LESSON PLAN

DISCIPLINE: Civil Engineering		**SEMESTER:**4th Semester	**NAME OF THE TEACHING FACULTY:** **P.P. PATRA** **Sr. Lect.**
SUBJECT:STRUCTURAL DESIGN – I		**NO. OF DAYS/PER WEEK CLASSES ALLOTTED:**5	**SEMESTER FROM DATE:**15.03.2022**TO DATE:** _____ **NO. OF WEEKS:15**

Week	Class Day		Theory Topic
1ST			**1. Introduction to WSM AND LSM**
	1st	1.1	Objectives of design and detailing. State the different methods of design of concrete structures.
	2nd	1.2	Introduction to reinforced concrete, R.C. sections their behavior, grades of concrete and steel. Permissible stresses, assumption in W.S.M.
	3rd	1.3	Flexural design and analysis of single reinforced sections from first principles.
	4th	1.4	Concept of under reinforced, over reinforced and balanced sections
	5th	1.5	Advantages and disadvantages of WSM, reasons for its obsolescence.
2ND			**2.Philosophy of Limit State Method (LSM)**
	1st	2.1	Definition, Advantages of LSM over WSM, IS code suggestions regarding design philosophy.
	2nd	2.2	Types of limit states, partial safety factors for materials strength, characteristic strength, characteristic load, design load, loading on structure as per I.S. 875
	3rd	2.3	Study of I.S specification regarding spacing of reinforcement in slab, cover to reinforcement in slab, beam column & footing, minimum reinforcement in slab, beam & column, lapping, anchorage, effective span for beam & slab.
			3.Analysis and Design of Single and Double Reinforced Sections (LSM)
	4th	3.1	Limit state of collapse (flexure), Assumptions, Stress-Strain relationship for concrete and steel, neutral axis, stress block diagram and strain diagram for singly reinforced section.
	5th		Limit state of collapse (flexure), Assumptions, Stress-Strain relationship for concrete and steel, neutral axis, stress block diagram and strain diagram for singly reinforced section.
3RD	1st		Limit state of collapse (flexure), Assumptions, Stress-Strain relationship for concrete and steel, neutral axis, stress block diagram and strain diagram for singly reinforced section.
	2nd		Limit state of collapse (flexure), Assumptions, Stress-Strain relationship for concrete and steel, neutral axis, stress block diagram and strain diagram for singly reinforced section.
	3rd		Limit state of collapse (flexure), Assumptions, Stress-Strain relationship for concrete and steel, neutral axis, stress block diagram and strain diagram for singly reinforced section.
	4th	3.2	Concept of under- reinforced, over-reinforced and limiting section, neutral axis co-efficient, limiting value of moment of resistance and limiting percentage of steel required for limiting singly R.C. section.

	5th		Concept of under- reinforced, over-reinforced and limiting section, neutral axis co-efficient, limiting value of moment of resistance and limiting percentage of steel required for limiting singly R.C. section.
4TH	1st		Concept of under- reinforced, over-reinforced and limiting section, neutral axis co-efficient, limiting value of moment of resistance and limiting percentage of steel required for limiting singly R.C. section.
	2nd		Concept of under- reinforced, over-reinforced and limiting section, neutral axis co-efficient, limiting value of moment of resistance and limiting percentage of steel required for limiting singly R.C. section.
	3rd	3.3	Analysis and design: determination of design constants, moment of resistance and area of steel for rectangular sections
	4th		Analysis and design: determination of design constants, moment of resistance and area of steel for rectangular sections
	5th		Analysis and design: determination of design constants, moment of resistance and area of steel for rectangular sections
5TH	1st		Analysis and design: determination of design constants, moment of resistance and area of steel for rectangular sections
	2nd	3.4	Necessity of doubly reinforced section, design of doubly reinforced rectangular section
	3rd		Necessity of doubly reinforced section, design of doubly reinforced rectangular section
			4. Shear, Bond and Development Length (LSM)
	4th	4.1	Nominal shear stress in R.C. section, design shear strength of concrete, maximum shear stress, design of shear reinforcement, minimum shear reinforcement, forms of shear reinforcement.
	5th		Nominal shear stress in R.C. section, design shear strength of concrete, maximum shear stress, design of shear reinforcement, minimum shear reinforcement, forms of shear reinforcement
6TH	1st	4.2	Bond and types of bond, bond stress, check for bond stress, development length in tension and compression, anchorage value for hooks 900 bend and 450 bend standards lapping of bars, check for development length.
	2nd	4.3	Numerical problems on deciding whether shear reinforcement is required or not, check for adequacy of the section in shear. Design of shear reinforcement; Minimum shear reinforcement in beams (Explain through examples only).
			5.Analysis and Design of T-Beam (LSM)
	3rd	5.1	General features, advantages, effective width of flange as per IS: 456-2000 code provisions.
	4th		General features, advantages, effective width of flange as per IS: 456-2000 code provisions.
	5th		General features, advantages, effective width of flange as per IS: 456-2000 code provisions.
7TH	1st		General features, advantages, effective width of flange as per IS: 456-2000 code provisions.
	2nd	5.2	Analysis of singly reinforced T-Beam, strain diagram & stress diagram, depth of neutral axis, moment of resistance of T-beam section with neutral axis lying within the flange.

	3rd		Analysis of singly reinforced T-Beam, strain diagram & stress diagram, depth of neutral axis, moment of resistance of T-beam section with neutral axis lying within the flange.
	4th		Analysis of singly reinforced T-Beam, strain diagram & stress diagram, depth of neutral axis, moment of resistance of T-beam section with neutral axis lying within the flange.
	5th		Analysis of singly reinforced T-Beam, strain diagram & stress diagram, depth of neutral axis, moment of resistance of T-beam section with neutral axis lying within the flange.
8TH	**1st**		Analysis of singly reinforced T-Beam, strain diagram & stress diagram, depth of neutral axis, moment of resistance of T-beam section with neutral axis lying within the flange.
	2nd		Analysis of singly reinforced T-Beam, strain diagram & stress diagram, depth of neutral axis, moment of resistance of T-beam section with neutral axis lying within the flange.
	3rd	**5.3**	Simple numerical problems on deciding effective flange width. (Problems only on finding moment of resistance of T-beam section when N.A. lies within or up to the bottom of flange shall be asked in written examination).
	4th		Simple numerical problems on deciding effective flange width. (Problems only on finding moment of resistance of T-beam section when N.A. lies within or up to the bottom of flange shall be asked in written examination).
	5th		Simple numerical problems on deciding effective flange width. (Problems only on finding moment of resistance of T-beam section when N.A. lies within or up to the bottom of flange shall be asked in written examination).
9TH	**1st**		Simple numerical problems on deciding effective flange width. (Problems only on finding moment of resistance of T-beam section when N.A. lies within or up to the bottom of flange shall be asked in written examination).
	2nd		Simple numerical problems on deciding effective flange width. (Problems only on finding moment of resistance of T-beam section when N.A. lies within or up to the bottom of flange shall be asked in written examination).
			6.Analysis and Design of Slab and Stair case (LSM)
	3rd	**6.1**	Design of simply supported one-way slabs for flexure check for deflection control and shear
	4th		Design of simply supported one-way slabs for flexure check for deflection control and shear
	5th		Design of simply supported one-way slabs for flexure check for deflection control and shear
10TH	**1st**	**6.2**	Design of one-way cantilever slabs and cantilevers chajjas for flexure check for deflection control and check for development length and shear.
	2nd		Design of one-way cantilever slabs and cantilevers chajjas for flexure check for deflection control and check for development length and shear.

	3rd		Design of one-way cantilever slabs and cantilevers chajjas for flexure check for deflection control and check for development length and shear.
	4th	6.3	Design of two-way simply supported slabs for flexure with corner free to lift.
	5th		Design of two-way simply supported slabs for flexure with corner free to lift.
11TH	1st		Design of two-way simply supported slabs for flexure with corner free to lift.
	2nd	6.4	Design of dog-legged staircase
	3rd		Design of dog-legged staircase
	4th		Design of dog-legged staircase
	5th	6.5	Detailing of reinforcement in stairs spanning longitudinally.
12TH	1st		Detailing of reinforcement in stairs spanning longitudinally.
	2nd		Detailing of reinforcement in stairs spanning longitudinally.
			7.Design of Axially loaded columns and Footings (LSM)
	3rd	7.1	Assumptions in limit state of collapse- compression.
	4th		Assumptions in limit state of collapse- compression.
	5th		Assumptions in limit state of collapse- compression.
13TH	1st		Assumptions in limit state of collapse- compression.
	2nd	7.2	Definition and classification of columns, effective length of column. Specification for minimum reinforcement; cover, maximum reinforcement, number of bars in rectangular, square and circular sections, diameter and spacing of lateral ties.
	3rd		Definition and classification of columns, effective length of column. Specification for minimum reinforcement; cover, maximum reinforcement, number of bars in rectangular, square and circular sections, diameter and spacing of lateral ties.
	4th		Definition and classification of columns, effective length of column. Specification for minimum reinforcement; cover, maximum reinforcement, number of bars in rectangular, square and circular sections, diameter and spacing of lateral ties.
	5th		Definition and classification of columns, effective length of column. Specification for minimum reinforcement; cover, maximum reinforcement, number of bars in rectangular, square and circular sections, diameter and spacing of lateral ties.
14TH	1st	7.3	Analysis and design of axially loaded short square, rectangular and circular columns (with lateral ties only).
	2nd		Analysis and design of axially loaded short square, rectangular and circular columns (with lateral ties only).
	3rd		Analysis and design of axially loaded short square, rectangular and circular columns (with lateral ties only).
	4th		Analysis and design of axially loaded short square, rectangular and circular columns (with lateral ties only).
	5th		Analysis and design of axially loaded short square, rectangular and circular columns (with lateral ties only).
15TH	1st	7.4	Types of footing, Design of isolated square column footing of uniform thickness for flexure and shear.

	2nd		Types of footing, Design of isolated square column footing of uniform thickness for flexure and shear.
	3rd		Types of footing, Design of isolated square column footing of uniform thickness for flexure and shear.
	4th		Types of footing, Design of isolated square column footing of uniform thickness for flexure and shear.
	5th		Types of footing, Design of isolated square column footing of uniform thickness for flexure and shear.