Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				
				Theory Marks		Practical Marks		Total Marks
L	T	P	C	ESE	PA	ESE	PA	
03	00	04	07	70	30	40	60	***200***

Legends: L- Lecture; **T-** Tutorial/Teacher Guided Student Activity; **P -** Practical; **C -**Credit; **ESE**-End Semester Examination; **PA**-Progressive Assessment

5. COURSE CONTENT DETAILS:

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics
UNIT – I Limit State Method	1a Explain Limit State Method and its types 2a Explain concrete and steel for its Design compressive and tensile strength and Limit State Load	1.1 Reinforced Cement concrete, necessity of steel in concrete, normal location of Tension steel in beams, slabs &in footing 1.2 Limit State, Limit State of Collapse – Flexure, Shear, Compression, Torsion, Limit State of Serviceability- Deflection, Cracking. 1.1 Characteristic Strength of Concrete and Steel, Partial Safety Factor for Concrete and Steel 1.2 Characteristic or Working Load, Partial Safety Factor for Load, Limit State or Factored Load

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics
UNIT – II **Limit State of Collapse: Flexure**	2a Analyse & Design of Singly Reinforced Rectangular Section (SRRS) under Flexure 2b Analyse SRRS for flexure using SP-16. 2c Analyse & Design Doubly Reinforced Rectangular Section 2d Analyse flanged beam for Flexure	2.1 Assumptions for Limit State of Collapse due to Flexure 2.2 Stress and Strain Diagram of SRRS 2.3 Equation (No Derivation) related to maximum depth of N.A- Xumax, Actual Depth of N.A- Xu , Limiting Moment of Resistance- Mulim , Actual Moment of Resistance- Mu , maximum % limiting steel – Ptlim as per IS 456-2000 & Design Aid SP-16 2.4 Balance Section, Under Reinforced Section, Over Reinforced Section 2.5 Minimum and Maximum steel in beam and in slab and clear cover as per IS 456-2000(Clause 26.4, 26.5, Table 16) 2.6 Design problem to find size of SRRS Beam and steel area for limit state Bending Moment 2.7 Numerical related to 1.6 to 1.9 using SP-16-Flexure Chart and Flexure Table. 2.8 Condition for Doubly Reinforced Section 2.9 Equation stated in SP-16 for D.R.S. 2.10 Conditions for the beam to act as Tee 2.11 Beam. 2.12 Width of Flange as per IS 456-2000 (Clause 23.1.2) 2.13 Equation regarding Tee Beam from IS 456-2000 (Annexure G). 2.14 Numerical to find Limiting Moment of Resistance of Tee Beam using equation of IS 456-2000 and using Flexure Table of SP-16 regarding Tee beam.

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics
UNIT – III Design of Slab	3.a Design Slab for Spanning under Dead Load & Live Load 3.b Design & Detail Cantilever Slab , One Way Simply Supported Slab , One Way Continuous Slab & Two Way Simply Supported Slab	3.1 Slab –Spanning in Shorter Span, Steel for Bending Moment, Distribution Steel, Depth of Slab as per Deflection, Effective span as per IS 456-2000 (Clause 22.2), Dead Load, Live Load on Slab, Shear and Cracking in Slab. 3.2 Numerical to design and detail Simply Supported One Way Slab for Bending Moment , Shear , Deflection , Cracking for the assigned Floor Finish & Live Load. 3.3 Numerical to design and detail One Way Continuous Slab for Bending Moment, Shear, Deflection, Cracking for the assigned Floor Finish & Live Load using IS 456 -2000 B.M and S.F coefficients(Table 12 & 13) 3.4 Numerical to design and detail Two Way Simply Supported Slab with and without Torsion Steel for Bending Moment, Shear, Deflection, Cracking for the assigned Floor Finish & Live Load using IS 456 -2000 B.M coefficients (Annexure D)*** Numerical in 2.1 to 2.4 , use of SP-16 is permitted

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics
UNIT – IV **Limit State of Collapse: Shear**	4a Design Stirrups for R.C Rectangular Beam 4b Apply shear requirements of IS 456-2000 to Designed Slab	4.1 Diagonal Tension Crack in Beam due to Shear 4.2 Equation related to Limit State of Collapse due to Shear as per IS 456-2000 (Clause 40). 4.3 IS 456-2000 clauses(26.5.1.5 & 1.6) related to Minimum and Maximum Spacing of Stirrups , minimum shear reinforcement 4.4 Clauses (40.2) related to Limit State of Collapse due to Shear for Slab in IS 456-2000 4.5 Numerical to check the slab for shear
UNIT – V **Limit State of Serviceability**	5a Apply Deflection clauses of IS 456-2000 to Slab & Beam 5b Apply Cracking clauses of IS 456-2000 to Slab & Beam Apply Development Length clauses of Is 456-2000	5.1 Span to effective depth ratio, Modification factor for SRRS as per IS 456-2000(Clause 23.2.1, 24.1) 5.2 Numerical to check Slab & Beam for Deflection 5.3 Maximum and Minimum spacing of Main steel and distribution steel in slab, Maximum and minimum spacing of bars in beam (Clause 26.3) 5.4 Numerical to check spacing of steel in slab for cracking 5.5 Equation to find Development Length of IS 456 -2000(Clause 26.2.1,) 5.6 Anchoring reinforcing bars in Tension and in Compression (Clause 26.2.2) Clauses related to Lap Length of Is 456-2000 (Clause 26.2.5.1)

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics
UNIT – VI **Axially Loaded Short Column and Isolated Footing**	6a Analyse and Design axially Loaded Short Column 6b Design Isolated Slope and Pad Footing and provide reinforcement details of footing	6.1 Column , slenderness Limit for Short & Long Column , Minimum Eccentricity in column , condition for axially loaded column , equation for axially loaded short column of IS 456-2000(Clause 25 & 39.3). 6.2 Clauses(26.5.3.1, 26.5.3.2(C ,1-2)) of IS 456-2000 related to % compression steel , numbers of compression bars and its spacing, lateral ties – diameter and pitch. 6.3 SBC of Soil, Types of Footing like Isolated foundation, combined footing, raft Foundation, pile foundation. 6.4 Numerical to design & to detail Isolated Pad and Slope Foundation for assigned limit state compression load of column and SBC of soil for Bending Moment, One Way Shear, Punching or Double Shear, Load Transfer from Column to Footings (Clause 34).