

SUBJECT CODE	SUBJECT NAME	PERIOD PER WEEK		CREDIT
26464	Design of Structure 1	T	P	C
		2	3	3

Rationale	Among all the engineering, Civil engineering is the ancient one. Its demand is very high in socio-economic development of any country. It serves fundamental requirement of human being, that is, residence. It has many branches. Among all branches of Civil Engineering, Design of Structure is the most vital branch. This course have been to serve the all purposes for the construction of respective structure. To achieve those purposes, Design of Structure-1 course deals with the strength, serviceability, durability of any RCC structure. In this course it is also discussed elaborately about the design procedure, safety issues and strength of various types Beams and Lintels which are the main parts of any building structures like human skeleton. Now a days, Frame Structure is very popular, effective and durable against earthquake. After completing this course Diploma in Civil Engineering students will be skill with sufficient knowledge and adequate manner regarding field.
Learning Outcome (Theoretical)	After undergoing the subject, students will be able to 1. Illustrate different type of cement concrete and structural safety. 2. Analyze the properties of reinforcing steel used in RCC. 3. State transformed section of beam. 4. Explain the shear stress developed with functions of web reinforcement in RCC beam. 5. Discuss the functions of web reinforcement in RCC beam. 6. Explain the flexure formula and design of RCC rectangular beam in WSD and USD method . 7. Explain the design of RCC cantilever & overhanging rectangular beam, RCC T-beam and RCC beam with compression reinforcement and RCC lintel.
Learning Outcome (Practical)	After undergoing the subject, students will be able to 1. Perform compression test of concrete cylinder and cube for particular proportion with different water-cement ratio. 2. Determine tensile strength test of mild steel for plain bar and deformed bar of different diameters. 3. Prepare a model for simply supported RCC rectangular beam, continuous RCC rectangular beam, semi-continuous RCC rectangular beam, double reinforced simply supported rectangular beam and RCC lintel with sunshade as per drawing.

DETAILED SYLLABUS (THEORY)

Unit	Topics with Contents	Class (1 Period)	Final Marks
1.	CEMENT CONCRETE AND STRUCTURAL SAFETY 1.1 State plain concrete, reinforced concrete and pre-stressed concrete. 1.2 Describe uses of the plain concrete, reinforced concrete and pre-stressed concrete. 1.3 Calculate young modulus of elasticity of concrete. 1.4 Describe test procedure of crushing Cubes and Cylinders for compression test. 1.5 Define Earthquake, Richter scale, Tectonic plate and Epicenter. 1.6 Illustrate the necessity of considering the seismic load and wind load in designing reinforced concrete work. 1.7 List different types of thrust. 1.8 Mention the significant of the thrust to be consider in designing reinforced concrete structure in coastal zone. 1.9 Explain the need for structural safety and safety provision.	2	3
2.	REINFORCING STEEL IN RCC 2.1. List the different types & grades of steel used in RCC and Pre-stressed concrete. 2.2. State the different types & grades of steel used in RCC and Pre-stressed concrete. 2.3. Mention the advantages of using mild steel in RCC. 2.4. Describe the scope of using welded wire fabric in RCC. 2.5. Illustrate the characteristics of Plain bar, Deformed bar, Twisted bar and Tendon. 2.6. Mention the advantages of using Deformed and Twisted bar in RCC. 2.7. State the minimum reinforcement used in RCC beam and slab.	2	3
3.	TRANSFORMED SECTION OF BEAM 3.1. Define Transformed section. 3.2. Explain the theory of Transformed section with sketch. 3.3. Derive the equation for investigating the stresses developed in Concrete and Steel by Transformed section method. 3.4. State WSD and USD Method. 3.5. Differentiate between WSD and USD method. 3.6. Calculate the stresses developed in rectangular beam and T-beam in WSD method. 3.7. Illustrate balanced reinforced beam, under reinforced beam and over reinforced beam. 3.8. Mention the effect of under reinforced and over reinforced in RCC	3	6

	beam.		
4.	SHEAR STRESS DEVELOPED IN RCC BEAM 4.1. Define Shear Stress. 4.2. Explain the effect of shear force and stress in RCC beam. 4.3. State the meaning of diagonal tension. 4.4. Illustrate the causes of diagonal tension in RCC beam. 4.5. Derive the formula to determine shear stress developed in RCC beam. 4.6. Solve the problems on shear stress developed in WSD method. 4.7. Solve the problems on shear stress developed in USD method. 4.8. Mention the allowable shear stress for RCC beam (v) and shear stress for concrete (v_c).	2	6
5.	WEB REINFORCEMENT IN RCC BEAM 5.1. Define web reinforcement. 5.2. Classify web reinforcement with sketch. 5.3. Mention the functions of web reinforcement in RCC beam. 5.4. Determine the spacing of vertical web reinforcement in WSD method. 5.5. Determine the spacing of web reinforcement in USD method. 5.6. Calculate the portion of the RCC beam requiring web reinforcement.	2	4
6.	BOND STRESS DEVELOPED IN RCC BEAM 6.1. State the meaning of bond stress. 6.2. Derive the formula to determine bond stress developed in RCC beam. 6.3. Illustrate the allowable bond stress for plain bar and deformed bar in WSD and USD method. 6.4. Determine the anchorage length of reinforcement in RCC beam. 6.5. Explain the necessity of standard hooks of reinforcement in RCC beam.	3	8
7.	FLEXURE FORMULA AND DESIGN OF RCC RECTANGULAR BEAM IN WSD METHOD 7.1. State the assumptions used in developing the flexure formula. 7.2. Explain the stress diagram of a loaded RCC beam. 7.3. Mention the notations used in flexure formula in WSD method. 7.4. Derive the flexure formula for RCC beam in WSD method. 7.5. Outline the design steps of RCC rectangular beam in WSD method. 7.6. Determine the minimum spacing of reinforcing bars in RCC beam. 7.7. Design a simply supported RCC rectangular beam in WSD method. 7.8. Design a semi-continuous RCC rectangular beam in WSD method. 7.9. Design a continuous RCC rectangular beam in WSD method.	5	7

8.	DESIGN OF RCC RECTANGULAR BEAM IN USD METHOD 8.1.Explain the stress diagram of loaded beam with showing the actual & equivalent rectangular stress distribution of ultimate load. 8.2.State load and load factors used in USD method. 8.3.Mention the notations used in flexure formula in USD method. 8.4.Express the derivation of the flexure formula in USD method. 8.5.Outline the design steps of RCC rectangular beam in USD method. 8.6.Design a simply supported RCC rectangular beam in USD method. 8.7.Design a semi-continuous RCC rectangular beam in USD method. 8.8.Design a continuous RCC rectangular beam in USD method.	5	7
9.	DESIGN OF RCC CANTILEVER & OVERHANGING RECTANGULAR BEAMS IN WSD METHOD 9.1.Determine the design load, shear force and bending moment of RCC cantilever & overhanging beam. 9.2.Design a cantilever RCC rectangular beam. 9.3.Design an overhanging RCC rectangular beam. 9.4. Describe curtailment technique of reinforcement in cantilever RCC beam.	2	4
10.	T-BEAM AND DESIGN OF RCC T-BEAMS 10.1 Define T-beam and rectangular beam. 10.2 List the different parts of a typical T-beam. 10.3 Determine the width of flange of T-beam considering span length and slab thickness. 10.4 State the ratio of width of web to the depth of web for T-beams. 10.5 Distinguish between RCC rectangular beam and T-beam. 10.6 Determine the depth and width of a simply supported T-beam in respect to shear force. 10.7 Outline the design steps of RCC T-beam in WSD method. 10.8 Design a simply supported RCC T-beam in WSD method. 10.9 Design a semi-continuous RCC T-beam in WSD method. 10.10 Design a continuous RCC T-beam in WSD method.	3	6
11.	DESIGN OF RCC BEAM WITH COMPRESSION REINFORCEMENT AND RCC LINTEL OVER DOORS & WINDOWS. 11.1. State the meaning of double reinforced beam. 11.2. Differentiate between RCC single and double reinforced beam. 11.3. Outline the design steps of double reinforced beam. 11.4. Design a simply supported double reinforced beam. 11.5. Design a semi-continuous double reinforced beam. 11.6. Design a continuous double reinforced beam. 11.7. Determine the area of wall to be considered the design load for RCC lintels.	3	6

	11.8. Outline the design steps of RCC lintel. 11.9. Design a RCC lintel over doors and windows.		
	Total	32	60

DETAILED SYLLABUS (PRACTICAL)

Sl.	Experiment name with procedure	Class (3 Period)	Continuous Marks
1.	PERFORM COMPRESSION TEST OF CONCRETE CYLINDER FOR PARTICULAR PROPORTION. 1.1 Select tools and raw materials. 1.2 Mix cement, sand and stone chips as per ratio with proper Water-cement ratio. 1.3 Prepare the concrete cylinder with concrete according to standard procedure. 1.4 Perform curing. 1.5 Perform compression test using UTM / compression test Machine. 1.6 Calculate compressive strength. 1.7 Maintain the record of performed job.	1	2
2.	PERFORM COMPRESSION TEST OF CONCRETE CUBE FOR PARTICULAR PROPORTION 2.1. Select tools and raw materials. 2.2. Mix cement, sand and stone chips as per ratio with proper water-cement ratio. 2.3. Prepare the concrete cube with concrete according to standard procedure. 2.4. Perform curing. 2.5. Perform compression test using UTM / compression test machine. 2.6. Calculate compressive strength. 2.7. Maintain the record of performed job.	2	3
3.	DETERMINE TENSILE STRENGTH OF MILD STEEL FOR PLAIN BAR IN DIFFERENT DIAMETERS 3.1 Select tools and raw materials. 3.2 Prepare mild steel for plain bar of different diameters according to standard procedure. 3.3 Perform tensile strength test according to standard Procedure using Universal Testing Machine (UTM). 3.4 Calculate tensile strength. 3.5 Maintain the record of performed job.	2	3

4.	DETERMINE TENSILE STRENGTH OF MILD STEEL FOR DEFORMED BAR OF DIFFERENT DIAMETERS 4.1 Select tools and raw materials. 4.2 Prepare mild steel for deformed bar of different diameters according to standard procedure. 4.3 Perform tensile strength test according to standard procedure using Universal Testing Machine (UTM). 4.4 Calculate tensile strength. 4.5 Maintain the record of performed job.	1	2
5.	PREPARE A MODEL OF SIMPLY SUPPORTED RCC RECTANGULAR BEAM AS PER DRAWING 5.1 Collect tools and raw materials. 5.2 Prepare a model of simply supported RCC rectangular beam as per drawing. 5.3 Check the accuracy of the work. 5.4 Maintain the model for demonstration.	2	3
6.	MAKE A MODEL OF SEMI-CONTINUOUS RCC RECTANGULAR BEAM AS PER DRAWING 6.1 Collect tools and raw materials. 6.2 Prepare a model of semi-continuous RCC rectangular beam as per drawing. 6.3 Check the accuracy of the work. 6.4 Maintain the model for demonstration.	2	3
7.	PREPARE A MODEL OF CONTINUOUS RCC RECTANGULAR BEAM AS PER DRAWING 7.1 Collect tools and raw materials. 7.2 Prepare a model of continuous RCC rectangular beam as per drawing. 7.3 Check the accuracy of the work. 7.4 Maintain the model for demonstration.	2	3
8.	CREATE A MODEL OF DOUBLE REINFORCED SIMPLY SUPPORTED RECTANGULAR BEAM AS PER DRAWING 8.1 Collect tools and raw materials. 8.2 Prepare a model of double reinforced simply supported rectangular beam as per drawing. 8.3 Check the accuracy of the work. 8.4 Maintain the model for demonstration.	2	3
9.	PREPARE A MODEL OF RCC LINTEL WITH SUNSHADE AS PER DRAWING 9.1 Collect tools and raw materials. 9.2 Prepare a model of RCC lintel with sunshade as per drawing. 9.3 Check the accuracy of the work. 9.4 Maintain the model for demonstration.	2	3
	Total	16	25

NECESSARY RESOURCES (TOOLS, EQUIPMENT'S AND MACHINERY):

SI	Item Name	Quantity
1.	LIST OF HAND TOOLS AND RAW MATERIALS: HAND TOOLS Hammer, Trowel, Shovel, Temping Rod, Bucket, Hand Gloves, Iron pan, Measuring box, Measuring tape, Rubber Boots, Safety glasses, Safety Helmet, Spade, Hack Saw, Slide Calipers, and Hand Rod Bender. RAW MATERIALS Plain & Deformed Bar, Cement, Sand, Stone Chips, Water, Galvanized Iron (G I) wire.	25
2.	LIST OF EQUIPMENT AND MACHINERY: Rod Shear Machine/Grinding Machine, Rod Bending Machine, GI wire binding machine. Universal Testing Machine(UTM), Compression Testing Machine	1

RECOMMENDED BOOKS:

SI	Book Name	Writer Name	Publisher Name & Edition
01.	Simplified Design of Reinforced Concrete	-by H Parker	
02.	R C C Design	by Abul Faraz Khan	
03.	Design of Concrete Structures	-by G Winter, L C Urquhart, C E O'Rourke, A H Nilson	
04.	Treasure of R C C Designs	-by Sushil Kumar	

WEBSITE REFERENCES:

SI	Web Link	Remarks
01.	https://www.youtube.com/watch?v=Nk6qq357ZSQ&t=2802s	Use this URL
02.	https://www.google.com/search?q=beam+design+calculation+youtube+video	Use this URL
03.	https://www.google.com/search?q=beam+design+calculation&oq	Use this URL
04	https://www.google.com/search?q=beam+design+calculation&oq=&gs_lcrp=EgZjaHJvbWUqCQgCECMYJxjqAjlJCAAQlxgnGOoCMgkIARAJGCcY6glyCQgCECMYJxjqAjlJCAMQlxgnGOoCMgkIBBAJGCcY6glyCQgFECMYJxjqAjlJCAYQlxgnGOoCMgkIBxBFGDsYwgPSAQwxODM1MjgzMmowajeoAgiwAgE&sourceid=chrome&ie=UTF-8#vhid=D3a966VWEccG7M&vssid=l	Use this URL