

SCIB3032	REPAIR AND REHABILITATION OF STRUCTURES	L	T	P	EL	Credits	Total Marks
		3	0	0	1	3	100

COURSE OBJECTIVE

- To understand the principles and techniques used for assessing the condition of structures.
- To explore different maintenance strategies and practices for extending the service life of structures.
- To study the repair and strengthening techniques of structural elements, such as beams, columns and slabs.

UNIT 1 MAINTENANCE AND REPAIR STRATEGIES 9 Hrs.

Maintenance, repair and rehabilitation, facets of maintenance and importance of maintenance, various aspects of inspection, Assessment procedures for evaluating damaged structures, causes of deterioration – Testing techniques, NDT, Rebound Hammer, types of failures in foundation, floors, roofs, walls etc., Safety evaluation of existing buildings.

UNIT 2 SERVICEABILITY AND DURABILITY OF CONCRETE 9 Hrs.

Quality assurance for concrete construction, concrete properties strength, workability, permeability, thermal properties and cracking. Effects due to climate, temperature, chemicals, wear and erosion, design and construction errors, corrosion mechanism, effects of cover thickness and cracking of corrosion protection, corrosion inhibitors, corrosion resistant steels, coatings, cathodic protection.

UNIT 3 MATERIALS AND TECHNIQUES FOR REPAIR 9 Hrs.

Special concrete and mortars, concrete chemicals, special elements for accelerated strength gain, expansive cement, polymer concrete, sulphur infiltrated concrete, Ferro-cement, fibre reinforced concrete, water-proofing materials, Admixtures. Polymer coating for rebars, vacuum concrete, gunite, shotcrete, Epoxy injection, Mortar repairs of cracks, Shoring & Underpinning.

UNIT4 REPAIR OF STRUCTURES 9 Hrs.

Repair of structures distressed due to Earthquake - Strengthening using FRP, Strengthening and Stabilization techniques for repair. Strengthening of bridge pier.

UNIT5 NDT OF STEEL 9 Hrs.

Correlating ASTM tensile test (or IS:1608) for rebar with chemical composition results with respect to IS:2062, use of digital thickness gauges and weld gauges, use of hardness testers – Correlation with fire damaged and virgin specimens simple surface NDT tests – Penetration tests, Magnetic particle tests, use of coating gauges for metallic and Non-Metallic coating and identification of details for corrosion (durability aspects) simple techniques in visual inspection of weldments.

Max.45 Hrs.

COURSE OUTCOMES

On the end of the course, student will be able to:

- CO1** - Assess various types of structural deterioration and damage
- CO2** - Analyze the parameters influencing the serviceability and durability of concrete
- CO3** - Understand the materials and techniques for repair and rehabilitation of structures
- CO4** - Apply the strengthening and stabilization techniques adopted for different types of structural elements
- CO5** - Correlate the application of various Non-destructive testing of steel
- CO6** - Develop the plan and procedure for strengthening of existing deteriorated structures

TEXT / REFERENCE BOOKS

1. Denison Campbell, Allen and Harold Roper, "Concrete Structures: Materials, Maintenance and Repair", Longman Scientific and Technical UK, 1991.
2. R.T.Allen and S.C.Edwards, "Repair of Concrete Structures", Blakie and Sons, UK, 1987.
3. Shetty, M.S., "Concrete Technology – Theory and Practice", S. Chand and Company, New Delhi, sixth edition, 2008.
4. Santhakumar, A.R., "Training Courses notes and damage assessment and repair in low cost housing", "RHDC-NBO" Anna University, 1992.
5. Raikar, R.N. "Learning from Failures – Deficiencies in Design, Construction and Service (SDCPL)", Raikar Bhavan, Bombay, 1987.
6. B.Raj, T.Jayakumar and M.Thavasimuthu, "Practical Non-destructive testing", Wood Head Publishing Ltd., 2002.
7. IS:1608(1995) Mechanical Testing of metals.
8. IS: 2062(1999) Steel for general structural purposes.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max.Marks:100

ExamDuration:3Hrs.

PART A:10 Questions of 2 Marks each – No choice

20 Marks

PART B:2 Questions from each unit of internal choice, each carrying 16 Marks

80 Marks

SCIB2603	CONCRETE TECHNOLOGY LAB	L	T	P	EL	Credits	Total Marks
		0	0	4	0	2	100

COURSE OBJECTIVES

- To provide students with hands-on experience in testing and analyzing the properties of
- concrete materials, such as workability, compressive strength, durability, and setting time,
- using standard laboratory procedures and equipment.
- To develop students' skills in proportioning and preparing concrete mixes with desired
- properties, considering factors such as aggregate grading, water-cement ratio, and admixture
- usage.
- To enable students to apply theoretical knowledge of concrete technology to practical situations
- by interpreting and analyzing the test results.

SUGGESTED LIST OF EXPERIMENTS

A)

Tests on Cement

1. Standard consistency of cement
2. Initial and final setting time of cement
3. Compressive strength of cement
4. Fineness of cement

B) Tests on Aggregates (Fine Aggregate & Coarse Aggregate)

1. Particle size distribution
2. Fineness modulus, bulk density, void ratio
3. Bulking of fine aggregate
4. Specific gravity of aggregate
5. Impact Value
6. Crushing Strength

C) Tests on Fresh Concrete

1. Mix Design
2. Slump test
3. Compaction factor test
4. Flow test

D) Tests on Hardened Concrete

1. Compressive strength of concrete
2. Flexural strength of concrete
3. Split tensile strength of concrete
4. Rebound hammer test
5. Durability test on concrete

COURSE OUTCOMES

On completion of the course, student will be able to

CO1 - Demonstrate the importance of testing of cement and its properties.

CO2 - Assess the different properties of aggregate.

CO3 - Learn the concept of workability and testing of concrete.

CO4 - Design the mix design for concrete.

CO5 - Describe the properties of hardened concrete.

CO6 - Interpret the results to assess the quality, performance, and durability of concrete structures.

SCIBOB 1601	STRUCTURAL ANALYSIS - II	L	T	P	EL	Credits	Total Marks
		3	0	0	0	3	100

COURSE OBJECTIVES

- To deepen students' understanding of advanced concepts and techniques in structural analysis.
- To analysis the indeterminate structures, matrix methods, and the application of numerical methods for solving complex structural problems.
- To enhance students' ability to analyze and assess the structural behavior and performance of different types of structures, such as beams, frames, considering different factors such as load distribution, deformation, and stability
- To learn the concept of plastic analysis structure

UNIT 1 ROLLING LOADS

9 Hrs.

Rolling loads – Single Concentrated load – Uniformly distributed load – Two Concentrated loads – System of moving loads – Curves of maximum B.M.D. and S.F.D.- Equivalent UDL.

UNIT 2 INFLUENCE LINE FOR STATICALLY DETERMINATE AND INDETERMINATE STRUCTURES

9 Hrs.

Influence line for Statically Determinate Beams for Bending moment and Shear force - Muller Breslau's Principles and its application to determine the influence lines of reactions. S. F and B. M at a section of continuous beams – propped cantilevers – Qualitative influence lines for Horizontal thrust, reactions and moments for portal frames.

UNIT 3 FLEXIBILITY MATRIX METHOD

9 Hrs.

Primary structures - Compatibility conditions – Formation flexibility matrices - Analysis of indeterminate pin-jointed plane frames, continuous beams and rigid jointed plane frames by direct flexibility approach.

UNIT 4 STIFFNESS MATRIX METHOD

9 Hrs.

Formation of element and global stiffness matrices - Co-ordinate transformations of Continuous Beams – and rigid jointed plane frames – Introduction to basics of Finite Element modelling.

UNIT 5 PLASTIC ANALYSIS OF STRUCTURES

9 Hrs.

Shape factor - simple sections - rectangular - triangle - circular - flanged sections - Load factor. Plastic moment of resistance - collapse load - analysis of continuous beams and portals - limiting conditions for applications.

Max. 45 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

- CO1** - Understand the position of rolling loads to get the maximum shear force and bending moment at given section of the beam and anywhere on the beam.
- CO2** - Determine the shear force and bending moment for determinate and indeterminate structure using graphical method.
- CO3** - Analyze the continuous beam, Rigid jointed frame and pin jointed plane frame using flexibility matrix method.
- CO4** - Analyze the continuous beam, Rigid jointed frame and pin jointed plane frame using flexibility matrix method.
- CO5** - Determine the shape factor of various shapes.
- CO6** - Analysis Indeterminate beams and frames using static and kinematic methods.

TEXT / REFERENCE BOOKS

1. Bhavikatti,S.S., "Structural Analysis",Vol.1 & Vol.2, Vikas Publications, 2013.
2. Igor A. Karnovsky and Olga Lebed, Advanced methods of Structural Analysis, Springer New York. 2010.
3. Reddy CS, "Basic Structural Analysis", Tata McGraw Hill Publishing Co., 2014.
4. Devdass Menon, "Structural Analysis, Alpha Science" International Limited, 2017.
5. Pandit.G.S, Gupta.S.P, "Structural Analysis, A Matrix Approach", 2nd Edition, Tata McGraw Hill Education, 2010.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks: 100****Exam Duration: 3 Hrs.****PART A:** 10 Questions of 2 marks each - No choice**20 Marks****PART B:** 2 Questions from each unit of internal choice; each carrying 16 marks**80 Marks**

SCIB7024	ADVANCED CONCRETE TECHNOLOGY	L	T	P	EL	Credits	Total Marks
		3	0	0	0	3	100

COURSE OBJECTIVE

- To provide students with a comprehensive understanding of the properties and behavior of concrete.
- To equip students with the skills to develop advanced concrete mix designs.
- To explore advanced concrete technologies that promote environmental friendliness and resource efficiency.

UNIT 1 CONCRETE CHARACTERIZATION 9Hrs.

Microstructure of concrete: Aggregate phase, hydrated cement paste, interfacial transition zone. Strength: strength-porosity relationship, failure modes in concrete, factors affecting compressive strength, behavior of concrete under various stress states. Dimensional stability: Elastic behavior, drying shrinkage and creep, thermal shrinkage and thermal properties of concrete.

UNIT 2 PROPORTIONING CONCRETE MIXTURES 9Hrs.

Significance and objectives, general considerations, procedures, Methods of concrete mix design, design of high strength and high performance concrete using relevant IS codes. Testing and quality control of concrete: Methods and significance, accelerated strength testing, core tests and quality control charts.

UNIT 3 DURABILITY OF CONCRETE 9Hrs.

Water as an agent of deterioration: structure of water, permeability, causes of deterioration of concrete: surface wear, crystallization of salts in pores, frost action, effect of fire, sulfate attack, alkali aggregate reaction, and corrosion of embedded steel in concrete: Mechanism-control, development of holistic model of concrete deterioration, concrete in the marine environment. Methods of providing durable concrete, short-term tests to assess long-term behaviour.

UNIT 4 SPECIAL TYPES OF CONCRETE 9Hrs.

Roller compacted concrete-self compacted concrete-shrinkage compensation concrete, pervious concrete-concrete containing polymers-heavy weight concrete for radiation shielding-high performance concrete, high strength concrete, shotcrete, fibre reinforced concrete- bacterial concrete-Mass concrete – their materials, mix proportions, properties, applications and limitations, Geopolymer concrete.

UNIT 5 NON-DESTRUCTIVE TESTING METHODS 9Hrs.

Surface hardness methods, Penetration resistance techniques, pull out tests, maturity method, stress wave propagation methods, electrical methods, electrochemical methods, electromagnetic methods, Tomography of reinforced concrete.

Max.45Hrs.

COURSE OUTCOMES

On the end of the course, student will be able to:

CO1 - discuss microstructure concrete and dimensional stability

CO2 - develop a mix design for the various mix proportions

CO3 – assess the durability of concrete

CO4 - assess the suitability and select appropriate types of concrete for specific engineering applications.

CO5 - explain different types of non-destructive testing methods.

CO6 - apply NDT methods for quality assurance, durability assessment, and diagnosis of deterioration in existing concrete structures

TEXT / REFERENCEBOOKS

1. Kumar Mehta, Paulo J.M Monteiro., Concrete Microstructure, properties and Materials, McGraw Hill Education(India) Pvt Ltd, New Delhi,2014
2. Gambhir.M.L., Concrete Technology, McGraw Hill Education, 2011.
3. Gupta.B.L., Amit Gupta, "Concrete Technology, Jain Book Agency, 2010.
4. Neville, A.M., Properties of Concrete, Prentice Hall, 2013, London.
5. Shetty M.S., Concrete Technology, S.Chand and Company Ltd. Delhi, 2008
6. IS 10262: 2019 – Concrete Mix Proportioning – Guidelines (Primary code for mix design)
7. IS 456: 2000 – Plain and Reinforced Concrete – Code of Practice (General requirements, durability, workability, quality control)

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max.Marks:100

PART A:5 Questions of 6 Marks each – No choice

PART B:2 Questions from each unit of internal choice, each carrying 14 Marks

ExamDuration:3Hrs.

30 Marks

70 Marks