**Course Code:** 18CE0115 **R18**

**SIDDHARTH GROUP OF INSTITUTIONS:: PUTTUR**
**(AUTONOMOUS)**
Siddharth Nagar, Narayanavanam Road – 517583

**QUESTION BANK (DESCRIPTIVE)**

**Subject with Code:** Structural Design (18CE0115) **Course & Branch**: B.Tech - CE

**Year & Sem:** III-B.Tech & I-Sem **Regulation:** R18

## UNIT –I
## RCC STRUCTURES, BEAMS AND LIMIT STATE OF SERVICEABILITY

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|---|---|---|---|---|
| **1** | **a** | State the different limit states considered in the design. | [L1][CO1] | **[2M]** |
| | **b** | Write a short notes on (i) Characteristics strength of materials and characteristic loads | [L1][CO1] | **[2M]** |
| | **c** | What is the partial safety factor for material and partial safety factor for load | [L1][CO1] | **[2M]** |
| | **d** | Write about depth of neutral axis and limiting depth of neutral axis | [L1][CO1] | **[2M]** |
| | **e** | Define effective depth and effective cover | [L1][CO1] | **[2M]** |
| **2** | | (A) State the assumption made in limit state of collapse in bending for the design of a reinforced concrete section. | [L1][CO1] | **[4M]** |
| | | (B) Draw the strain and stress distribution for singly reinforced beam and derive expression for depth of neutral axis, leaver arm and moment of resistance with respect to concrete and steel. | [L2][CO1] | **[6M]** |
| **3** | | A singly reinforced rectangular beam of width 230mm and 535mm effective depth is subjected to a bending moment of 90KNm at working loads. Find the steel area required. The material used are M20 grade concrete and Fe 415 grade steel. | [L3][CO2] | **[10M]** |
| **4** | | A singly reinforced concrete beam 300x550mm is reinforced with 5 bars of 16mm diameter with an effective cover of 50mm.The beam is simply supported over a span of 5m. Find the safe uniformly distributed load the beam can carry use M20 grade concrete and Fe 415 grade steel. | [L3][CO2] | **[10M]** |
| **5** | | Design the reinforcement for a reinforced concrete beam 250 mm wide and 550 mm deep of M20 grade concrete to resist an ultimate moment of 200 KNm and effective cover is 50 mm. Use Fe415 grade steel. | [L4][CO2] | **[10M]** |
| **6** | | Determine the ultimate moment of resistance of a reinforced concrete beam of rectangular section 250mm wide and 500mm effective depth. Area of steel consists of 6 Nos 20mm diameter in tension side and 2 Nos of 20mm diameter in compression side. Using M25 grade concrete and Fe 415 grade steel and an effective cover 40mm on both sides. | [L3][CO2] | **[10M]** |
| **7** | | A T- beam of effective flange width of 740 mm, thickness of slab 100mm,width of rib 240mm and effective depth 400mm is reinforced with 5 numbers of 20mm diameter bars. Determine the moment of resistance of the section. The materials are M15 grade concrete and Fe250 grade steel. | [L3][CO2] | **[10M]** |
| **8** | | 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 grade steel. | [L4][CO2] | **[10M]** |
| **9** | | Design a reinforced concrete beam of rectangular section of effective span 8m to support a design working live load of 30 KN/m. The overall size of the beam has to be restricted to 300 mm x 650 mm. Use M20 grade concrete and Fe 415 grade steel. Effective cover is 50 mm. | [L4][CO2] | **[10M]** |

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| **10** | Design a rectangular simply supported reinforced concrete beam over a clear span of 6m.The superimposed load is 30KN/m and support width is 230mm each. Use M20 grade concrete and Fe 415 grade steel. Check the design for deflection. | [L4][CO2] | **[10M]** |

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## UNIT –II
## DESIGN FOR SHEAR, TORSION, BOND AND RC SLABS, STAIRCASE

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|---|---|---|---|---|
| **1** | **a** | Write the formula for development length | [L1][CO3] | **[2M]** |
| | **b** | State the minimum requirement of shear reinforcement | [L1][CO3] | **[2M]** |
| | **c** | Define one way slab | [L1][CO3] | **[2M]** |
| | **d** | Define two way slab | [L1][CO3] | **[2M]** |
| | **e** | Define staircase | [L1][CO3] | **[2M]** |
| **2** | A reinforced concrete beam of rectangular section has a width of 250 mm and an effective depth of 500 mm. The beam is reinforced with 4 bars of 25 mm diameter on the tension side. Two of the tension bars are bent up at $45^o$ near the support section. In addition the beam is provided with two legged stirrups of 8 mm diameter at 150 mm centers near the support. If $f_{ck}$= 25 N/mm$^2$ and $f_y$ = 415 N/mm$^2$, estimate the ultimate shear strength of the support section. | | [L3][CO3] | **[10M]** |
| **3** | A reinforced concrete beam of rectangular section 300 mm wide is reinforced with four bars of 25 mm diameter at an effective depth of 600 mm. The beam has to resists a factored shear force of 400 KN at support section. Assume $f_{ck}$= 25 N/mm$^2$ and $f_y$ = 415 N/mm$^2$, design vertical stirrups for the section. | | [L4][CO3] | **[10M]** |
| **4** | A simply supported beam is 8 m in span and carries a uniformly distributed load of 50 KN/m. If 6 Nos. of 25 mm bars are provided at the centre of the span and 3 Nos. of these bars are continued into the supports, check the development length at the supports assuming M 20 grade concrete and Fe 415 steel. | | [L4][CO3] | **[10M]** |
| **5** | Design a reinforced concrete beam of clear span 5m to support a design working live load of 10 KN/m. Adopt M20 concrete and Fe 415 grade steel. | | [L4][CO3] | **[10M]** |
| **6** | Design a simply supported RCC slab for an office floor having clear dimensions of 4 m x 10 m with 230 mm wall all-round. Using M20 grade concrete and Fe415 grade steel. Live load on the slab is 4 KN/m$^2$ and weight of weathering course over the slab is 1.5 KN/m$^2$. | | [L4][CO3] | **[10M]** |
| **7** | Design a reinforced concrete slab to carry a live load of 3 KN/m$^2$ on an effective span of 3.5 m. Use M 20 grade concrete and Fe 415 grade steel. Assume floor finish is 1 KN/m$^2$. | | [L4][CO3] | **[10M]** |
| **8** | Design a two-way slab for a room of size 4 m x 5 m with discontinuous and simply supported edges on all the sides with corners prevented from lifting to support a live load of 4 KN/m$^2$ and weight of weathering course over the slab is 0.6 KN/m$^2$.Adopt M 20 grade concrete and Fe 415 grade steel. | | [L4][CO3] | **[10M]** |
| **9** | Design the floor slab for a hall 4 m x 3.5 m clear in size, if live load is 3 KN/m$^2$ and floor finish of 1 KN/m$^2$.The edges of the slab are simply supported and corners are not held down. Use M 20 grade concrete and Fe 415 grade steel. | | [L4][CO3] | **[10M]** |
| **10** | Design a dog-legged stair for a building in which the vertical distance between floors is 3.3 m. Adopt rise and tread of each step are 150 mm and 225 mm respectively. The stair hall measures 2.5 m x 4.5 m. The live load may be taken as 3 KN/m$^2$ and floor finish is 0.6 KN/m$^2$.Use M 20 grade concrete and Fe 415 grade steel. Assume the stairs are supported on 230 mm walls at the ends of outer edges of landing slabs. | | [L4][CO3] | **[10M]** |

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## UNIT –III
## DESIGN OF RC COMPRESSION MEMBERS AND RC FOUNDATION

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|---|---|---|---|---|
| **1** | **a** | Define axially loaded column | [L1][CO4] | **[2M]** |
| | **b** | Define eccentrically loaded column | [L1][CO4] | **[2M]** |
| | **c** | What is the minimum eccentricity to be adopted while designing columns | [L1][CO4] | **[2M]** |
| | **d** | Define short column and long column | [L1][CO4] | **[2M]** |
| | **e** | Define isolated footing | [L1][CO4] | **[2M]** |
| **2** | | Design a short axially loaded square column 500 mm x 500 mm for a service load of 2000 KN. Use M 20 grade concrete and Fe 415 HYSD bars. | [L4][CO4] | **[10M]** |
| **3** | | Design a circular column to carry an axial load of 1000 KN. Use M 20 grade concrete and Fe 415 steel. | [L4][CO4] | **[10M]** |
| **4** | | Design the reinforcement in a column of size 400 mm × 600 mm, subjected to an axial working load of 2000 KN. The column has an unsupported length of 3 m and is braced against side way in both directions. Use M 20 grade concrete and Fe 415 steel. | [L4][CO4] | **[10M]** |
| **5** | | Design the longitudinal and lateral reinforcement in a rectangular reinforced concrete column of size 300 mm x 400 mm subjected to a design ultimate load of 1200 KN and an ultimate moment of 200 KNm with respect to the major axis. Use M 20 grade concrete and Fe 415 HYSD bars. | [L4][CO4] | **[10M]** |
| **6** | | Design the reinforcements in a short column 400 mm x 600 mm subjected to an ultimate axial load of 1600 KN together with ultimate moments of 120 KNm and 90 KNm about the major and minor axis respectively. Use M 20 grade concrete and Fe 415 steel. | [L4][CO4] | **[10M]** |
| **7** | | Design a reinforced concrete footing of uniform thickness for a reinforced concrete column of 400 mm x 400 mm size carrying an axial load of 1200 KN. Use M 20 grade concrete and Fe 415 steel. The safe bearing capacity of soil is 220 KN/$m^2$. | [L3][CO4] | **[10M]** |
| **8** | | With neat sketches show various types of shallow footings and briefly explain | [L2][CO4] | **[10M]** |
| **9** | | A reinforced concrete column of size 300 mm x 300 mm carries a load of 750 KN. The safe bearing capacity of soil is 200 KN/$m^2$.Design an isolated column footing with uniform thickness. Use M 20 grade concrete and Fe 415 steel. | [L3][CO4] | **[10M]** |
| **10** | | Design a square footing of uniform thickness for a reinforced concrete circular column of diameter 400 mm carrying an axial load of 1000 KN. The safe bearing capacity of soil is 200 KN/$m^2$. Use M 20 grade concrete and Fe 415 steel. | [L3][CO4] | **[10M]** |

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## UNIT –IV
## STEEL STRUCTURES, CONNECTIONS AND TENSION MEMBERS

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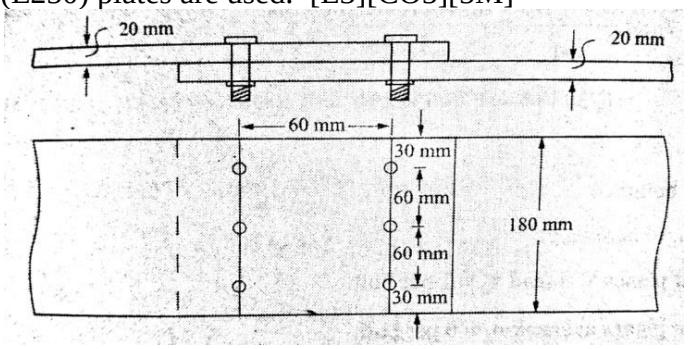
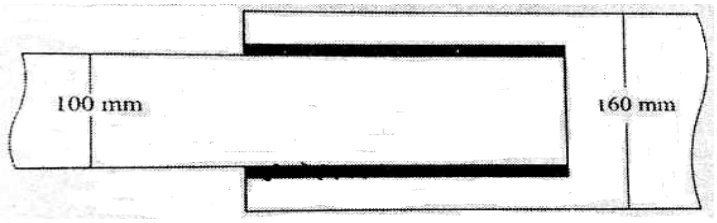
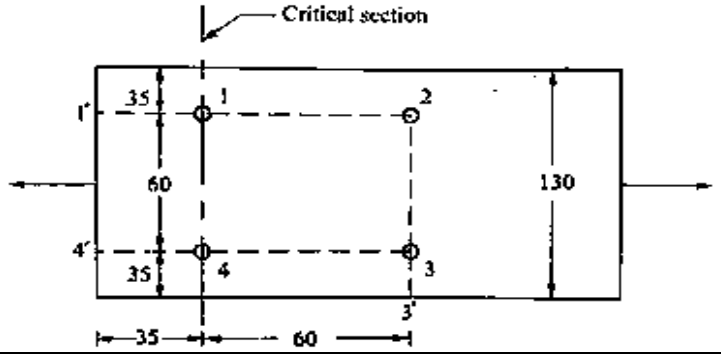
| **1** | **a** | What are the different types of steel structures? | [L1][CO5] | **[2M]** |
| | **b** | Write down the properties of steel structures | [L1][CO5] | **[2M]** |
| | **c** | Write types of loads to act on structures | [L1][CO5] | **[2M]** |
| | **d** | Define tension member | [L1][CO6] | **[2M]** |
| | **e** | What is Lug angle? | [L1][CO6] | **[2M]** |
| **2** | (a) Explain the various types of bolted connections with neat sketches | | [L2][CO5] | **[5M]** |
| | (b) A 18mm thick plate is joined to 16mm plate by 200 mm long(effective) butt weld. Determine the strength of joint if (i) A Double V butt weld is used and (ii) A Single V butt weld is used**.** | | [L3][CO5] | **[5M]** |
| **3** | Find the efficiency of the lap joint shown in figure. Given by M20 bolts of grade 4.6 and Fe 410(E250) plates are used. [L3][CO5][5M]   | | [L3][CO5] | **[10M]** |
| **4** | (a)Define welding. Explain various types of weld connections with neat sketches. | | [L1][CO5] | **[5M]** |
| | (b)What are the advantages and disadvantages of welded connections? | | [L1][CO5] | **[5M]** |
| **5** | (a)Define bolting and explain various terminologies in bolted connections. | | [L2][CO5] | **[5M]** |
| | (b)Difference between black bolts and High strength Friction Grip bolts. | | [L2][CO5] | **[5M]** |
| **6** | Design a suitable longitudinal fillet weld to connect the plates as shown in figure to transmit a pull equal to the full strength of small plate. Given plates are 12 mm thick, grade of plate Fe 410 and welding to be made in workshop.   | | [L4][CO5] | **[10M]** |
| **7** | Determine the design strength of the plate 130mm x 12mm with the holes for 16mm diameter bolts as shown in figure. Steel used to Fe 410 grade quality.   | | [L3][CO6] | **[10M]** |

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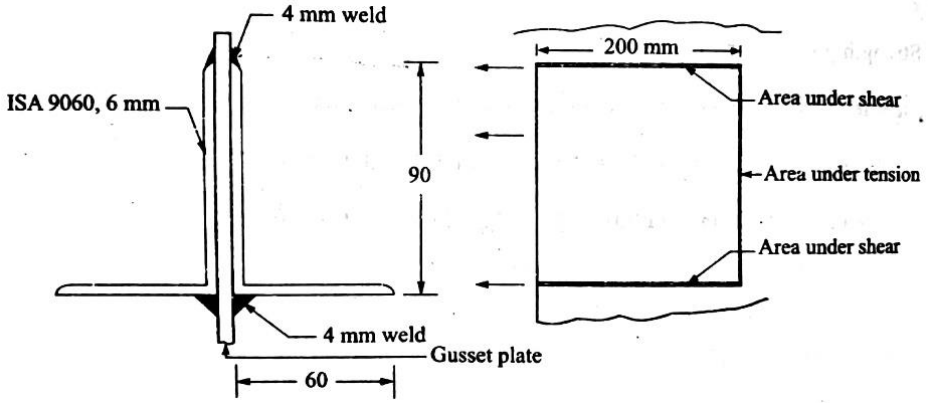
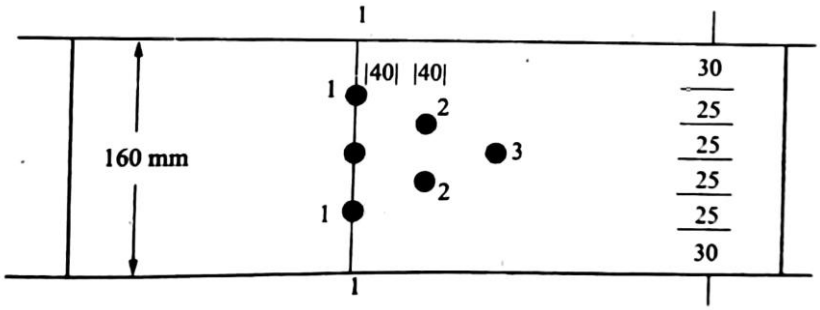
| **8** | Determine the tensile Strength of a roof truss member 2ISA 9060,6 mm connected to the gusset plate of 8mm thickness by 4 mm weld as shown in figure below. The effective length of weld is 200mm.<br>  <br> | [L3][CO6] | **[10M]** |
| **9** | Determine the design tensile strength of 160 x 8 mm plate with the holes for 16 mm bolts as shown in figure. Plates are of steel, grade Fe 415<br>  <br> | [L3][CO6] | **[10M]** |
| **10** | Design a double angle tension member connected on each side of a 10 mm thick gusset plate to carry an axial factored load of 375 KN. Use 20 mm black bolts, Assume shop Connection. | [L4][CO6] | **[10M]** |

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## UNIT –V
## DESIGN OF COMPRESSION MEMBERS AND BEAMS

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|---|---|---|---|---|
| **1** | **a** | Define Slenderness ratio | [L1][CO6] | **[2M]** |
| | **b** | Write the formula for the design compressive stress of axially loaded compression members | [L1][CO6] | **[2M]** |
| | **c** | Draw the column base plate diagram | [L1][CO6] | **[2M]** |
| | **d** | Define Plastic moment capacity | [L1][CO6] | **[2M]** |
| | **e** | Define Plastic section modulus | [L1][CO6] | **[2M]** |
| **2** | | Design a single angle strut connected to the gusset plate to carry 180 KN factored load. The length of the strut between center to center connections is 3m. | [L4][CO6] | **[10M]** |
| **3** | | A column 4 m long has to support a factored load of 6000 KN. The column is effectively held at both ends and restrained in direction at one of the ends. Design the column using beam sections and plates. | [L4][CO6] | **[10M]** |
| **4** | | Determine the design axial load capacity of the column ISMB300@577 N/m**,** If the length of the column is 3m and its both ends pinned. | [L3][CO6] | **[10M]** |
| **5** | | A column section ISHB 300 @ 577 N/m is carrying a factored load of 600 KN. A factored moment of 30 KN-m and factored shear force of 60 KN. Design a suitable column splice. Assume ends are milled. | [L3][CO6] | **[10M]** |
| **6** | | Design a slab base for a column ISHB 300 @ 577 N/m carrying an axial factored load of 1000 KN. M20 Concrete is used for the foundation. Provide welded connection between column and base plate. | [L4][CO6] | **[10M]** |
| **7** | | Design a simply supported I-section to support the slab of hall 9m x 24m with beam spaced at 3m centre to centre. Thickness of slab is 100mm. Consider floor finish load 0.5 $KN/m^2$ and live load of 3 $KN/m^2$. The grade of steel is E=250.Assume that adequate lateral support is provided to compression flange. | [L4][CO6] | **[10M]** |
| **8** | | Design a simply supported beam of 10 m effective span carrying a total factored load of 60 KN/m. The depth of beam should not exceed 500 mm. The compression flange of the beam is laterally supported by floor construction. Assume stiff end bearing is 75 mm. | [L4][CO6] | **[10M]** |
| **9** | | Design a beam 4m effective length subjected to 50 KN/m UDL (Including self weight) the flanges are embedded in slab and simply supported at both the ends. | [L4][CO6] | **[10M]** |
| **10** | | Design a slab base for a column ISHB 350 @ 710 N/m carrying an axial factored load of 1100 KN including self weight. The grade of concrete is M20.Provide same projection of base plate beyond the column in both directions. | [L4][CO6] | **[10M]** |

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