



GOVT. POLYTECHNIC KORAPUT

ACADEMIC SESSION 2020-2021

SEMESTER- 4<sup>th</sup>

BRANCH - CIVIL ENGINEERING

SUBJECT – STRUCTURAL DESIGN I

FACULTY NAME – SUCHITRA LENKA

Period	Module	Topics to be covered
1	Module – I Working stress method (WSM)	Objectives of design and detailing & different methods of design of concrete structure
2		Introduction to reinforced concrete, grades of concrete and steel, advantages of reinforced cement concrete, concept of under reinforced, balanced & over reinforced section
3		Assumptions in working stress method, derivation of formula for balanced design
4		Problem discussion on finding out the design constants and analysis of the section using WSM
5		Problem discussion on design of the section using WSM
6	Module – II (Philosophy of limit state method)	definition, advantages of LSM over WSM, Limit state of collapse & serviceability, Characteristic strength of material
7		characteristic load, partial safety factor, design load, loading on structure, I.S specification regarding spacing of reinforcement in slab
8		IS specification regarding cover to reinforcement and minimum reinforcement in slab, beam & column, concept of lapping, anchorage, effective span for beam and slab.
9	Module – III Analysis and design of single and double reinforced section (LSM)	Assumptions, idealised stress - strain curve for steel and concrete
10		Design stress block parameter, derivation of formula for singly reinforced rectangular beam
11		Finding out M.R, limiting M.R, percentage of steel and limiting percentage of steel
12		Problem discussion on finding out the type of the beam
13		Problem discussion on analysis of singly reinforced section
14		Problem discussion on analysis of singly reinforced section
15		OMR TEST - I
16		Problem discussion on design of singly reinforced beam
17		Problem discussion on design of singly reinforced beam

18	Necessity of providing doubly reinforced beam, stress & strain diagram, finding out depth of N.A and moment of resistance
19	Finding out the area of tensile & compression reinforcement, problem discussion on analysis of doubly reinforced beam
20	Problem discussion on analysis of doubly reinforced beam

21		Problem discussion on analysis of doubly reinforced beam
22		Problem discussion on design of doubly reinforced beam
23		Problem discussion on design of doubly reinforced beam
24	Module – IV Shear, Bond & Development length (LSM)	Nominal shear stress, design shear strength of concrete, maximum shear stress, criteria of minimum shear reinforcement and different forms of shear reinforcement
25		Problem discussion on design of shear reinforcement in beam
26		Concept of bond, types of bond, bond stress, development length for tension and compression, anchorage values for hook and bend, Problem discussion on checking of development length criteria in beams.
27		OMR TEST - 2
28	Module – V Analysis and design of T – Beam (LSM)	General features, advantages, effective width of flange
29		Finding out position of neutral axis, Analysis of singly reinforced T – beam, stress-strain diagram
30		UNIT DISCUSSION – III & IV
31		CLASS TEST
32		Problem discussion on finding moment of resistance of a T-beam section with N.A lies within the flange.
33		Design of a T – beam section
34		Design of a T – beam section
35		Derivation of formula for T – beam section when the N.A lies in the web
36		Problem discussion on design of simply supported beam along with provision of check for flexure
37		Design of simply supported beam along with check for shear and development length
38		Design of simply supported beam along with check for deflection and detailing of the beam
39		Problem discussion on analysis of the T – Beam section
40		OMR TEST - 3
41		Problem discussion on design of the T – Beam section
42		INTERNAL QUESTION DISCUSSION AND DISTRIBUTION OF EVALUATED ANSWER SHEET TO THE STUDENT
43	Module – VI Analysis of design of slab & staircase(LSM)	Concept of one way and two way spanning slab, reinforcement requirement, shear stress, spacing of reinforcement, cover and development length criteria for slab
44		Design of simply supported one way slab with design of flexure
45		Design of slab with check for shear and development length.
46		Design of slab with check for deflection and detailing of the slab.
47		Design of cantilever slab with check for flexure, check for shear, development length, deflection and detailing of the slab

48	OMR TEST - 4
49	Design of two way simply supported slab- moment and shear force calculation
50	Design of two way slab with corners free to lift – design of flexure

51		Design of two way slab with provision of check for shear and development length
52		Design of two way slab with check for deflection and detailing of the slab
53		Types of staircase, structural classification of staircase, Loads and their effect on stair slab
54		Design of stair slab spanning longitudinally – design of main bar, distribution bar and detailing of the staircase
55		Design of a waist slab type dog legged stair case – load and moment calculation
56		Design of a waist slab type dog legged stair case – design of main bar, distribution bar and detailing of the slab
57		UNIT DISCUSSION – V & VI
58	Module – VII Design of axially loaded columns and footing (LSM)	definition and classification of column, assumptions in limit state of collapse
59		Effective length of column, specification for longitudinal & transverse reinforcement.
60		Minimum eccentricity and ultimate load carrying capacity of column
61		Design of a short axially loaded square column and detailing
62		Design of a short axially loaded square column and detailing
63		Design of a short axially loaded rectangular column and detailing
64		Design of a short axially loaded rectangular column and detailing
65		Design of a short axially loaded circular column and detailing
66		Design of a short axially loaded circular column and detailing
67		Definition, Types of foundation , Bearing capacity of soil & depth of foundation, determination of area of footing from load and bearing capacity of soil
68		OMR TEST - 5
69		Analysis of foundation – critical section for bending moment and shear force, transfer of load at base of column
70		Design of isolated square footing for column – design of flexure
71		Design of isolated square footing for column – shear one way action and two way action
72		Design of isolated square footing for column – development length , load transfer from column to footing & detailing
73		Design of isolated square footing for column – design of flexure
74		Design of isolated square footing for column – shear one way

	action and two way action, development length & detailing
75	UNIT DISCUSSION – VII

Period	Module	Topics to be covered	Remarks/Sign of the faculty member
1	Module - I	Working stress method - Objectives of design and detailing & different methods of design of concrete structure	
2		Introduction to reinforced concrete, grades of concrete and steel, advantages of reinforced cement concrete, concept of under reinforced, balanced & over reinforced section	
3		Assumptions in working stress method, derivation of formula for balanced design	
4		Problem discussion on finding out the design constants and analysis of the section using WSM	
5		Problem discussion on design of the section using WSM	
6	Module - II	Philosophy of limit state method – definition, advantages of LSM over WSM, Limit state of collapse & serviceability, Characteristic strength of material	
7		characteristic load, partial safety factor, design load, loading on structure, I.S specification regarding spacing of reinforcement in slab	
8		IS specification regarding cover to reinforcement and minimum reinforcement in slab, beam & column, concept of lapping, anchorage, effective span for beam and slab.	
9	Module - III	Analysis and design of single and double reinforced section (LSM) – Assumptions, idealised stress - strain curve for steel and concrete	
10		Design stress block parameter, derivation of formula for singly reinforced	



		rectangular beam	
11		Finding out M.R, limiting M.R, percentage	

		of steel and limiting percentage of steel	
12		Problem discussion on finding out the type of the beam	
13		Problem discussion on analysis of singly reinforced section	
14		Problem discussion on analysis of singly reinforced section	
15		Problem discussion on design of singly reinforced beam	
16		Problem discussion on design of singly reinforced beam	OMR 1
17			
18		Necessity of providing doubly reinforced beam, stress & strain diagram, finding out depth of N.A and moment of resistance	
19		Finding out the area of tensile & compression reinforcement, problem discussion on analysis of doubly reinforced beam	
20		Problem discussion on analysis of doubly reinforced beam	
21			
22		Problem discussion on design of doubly reinforced beam	
23		Problem discussion on design of doubly reinforced beam	
24	Module - IV	Shear, Bond & Development length (LSM) – Nominal shear stress, design shear strength of concrete, maximum shear stress, criteria of minimum shear reinforcement and different forms of shear reinforcement	
25		Problem discussion on design of shear reinforcement in beam	
26		Concept of bond, types of bond, bond stress, development length for tension and compression, anchorage values for hook and bend	
27		Problem discussion on checking of development length criteria in beams.	Units discussion
28	Module - V	Analysis and design of T – Beam (LSM)- General features, advantages, effective width of flange	internal
29		Finding out position of neutral axis, Analysis of singly reinforced T – beam, stress-strain diagram	

30		Finding out depth of neutral axis and M.R of a T - beam section with N.A lies within the flange	Omr 2
31		Problem discussion on finding moment of resistance of a T- beam section with N.A	

		lies within the flange.	
32			
33		Design of a T – beam section	
34		Design of a T – beam section	Internal question discussion and distribution of evaluated answer book
35			
36		Problem discussion on design of simply supported beam along with provision of check for flexure	
37		Design of simply supported beam along with check for shear and development length	
38		Design of simply supported beam along with check for deflection and detailing of the beam	
39		Problem discussion on analysis of the T – Beam section	
40			
41			
42			
43	Module - VI	Analysis of design of slab & staircase(LSM) – Concept of one way and two way spanning slab, reinforcement requirement, shear stress, spacing of reinforcement, cover and development length criteria for slab	
44		Design of simply supported one way slab with design of flexure	
45		Design of slab with check for shear and development length.	Omr 3
46		Design of slab with check for deflection and detailing of the slab.	
47		Design of cantilever slab with check for flexure	
48		Design of cantilever slab with check for shear, development length, deflection and detailing of the slab	
49		Design of two way simply supported slab- moment and shear force calculation	
50		Design of two way slab with corners free to lift – design of flexure	
51		Design of two way slab with provision of check for shear and development length	
52		Design of two way slab with check for deflection and detailing of the slab	

53		Types of staircase, structural classification of staircase	
54		Loads and their effect on stair slab, load and moment calculation of a stair slab	

		spanning longitudinally	
55		Design of stair slab spanning longitudinally – design of main bar, distribution bar and detailing of the staircase	
56		Design of a waist slab type dog legged stair case – load and moment calculation	
57		Design of a waist slab type dog legged stair case – design of main bar, distribution bar and detailing of the slab	
58	Module - VII	Design of axially loaded columns and footing (LSM)- definition and classification of column, assumptions in limit state of collapse	
59		Effective length of column, specification for longitudinal & transverse reinforcement.	
60		Minimum eccentricity and ultimate load carrying capacity of column	Omr 4
61		Design of a short axially loaded square column and detailing	
62		Design of a short axially loaded square column and detailing	
63		Design of a short axially loaded rectangular column and detailing	
64		Design of a short axially loaded rectangular column and detailing	
65		Design of a short axially loaded circular column and detailing	
66		Design of a short axially loaded circular column and detailing	
67		Definition, Types of foundation	
68		Bearing capacity of soil & depth of foundation, determination of area of footing from load and bearing capacity of soil	
69		Analysis of foundation – critical section for bending moment and shear force, transfer of load at base of column	
70		Design of isolated square footing for column – design of flexure	omr
71		Design of isolated square footing for column – shear one way action and two way action	
72		Design of isolated square footing for column – development length , load transfer from column to footing & detailing	
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