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SEMESTER VII

COURSE CODE	CATEGORY	COURSE NAME	L	T	P	CREDITS	TEACHING & EVALUATION SCHEME				
							THEORY			PRACTICAL	
							END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*
BTEE 503		**CONTROL SYSTEM ENGINEERING**	3	1	2	5	60	20	20	30	20

Legends: L - Lecture; T - Tutorial/Teacher Guided Student Activity; P – Practical; C - Credit; Q/A Quiz/Assignment/Attendance, MST Mid Sem Test.

Course Educational Objectives (CEOs):

The course will provide understanding of control system and mathematical modeling of the system

Course Outcomes (COs):

After the successful completion of this course students will be able to

1. Demonstrate the understanding of basic element and modeling of the control system.
2. Analyze the stability in time domain and frequency domain
3. Design the controller and compensators for the system

Syllabus

UNIT 1 **8 Hrs**

Introduction: Basic Elements of Control System, Open loop and Closed loop systems, Differential equation, Transfer function, Modeling of Electric systems, Translational and rotational mechanical systems, Block diagram reduction Techniques, Signal flow graph, Constructional and working concept of ac servomotor.

UNIT 2 **8 Hrs**

Time Domain Analysis: Standard test signals ,Time response of first order systems ,Characteristic Equation of Feedback control systems, Transient response of second order systems ,Time domain specifications , Steady state response , Steady state errors and error constants , P, PI, PD and PID Compensation

UNIT 3 **8 Hrs**

Stability Analysis and Root locus: The concept of stability – Routh's stability criterion – qualitative stability and conditional stability – limitations of Routh's stability.The root locus concept - construction of root loci-effects of adding poles and zeros to G(s) H(s) on the root loci.

UNIT 4 **8 Hrs**

Frequency domain Analysis: Frequency domain specifications-Bode diagrams-Determination of Frequency domain specifications and Phase margin and Gain margin-Stability Analysis from Bode Plots. Polar Plots, Nyquist Plots,Stability analysis. Compensation techniques – Lag, Lead, Lead-Lag Controllers design in frequency Domain

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UNIT 5 **8 Hrs**

State Space Analysis of Continuous Systems: Concepts of state, state variables and state model, derivation of state models from block diagrams, Diagonalization- Solving the Time invariant state Equations- State Transition Matrix and it's Properties – Concepts of Controllability and Observability.

Text Books

1. I.J.Nagrath and M.Gopal," Control System Engineering", New Age International Publis hers, 5th Edition, 2008.
2. Richard C Dorf; Robert H Bishop, "Modern control system", Pearson Education, 13th Edition, 2017.

Reference Books

1. M F Golnaraghi and Benjamin C Kuo, "Automatic control systems", New York McGraw- Hill Education, 9th Edition, 2017.
2. M.Gopal, Digital Control and State Variable Methods, Tata McGraw- Hill 4th Edition, 2014.
3. Joseph J DiStefano, Allen R Stubberud and Ivan J Williams , Schaum's Outline Series, "Feedback and Control Systems", Tata McGraw- Hill, 2nd Edition 2014.
4. John J.D'azzo & Constantine H.Houpis, 'Linear control system analysis and design', Tata McGraw-Hill., 4th Edition 2000 .

List of Practicals:

1. Perform step response of a transfer function
2. Perform impulse response of a transfer function
3. Perform ramp response of a transfer function
4. Analyze torque speed characteristics and determine the transfer function of a DC servomotor.
5. Analyze characteristics of a small AC servomotor and determine its transfer function.
6. Perform the transient and frequency response of a second order network.
7. Perform the performance of various types of controllers used to control the temperature of oven.
8. Draw nyquist plot from a transfer function
9. Draw root locus from a transfer function
10. Draw bode plot from a transfer function

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			THEORY			PRACTICAL		Th	T	P	CREDITS
			END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
BTCE 707		STRUCTURAL DESIGN AND BRIDGE ENGINEERING	60	20	20	30	20	2	1	2	4

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; **C** - Credit; ***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

Course Objective

1. Student will be able to analyze various loads acting and will be able to design different structural systems
2. Student will to develop an understanding for basic concepts in proportioning and design of bridges in terms of aesthetics, geographical location and functionality.

Course Outcomes:

1. Ability to analyze various loads and design riveted and welded connections.
2. Ability to design compression and tension member with available steel sections.
3. To understand the load flow mechanism and identify loads on bridges.
4. To carry out a design of bridge starting from conceptual design, selecting suitable bridge, geometry to sizing of its elements

Syllabus:

UNIT I

Properties of steel; Structural steel sections; Limit State Design Concepts; Loads on structures; Design of structural connections -Bolted and Welded connections; Eccentric connections

UNIT II

Design of compression members; Design of laced and battened type columns; Design of simple beams

UNIT III

Introduction to bridge engineering; General Considerations for Design, loading and standards for railway bridges; IRS loading

UNIT IV

Steel bridges; Plate Girder Bridge; Web flanges, intermediate stiffeners, vertical stiffeners, end bearing stiffeners

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UNIT V

Box Girder Bridge, elements and design; Trussed girder bridges for railways (IRS holding); Bearings for bridges

Text Books:

1. Limit State Design of Steel Structures by S K Duggal, McGraw Hill Education 2010
2. Design of Steel Structures, B.C Punmia, Laxmi Publications; Second edition 2015
3. Raju Krishna, Design of Bridges, Oxford & IBH Publishing Co. Pvt Ltd 2012
4. D. Johnson Victor, Design of Bridges, Oxford & IBH, (2012)

Reference Books:

1. Steel Structures by Ramchandra, Vol II, Scientific Publishers 2017
2. Design of Steel Structures – Ramammutham, Dhanpat Rai Publishing Co (p) Ltd,2012

List of Practical's:

1. Detailed drawing of various structural systems as per the syllabus.

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							THEORY			PRACTICAL	
							END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*
BTRW 711		SIGNALLING RELAY	3	1	0	4	60	20	20	0	0

Legends: L - Lecture; T - Tutorial/Teacher Guided Student Activity; P – Practical; C - Credit; Q/A Quiz/Assignment/Attendance, MST Mid Sem Test.

Course Educational Objectives (CEOs):

To prepare the students to have a basic and practical knowledge of different types of signals.
To prepare the students to have a basic and practical knowledge of types of relays used in railways.

Course Outcomes (COs): Upon completion of this course students will be able to:

1. Demonstrate various parts of relay.
2. Conduct Different test on relays.
3. Understand and analyze relays.

Syllabus

UNIT I **[8 Hrs]**

Power Supply Systems for Signalling: Conventional Power Supply System, Integrated Power Supply System, Low Tension (LT) Power Panel for RRI, Power Supply requirements of specific Signalling, Non-conventional energy sources-Solar Energy Power Supply arrangement for Level crossing Gate/Intermediate Block Working/Intermediate Relay hut.

UNIT II **[8 Hrs]**

Signalling relays: Need for signalling, Types of signal, signalling plan, signalling equipments, signalling relay, types of relay, maintenance.

UNIT III **[6 Hrs]**

Principles of Interlocking: Interlocking, Essentials of Interlocking, Electrical Lockings, Salient features of Relay based Interlocking.

UNIT IV **[4 Hrs]**

Earthing of Signal & Telecom.installations: Earthing of Signalling and Telecommunication equipment in 25 KV 50Hz AC Electrified sections, Installations to be earthed, Specific Resistance, Soil Resistivity.

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UNIT V **[4 Hrs]**

Lightning & Surge Protection: Protection of S&T equipments, Surge protection devices, Different types of protective arrangements, Lightning protection, Lightning and Surge protection of IPS installation

Text Books:

1. Relays For Railway Signaling, Signal & Telecommunication Training Centre, Byculla, Mumbai
2. Hand Book on Railway Signalling in Indian Railways
3. Handbook on Power Supply Systems for Signalling, Indian Railways Centre for Advanced Maintenance Technology, 2017

Reference Books:

1. Management of Signalling Relays, IRSE, 2013

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COURSE CODE	CATEGORY	COURSE NAME	TEACHING & EVALUATION SCHEME								
							THEORY			PRACTICAL	
			L	T	P	CREDITS	END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*
BTMERW711	DES	SURFACE COATING TECHNOLOGY	3	1	0	4	60	20	20	0	0

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; C - Credit;
***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

Course Educational Objectives (CEOs):

(A)This course on Surface Coating Technologies covers the various techniques of surface modifications for applications such as engineering components, in which the substrate / bulk material properties are the primary consideration and the surface properties must be modified for aesthetics, oxidation resistance, hardness, wear resistance, fatigue resistance or other considerations. (B)This course shall be very helpful to the engineering student to develop essential skill & knowledge of the surface coating technologies in demand.

Course Outcomes (COs):

After learning the course the students should be able to:

1. Decide the surface preparation methods suitable for different substrate materials.
2. Apply knowledge on properties offered by different Coatings based on the application requirement.
3. Understand & interpret testing &evaluation of metallic coatings.
4. Explain importance of specific coatings & its applications on specific Engineering components.
5. Explain the effect of process parameters on the properties & microstructure of the surface coating processes.
6. Understand the importance & role of surface modifications to achieve several technological properties.

Syllabus

Unit-I

Surface Engineering: Introduction to surface engineering, Scope of surface engineering for different engineering materials, Surface Preparation methods such as Chemical, Electrochemical; Mechanical; Sand Blasting, Shot peening, Shot blasting, Hydro-blasting, Vapor Phase Degreasing etc.

Coatings: Classification, Properties and applications of Various Coatings.

Unit-II

Chemical Conversion Coating: Chromating, Phosphating, Anodizing, Thermochemical

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processes: Methodology used, mechanisms, important reactions involved, Process parameters and applications.

Metallic coating: Hot Dipping, Galvanizing, Electrolytic and Electro less plating: Methodology used, mechanisms, important reactions involved, Process parameters and applications. Testing/ evaluation of metallic coatings.

Unit-III

Coating from Vapour Phase: PVD, and CVD: Various Methods used, mechanisms, important reactions involved, Process parameters and applications.

Different methods for surface modification: Surface modification by use of directed energy beams, Plasma, Sputtering & Ion Implantation. Surface modification by Friction stir processing. Surface composites.

Unit-IV

Thermal spray coatings: Processes, Types of spray guns, Comparison of typical thermal spray processes, Surface Preparation, Finishing Treatment, Coating Structures and Properties, Applications.

Diffusion Coating: Carburizing, Carbonitriding, Siliconizing, Chromizing, Aluminizing, Boronizing, Boronitriding. Various Methods, used mechanisms, important reactions involved, Process parameters and applications.

Unit-V

Case studies based on coatings and surface modification of important engineering components.

Reference Books:

1. *"Materials Degradation & Its Control by Surface Engineering" by A.W. Batchelor, N.L. Loh & M. Chandrasekaran, Imperial College Press, 2011.*
2. *"Surface Engineering for Corrosion and Wear Resistance." by J. R. Davis,* ASM International, 2001.
3. *"Surface Preparation and Finishes for Metal", by James A. Murphy, McGraw-Hill, New York 1971.*
4. *"Friction Stir Welding and Processing", by R.S. Mishra and M.W. Mahoney, ASM International, 2007.*
5. *"Surface Coatings for Protection against Wear", by B.G. Mellor (ed.),Woodhead Publishing, 2006.*
6. *"Corrosion Engineering", by M.G. Fontana, Tata-McGraw Hill, 3rd ed. 2005.*
7. *"Advances in Friction-Stir Welding and Processing", by M-K Besharati-Givi and P. Asadi, Elesevier, Woodhead Publishing, 2014.*

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							THEORY			PRACTICAL	
			L	T	P	CREDITS	END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*
BTMERW710	DES	NANO TECHNOLOGY AND APPLICATIONS	3	1	0	4	60	20	20	0	0

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; C - Credit;
***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

Course Educational Objectives (CEOs):

(A) This course on nanotechnology covers the basic scientific concepts of nanoscience. Understand the properties of nano materials, characterization of materials, synthesis and fabrication. Understand the applications of nano technology in various science, engineering and technology fields.(B) This course shall be very helpful to the engineering student to develop essential skill & knowledge of the nanotechnologies and nano materials in demand.

Course Outcomes (COs):

After learning the course the students should be able to:

1. Understand the importance & role of nanotechnology and Nano-science.
2. Apply the knowledge of properties of different Nano-materials based on the application requirement.
3. Understand the 2D, 3D structures of Nano-materials.
4. Understand the Methods by which Properties can be Measure.
5. Understand the Applications of Nano Technology.

Syllabus

Unit-I

Introduction of Nanotechnology

History of nano science, introduction to Nanotechnology, Nanotechnology: Definition, Difference between Nanoscience and Nanotechnology, definition of nano meter. Evolution of science and technology.

Unit-II

Nanomaterials and Properties

Nanomaterials: Definition, Classification of nano materials, Crystal symmetries, crystal directions, crystal planes, Band structure. Mechanical properties, electrical properties, dielectric properties, thermal properties, magnetic properties, opto electronic properties. Effect of size reduction on properties, electronic structure of nano materials.

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Unit-III

Types of Nanostructures

Definition of a Nano system, Types of Nanocrystals. One Dimensional (1D), Two Dimensional (2D) and Three Dimensional (3D) nanostructured materials. Quantum dots, Quantum wire Core/Shell structures.

Unit-IV

Methods of Measuring Properties

Crystallography, particle size determination, surface structure, Scanning Prob Microscopy (SPM), Atomic Force Microscopy (AFM), Field Ion Microscopy, Scanning Electron Microscopy, Transmission Elecrtron Microscopy (TEM).

Unit-V

Applications of Nano Technology

Applications in material science, biology and medicine, surface science, energy and environment. Applications of nano structured thin fins, applications of quantum dots.

Reference Books:

1. *"Nanotechnology: Basic science and Emerging technologies", by M. Wilson, K. Kannangara, G Smith, M. Simmons, B. Raguse, Overseas Press India Pvt Ltd, New Delhi, First Edition, 2005.*
2. *"The chemistry of nanomaterials: Synthesis, properties and applications", by C.N.R.Rao, A.Muller, A.K.Cheetham (Eds), Wiley VCH Verlag Gmbh & Co, Weinheim, 2004.*
3. *"Nanoscale Materials Science", by Kenneth J. Klabunde (Eds), John Wiley & Sons, InC, 2001.*
4. *"Nano Electronics and information Technology", by W. Rainer, Wiley, 2003.*
5. *"Nano systems" by K.E. Drexle , Wiley, 1992.*
6. *"Naostructures and Nanomaterials: Synthesis, properties and applications", by G. Cao, Imperical College Press, 2004.*

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			THEORY			PRACTICAL		Th	T	P	CREDITS
			END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
BTCE 708		GROUND IMPROVEMENT	60	20	20	0	0	3	0	0	3

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; **C** - Credit; ***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

Course Objective

1. To impart fundamental knowledge of ground improvement techniques.
2. To make capable of choosing and designing the appropriate method of Ground Improvement according to site conditions and requirement.

Course Outcomes:

1. An understanding about types of ground improvement techniques and soil distribution in India
2. Knowledge about various types of grouts and their applications
3. Knowledge about types of chemical stabilization and their construction method
4. Understanding about ground anchors, rock bolts and soil nailing
5. Knowledge about compaction of soil

Syllabus:

UNIT I

Introduction to engineering ground modification; Classification of ground modification techniques; Soil distribution in India; Reclaimed soils; Ground improvement potential

UNIT II

Grouting aspects, Grouting materials, suspension grouts and solution grouts; Compaction grouting, procedure and applications of grouting

UNIT III

Chemical stabilization; granular admixtures, cement, lime, calcium chloride, fly ash, bitumen, chemical admixtures

UNIT IV

Ground anchors, applications, types and components; Anchor tests; Rock bolts, applications and types, rock bolt action around an excavation; Soil Nailing, construction sequence, analysis of nailed soil

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UNIT V

Compaction; Moisture Density relationship; Compaction rollers, operational aspects; Deep Compaction; Explosion, heavy tamping, vibro-compaction and vibro-replacement; Properties of compacted soil; Compaction control tests.

Text Books:

1. Purushothama Raj, P.Ground Improvement Techniques, Laxmi Publications (p) Ltd., New Delhi,2012
2. Moseley M.P., Ground Improvement Blockie Academic and Professional, Chapman and Hall, Glassgow, 2005
3. Hausmann, M. R, Engineering Principles of Ground Modifications, McGraw Hill publications

Reference Books:

1. Koerner, R. M (1994) — Designing with Geosynthetics — Prentice Hall, New Jersey_
2. Jones C. J. F. P. (1985) — Earth Reinforcement and soil structures — Butterworths, London.

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			THEORY			PRACTICAL					
			END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*	Th	T	P	CREDITS
BTCE 709		SOIL MECHANICS	60	20	20	0	0	3	0	0	3

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; **C** - Credit;
***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

Course Objective

To teach concepts governing the mechanical and fluid transport properties of soils through integrated lectures, readings and exercises.

Course Outcomes:

1. To develop an understanding of the relationships between physical characteristics and mechanical properties of soils
2. To impart knowledge about the different types of foundation.
3. To Identify the suitability of the soil for different foundations

Syllabus:

UNIT I

Basic Definitions & Index Properties: Definition and scope of soil mechanics; Historical development; Formation of soils, soil structure (two & three phase system); Index properties (water content,void ratio,porosity, unit weight etc.) and their determination; Atterberg's limits ; Classification systems based on particle size and consistency limits

UNIT II

Shallow Foundations: Type of foundations shallow and deep. Bearing capacity of foundation on cohesion less and cohesive soils; General and local shear failures; Factors effecting bearing capacity; Theories of bearing capacity - Prandtl, Terzaghi and I.S. code on bearing capacity.

UNIT III

Deep Foundation: Pile foundation, types of piles; Estimation of individual and group capacity of piles in cohesion less and cohesive soils; Static and dynamic formulae; Settlement of pile group; Negative skin friction

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UNIT IV

Soil Improvement Techniques: Compaction; Field and laboratory methods; Proctor compaction tests; Factors affecting compaction; Various equipment for field compaction and their suitability; Field compaction control

UNIT V

Soil Stabilization: Mechanical, lime, cement, bitumen, chemical, thermal, electrical stabilization and stabilization by grouting; Geo-synthetics, types, functions, materials and uses.

Text Books:

1. Soil Mechanics and Foundation Engineering, Dr. K.R. Arora, Standard. Publishers Delhi, 2011.
2. Soil Mechanics and Foundation Engineering Dr. B. C. Punamia, Laxmi Publications, Delhi, 2010.
3. Geotechnical Engineering, C. Venkatramaiah –New Age International Publishers, Delhi, 2006

Reference Books:

1. Soil Mechanics and Foundation Engineering, S.K. Garg, Khanna Publishers, Delhi.
2. Geotechnical Laboratory Manual
3. Relevant I.S. Codes.

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							THEORY			PRACTICAL	
							END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*
BTRW 712		RAILWAY OPERATIONS AND MANAGEMENT	3	0	0	3	60	20	20	0	0

Legends: L - Lecture; T - Tutorial/Teacher Guided Student Activity; P – Practical; C - Credit; Q/A Quiz/Assignment/Attendance, MST Mid Sem Test.

Course Educational Objectives (CEOs):

The course covers topics on evolution of the organization of the railways, benefit and cost of project management, Purpose, needs and methods for the forecast of rail demand. It also covers topics on ballast, railway stations and yards.

Course Outcomes (COs):

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

1. Demonstrate the Comparative Advantages of the Railways.
2. Express the Function Ballast.
3. Illustrate the Parameter Affecting the Rail Demands Globally.
4. Learn planning and Management of the Railways.
5. Compare the Various Types of Sleeper and Their Function of the Railways.

Syllabus

UNIT I **[10 Hours]**

Ballast: 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, Guidelines for Provision of Sub-ballast.

UNIT II **[8 Hours]**

Railway Stations and Yards: Purpose of a Railway Station, Selection of Site for a Railway Station, Facilities Required at Railway Stations, Requirements of a Passenger Station Yard, Classification of Railway Stations, Station Platforms, Main Building Areas for Different Types of Stations, Types of Yards, Catch Sidings and Ship Sidings.

UNIT III **[3 Hours]**

Management of the Infrastructure: Task and objectives for rail in restructure, a new management approach, the issue of outsourcing, the need for a homogeneous rail product at the world level.

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UNIT IV **[7 Hours]**

Management and Policy for Rail Passenger Transport: Task and objectives for rail passenger transport a segment of traffic, a new strategy combing completion cooperation and alliances, traditional weakness and offer a new global product of the railways, application of informatics technologies (Internet, SMS).

Management and Policy for Rail Freight Transport: Task and objective of rail freight transport, a merciless completion, integration of rail fright in logistics chain,

UNIT V **[12 Hours]**

Sleepers –Feastings: Various Type of Sleeper and their Function, Steel Sleeper: Form and Properties, Dimension, Weight and Chemical Composition, Advantage and Disadvantages, Timber Sleepers, Deformability of Timber Sleepers, Concrete Sleeper: Inherent Weakness of Concrete Sleepers, the Two Type of Concrete Sleepers, Feastings: Functional Characteristics, Types of Fastenings, Rigid Fastenings, Elastic Feastings, Types of Elastic Feastings, Operating Principles of Elastic Fastenings.

Text Books:

1. Vassilios, A., "Railway Management and Engineering" Rout ledge Taylor and Francis Group,4th Edition,2014
2. Chandra, S., Agarwal, M.M., "Railway Engineering", Oxford University Press, 2nd Edition, 2013.

References Books:

1. Gupta, B.L.& Gupta, Amit, "Roads Railways, Bridges, Tunnels & Harbour dock Engineering", Standard Publishers, Delhi, 21th Edition,2009
2. Bindra, S.P., "Element of Bridge Tunnel & Railway Engineering", Dhanpat Rai Publications, Latest Edition, 2016.
3. Rangwala, C.N., "Railway Engineering", Charotar Publishing, 26th Edition, 2016.
4. Mundrey, J.S., "Railway Track Engineering" McGraw Hill Education, Chenni, 5th Edition, 2017

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