :

Student should implement the following:

1. Implementation of Substitution Cipher
2. Implementation of Poly alphabetic Cipher (Vigenere Cipher and Vernam Cipher)
3. Implementation of Transposition Cipher
4. Implementation of Play fair Cipher
5. Implementation of Secure file transfer in Client/Server environment (use any one of above method for encryption and decryption).
6. Write a program to simulate RSA algorithm.
7. Implement Cryptopgraphic Hash function
8. Simulate Kerberos authentication system

Text Book:

1. Williams Stallings–Cryptography and Network security principles and practices. PearsonEducation (LPE) 6th Edition (Covers all above Units)

Reference Books:

1. Menezes, A.J., P.C.Van Oorschot, and S.A.Vanstone, "Handbook of Applied Cryptography"
2. Schneir, Bruce, "Applied Cryptography: Protocols and Algorithms"
3. Nina Godbbole --Information systems security-Security management, metrics, frameworks and best practices (WILEY)

PunyashlokAhilyadevi Holkar Solapur University, Solapur
Electronics & Telecommunication Engineering

Structure for Honors Degree – 5. Railway Engineering
w.e.f 2021-22

Course Code	*Semester*	*Course Name*	*Hrs./week*			*Credits*	*Examination Scheme*			
			L	*T*	*P*		*ISE*	*ESE*	*ICA*	*Total*
HET51	SY Sem II	Railway Engineering: A Beginner's Perspective	3	1	--	4	30	70	25	125
HET52	TY SemI	Data Communication and Signalingin Railway	3	--	2	4	30	70	25	125
HET53	TY SemII	Seminar	--	--	2*	1	--	--	25	25
HET54	TY SemII	Applications of IT and Control Engineering in Railway	3	--	2	4	30	70	25	125
HET55	B Tech Sem I	Mini Project	--	--	4*	2	--	50#	50	100
HET56	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

There will be Oral Examination of 50 marks at the end of the semester for Mini Project.

This Mini Project will be different than the Mini Project done at TY Sem-II in the regular Curriculum.

Punyashlok Ahilyadevi Holkar Solapur University, Solapur

Electronics & Telecommunication Engineering

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

HET51: Railway Engineering: A Beginner's Perspective

Teaching Scheme:
Lecture : 3Hrs/Week, 3 credits
Tutorial: 1Hr/Week, 1 credit

Examination Scheme:
ISE:30 Marks
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

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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

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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, SushilKodgire, 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 VidyarthiGrihaPrakashan
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, DhanpatRai Publications (p) Ltd.-new Delhi, 2010.