Ref No:

SRI KRISHNA INSTITUTE OF TECHNOLOGY , BANGALORE-90

COURSE PLAN

Academic Year 2019-20

Program:	B E – CIVIL ENGINEERING
Semester :	5
Course Code:	17CV51
Course Title:	Design Of RC Structural Elements
Credit / L-T-P:	4 / 4-0-0
Total Contact Hours:	50
Course Plan Author:	VINOD M

Academic Evaluation and Monitoring Cell

#29, Hesaragatta Main Road, Chimney Hills
Chikkabanavara Post Bangalore-560090
PH-080-23821488/23821315
www.Skit.org, Email: skitprinci1@gmail.com

Table of Contents

Note : Remove “Table of Content” before including in CP Book
Each Course Plan shall be printed and made into a book with cover page
Blooms Level in all sections match with A.2, only if you plan to teach / learn at higher levels

A. COURSE INFORMATION

1. Course Overview

Degree:	BE	Program:	CIVIL ENGINEERING
Semester:	5	Academic Year:	2019-20
Course Title:	Design Of RC Structural Elements	Course Code:	15CV51
Credit / L-T-P:	4 / 4-0-0	SEE Duration:	180 Minutes
Total Contact Hours:	50 Hours	SEE Marks:	60 Marks
CIA Marks:	40 Marks	Assignment	1 / Module
Course Plan Author:	VINOD M	Sign ..	
Checked By:	MOHAN K T	Sign ..	
CO Targets	65	SEE Target:	60

Note: Define CIA and SEE % targets based on previous performance.

2. Course Content

Content / Syllabus of the course as prescribed by University or designed by institute. Identify 2 concepts per module as in G.

Module	Content	Teaching Hours	Identified Module Concepts	Blooms Learning Levels
1	Introduction to working stress method, Difference between Working stress and Limit State Method of design, Modular Ratio and Factor of Safety. Philosophy and principle of limit state design with assumptions. Partial Safety factors, Characteristic load and strength. Stress block parameters, concept of balanced section, under reinforced and over reinforced section. Limiting deflection, short term deflection, long term deflection, Calculation of deflection of singly reinforced beam only. Cracking in reinforced concrete members, calculation of crack width of singly reinforced beam. Side face reinforcement, slender limits of beams for stability.	10	Acceptable Limits of Safety and Serviceablity Requirments before failure, Economy, Life of Span	L3 Apply
2	Analysis of singly reinforced, doubly reinforced and flanged beams for flexure and shear	10	Beams, BM, SF	L4 Analysis
3	Design of singly and doubly reinforced beams, Design of flanged beams for shear, design for combined bending and torsion as per IS-456	10	Beams, BM, SF	L5 Design
4	Introduction to one way and two way slabs, Design of cantilever, simply supported and one way continuous slab. Design of two way slabs for different boundary conditions. Design of dog legged and open well staircases. Importance of bond, anchorage length and lap length.	10	Slabs, Staircase BM, SF	L5 Design
5	Analysis and design of short axially loaded RC column. Design of columns with uniaxial and biaxial moments, Design concepts of the footings. Design of Rectangular and square column footings with axial load and also for axial load & moment	10	Columns, Footing BM, SF	L5 Design
-	**Total**	**50**	-	-

3. Course Material

Books & other material as recommended by university (A, B) and additional resources used by course teacher (C).

1. Understanding: Concept simulation / video ; one per concept ; to understand the concepts ; 15 – 30 minutes
2. Design: Simulation and design tools used – software tools used ; Free / open source
3. Research: Recent developments on the concepts – publications in journals; conferences etc.

Modules	Details	Chapters in book	Availability
A	**Text books (Title, Authors, Edition, Publisher, Year.)**	**-**	**-**
1,2,3,4,5	B.S. Basavarajaiah, P.Mahadevappa "Strength of Materials" in SI Units, University Press (India) Pvt. Ltd., 3rd Edition, 2010	1,2,3,4,5	In Lib / In Dept
1,2,3,4,5	Ferdinand P. Beer, E. Russell Johnston and Jr.John T. DeWolf "Mechanics of Materials", Tata McGraw-Hill, Third Edition, SI Units	1,2,3,4,5	In Lib/ In dept
B	**Reference books (Title, Authors, Edition, Publisher, Year.)**	**-**	**-**
	D.H. Young, S.P. Timoshenko " Elements of Strength of Materials" East West Press Pvt. Ltd., 5th Edition (Reprint 2014).		In Lib/ In dep
	R K Bansal, "A Textbook of Strength of Materials", 4th Edition, Laxmi Publications, 2010		In Lib/ In dept
	S.S. Rattan " Strength of Materials" McGraw Hill Education (India) Pvt. Ltd., 2 Edition (Sixth reprint 2013).		In Lib/ In dept
	Vazirani, V N, Ratwani M M. and S K Duggal "Analysis of Structures Vol. I", 17nd thEdition, Khanna Publishers, New Delhi.		
C	**Concept Videos or Simulation for Understanding**	**-**	**-**
	• http://nptel.ac.in/courses.php?disciplineID=111 • http://wwww.khanacademy.org/ • http://www.class-central.com/subject/strength		
E	**Recent Developments for Research**	**-**	**-**
F	**Others (Web, Video, Simulation, Notes etc.)**	**-**	**-**

4. Course Prerequisites

Refer to GL01. If prerequisites are not taught earlier, GAP in curriculum needs to be addressed. Include in Remarks and implement in B.5.
Students must have learnt the following Courses / Topics with described Content . . .

Modules	Course Code	Course Name	Topic / Description	Sem	Remarks	Blooms Level

5. Content for Placement, Profession, HE and GATE

The content is not included in this course, but required to meet industry & profession requirements and help students for Placement, GATE, Higher Education, Entrepreneurship, etc. Identifying Area / Content requires experts consultation in the area.
Topics included are like, a. Advanced Topics, b. Recent Developments, c. Certificate Courses, d. Course Projects, e. New Software Tools, f. GATE Topics, g. NPTEL Videos, h. Swayam videos etc.

Modules	Topic / Description	Area	Remarks	Blooms Level
1				
3				
3				
5				
-				
-				

B. OBE PARAMETERS

1. Course Outcomes

Expected learning outcomes of the course, which will be mapped to POs. Identify a max of 2 Concepts per Module. Write 1 CO per Concept.

Modules	Course Code.#	Course Outcome **At the end of the course, student should be able to . . .**	Teach. Hours	Concept	Instr Method	Assessment Method	Blooms' Level
1	17CV51.1	Students should be able to understand the design philosophy and principles and apply the different loads on the structure by using limit state method as per IS 456-2000	12	Acceptable Limits of Safety and Serviceablity Requirments before failure, Economy, Life of Span	BB	IA Assignment,Unit Test	L3 Apply
1	17CV51.2	Students should be able to analyzing the Beams by using limit state method as per IS 456-2000	08	Beams, BM, SF	BB	IA Assignment,Unit Test	L4 Analysis
2	17CV51.3	Students should be able to Design the Beams by using limit state method as per IS 456-2000	10	Beams, BM, SF	BB	IA Assignment,Unit Test	L5 Design
2	17CV51.4	Students should be able to Design the Slabs by using limit state method as per IS 456-2000	05	Slabs, BM, SF	BB	IA Assignment,Unit Test	L5 Design
3	17CV51.5	Students should be able to Design the Staircase by using limit state method as per IS 456-2000	05	Staircase, BM, SF	BB	IA Assignment,Unit Test	L5 Design
3	17CV51.6	Students should be able to Design the Columns by using limit state method as per IS 456-2000	05	Columns, BM, SF	BB	IA Assignment,Unit Test	L5 Design
4	17CV51.7	Students should be able to Design the Footings by using limit state method as per IS 456-2000	05	Footings, BM, SF	BB	IA Assignment,Unit Test	L5 Design
-	**-**	**Total**	**10**	**-**	**-**	**-**	**L2-L4**

2. Course Applications

Write 1 or 2 applications per CO.
Students should be able to employ / apply the course learnings to . . .

Modules	Application Area Compiled from Module Applications.	CO	Level
1	Select the suitable loads on the different Reinforced Cement Concrete structural Elements on the buildings	CO1	L3
2	Beams are used in Residential, Commercial, Educational and Office buildings	CO2	L4
3	Beams are used in Residential, Commercial, Educational and Office buildings	CO3	L5
4	Slabs are used in Residential, Commercial, Educational and Office buildings	CO4	L5
5	Staircase are used in Residential, Commercial, Educational and Office buildings	CO5	L5
6	Columns are used in Residential, Commercial, Educational and Office buildings	CO6	L5

7	Footings are used in Residential, Commercial, Educational and Office buildings	CO7	L5

3. Mapping And Justification

CO – PO Mapping with mapping Level along with justification for each CO-PO pair.
To attain competency required (as defined in POs) in a specified area and the knowledge & ability required to accomplish it.

Modules	Mapping		Mapping Level	Justification for each CO-PO pair	Level
-	**CO**	**PO**	-	**'Area': 'Competency' and 'Knowledge' for specified 'Accomplishment'**	-
1	CO1	PO1	L2	Applies knowledge of mathematics, science & fundamentals Engineering specialization to the solution of complex engineering problems. Different loads and loads combinations considered in the structures based on limit state method of design	L2
1	CO1	PO2		Engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences. Identify, formulate, review research literature and analyze complex.	L2
1	CO1	PO3	L2	Design solutions for complex engineering problems and design system components. processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental consideration	L2
2	CO2	PO1	L2	Applies knowledge of mathematics, science & fundamentals Engineering specialization to the solution of complex engineering problems.	L3
2	CO2	PO2		Engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences. Identify, formulate, review research literature and analyze complex. Analysis of the beam under the applied loads, BM, SF	L3
2	CO2	PO3	L5	Design solutions for complex engineering problems and design system components. processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental consideration	L4
3	CO3	PO1	L5	Applies knowledge of mathematics, science & fundamentals Engineering specialization to the solution of complex engineering problems.	L2
3	CO3	PO2		Engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences. Identify, formulate, review research literature and analyze complex.	L2
3	CO3	PO3	L5	Design solutions for complex engineering problems and design system components. processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental consideration Design the beam under the applied loads, BM, SF	L3
4	CO4	PO1	L5	Applies knowledge of mathematics, science & fundamentals Engineering specialization to the solution of complex engineering problems.	L4
4	CO4	PO2		Engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences. Identify, formulate, review research literature and analyze complex.	L2
4	CO4	PO3	L5	Design solutions for complex engineering problems and design system components. processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental consideration Design the slabs under the applied loads, BM, SF	L2
5	CO5	PO1	L5	Applies knowledge of mathematics, science & fundamentals Engineering specialization to the solution of complex engineering problems.	L2
5	CO5	PO2		Engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences. Identify, formulate, review research literature and analyze complex.	L4
5	CO5	PO3	L5	Design solutions for complex engineering problems and design system components. processes that meet the specified needs with appropriate	L3

				consideration for the public health and safety, and the cultural, societal, and environmental consideration Design the staircase under the applied loads, BM, SF	
6	CO6	PO1	L5	Applies knowledge of mathematics, science & fundamentals Engineering specialization to the solution of complex engineering problems.	L4
6	CO6	PO2		Engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences. Identify, formulate, review research literature and analyze complex.	L3
6	CO6	PO3	L5	Design solutions for complex engineering problems and design system components. processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental consideration Design the columns under the applied loads, BM, SF	L4
7	CO7	PO1	L5	Applies knowledge of mathematics, science & fundamentals Engineering specialization to the solution of complex engineering problems.	L3
7	CO7	PO2		Engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences. Identify, formulate, review research literature and analyze complex.	L3
7	CO7	PO3		Design solutions for complex engineering problems and design system components. processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental consideration Design the footings under the applied loads, BM, SF	

4. Articulation Matrix

CO – PO Mapping with mapping level for each CO-PO pair, with course average attainment.

-	-	Course Outcomes	Program Outcomes														-
Modules	CO.#	**At the end of the course student should be able to . . .**	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	Level
1	15CV51.1	Student should be able to understand the basics of surveying.	3	3	3	-	-	-	-	-	-	-	-	-	L2			L3
1	15CV51.2	Student should be able to learn the techniques of survey instruments.	3	3	3	-	-	-	-	-	-	-	-	-	L3			L4
2	15CV51.3	Student should be able to determine the measurement of horizontal distances.	3	3	3	-	-	-	-	-	-	-	-	-	L3			L5
2	15CV51.4	Student should be able to understand the practical applications of theodolite	3	3	3	-	-	-	-	-	-	-	-	-	L2			L5
3	15CV51.5	Student should be able to understand the techniques of compass survey	3	3	3	-	-	-	-	-	-	-	-	-	L3			L5
3	15CV51.6	Student should be able to understand the methods of tacheometry survey	3	3	3	-	-	-	-	-	-	-	-	-	L3			L5
4	15CV51.7	Student should be able to Analise the different methods of leveling using dumpy level	3	3	3	-	-	-	-	-	-	-	-	-	L5			L5
5	15CV51.1	Student should be able to Analise the detailed calculations of leveling by using dumpy level.	3	3	3	-	-	-	-	-	-	-	-	-				L3
5	15CV51.2	Student should be able to determine the areas and volume by using arithmetic equations.	3	3	3	-	-	-	-	-	-	-	-	-				L4
5	15CV51.3	Student should be able to understand the spatial data and	3	3	3	-	-	-	-	-	-	-	-	-	L5			L5

		uses of contours.																
-	15CV51.4	**Average attainment (1, 2, or 3)**	3	3	3	-	-	-	-	-	-	-	-	-				-
-	*PO, PSO*	*1.Engineering Knowledge; 2.Problem Analysis; 3.Design / Development of Solutions; 4.Conduct Investigations of Complex Problems; 5.Modern Tool Usage; 6.The Engineer and Society; 7.Environment and Sustainability; 8.Ethics; 9.Individual and Teamwork; 10.Communication; 11.Project Management and Finance; 12.Life-long Learning; S1.Software Engineering; S2.Data Base Management; S3.Web Design*																

5. Curricular Gap and Content

Topics & contents not covered (from A.4), but essential for the course to address POs and PSOs.

Modules	Gap Topic	Actions Planned	Schedule Planned	Resources Person	PO Mapping
1					
2					
3					
4					
5					

6. Content Beyond Syllabus

Topics & contents required (from A.5) not addressed, but help students for Placement, GATE, Higher Education, Entrepreneurship, etc.

Modules	Gap Topic	Area	Actions Planned	Schedule Planned	Resources Person	PO Mapping

C. COURSE ASSESSMENT

1. Course Coverage

Assessment of learning outcomes for Internal and end semester evaluation. Distinct assignment for each student. 1 Assignment per chapter per student. 1 seminar per test per student.

Modules	Title	Teaching Hours	No. of question in Exam						CO	Levels
			CIA-1	CIA-2	CIA-3	Asg	Extra Asg	SEE		
1	Introduction to Limit State Design and Serviceability	12	2	-	-	1	1	2	CO1	L3
2	Limit State Analysis of Beams	08	2	-	-	1	1	2	CO2	L4
3	Limit State Design of Beams	10	-	2	-	1	1	2	CO3	L5
4	Limit State Design of Slabs and Stairs	10	-	2	-	1	1	2	CO4 CO5	L5
5	Limit State Deign of Columns and Footings	10	-	-	4	1	1	2	CO6 CO7	L5
-	**Total**	**50**	**4**	**4**	**4**	**5**	**5**	**10**	**-**	**-**

2. Continuous Internal Assessment (CIA)

Assessment of learning outcomes for Internal exams. Blooms Level in last column shall match with A.2.

Evaluation	Weightage in Marks	CO	Levels	Evaluation
CIA Exam – 1	30	CO1 , CO2	L3, L4	CIA Exam – 1

CIA Exam – 2	30	CO3,CO4,CO5	L5	CIA Exam – 2
CIA Exam – 3	30	CO6,CO7	L5	CIA Exam – 3
Assignment - 1	05	CO1 , CO2	L3, L4	Assignment - 1
Assignment - 2	05	CO3,CO4,CO5	L5	Assignment - 2
Assignment - 3	05	CO6,CO7	L5	Assignment - 3
Other Activities – define – Slip test		CO1 to Co9	Other Activities – define – Slip test	
Final CIA Marks	**40**	**-**	**-**	

D1. TEACHING PLAN - 1

Module - 1

Title:	Introduction to Limit State Design and Serviceability	Appr Time:	12Hrs
a	***Course Outcomes***	-	**Blooms**
-	The student should be able to:	-	**Level**
1	Students should be able to understand the design philosophy and principles and apply the different loads on the structure by using limit state method as per IS 456-2000	CO1	L3
b	***Course Schedule***	-	-
Class No	**Module Content Covered**	**CO**	**Level**
1	Introduction to RCC	CO1	L1
2	Introduction to working stress method and Limit State Method of design	CO1	L2
3	Difference between Working stress and Limit State Method of design	CO1	L3
4	Modular Ratio and Factor of Safety.	CO1	L3
5	Philosophy and principle of limit state design with assumptions. Partial Safety factors and Characteristic load and strength	CO1	L3
6	Stress block parameters, concept of balanced section, under reinforced and over reinforced section.	CO1	L3
7	Limiting deflection, short term deflection, long term deflection	CO1	L3
8	Calculation of deflection of singly reinforced beam	CO1	L3
9	Cracking in reinforced concrete members	CO1	L3
10	calculation of crack width of singly reinforced beam	CO1	L3
11	Side face reinforcement	CO1	L3
12	slender limits of beams for stability	CO1	L3
c	**Application Areas**	**CO**	**Level**
1	Select the suitable loads on the different structural elements on the buildings	CO1	L3
d	**Review Questions**	-	-
1	Explain working stress method, limit state method of RCC design	CO1	L2
2	Distinguish between balanced, under reinforced and over reinforced section of RCC design.	CO1	L3
3	Derive the expression for depth of NA y — ▫ 0.42x u , in the case of rectangular RCC beam design.	CO1	L3
4	Obtain an expression for limiting percentage of steel for a rectangular RCC section with M20 concrete and Fe500 steel.	CO1	L3
5	Enlist the reasons for adopting partial safety factors for loads and material strength.	CO1	L3
6	Briefly explain singly and doubly reinforced RCC beam. Enlist the situations where doubly reinforced RCC beam adaptation required.	CO1	L3

7	Explain different limit states to be considered in the design of RCC beam and derive the expression for stress block parameter.	C01	L3
8	Explain short term and long term deflections.	C01	L3
9	Dfferentiate between working stress method and limit state method of RCC design.	C01	L3

Module – 2

Title:	Limit State Analysis of Beams	Appr Time:	10 Hrs
a	***Course Outcomes***	08	**Blooms**
-	The student should be able to:	-	**Level**
1	Students should be able to analyzing the Beams by using limit state method as per IS 456-2000	CO2	L4
b	***Course Schedule***	-	-
Class No	**Module Content Covered**	**CO**	**Level**
13	Introduction to singly reinforced, doubly reinforced and flanged beams	CO2	L2
14	Analysis of singly reinforced beams for flexure and shear	CO2	L4
15	Analysis of singly reinforced beams for flexure and shear	CO2	L4
16	Analysis of doubly reinforced beams for flexure and shear	CO2	L4
17	Analysis of doubly reinforced beams for flexure and shear	CO2	L4
18	Analysis of flanged beams for flexure and shear	CO2	L4
19	Analysis of flanged beams for flexure and shear	CO2	L4
20	Analysis of flanged beams for flexure and shear	CO2	L4
		CO2	L4
c	**Application Areas**	**CO**	**Level**
1	Beams are used in Residential, Commercial, Educational and Office buildings	CO2	L4
d	**Review Questions**	-	-
12	A singly RCC beam of dimensions 230x500 mm overall, simply supported over a span of 5 m (effective). The beam consists of 4 # 16mm diameter bars in tension zone use M20 and Fe-415 grade. Calculate the UDL the beam can carry. Take clear cover 25 mm.	CO2	L4
13	Determine the moment of resistance of the T-beam having following section properties: Effective width of flange = 1100 mm Thickness of flange= 110 mm Width of rib = 250 mm Effective depth = 450 mm Area of steel = 5 # 20 mm diameter. Use M-25 grade concrete and Fe-415 grade steel.	CO2	L4
14	simply supported beam of rectangular section spanning over 6m has a width of 300mm and overall depth 600mm. The beam is reinforced with 4-25mm bars on tension side. The beam is subjected to moment of 160kNm. Check the beam for serviceability limit state of cracking. Assume M25 and Fe415.	CO2	L4
15	simply supported beam of rectangular section 250mm wide by 450mm overall depth is used over an effective span of 4m. the beam is reinforced with 3 bars of 20mm. Two hanger bars of 10mm diameter are provided. The self weight of the beam is 4kN/m and service loadis 10kN/m. Assume M20, Fe415. Compute: i) Short term deflection; ii) Long term deflection.	CO2	L4
16	Define simply and doubly reinforced beams, list the situations when they are adopted.	CO2	L4
17	Determine moment of resistance of T-beam for the following data: Width of the flange = 2500mm, effective depth = 800mm, width of the web =	CO2	L4

	300mm, number of bars = 8 of 25mm diameter, depth of flange = 150mm. Assume M20 and Fe415 steel.		
18	simply reinforced concrete beam 250 x 450mm deep upto the centre of reinforcement is reinforced with 3-16mm bars with an effective cover of 50mm. The effective span of the beam is 6m. Determine the central point load that the beam can carry excluding self weight. Assume M7.0 and Fe415.	CO2	L4
19	A doubly reinforced beam is 250mm wide and 450mm deep to the centre of tensile reinforcement. It is reinforced with 2-16 compression reinforcement and 4-25 as tensile reinforcement. Calculate the ultimate moment of resistance of the beam. Assume M15 and Fe250 steel	CO2	L4
e	**Experiences**	-	-
1		CO1	L2
2			

E1. CIA EXAM – 1

a. Model Question Paper - 1

Crs Code:	15CV51	Sem:	V	Marks:	40	Time:	75 minutes
Course:	Design Of RC Structural Elements						

-	-	**Note: Answer any ONE FULL question from each Module**	**Marks**	**CO**	**Level**
1	a	Define Limit state of collapse Limit state of serviceability Characteristic strength Characteristic load Partial safety factor	05	CO1	L1, L2
	b	A Rectangular beam section 250mm wide and 500mm deep up to the centre of tension steel Consists of 4no of 22mm diameter bars. Find the position of netural axis, lever arm, compressive force, tensile force and the safe moment of resistance . if concrete is M20 and steel is Fe415Grade. Adopt limit state method and also find what concentrated load it can carry of mid span of this beam have an effective span of 6mts.	10	CO1	L2, L3
2	a	Derive the expression for stress block parameters for compressive force and tensile force and locate its depth from top.	05	CO1	L1, L2
	b	Find the concentrated load on the beam at free end in addition to its self weight on a effective cantilever span of 3mts. The beam has a width 230mm & effective depth of 569mm with 4nos of 12mm dia bars. Used M20 grade of concrete & Fe415 steel. Use limit state method.	10	CO1	L2, L3
3	a	Find moment of resistance of a doubly reinforced rectangular section 230mm wide and 450mm effective depth 2nos of 20mm dia bars are placed on compression side with an effective cover of 40mm. Tension steel consists of 3nos of 25mm dia bars. Assme M20 grade of concrete and Fe415 steel.	06	CO2	L2, L4
	b	An Isolated T- beam has a flange of 1200mm and 100mm width of rib is 250mm & effective depth is 600mm. Tension steel is 2000mm^2. Use M20 grade of concrete and Fe415 steel. Compute the ultimate moment of resistance , span of simply supported beam is 8m. Also calculated the safe superimposed load, the T- beam can carry effective cover is 50mm.	09	CO2	L2, L4
4	a	A doubly reinforced beam is 300mm and 700mm overall dimensions. Ast= 8nos of 25dia bars (two layers) and Asc= 4nos of 25dia bars. Effective cover to tension steel and compression steel is 75mm & 50mm respectively. Use M25grade of concrete and Fe415 steel. Compute ultimate moment. Also calculated the safe working load if c/s is used as a cantilever of 4m span. Compute limiting moment also.	06	CO2	L2, L4

	b	Determine ultimate moment for a flanged section , centre to centre distance b/w beams is 3500mmc/c, thickness of flange is 125mm, width of rib is 300mm, depth of rib is 600mm, effective cover is 75mm. Ast= 8nos of 25dia bars (two layers) Use M25 grade of concrete and Fe500 steel. If the above c/s is used over a clear span of 9m supported by a wall of 250mm thickness. Calculate the safe super imposed Load on the beam.	09	CO2	L2, L4
-	-	**Note: Answer any ONE FULL question from each Module**	**Marks**	**CO**	**Level**
1	a	Define Limit state of collapse Limit state of serviceability Characteristic strength Characteristic load Partial safety factor	05	CO1	L1, L2
	b	A Rectangular beam section 250mm wide and 500mm deep up to the centre of tension steel Consists of 4no of 22mm diameter bars. Find the position of netural axis, lever arm, compressive force, tensile force and the safe moment of resistance . if concrete is M20 and steel is Fe415Grade. Adopt limit state method and also find what concentrated load it can carry of mid span of this beam have an effective span of 6mts.	10	CO1	L2, L3

b. Assignment -1

Note: A distinct assignment to be assigned to each student.

Model Assignment Questions							
Crs Code:	15CV51	Sem:	V	Marks:	10	Time:	90 – 120 minutes
Course:	Design Of RC Structural Elements						
Note: Each student to answer 2-3 assignments. Each assignment carries equal mark.							

SNo	USN	Assignment Description	Marks	CO	Level
1		Explain working stress method, limit state method of RCC design	5	CO1	L2
2		Distinguish between balanced, under reinforced and over reinforced section of RCC design.	5	CO2	L3
3		Derive the expression for depth of NA y — = 0.42x u , in the case of rectangular RCC beam design.		CO2	L3
4		Obtain an expression for limiting percentage of steel for a rectangular RCC section with M20 concrete and Fe500 steel.	5	CO1	L3
5		Enlist the reasons for adopting partial safety factors for loads and material strength.	5	CO1	L2
6		Briefly explain singly and doubly reinforced RCC beam. Enlist the situations where doubly reinforced RCC beam adaptation required.	5	CO2	L3
7		Explain different limit states to be considered in the design of RCC beam and derive the expression for stress block parameter.	5	CO2	L3
8		Explain short term and long term deflections.	5	CO1	L3
9		Dfferentiate between working stress method and limit state method of RCC design.	5	CO1	L2
10		Define: i)Partial safety factor for load and materials. ii)Characteristic load. iii) Characteristic strength.	5	CO2	L3
11		Derive the expression for stress block parameter for compresive force ci tens i le force Tu and locate the depth of neutral axis y = 0.42 xu from top of the beam	5	CO2	L3
12		Explain briefly under reinforced, over reinforced and balanced sections with sketch.	5	CO1	L3

13		Explain briefly under reinforced, over reinforced and balanced sections with sketch.	5	CO1	L2
14		A singly RCC beam of dimensions 230x500 mm overall, simply supported over a span of 5 m (effective). The beam consists of 4 # 16mm diameter bars in tension zone use M20 and Fe-415 grade. Calculate the UDL the beam can carry. Take clear cover 25 mm.	5	CO2	L3
15		Determine the moment of resistance of the T-beam having following section properties: Effective width of flange = 1100 mm Thickness of flange = 110 mm Width of rib = 250 mm Effective depth = 450 mm Area of steel = 5 # 20 mm diameter. Use M-25 grade concrete and Fe-415 grade steel.	5	CO2	L3
16		simply supported beam of rectangular section spanning over 6m has a width of 300mm and overall depth 600mm. The beam is reinforced with 4-25mm bars on tension side. The beam is subjected to moment of 160kNm. Check the beam for serviceability limit state of cracking. Assume M25 and Fe415.	5	CO1	L3
17		simply supported beam of rectangular section 250mm wide by 450mm overall depth is used over an effective span of 4m. the beam is reinforced with 3 bars of 20mm. Two hanger bars of 10mm diameter are provided. The self weight of the beam is 4kN/m and service load is 10kN/m. Assume M20, Fe415. Compute: i) Short term deflection; ii) Long term deflection.	5	CO1	L2
18		Define simply and doubly reinforced beams, list the situations when they are adopted.	5	CO2	L3
19		Determine moment of resistance of T-beam for the following data: Width of the flange = 2500mm, effective depth = 800mm, width of the web = 300mm, number of bars = 8 of 25mm diameter, depth of flange = 150mm. Assume M20 and Fe415 steel.	5	CO2	L3
20		simply reinforced concrete beam 250 x 450mm deep upto the centre of reinforcement is reinforced with 3-16mm bars with an effective cover of 50mm. The effective span of the beam is 6m. Determine the central point load that the beam can carry excluding self weight. Assume M7.0 and Fe415.	5	CO2	L3
21		A doubly reinforced beam is 250mm wide and 450mm deep to the centre of tensile reinforcement. It is reinforced with 2-16 compression reinforcement and 4-25 as tensile reinforcement. Calculate the ultimate moment of resistance of the beam. Assume M15 and Fe250 steel	5	CO2	L3
22					
23					
24					
25					
26					
27					

D2. TEACHING PLAN - 2

Module – 3

Title:	Limit State Design of Beams	Appr Time:	10Hrs
a	***Course Outcomes***	-	**Blooms**
-	The student should be able to:	-	**Level**

1	Students should be able to Design the Beams by using limit state method as per IS 456-2000	CO3	L5
b	***Course Schedule***		
Class No	**Module Content Covered**	**CO**	**Level**
1	Introduction to singly reinforced,	CO3	L5
2	Design of singly reinforced beams for shear	CO3	L5
3	Design of singly reinforced beams for shear	CO3	L5
4	Introduction to doubly reinforced beams	CO3	L5
5	Design of doubly reinforced beams for shear	CO3	L5
6	Design of doubly reinforced beams for shear	CO3	L5
7	Introduction to flanged beams	CO3	L5
8	Design of flanged reinforced beams for shear	CO3	L5
9	Design of flanged reinforced beams for shear	CO3	L5
10	Design for combined bending and torsion as per IS-456	CO3	L5
c	**Application Areas**	**CO**	**Level**
1	Beams are used in Residential, Commercial, Educational and Office buildings	CO3	L5
d	**Review Questions**	-	-
1	Design a reinforced concrete beam of rectangular section using the following data: Effective span = 5m, width of the beam — 250mm, overall depth = 500mm,	CO3	L5
2	T beam slab floor of an office comprises of a slab 150mm thick resting on beams 3m c/c. The effective span of beam is 8m. Assume live load on the floor as 4kN/m2. Use M20 an dFe415. Design one of the intermediate f beams.	CO3	L5
3	reinforced concrete beam over an effective span 5m carries a load of 8kN/m inclusive of self weight. Assume M20 and Fe415. Design the beam to satisfy the collapse and serviceability limit states	CO3	L5
4	A cantilever beam of 4m span carries a load of 401(N/m. The width of the beam is 230mm. Design the beam for flexure and shear. Sketch the details of reinforcement. Assume M20	CO3	L5
5	A Rectangular beam is to be simply supported on supports of 230 mm width. The clear span of the beam is 6m. The beam is to have width of 300 mm. The super imposed load is 12 IcNini. Using M20 concrete and Fe415 steel. Design the beam. Apply check for deflection.	CO3	L5
6	Design a rectangular beam of section 230 mm x 600 mm of effective span 6m. Effective cover of reinforcement should be kept as 50 mm. Imposed load on the beam is 40 kN/m. Use M20 concrete and Fe 415 steel.	CO3	L5
7	simply supported RCC beam of size 300 x 600 mm carries a udl live load of 250 kN/m and superimposed dead load 12 kN/m over an effective span of 5 m. It is reinforced with 4#16 mm diameter bars. The effective cover is 50 mrn calculate the short term and long term deflection of beam tcs = 0.003 and creep coefficient = 1.6.	CO3	L5
8	A R.C.C beam of rectangular section 300x600mm is reinforced with 4 bars of 20mm dia with an effective cover 50mm, effective span of the beam is 6m. Assuming M20 concrete and Fe250 steel. Determine the central concentrated P, that can be carried by the beam in addition to its self weight.	CO3	L5
9	A rectangular simply supported beam of span 5m is 300mmx650mm in cross section and is reinforced with 3 bars of 20mm on tension side at an effective cover of 50mm. Determine the shaft term defection due to an imposed working load of 201.1\l/m (excluding self wt). Assume grade of concrete M20 and grade of steel Fe415.	CO3	L5
10	A T-Beam slab floor has 125mm thick slab forming part of T — beam which are of 8m clearspan. The end bearing are 450mm thick. Spacing of T-beams is 3.5m. The live load on the floor is 3kN/m2 . Design one of the intermediate	CO3	L5

	beams. Use M20 concrete and Fe415 steel.		
e	**Experiences**		
		-	-

Module – 4

Title:	Limit State Design of Slabs and Stairs	Appr Time:	10Hrs
a	***Course Outcomes***	-	**Blooms**
-	The student should be able to:	-	**Level**
1	Students should be able to Design the Slabs by using limit state method as per IS 456-2000	CO4	L5
2	Students should be able to Design the Staircase by using limit state method as per IS 456-2000	CO5	L5
b	***Course Schedule***		
Class No	**Module Content Covered**	**CO**	**Level**
1	Introduction to one way and two way slabs, Design of one way slab	CO4	L5
2	Design of two way slabs for different boundary conditions	CO4	L5
3	Design of two way slabs for different boundary conditions	CO4	L5
4	Design of two way slabs for different boundary conditions	CO4	L5
5	Design of one way continuous slab	CO4	L5
6	Introduction to dog legged and open well staircases.	CO5	L5
7	Design of dog legged staircases	CO5	L5
8	Design of dog legged staircases	CO5	L5
9	Design of open well staircases	CO5	L5
10	Design of open well staircases	CO5	L5
c	**Application Areas**	**CO**	**Level**
1	Slabs are used in Residential, Commercial, Educational and Office buildings	CO4	L5
2	Staircase are used in Residential, Commercial, Educational and Office buildings	CO5	L5
d	**Review Questions**	-	-
1	Distinguish between one way slab and two way slab.	CO4	L2
2	Explain the importance of bond, anchorage length.		
3	Design a two way slab for an office floor of 3.5 x 4.5m simply supported on all sides with ',corners prevented from lifting. Take live load of 4kN/m2. Assume M20 and Fe415.	CO4	L5
4	What is development length? Write the expression for development length,	CO4	L5
5	Design one of the flights of dog logged stair case spanning between landing beams using the following dataNumber of steps in the flight = 10= 300mm Tread = 150mm Rise Width of landing beams= 300mm Assume M20 and Fe415	CO5	L5
6	Design a continuous RC slab for a class room 7m wide and 14 m long. The roof is to be supported on RCC beams spaced at 3.5 m intervals. The width of beam should be kept 230 mm. The super imposed load is 3 kN/m2 and furnishing load expected is 1 kN/m2. Use M20 concrete and Fe415 steel.	CO4	L5

7	Design a dog legged stairs for an office building in a room measuring 2.8m * 5.8 m clear. Vertical distance between the floor is 3 6in. Width of flight is to be 1.25 m. Allow a live load of 3 kN/m2. Sketch the details of reinforcement. Use M20 concrete and Fe 415 steel. Assume the stairs are supported on 230 mm walls at the end of outer edges of landing slabs	CO5	L5
8	Design a waist 4b type dog legged staircase for an office building given the following data Clear dither** of room = 2.6 m x 4.75 m Height of 000 = 3.2 m Rise = 160mm, Tread = 250 mm Width, of flight = 1.25 m Use M-20 grade concrete and Fe-415 grade steel. Landing slab spans in the same direction of the staircase. Assume wall thickness 230 mm. Take live load = 3 kN/m2 and floor finish = 1 kN/m2.	CO4	L5
9	Design a corner rectangular slab panel of size 4m x 5.5m. Assume that slab supports an imposed load of 3 kN/m2 and floor finish 1 IN/m2. The slab is subjected to moderate exposure condition and is made of M-25 grade concrete, Fe-415 grade steel. Wall support is 230 mm.	CO5	L5
10	Design a slab for a room of clear dimensions 3mx5m supported on wall of 300mm thickness with corners held down. Two adjacent sides of the slab are continuous and other discontinuous. LL on slab is 3kN/m2 . Assume floor finish of lkN/m2 . Use M20 concrete and Fe415 steel. Sketch the details of reinforcement.	CO5	L5
11	Design a dog-legged stairs for an building in a room measuring 3.6x5.2m clear. The vertical distance between the Floors is 3.2m. Consider LL 3kN/m2 . Use M20 concrete and Fe415 grade of steel. Assume stairs are supported on 300mm wall at the outer edges of landing slabs. Consider Rise = 160mm, and Tread ---- 300mm.	CO5	L5
e	**Experiences**	-	-

E2. CIA EXAM – 2

a. Model Question Paper - 2

Crs Code:	15CV51	Sem:	V	Marks:	40	Time:	75 minutes
Course:	Design Of RC Structural Elements						

-	-	**Note: Answer any ONE FULL question from each Module**	**Marks**	**CO**	**Level**
1	a	Define one way slab and Two way slab.	03	CO4	L1
	b	Design a slab over a room of internal dimension 4m×5m supported on 230mm thick brick wall. All the four edges are discontinuous. (All the four corners are prevented from lifting) Use live load 3kn/m^2. Floor finish 1kn/m^2. If concrete is M20 and steel is Fe415. Also sketch the reinforcementdetails.	12	CO4	L5
2	a	Distinguish between one way slab and two way slab with neat sketch.	03	CO4	L1
	b	Design a slab over a room of internal dimension 4.5m×5.5m supported on beams of 230mm width. Two adjacent edges are discontinuous. Use live load on slab 3kn/m^2. Floor finish 1kn/m^2. If concrete is M20 and steel is Fe415. Also sketch the reinforcement details.	12	CO4	L5
3	a	Define Dog-legged staircase and open-well staircase.	03	CO5	L1,

	b	Design a dog legged staircase for a public building. Given the following data. Clear dimensions of staircase hall is 3m×5m, Height between the floors= 3.5m , Rise =150mm, Tread =280mm ,Width of flight = landing width =1.45m Assume the stairs to be supported on 230mm thick masonry wall at the outer edges of the landings, Parallel to rises. Use M 20 concrete & Fe 415 steel. Sketch the details of reinforcement.	12	CO5	L5
4	a	Distinguish between Dog-legged staircase and open-well staircase with neat sketch.	03	CO5	L1
	b	Design an open well staircase for a public building. The staircase room has clear dimensions of 6000×4500mm. The height between the floors is 4500 mm. The stairs are supported at the outer edges of the landing parallel to the rises. Use M 25 concrete & Fe 500 steel. Sketch the details of reinforcement. wall thickness 230mm	12	CO5	L5

b. Assignment – 2

Note: A distinct assignment to be assigned to each student.

Model Assignment Questions							
Crs Code:	15CV51	Sem:	V	Marks:	10	Time:	90 – 120 minutes
Course:	Design Of RC Structural Elements						
Note: Each student to answer 2-3 assignments. Each assignment carries equal mark.							

SNo	USN	Assignment Description	Marks	CO	Level
1		Design a reinforced concrete beam of rectangular section using the following data: Effective span = 5m, width of the beam — 250mm, overall depth = 500mm,	5	CO3	L5
2		T beam slab floor of an office comprises of a slab 150mm thick resting on beams 3m c/c. The effective span of beam is 8m. Assume live load on the floor as 4kN/m2. Use M20 and Fe415. Design one of the intermediate f beams.	5	CO3	L5
3		reinforced concrete beam over an effective span 5m carries a load of 8kN/m inclusive of self weight. Assume M20 and Fe415. Design the beam to satisfy the collapse and serviceability limit states	5	CO3	L5
4		A cantilever beam of 4m span carries a load of 401(N/m. The width of the beam is 230mm. Design the beam for flexure and shear. Sketch the details of reinforcement. Assume M20	5	CO3	L5
5		A Rectangular beam is to be simply supported on supports of 230 mm width. The clear span of the beam is 6m. The beam is to have width of 300 mm. The super imposed load is 12 IcNini. Using M20 concrete and Fe415 steel. Design the beam. Apply check for deflection.	5	CO3	L5
6		Design a rectangular beam of section 230 mm x 600 mm of effective span 6m. Effective cover of reinforcement should be kept as 50 mm. Imposed load on the beam is 40 kN/m. Use M20 concrete and Fe 415 steel.	5	CO3	L5
7		simply supported RCC beam of size 300 x 600 mm carries a udl live load of 250 kN/m and superimposed dead load 12 kN/m over an effective span of 5 m. It is reinforced with 4#16 mm diameter bars. The effective cover is 50 mrn calculate the short term and long term deflection of beam tcs = 0.003 and creep coefficient = 1.6.	5	CO3	L5
8		A R.C.C beam of rectangular section 300x600mm is reinforced with 4 bars of 20mm dia with an effective cover 50mm, effective span of the beam is 6m. Assuming M20 concrete	5	CO3	L5

		and Fe250 steel. Determine the central concentrated P, that can be carried by the beam in addition to its self weight.			
9		A rectangular simply supported beam of span 5m is 300mmx650mm in cross section and is reinforced with 3 bars of 20mm on tension side at an effective cover of 50mm. Determine the shaft term defection due to an imposed working load of 201.1\l/m (excluding self wt). Assume grade of concrete M20 and grade of steel Fe415.	5	CO3	L5
10		A T-Beam slab floor has 125mm thick slab forming part of T — beam which are of 8m clear span. The end bearing are 450mm thick. Spacing of T-beams is 3.5m. The live load on the floor is 3kN/m2 . Design one of the intermediate beams. Use M20 concrete and Fe415 steel.	5	CO3	L5
11		Distinguish between one way slab and two way slab.	5	CO3	L2
12		Explain the importance of bond, anchorage length.	5	CO3	L2
13		Design a two way slab for an office floor of 3.5 x 4.5m simply supported on all sides with ',corners prevented from lifting. Take live load of 4kN/m2. Assume M20 and Fe415.			
14		What is development length? Write the expression for development length,	5	CO4	L3
15		Design one of the flights of dog logged stair case spanning between landing beams using the following data: Number of steps in the flight = 10 = 300mm Tread = 150mm Rise Width of landing beams= 300mm Assume M20 and Fe415	5	CO4	L5
16		Design a continuous RC slab for a class room 7m wide and 14 m long. The roof is to be supported on RCC beams spaced at 3.5 m intervals. The width of beam should be kept 230 mm. The super imposed load is 3 kN/m2 and furnishing load expected is 1 kN/m2. Use M20 concrete and Fe415 steel.	5	CO4	L5
17		Design a dog legged stairs for an office building in a room measuring 2.8m * 5.8 m clear. Vertical distance between the floor is 3 6in. Width of flight is to be 1.25 m. Allow a live load of 3 kN/m2. Sketch the details of reinforcement. Use M20 concrete and Fe 415 steel. Assume the stairs are supported on 230 mm walls at the end of outer edges of landing slabs	5	CO4	L5
18		Design a waist 4b type dog legged staircase for an office building given the following data Clear dither** of room = 2.6 m x 4.75 m Height of 000 = 3.2 m Rise = 160mm, Tread = 250 mm Width, of flight = 1.25 m Use M-20 -20 grade concrete and Fe-415 grade steel. Landing slab spans in the same direction of the staircase. Assume wall thickness 230 mm. Take live load = 3 kN/m2 and floor finish = 1 kN/m2.	5	CO4	L5
19		Design a corner rectangular slab panel of size 4m x 5.5m. Assume that slab supports an imposed load of 3 kN/m2 and floor finish 1 IN/m2. The slab is subjected to moderate exposure condition and is made of M-25 grade concrete, Fe-415 grade steel. Wall support is 230 mm.	5	CO4	L5

20		Design a slab for a room of clear dimensions 3mx5m supported on wall of 300mm thickness with corners held down. Two adjacent sides of the slab are continuous and other discontinuous. LL on slab is 3kN/m2 . Assume floor finish of lkN/m2 . Use M20 concrete and Fe415 steel. Sketch the details of reinforcement.	5	CO4	L5
21		Design a dog-legged stairs for an building in a room measuring 3.6x5.2m clear. The vertical distance between the Floors is 3.2m. Consider LL 3kN/m2 . Use M20 concrete and Fe415 grade of steel. Assume stairs are supported on 300mm wall at the outer edges of landing slabs. Consider Rise = 160mm, and Tread ---- 300mm.	5	CO4	L5

D3. TEACHING PLAN - 3

Module – 5

Title:	Limit State Deign of Columns and Footings	Appr Time:	10Hrs
a	***Course Outcomes***	-	**Blooms**
-	The student should be able to:	-	**Level**
1	Students should be able to Design the Columns by using limit state method as per IS 456-2000	CO6	L5
2	Students should be able to Design the Footings by using limit state method as per IS 456-2000	CO7	L5
b	***Course Schedule***		
Class No	**Module Content Covered**	**CO**	**Level**
1	Introduction to columns and design of short axially loaded RC column	CO6	L5
2	Design of columns with uniaxial moments	CO6	L5
3	Design of columns with uniaxial moments	CO6	L5
4	Design of columns with biaxial moments	CO6	L5
5	Design of columns with biaxial moments	CO6	L5
6	Introduction to footings and types, design concepts of the footings.	CO7	L5
7	Design of Rectangular column footings with axial load and moment	CO7	L5
8	Design of Rectangular column footings with axial load and moment	CO7	L5
9	Design of square column footings with axial load and moment	CO7	L5
10	Design of square column footings with axial load and moment	CO7	L5
c	**Application Areas**	**CO**	**Level**
1	Columns are used in Residential, Commercial, Educational and Office buildings	CO6	L5
2	Footings are used in Residential, Commercial, Educational and Office buildings	CO7	L5
d	**Review Questions**	-	-
1	What is the role of transverse reinforcement in columns? What are the codal provisions to design the transverse reinforcement?	CO6	L3
2	Design the reinforcement for a column of size 300 x 500mm to support a factored load of 500kN and a factored moment of 200 kNm. Assume M20 and Fe415. Sketch the reinforcement details.	CO6	L3
3	Explain the different between short columns and long columns. Why is reduction coefficient applied to long column?	CO6	L3
4	Design a isolated forting for a rectangular column of 300mm x 500mm	CO7	L5

	supporting an axial load of 15001(N factored. Assume SBC of soil as 185 kN/m2. Use M20 and Fe415. Sketch the reinforcement and perform the necessary checks.		
5	A corner column 400 * 400 mm, is subjected to the factored loads Pt, = 1300 Kn, Mu. = 190 kN-m and Muy = 110 kN-m. Design the reinforcement in the column, assuming M25 concrete and Fe 415 steel and effective cover of 60 mm. Assume it as short column.	CO7	L5
6	Design a square footing for a short axially loaded column of size 300 mm * 300 mm carrying 600 kN load. Use M20 concrete and Fe415 steel. SBC of soil is 180 kN/m2. Sketch the details of reinforcement.	CO7	L5
7	Design a footing for a column of size 300mm x 300mm, carrying a load of 1200 kN. Take SBC of sail as 180 kN/m2. Use M20, grade concrete and Fe-415 grade steel. Sketch the reinforcement details.	CO7	L5
8	Design the reinforcement in a column of size 400mm x 500mm subjected to an axial load of 2000 kN. The column has unsupported length of 3.3m and is held in position at both the ends, restrained against rotation at one end. Use M-25 grade concrete and Fe-415 grade steel.	CO7	L5
9	Design the reinforcement for a axially loaded square column of size 450rrim x 450mm to support a load of 1500 kN. Use M20 concrete and Fe415 steel.	CO7	L5
10	column size of 300x400mm has effective length of 3.6m and is subjected to P and Mu = 150 kN-m, about the major axies. Assume the bars on two side, design the column using M25 concrete and Fe415 steel.	CO7	L5
11	Design on Isolated rectangular Footing of uniform depth for the column size of 230mmx300mm supporting an axial service load of 850kN. he safe bearing capacity of soil is 150kN/m2 . Adopt M20 grade concrete and Fe415 grade steel. Sketch the reinforcement details.	CO7	L5
e	**Experiences**	-	-
1		CO10	L2
2			
3			
4		CO9	L3

E3. CIA EXAM – 3

a. Model Question Paper - 3

Crs Code:	15CV51	Sem:	V	Marks:	15	Time:	75 minutes
Course:	Design Of RC Structural Elements						

-	-	**Answer any ONE FULL question from each Module**	**Marks**	**CO**	**Level**
1	a	Determine the reinforcement required for a short column for the following data. Column size is 400×600 mm, P_U=2000KN, M_{UX}=160 kn-mt, M_{UY}=120 kn-mt. Assuming M20 grade concrete and Fe415 steel. The column is subjected to biaxial bending. Assuming moments due to minimum eccentricity are less than the values given above. Also sketch the reinforcement details. Use SP16 charts.	15	CO6	L5
2	a	A rectangular column is subjected to a service load of 2000KN. If the unsupported height of the column is 5m. Design the column. Columns are hinged at ends. Sketch the details. Width of column= 300mm. Use M25 concrete and Fe415 steel. Use limit state method of design. Use SP16 charts.	15	CO6	L5
3	a	A column 450×450 mm in size with 8 steel bars of 18mm diameter transfers a dead load of 620 KN and a live load of 860 KN to the footing. The bearing capacity of soil is 120 kn/m^2. M20 grade of concrete and HYSD steel bars of Fe 415 shall be used. Design a square footing to	15	CO7	L5

		support the column.			
4	a	A rectangular column450×600 mm transfer a dead load of 880 KN & a live load of 1420 KN without any movement & there is no overburden. The safe bearing capacity of soil is 140 KN/m^2. M20 grade of concrete and HYSD steel bars of Fe 415 shall be used. Design a rectangular footing to support the column.	15	CO7	L5
-	**-**	**Answer any ONE FULL question from each Module**	**Marks**	**CO**	**Level**
1	a	Determine the reinforcement required for a short column for the following data. Column size is 400×600 mm, P_U=2000KN, M_{UX}=160 kn-mt, M_{UY}=120 kn-mt. Assuming M20 grade concrete and Fe415 steel. The column is subjected to biaxial bending. Assuming moments due to minimum eccentricity are less than the values given above. Also sketch the reinforcement details. Use SP16 charts.	15	CO6	L5
2	a	A rectangular column is subjected to a service load of 2000KN. If the unsupported height of the column is 5m. Design the column. Columns are hinged at ends. Sketch the details. Width of column= 300mm. Use M25 concrete and Fe415 steel. Use limit state method of design. Use SP16 charts.	15	CO6	L5
3	a	A column 450×450 mm in size with 8 steel bars of 18mm diameter transfers a dead load of 620 KN and a live load of 860 KN to the footing. The bearing capacity of soil is 120 kn/m^2. M20 grade of concrete and HYSD steel bars of Fe 415 shall be used. Design a square footing to support the column.	15	CO7	L5
4	a	A rectangular column450×600 mm transfer a dead load of 880 KN & a live load of 1420 KN without any movement & there is no overburden. The safe bearing capacity of soil is 140 KN/m^2. M20 grade of concrete and HYSD steel bars of Fe 415 shall be used. Design a rectangular footing to support the column.	15	CO7	L5

b. Assignment – 3

Note: A distinct assignment to be assigned to each student.

Model Assignment Questions							
Crs Code:	15CV51	Sem:	V	Marks:	10	Time:	90 – 120 minutes
Course:	Design Of RC Structural Elements						

Note: Each student to answer 2-3 assignments. Each assignment carries equal mark.

SNo	USN	Assignment Description	Marks	CO	Level
1		What is the role of transverse reinforcement in columns? What are the codal provisions todesign the transverse reinforcement?	5	CO6	L5
2		Design the reinforcement for a column of size 300 x 500mm to support a factored load of 500kN and a factored moment of 200 kNm. Assume M20 and Fe415. Sketch the reinforcement details.	5	CO6	L5
3		Explain the different between short columns and long columns. Why is reduction coefficient applied to long column?	5	CO7	L5
4		Design a isolated forting for a rectangular column of 300mm x 500mm supporting an axial load of 15001(N factored. Assume SBC of soil as 185 kN/m2. Use M20 and Fe415. Sketch the reinforcement and perform the necessary checks.	5	CO7	L5

5		A corner column 400 * 400 mm, is subjected to the factored loads Pt, = 1300 kN, Mu. = 190 kN-m and Muy = 110 kN-m. Design the reinforcement in the column, assuming M25 concrete and Fe 415 steel and effective cover of 60 mm. Assume it as short column.	5	CO6	L5
6		Design a square footing for a short axially loaded column of size 300 mm * 300 mm carrying 600 kN load. Use M20 concrete and Fe415 steel. SBC of soil is 180 kN/m2. Sketch the details of reinforcement.	5	CO7	L5
7		Design a footing for a column of size 300mm x 300mm, carrying a load of 1200 kN. Take SBC of sail as 180 kN/m2. Use M20, grade concrete and Fe-415 grade steel. Sketch the reinforcement details.	5	CO6	L5
8		Design the reinforcement in a column of size 400mm x 500mm subjected to an axial load of 2000 kN. The column has unsupported length of 3.3m and is held in position at both the ends, restrained against rotation at one end. Use M-25 grade concrete and Fe-415 grade steel.	5	CO6	L5
9		Design the reinforcement for a axially loaded square column of size 450rrim x 450mm to support a load of 1500 kN. Use M20 concrete and Fe415 steel.	5	CO6	L5
10		column size of 300x400mm has effective length of 3.6m and is subjected to P and Mu = 150 kN-m, about the major axies. Assume the bars on two side, design the column using M25 concrete and Fe415 steel.	5	CO6	L5
11		Design on Isolated rectangular Footing of uniform depth for the column size of 230mmx300mm supporting an axial service load of 850kN. he safe bearing capacity of soil is 150kN/m2 . Adopt M20 grade concrete and Fe415 grade steel. Sketch the reinforcement details.	5	CO7	L5

F. EXAM PREPARATION

1. University Model Question Paper

Course:	Design Of RC Structural Elements					Month / Year	Dec/19	
Crs Code:	15CV51	Sem:	V	Marks:	100	Time:	180 minutes	
-	**Note**	Answer all FIVE full questions. All questions carry equal marks.				**Marks**	**CO**	**Level**
1	a	Differentiate between working stress method and limit state method of RCC design				5	CO1	L2
	b	Explain the following i)Partial safety factor for loads and materials (b)ii)Characteristics load iii)Characteristic strength				6	CO1	L1
	c	Calculate the crack width directly under the bar on tension face at the location of max bendingmoment in the beam of b=300mm, D=600mm, off cover on comp. side (d')=37.5mm,2 (c)Reinforcement -3 bars of 20mm dia bars. M=200 kN-m, Ast=1855mm .				5	CO1	L3
		OR						
-	a	Derive the expression for stress block parameter for compressive force C u and Tensile force T u and locate a depth of neutral axis y= 0.42 x u from top				5	CO1	L2
	b	Briefly explain under reinforced, over reinforced and balanced sections with sketch.				4	CO1	L2
	c	A reinforced concrete beam of cross section 300mmx600mm overall is reinforced with 3 barsof 20mm HYDS bars of Fe415 grade on tension side with an effective cover of 50mm.compute short term deflection of the beam at mid span, consisting of service load of 20kN/m and concentrated load of 25kN at the center of span. The beam is simply				7	CO2	L3

		supported over a span of 5m. Use M20 grade concrete and Fe415steel.			
2	a	Define Singly reinforced beam and doubly reinforced beam. List the situation which requiresthe adoption of the same.	6	CO3	L3
	b	A singly reinforced beam 250mmx450mm deep up to center of reinforcement Effective cover 50mm Effective span 6m using M20 concrete and Fe500 steel. Determine the central point load that can be supported in addition to self weight. When i)3-16mm dia bars ii) 3-20mm dia bars are used as reinforcement.	10	CO3	L4
		OR			
-	a	Determine the moment of resistance of a T-beam for the following data Breadth of the flange=740mm; Effective depth=400mm; Breadth of web=240mm; Tensilereinforcement =5-20Φ; Depth of flange =110mm; Adopt M20 grade concrete and Fe415 grade steel	8	CO3	L4
	b	A doubly reinforced beam section is 250mm wide and 450mm deep to the centre of the tensile reinforcement. It is reinforced with 2#16Φ as compression reinforcement at an effective coverof 50mm and 4#25Φ as tensile steel. Using M15 concrete and Fe250 steel. Calculate the ultimate moment of resistance of the beam section.	8	CO4	L4
3	a	A rectangular RC beam of size 250mm * 600 mm of effective simply supported span of 7 mhas a support service load of 26.25 kN/m excluding self-weight. The effective cover = 50mm Design the beam for flexure and shear. Check the beam depth for control of deflection (a) using empirical method. Design the stress value for different strain in steel is given below Strain 0.00276 0.0038 Stress (N/mm2) 351.8 360.9	9	CO5	L4
	b	A reinforced concrete beam is to be designed over an effective span of 5m to support a serviceload of 8 kN/m . Adopt M20 grade concrete and Fe 415 steel. Design a beam to satisfy thecollapse and serviceability limit states.	7	CO3	L5
-	a	A hall of 16 m * 6m supported by beams spaced 4 m C/C thickness of slab is 120 mm UDL 4kN/m .Design a T beam using M20 Concrete and Fe 415 steel for flexure and shear . Takebearing as 500 mm. Also show check for deflection and bond	8	CO3	L5
	b	A doubly reinforced concrete beam 250 mm wide 500mm deep is required to support 40 kN/m (b) including self-weight with effective span 5m .Effective cover of 50 mm using M20 concrete and Fe 415 steel find steel for flexure and shear	8	CO3	L5
4	a	Distinguish between one way slab and Two way slab	4	CO4	L2
	b	Explain Importance of Bond , Anchorage length	4	CO4	L2
	c	Design a slab for a room 5m x 10m live load 4kN/m . Use M20 concrete and Fe415 steel. Also (b) check for bond length deflection and shear. Assume corners are held down, bearing 300mm. Sketch the reinforcement details.	8	CO4	L5
		OR			
-	a	What is development length? Obtain the expression for development length in tension?	3	CO4	L2
	b	Design a two way slab 5m x 6m. Live load is 3kN/m . M20 concrete Fe415 steel. Alsocheck for bond length and shear. Assume corners are held down, bearing 300mm.	6	CO4	L5

	c	Design the middle flight of a open well type stair case to be provided for a stair hall of size3.25m x 3.25m. Size of open well = 1.25m x 1.25m. Floor to floor height = 3.6m. Size o (b) landing at each corner = 1m x 1m. Stair had to be provided along all the four walls of hall.Thickness of stair hall is 230mm. the stair slab is embedded in to the wall by 200mm. The service live load is 3kN/m .	7	CO5	L5
5	a	What is necessity of transverse reinforcement in columns	3	CO6	L2
	b	Design RCC column having unsupported length 2.75 m to support a load of 2000 KN using M20 concrete and Fe 415 steel	6	CO6	L5
	c	A square column 400mm sides carries a load of 900kN. Design a footing SBC of soil 100kN/m2. Adopt M20 concrete Fe415 steel. Check the necessary conditions.	7	CO6	L5
		OR			
	a	i) Explain difference between short column and long column ii) What are the advantages of Providing pedestal to columns	3	CO6	L2
	b	A column 300mm x 400mm is to support a ultimate load of 1200kN and Mu 200kN-m. Find steel using M20 concrete Fe415 steel, assuming effective cover 50mm. Sketch the reinforcement details.	6	CO6	L5

2. SEE Important Questions

Course:	Design Of RC Structural Elements					Month / Year	Dec/19	
Crs Code:	15CV51	Sem:	V	Marks:	100	Time:	180 minutes	
	Note	Answer all FIVE full questions. All questions carry equal marks.				-	-	
Module	Qno.	Important Question				**Marks**	**CO**	**Year**
1	1	Explain the philosophy and principles of limit state method of RCC design.				16		2004
	2	Explain the following : i) Characteristic loads ii) Characteristics strength iii) Partial safety factor for loads iv) Partial safety factor for materials. c. Explain different types of steel used in RCC.						2004
	3	What is a stress block? Derive from fundamentals the expression for area of stress block 0.36 tek xu and depth of centre of compressive force from the extreme fibre in compression 0.42 xu.						2004
	4	what are the different loads to be considered in the design of an reinforced concrete element?						2007
	5	Explain the philosophy and principles of limit state method of design.						2007
	6	Explain the necessity of adopting partial safety factors for loads and material strength.						
2	1	single reinforced concrete beam 250 x 450 mm deep upto the centre of reinforcement is reinforced with 3-16 mm dia at an effective cover 50 mm, effective span 6 m, M20 concrete and Fe415 steel. Determine the central point load that can be supported in addition to the self weight.				16		2005
	2	Determine the moment of resistance of a T-beam for the following data: Breadth of the flange = 740 mm; Effective depth = 400 mm; Breadth of the web = 240 mm; Area of steel = 5 — 20; Depth of flange = 110 mm; Adopt M20 grade concrete and Fe415 grade steel.						2005
	3	RC beam 200mm wide by 500mm deep effective is reinforced with 3 nos						2009

		of 16mm dia bars. Find the moment of resistance of the beam. Effective span is 5.0m. If the effective cover is 40mm, find the safe working load as well as superimposed load. Use M25 grade concrete and Fe 415 steel.			
	4	Explain the importance of side face reinforcement. Give the specification for the same.			2006
	5	simply supported rectangular beam of 12m span has an effective depth of 800mm. The area of reinforcement required to support the loads is designed as 1.6 percent. Check the deflection control of the beam by empirical method if i) Fe 415 grade HYSD bars are used ii) Fe 500 grade bars are used			2004
3	1	simply supported rectangular beam of 12m span has an effective depth of 800mm. The area of reinforcement required to support the loads is designed as 1.6 percent. Check the deflection control of the beam by empirical method if i) Fe 415 grade HYSD bars are used ii) Fe 500 grade bars are used.	16		2006
	2	Design a singly reinforced concrete beam of clear span 5m to support a design working live load of 10 kN/m. Adopt M20 grade concrete and Fe 415 HYSD bars. Also show the detailing of reinforcements.			2006
	3	A Tee beam slab floor of an office comprises a slab 150 mm thick spanning between ribs of 250 mm wide spaced at 3.2 m centre to centre. Clear span of beam = 7.70 m. The beam is 600 mm deep including slab and simply supported over walls of 300 mm wide. Live load on floor = 4 kN/m2, Floor and ceiling finish = 0.75 kN/m2. The beam also support a partition wall which transmits a load of 12 kN/m. Design one of the intermediate beam for flexure and shear. Also check for beam for deflection control. Assume effective cover = 50 mm. M20 grade and Fe415 steel.			2007
	4	A rectangular section 200x450mm overall is reinforced with 3 — 16mm dia of an effective depth 420mm. Two hanger bars 12mm dia effective span 5m. The beam support a load of 10kN/m. Calculate short term deflection and long term deflection using M20 concrete and Fe415 steel.			2004
	5	Adoubly reinforced concrete beam 250mm wide 500mm deep is required to support 40kN/m including self wt effective span is 5m. Effective cover 50mm, using M20 concrete Fe 415 steel, find steel for flexure and shear			2004
4	1	esign a two way slab for a room of internal dimensions 4m x 5m, supported on walls of 300 mm thickness with one corner held down. Two adjacent edges of the slab are discontinuous. Thickness of slab = 150 mm. The slab is to support a live load of 3 kN/m2 and floor finish of 1 kN/m2. Sketch the reinforcement details M20, Fe415	16		2004

		grade.			
	2	Distinguish between one way and two way slab.			2004
	3	Design a dog legged stair for an office building in a room measuring 2.8m x 5.8m . Clear vertical distance between the floor is 3.6 m. The width of flight is to be 1.25 m. Assume imposed load of 3 kN/m2 . Use M20 concrete and Fe415 grade steel. Assume that the stairs are supported on 230 mm at the outer edges of landing slabs. Sketch the reinforcement details.			2006
	4	Design RC slab rectangular panel discontinuous and restrained all-round, has an effective spans of 3.5m x 5.0m. Live load is 2 kN/m2 and floor finish is 0.6 kN/m2. Use M20 grade concrete and Fe-415 grade steel. All corners are held down.			2004
	5	The main stair of an office building has to be located in a stair case room measuring 2.5m x 5.6m. The vertical distance between the floors is 3.75m. Live load on stairs 5 kN/m2. Design the flight slab using M20 and Fe 415 if flight slab and landing slab span in the same direction.			2007
5	1	column of size 300 mm x 400 mm is subjected to an axial factored load of 1200 kN and a factored moment of 250 kN-m. Design the column using M25 concrete and Fe 415 steel. Provide 40mm cover. Use of SP-16 is allowed.	16		2009
	2	Design short column (rectangular) subjected to an axial load of 3000 kN. Take effective length = 3.0m. Use M20 grade concrete Fe 415 grate steel. Check for minimum eccentricity in the direction.			2007
	3	A rectangular column of size 350mm x 550mm carries a live load of 1800 kN. The safe bearing capacity of soil is 200kN/m2 . Using M25 concrete and Fe 415 steel. Design a rectangular footing to support the column. Sketch the details of reinforcement.			2007
	4	Design a column 4 m long restrained in position and direction at both ends to carry an axial load of 1600 kN. Use M-20 grade concrete and Fe-415 grade steel. Sketch the reinforcement details			2004
	5	Design an isolated footing of uniform thickness for an RC square column, of size 500mm x 500mm bearing a vertical load of 600 kN. The safe bearing capacity of the soil may be taken as 120 kN/m2 . Use M-20 grade concrete and Fe-415 grade steel. Sketch the reinforcement details.			2005