TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2081 Bhadra

Exam.	**Regular**		
Level	BE	**Full Marks**	80
Programme	BCE	**Pass Marks**	32
Year / Part	IV / I	**Time**	3 hrs.

Subject: - Design of RCC Structure (~~*CE 702*~~)

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ *Attempt **All** questions.*
- ✓ *The figures in the margin indicate **Full Marks**.*
- ✓ ***IS456, IS1893, IS 13920 and SP16(only for column design) is allowed in exam.***
- ✓ *Assume suitable data if necessary.*

1. a) Explain how limit state method of design differs from working stress method of design. [4]

   b) Describe failure modes in under-reinforced, balanced, and over-reinforced sections. [4]

   c) A rectangular beam is 300 mm wide and has 550 mm effective depth. It is reinforced with 4 bars of 12 mm diameter. Determine moment of resistance using working stress method of analysis. Use M20 concrete and Fe415 steel. [8]

2. a) A beam of size 250mm x 300mm is simply supported on masonry walls of thickness 300 m and 4 m apart to support a live load of 8 kN/m and dead load of 10 kN/m including its self-weight. Design the beam in flexure. Use M20 grade concrete and Fe 415 steel. [8]

   b) A rectangular RC beam of size 250 mm × 500 mm (effective size) is subjected to factored shear force of 110 kN and torsional moment of 20 kNm. The beam is reinforced with 3-20 mm diameter bars in tension side. Design the shear reinforcement. Consider M20 concrete and Fe 500 steel. [8]

3. a) Derive expression for development length. [3]

   b) A rectangular slab panel 5m x 4 m (clear span) is continuous over three edges and discontinuous over one short edge. The slab is to rest on 230 mm wide beam. The slab is subjected to live load of 5 kNm^2 and floor finish of 1.2 kNm^2. Design the slab and check whether the provided section satisfies the deflection criteria. Also, sketch the arrangement of reinforcement bars at the support and at the mid-span. Use M20 grade concrete and Fe 415 steel. [13]

4. a) Draw a neat sketch of beam-column joint including ductile details. [4]

   b) Design a RC slender column of size 400 mm x 500 mm with the following data:

   Effective lengths, l_{ex} = 7.0 m, l_{ey} = 6.0 m; Factored axial load = 1600 kN; Factored moments at top, M_{ux}' = 180 kNm, M_{uy}' = 110 kNm; Factored moments at bottom, M_{ux}" = 100 kNm, M_{uy}" = 50 kNm. The column bends in single curvature. Use M20 concrete and Fe 415 steel. [12]

5. a) Describe the design procedure for the mat foundation. [4]

   b) Design an isolated footing for a column of size 400mm x 400mm with 8-25 mm diameter bars as longitudinal reinforcement in order to carry a service axial load of 1200 kN and service moment of 120 kNm. Take the safe bearing capacity of soil as 150 kNm^2. Use M20 concrete and Fe 415 steel. [12]

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TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2081 Baishakh

Exam.	**Back**		
Level	BE	**Full Marks**	80
Programme	BCE	**Pass Marks**	32
Year / Part	IV / I	**Time**	3 hrs.

Subject: - Design of RCC Structure (*CE 702*)

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ *Attempt **All** questions.*
- ✓ *The figures in the margin indicate **Full Marks**.*
- ✓ ***Use of IS456 and IS13920 are allowed. SP16 is allowed to design column only.***
- ✓ *Assume suitable data if necessary.*

1. a) Describe under-reinforced, over-reinforced and balanced reinforced concrete sections. [7]
   b) A rectangular beam of size 300 mm x 550 mm effective depth is reinforced with 4-16 mm diameter tension bars. Determine the stress induced in the top compression fibre of the concrete and tension steel when it is subjected to a moment of 50 kN-m. Take M20 concrete and Fe 415 grade steel with the permissible stress in concrete and steel not exceeding 5 MPa and 140 MPa respectively. [9]
   c) Define design strength and design load for limit state design method. [4]
2. a) Design a beam 425 mm x 550 mm subjected to factored bending moment of 100 kN-m, twisting moment of 28kN-m and shear force at critical section of 100 kN. The beam is under mild exposure condition. Use M20 grade concrete and Fe415 grade steel. [10]
   b) Describe the design steps of flanged beam sections. [4]
   c) Determine the limiting moment of resistance and limiting area of steel for a reinforced concrete T-beam having effective width of flange 1500 mm, effective depth of 590 mm, depth of flange 150 mm and width of web 240 mm. Use M20 grade concrete and Fe415 grade steel. [6]
3. a) Design a RC slab (interior panel) resting on RCC beams on all sides for a room having clear dimensions of 4 m x 5 m. The slab is subjected to superimposed live load of 3 kN/m^2 and floor finish load of 2 kN/m^2. Use M20 grade concrete and Fe415 grade steel. Perform necessary checks and provide structural drawings. [15]
   b) Describe importance of ductile detailing in RC structures with neat sketches of ductile detailing for beams and columns. [5]
4. a) Design longitudinal and transverse reinforcement in a rectangular RC column of size 350 mm x 550 mm subjected to a factored axial load of 900 kN and moment equal to 200 kN-m with respect to the major axis. Take unsupported length of 3 m and effective length of 3.6 m. Use M25 grade concrete and Fe415 grade steel. [10]
   b) Design a footing for supporting a square column of 400 mm x 400 mm. The column carries a service load of 1500 kN. The safe bearing capacity of soil is 150 kN/m^2. Use M20 grade concrete and Fe415 grade steel. [10]

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TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2080 Bhadra

Exam.	Regular		
Level	BE	Full Marks	80
Programme	BCE	Pass Marks	32
Year / Part	IV / I	Time	3 hrs.

Subject: - Design of RCC Structure (*CE 702*)

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ *Attempt **All** questions.*
- ✓ *The figures in the margin indicate **Full Marks**.*
- ✓ ***Use of IS 456 and IS 13920 are allowed. IS 456 SP-16 is allowed to design column only.***
- ✓ *Assume suitable data if necessary.*

1. a) Discuss different types of flexural sections according to amount of reinforcement in tension zone. Describe different types of failure modes in above mentioned sections. [8]

   b) Determine area of steel required and the moment of resistance for a RC beam 250 mm x 450 mm. Consider M15 grade concrete and mild steel. Use working stress method. [8]

2. a) Describe anchorage and flexural bond stress. Derive equation for development length and bond stress. [6]

   b) Design a rectangular RC beam having cross sectional dimension 200 mm x 400 mm subjected to design bending moment 100 kN-m, design shear force 80 kN (at critical section) and design torsional moment 15 kN-m. Consider M25 grade concrete and Fe415 grade steel. [10]

3. a) Define interaction diagram with its features and neat sketches. Discuss on the modes of failure for compression members in eccentric compression within the interaction diagram. [4]

   b) Design a braced rectangular RC column having clear height of 4.0 m, with cross sectional dimension of 450 mm x 350 mm subjected to design axial load of 700 kN, design bending moments of 100 kN-m about major axis and 80 kN-m about minor axis. The column is held effectively at both ends and restrained against rotation at one end. Consider M25 concrete and Fe415 steel. [12]

4. a) Explain the ductility requirement for the reinforced concrete beam with a neat sketche. [2]

   b) Design a two-way slab simply supported on all four edges for a room 6 m x 4 m clear in size supported on 230 mm thick walls. The superimposed working load is 4 kN/m^2 and corners are not held down. Use M25 mix and Fe 415 grade steel. [14]

5. a) Discuss special confining reinforcement for ductile detailing of column with neat sketches. [2]

   b) Design an isolated footing supporting a square column 400 mm x 400 mm with 8-20 ϕ longitudinal reinforcement. The Column is subjected to axial service load of 1000 kN. Consider base of footing is 1 m below the ground level. Take allowable bearing capacity of soil 100 kN/m^2, M15 concrete and Fe 415 steel. Also check for load transfer from column to footing. [14]

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TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2080 Baishakh

Exam.	Back		
Level	BE	Full Marks	80
Programme	BCE	Pass Marks	32
Year / Part	IV / I	Time	3 hrs.

Subject: - Design of RCC Structure (*CE 702*)

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ *Attempt **All** questions.*
- ✓ *The figures in the margin indicate **Full Marks**.*
- ✓ *Assume suitable data if necessary.*

1. a) What are balanced, under-reinforced and over-reinforced sections? Explain with neat sketches of the stress distributions and expressions for moment resistance of each section. [6]

   b) An RC beam 230 mm wide and 400 mm deep (effective depth of 380 nm with area of steel 580 mm^2 has permissible stress in concrete and steel 5 N/mm^2 and 140 N/mm^2 respectively. Find the moment of resistance of the section and actual stresses in concrete and steel. [8]

   c) Explain about design steps of doubly reinforced section with neat sketches. [6]

2. a) An RC beam with effective depth of 550 mm and breadth of 400 mm contains 5#25 mm diameter bars, out of which two bars are to be bent-up at 45°near the end of the support. The beam carrying a uniformly distributed factored load of 100 kN/m over a 6 m clear span. Calculate the shear resistance of the bent-up bars and design the additional stirrups if needed. Use M20 grade concrete and Fe415 grade steel. [10]

   b) Design column 400 mm × 500 mm having unsupported length of 4.0 m with both ends effectively held and restrained against rotation at one end with the following data: [10]
   Factored axial load = 1600 kN
   Factored moments = 150 kN-m and 50 kN-m
   Use M25 concrete grade and Fe500 steel grade.

3. a) Design a reinforced concrete rectangular slab of size 4.0 m × 5.0 m to support an imposed load of 4 kN/m^2 and floor finish of 1 kN/m^2. The slab has two adjacent edges discontinuous with the slab resting on 275 mm wide beam. Check the safety of slab against shear and deflection. Use M20 grade concrete and Fe415 grade steel. (Design of torsional reinforcements is not required) [12]

   b) What is the philosophy of design of structures in earthquake prone region? Explain about design for strength and ductility. [4+4]

4. a) Design an isolated footing for a 450 mm × 500 mm sized column, with 6#20 mm diameter bars. Carrying factored axial load of 1100 kN and factored uniaxial moment of 120 kN-m at the column base. Take the depth of footing 1.5 m and safe bearing capacity of soil 100 kN/m^2. Use M20 grade concrete and Fe500 grade steel. [12]

   b) Explain about ductile detailing in beams and columns. Why ductile detailing is needed in joints? [4+4]

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TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2079 Bhadra

Exam.	Regular		
Level	BE	Full Marks	80
Programme	BCE	Pass Marks	32
Year / Part	IV / I	Time	3 hrs.

Subject: - Design of RCC Structure (*CE 702*)

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ *Attempt **All** questions.*
- ✓ *The figures in the margin indicate **Full Marks**.*
- ✓ *Assume suitable data if necessary.*

1. a) Describe the difference between working stress and limit stress design. Explain characteristic strength and load. [2+2]

   b) Derive equations for bending moment carrying capacity of double reinforced rectangular section using assumptions for working stress method given by IS 456:2000. [6]

   c) A simply supported RCC beam of effective span 4 meter and overall dimensions 250 mm × 475 mm is subjected to superimposed load of 45 kN/m excluding its self-weight with point load 75 kN at midspan. Design the beam for limit state of collapse in flexure. Also, check whether the beam is safe in deflection or not. Consider effective cover to ne 45 mm, Take M 25 concrete and TMT bars. All the loads are in service level. [10]

2. a) A simply supported RCC beam 300 mm wide and 400 mm deep (effective) is reinforced with a 4-20 mm diameter bars. Design the shear reinforcement if M 25 grade of concrete and TOR steel bars is used and beam is subjected to a shear force of 130 kN and torsional moment 45 kN-m at service state. [10]

   b) A rectangular slab panel 5m × 4 m (clear span) is continuous over three edges and discontinuous over one short edge. The slab is to rest on 250 mm wide beam. The slab is subjected to live load of 4 kN/m^2 and floor finish of 1.5 kN/m^2. Design the slab and check whether the provided section satisfies the deflection criteria. Also, sketch the arrangement of reinforcement bars at the support and at the midspan with torsional bars. [10]

3. a) Define development length and lap splice. Derive the expression $L_d \le 1.3\frac{M_1}{V_u} + L_0$ at simply supported end, where symbols have their usual meaning. [2+4]

   b) Design an unbraced rectangular RC column having clear height 6.0 m, with x-sectional dimension 400 mm × 350 mm subjected to design axial load of 600 kN, design bending moments 100 kNm about major axis and 50 kNm about minor axis. Consider M20 concrete and Fe 415 steel. [14]

4. a) Discuss about requirements for good detailing. Also describe bar bending schedule. [3+3]

   b) Design a footing for a rectangular column of size 30 cm × 35 cm reinforced with 8-20 mm dia. bars. The column is subjected to a factored axial load and moment of 1000 kN and 80 kN-m, respectively. The allowable bearing capacity of soil is 140 kN/m^2. At a depth of 1.6 m. Use M25 concrete and TMT bars for column and footing both. Sketch all of the reinforcement required. [14]

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TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2078 Bhadra

Exam.	Regular		
Level	BE	Full Marks	80
Programme	BCE	Pass Marks	32
Year / Part	IV / I	Time	3 hrs.

Subject: - Design of Reinforced Concrete Structures *(CE 702)*

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ *Attempt **All** questions.*
- ✓ *The figures in the margin indicate **Full Marks**.*
- ✓ ***Use of IS 456, IS 1343, IS 13920 are allowed. IS 456 SP-16 is allowed to design column only.***
- ✓ *Assume suitable data if necessary.*

1. a) Define characteristics loads and characteristic strength. Discuss stress strain relation for steel and concrete in Limit State Method (LSM) and Working Stress Method (WSM). [1+1+2+2]

   b) An R.C.C beam 25 cm wide and 60 cm deep has 4 bars of 20 mm dia. as tension reinforcement. The centre of bars being 5 cm above the bottom of the beam. Determine the uniformly distributed load the beam can carry over a simply supported effective span of 6.10m. The permissible stresses in concrete and steel are taken as 7 MPa and 230 MPa respectively. Use modular ratio. [8]

   c) What are the factors affecting the ductility. Explain the ductility requirements of R.C.C. beam as per IS 13920. [6]

2. a) Explain about behaviour of concrete under shear with sketches. Explain the different conditions. [4]

   b) Design a two adjacent sides (edges) discontinuous reinforced concrete slab for room having clear dimensions of 3.5m × 4.5m. The slab rest on 250mm wide beam. Consider 25mm thick PCC floor finish and live load an slab as 4.0KN/m^2 and partition wall load on slab as 1.0kN/m^2. Use M20 concrete and Fe415 steel. Check also the slab safe in shear deflection or not. Show the reinforcement and arrangement in plan and section (along short span only). (Design of Torsional reinforcements in slab not required). [16]

3. a) Determine the longitudinal and transverse reinforcements to be provided in a biaxially loaded short square shaped RCC column with following data:
   Size of column = 400×400mm.
   Ultimate factored axial load = 800kN
   Inclusive of live load at an eccentricity of 80mm in both X and Y direction.
   Use concrete grade of M20 and steel grade of Fe415. [10]

   b) Explain about bond and development length with formula derivation. [5]

   c) Explain the design steps of flange beams. [5]

4. a) Design an isolated square footing foundation of uniform thicknesss for a 400mm×400mm column subjected to an axial load of 650kN at service state. Consider safe bearing capacity of soil as 170 kN/m^2 and concrete of M20 and steel grade of Fe500. Show the reinforcements in plan and in section of footing. [12]

   b) A simply supported normal T beam of 6m clear span with service load of 40kN/m. It is reinforced with 4 numbers of 20mm diameter bars at support. Design the shear reinforcement near the support considering the shear contribution of 2 numbers of 20mm dia bars near support. The beam has cross section of 300mm×600mm overall. Use M20 concrete and Fe 415 steel. [8]

TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2076 Chaitra

Exam.	**Regular**		
Level	BE	**Full Marks**	80
Programme	BCE	**Pass Marks**	32
Year / Part	IV / I	**Time**	3 hrs.

Subject: - Design of RCC Structure *(CE 702)*

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ *Attempt **All** questions.*
- ✓ *The figures in the margin indicate **Full Marks**.*
- ✓ ***Use design codes IS456, IS1893, IS13920 are allowed.***
- ✓ ***SP16 is allowed for column design only.***
- ✓ *Assume suitable data if necessary.*

1. a) Describe about the requirement of steel as reinforcement in RCC structure. Explain about moment of resistance of doubly reinforced section. Derive the formula. [2+2+4]

   b) Calculate the tensile reinforcement required for a rectangular RC beam of size 230mm×425mm (overall) if it has to carry a moment of 64KNm at service condition. Use M20 grade concrete mix and Fe500 grade steel in working stress method. [8]

2. a) Describe the method of controlling deflection and cracking in RCC structure. [2+2]

   b) Determine the longitudinal and transverse reinforcement of RC column subjected to a factored axial load of 1440KN and factored moment Mux about major axis of 195 KNm and Muy about minor axis 180KNm. The size of column is 350mm × 350mm and unsupported length of 3.60m.Adopt M20 concrete and Fe500 grade (TMT) steel. Also do the ductile detailing of transversal reinforcement. [12]

3. a) Define development length and ductility. Describe the ductility requirements in different joints of RCC structure. [1+1+4]

   b) A RC beam has an effective depth of 550mm and a breadth of 300mm. It contains 4 no. of 20mm dia bars out of which two bars are to be bent up at 45° near end of the support. Calculate the shear resistance of bent up bars and the additional stirrups needed if the factored shear force due to uniformly distributed load is 425KN at the support. The span of the beam is 6m. Use M20 grade concrete mix and Fe415 grade (TOR) steel. [10]

4. a) Define balanced, under-reinforced and over-reinforced sections. [3]

   b) Design a RCC footing to carry a column load of 1250KN from 400×400mm square column having 20mm diameter bar as longitudinal steel. The bearing capacity of soil is 140KN/m^2. Consider the depth of foundation as 1.8m. Take unit weight of earth as 18KN/m^3. Use M20 grade concrete mix and Fe415 grade steel. Also sketch the reinforcements in plan and section. [13]

5. a) What is splicing and why it is required in RCC structures. [2]

   b) Design a RC slab over a room 5m×6m. The slab is supported on masonry walls all round with adequate restraint and corners are held down. The live load on slab is 3KN/m^2 and floor finish 1.5KN/m^2. The thickness of supporting wall is 230mm. Use M20 concrete mix and Fe415 grade steel. Also draw the tp and bottom reinforcement detailing with their section and plan. Check for deflection and development length is necessary. [14]

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TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2076 Ashwin

Exam.	Back		
Level	BE	Full Marks	80
Programme	BCE	Pass Marks	32
Year / Part	IV / I	Time	3 hrs.

Subject: - Design of RCC Structure *(CE 702)*

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ *Attempt **All** questions.*
- ✓ *The figures in the margin indicate **Full Marks**.*
- ✓ ***Use design codes IS 456, IS 1893, IS 13920 are allowed and SP16 is allowed to column design only.***
- ✓ *Assume suitable data if necessary.*

1. A rectangular RC beam of overall dimensions 300 mm × 500 mm is reinforced with 4-25 mm dia. bars in tension at an effective cover of 50 mm. The beam is simply supported over an effective span of 5m. Calculate the total uniformly distributed load the beam can carry inclusive of its self weight. Use working stress method of design. Adopt M20 concrete and Fe415 grade (TOR) steel. [8]

   b) A T-beam of effective flange width of 1600 mm, depth of flange 110 mm, breadth of web 300 mm and overall depth 460 mm is reinforced with 4-20 mm bars in tension at an effective cover of 40 mm. Determine the moment of resistance of the section using M20 grade concrete and Fe415 grade steel in Limit state method of design. [8]

2. a) Derive the formula $L_d \leq 1.3 \frac{M_1}{V} + L_0$, where the symbols have their usual meanings. [6]

   b) Design an isolated footing to carrying an axial factored load of 1600 kN. The column is 400 mm by 400 mm in size with 20 mm dia longitudinal bars. The bearing capacity of soil is 180 kN/m^2. For footing, adopt M20 grade concrete and 415 grade HSD bars. Check for shear is necessary. [10]

3. Design a slab for a room of size 5 m × 4 m for a live load of 4 kN/m^2 and floor finish of 1.2 kN/m^2. The slab is supported on 250 mm thick brick masonry walls with two adjacent edges discontinuous. Use M20 grade concrete and Fe415 grade bars. Carry out all checks required for the slab design. Sketch the reinforcement detailing plan and sectional view. Also sketch the torsional reinforcement if required. [16]

4. a) Determine the longitudinal and transverse reinforcements in a short RC column subjected to factored axial load of 1400 kN and factored moment M_{ux} of 200 kN-m and M_{uy} of 110 kNm. The size of the column is 300 mm × 400 mm and unsupported length of 3m. Adopt M20 concrete and Fe500 grade (TMT) bars. Also, do the ductile detailing of transverse reinforcements. [12]

   b) Define development length. Why splices are required in RCC structure. [4]

5. a) Explain how a RC structural member subjected to bending, shear and torsion is designed by IS code method. [5]

   b) Write down the provisions of ductile detailing for columns with neat sketches. [6]

   c) Describe methods of controlling deflection and crack width in RCC structures. Describe the empirical formula for calculating the design surface crack width. [3+2]

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TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2075 Chaitra

Exam.	Regular / Back		
Level	BE	Full Marks	80
Programme	BCE	Pass Marks	32
Year / Part	IV / I	Time	3 hrs.

Subject: - Design of RCC Structure *(CE 702)*

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ *Attempt **All** questions.*
- ✓ *The figures in the margin indicate **Full Marks**.*
- ✓ ***Use design codes IS 456, IS 1893, IS 13920 are allowed and SP16 is allowed to column design only.***
- ✓ *Assume suitable data if necessary.*

1. a) Explain with the help of sketches, under-reinforced, over-reinforced and balanced sections. [4]

   b) What are the serviceability requirements in the limit state design of RC structures? Explain them briefly. [4]

   c) A rectangular RC beam of overall dimensions 250mm × 450mm is reinforced with 4-16 mm dia. bars in tension at an effective cover of 40mm. Calculate the moment of resistance of the beam using working stress method. Adopt M20 concrete and Fe415 grade steel. [8]

2. a) A reinforced concrete rectangular beam has an overall depth of 500mm and breadth of 300 mm. It consists of 5-25 mm dia bars in tension and 3-16 mm dia. bars in compression. Calculate the shear reinforcement needed for a factored shear force of 370 kN. Take M20 grade concrete and Fe415 grade (TOR) steel. Also check the spacing for minimum shear reinforcement. [8]

   b) A rectangular RC beam of overall dimensions 650 mm by 300 mm is subjected to a factored bending moment of 85 kN-m, factored shear force of 110 kN and factored twisting moment of 25 kN-m. Design the beam for longitudinal and transverse reinforcements. Use M25 grade concrete and Fe415 grade steel. [8]

3. a) Design a short rectangular column of size 350mm × 500mm and unsupported length of 3.30m subjected to an axial factored load of 1500 kN and factored moments 130 kN-m and 80 kN-m about major and minor axes respectively. Adopt M30 grade concrete and Fe500 grade steel. Sketch the reinforcement details. [14]

   b) Define development length and lap splice. [2]

4. Design a RCC slab for a room of clear dimensions 6m × 4m whose one short edge is discontinuous and corners are restrained at supports. The live load on the slab is 4 kN/m^2 and superimposed load of 1.20 kN/m^2. Adopt M20 grade concrete and Fe415 grade steel. Check the slab for deflection, and development length. Give the detail sketches, sectional view along short span with reinforcement details along with torsional reinforcements. [16]

5. a) Design a R.C.C isolated footing to carry an axial load of 1500 kN. The column is 350mm ×350mm in size with 20mm diameter, 8 Nos longitudinal bars. The bearing capacity of soil is 175 kN/m^2. Use M20 grade concrete and Fe415 grade steel. Assume missing datas. [10]

   b) Explain with the help of sketches the ductile detailing of RC beams. [6]

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01 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2075 Ashwin

Exam.	Back		
Level	BE	Full Marks	80
Programme	BCE	Pass Marks	32
Year / Part	IV / I	Time	3 hrs.

Subject: - Design of RCC structure *(CE702)*

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ *Attempt **All** questions.*
- ✓ *The figures in the margin indicate **Full Marks**.*
- ✓ *Use of IS 456, IS 13920 are allowed. IS 456 SP-16 is allowed to design column only.*
- ✓ *Assume suitable data if necessary.*

1. a) A rectangular R.C beam of size 230×350 mm overall is reinforced with 4-16 mm dia bars at tension zone in bottom, determine the moment of resistance of that beam section if the permissible stresses in concrete and steel does not to exceed 7.0 Mpa and 140 Mpa respectively. Take Nominal cover to re-bar as 25 mm and m =13.33. [7]

   b) Define anchorage bond and flexural bond stress. Prove that flexure bond stress is the function of shear force (V) and $L_d \leq 1.3\frac{M_1}{V_u} + L_0$ at supply support end, where symbol have their usual meaning. [7]

   c) With the help of neat sketch, describe the requirement for confining reinforcements in RC columns for earthquake resistant design. [6]

2. a) A Reinforced concrete beam has an effective depth of 600 mm and a breadth of 400 mm. It contains 5 no of 25 mm dia bars out of which two bars are to be bent up at 45° near end of the support. Calculate shear resistance of bent up bars and additional stirrups needed if the factored shear force diagram is 250 kN at support and 0 kN at mid span of 6 m span beam. Use M20 grade steel and Fe 415 steel. [14]

   b) Describe the step-by-step procedure used for the design of RC bean subjected to shear moment and torsion. [6]

3. a) A rectangular slab panel 5 m × 4 m (clear span) is continuous over three edges and discontinuous over one short edge. The slab carries a floor finish of 1.20 KN/m^2 and live load of 4.0 KN/m^2. Design the slab panel with detailing the top and bottom reinforcements. Sketches the re-bar details clearly. The width of slab supported beam as 225 mm. Take M20 concrete and Fe 415 steel. [14]

   b) Explain different category of limit state design with necessary details. [6]

4. a) Determine the longitudinal and transverse reinforcement in bi-axialy loaded column having a following parameters: [15]

   Unsupported length of column = 3.10 m

   Size of column = 500 mm×600 mm

   Factored moment, Mux = 125 kN.m;

   Factored load, p_u = 1300 KN

   Factored moment, M_{uy} = 200 KN.m

   Use M25 concrete and Fe 500 steel. Take reinforcement in four side. Sketch the details.

   b) Describe the design procedure for mat foundation. [5]

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01 TRIBHUVAN UNIVERSITY

INSTITUTE OF ENGINEERING

Examination Control Division

2074 Chaitra

Exam.	Regular		
Level	BE	Full Marks	80
Programme	BCE	Pass Marks	32
Year / Part	IV / I	Time	3 hrs.

Subject: - Design of RCC structure *(CE702)*

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ *Attempt **All** questions.*
- ✓ *The figures in the margin indicate **Full Marks**.*
- ✓ *Use of IS 456, IS 13920 are allowed. IS 456 SP-16 is allowed to design column only.*
- ✓ *Assume suitable data if necessary.*

1. a) Explain how would you design shear reinforcements for flanged beam sections. [5]

   b) A beam of rectangular section is 300mm wide and 500mm deep to the centre of tensile reinforcement. It has to carry a dead load of 45 kN/m excluding its self weight. Find the steel reinforcement required for the mid span section. The beam has a span of 7m. Use M20 concrete and Fe 415 steel. Effective cover to compression steel = 40 mm. Use limit state method. [15]

2. a) Explain briefly ductile detailing requirements for beam and column with neat sketches. [6]

   b) Design a short RC column with following datas: [14]

   Unsupported length = 3.0 m

   Factored load, p_u = 1550 kN

   Factored moments: M_{ux} = 130 kN.m

   : M_{uy} = 90 kN.m

   Size of column = 300×450 mm

   Do ductile detailing for transverse steel.

3. a) Differentiate between working stress and limit state methods. [5]

   b) Design a restrained floor slab for a room 4m×5m in size to support a live load of 5 kN/m^2, with two adjacent sides discontinuous. Use M20 concrete and Fe415 grade steel. Sketch the details of reinforcements. [15]

4. a) Design an isolated footing to support a square column of 400×400 mm. The column (400×400mm) carries a service load of 1200 kN. The allowable soil pressure is 150 kN/m^2. Use M20 concrete and Fe415 grade steel. Unit weight of soil above footing base = 18 kN/m^3. Necessary missing data assume suitably. [10]

   b) A L-beam of effective and flange width as 925 mm, effective depth as 450 mm, depth of flange as 100 mm, breadth of rib as 250 mm is reinforced with 4-20 mm bars as tension reinforcement and 3-16 mm dia bars as compression reinforcement. Find the ultimate moment of resistance of the section at limit state of collapse. Use M20 grade concrete mix and Fe415 grade steel. [10]

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02 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2074 Ashwin

Exam.	Back		
Level	BE	Full Marks	80
Programme	BCE	Pass Marks	32
Year / Part	IV / I	Time	3 hrs.

Subject: - Design of RCC Structure *(CE702)*

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ *Attempt **All** questions.*
- ✓ *The figures in the margin indicate **Full Marks**.*
- ✓ *Use of IS:456-2000, IS:1893, IS:13920 are allowed.*
- ✓ *Students are not allowed to use SP16 except for the column design.*
- ✓ *Assume suitable data if necessary.*

1. a) Explain under-reinforced, balanced and over-reinforced sections in Limit state design. [6]

   b) A simply supported rectangular RC beam of effective span 4.2 m and overall dimensions 230 mm × 450 mm is reinforced with 4-20 mm dia. bars in tension. Determine the moment of resistance. Take permissible stresses for M20 concrete and Fe415 grade steel. [6]

   c) A rectangular RC beam of size 250 mm × 500 mm (effective depth) is subjected to a factored shear force of 110 KN. The beam is reinforced with 3-22 mm dia. bars in tension. Design the shear reinforcement. Consider M20 concrete and Fe500 steel. [8]

2. a) Design a slab panel having one short edge discontinuous for a room size of 4 m × 5 m. The edges of slab is supported on walls of width 250 mm. The slab is carrying a live load of 4 KN/m^2 and floor finish of 0.75 KN/m^2. Use M20 Concrete and Fe415 steel. Sketch the reinforcement detailing in plan and sections. Check for deflection and development length are necessary. [15]

   b) What is anchorage bond? Derive the expression $L_d \le 1.3\frac{M_1}{V} + L_o$, with usual notations. [1+4]

3. a) Explain the limit state of serviceability and its requirements in RCC structure. Also list the different types of splicing of reinforcements in RC structure. [4+1]

   b) A RC column of size 35 cm × 40 cm with unsupported length of 3.10 m is subjected to a factored axial load of 1500 KN and biaxial moments, M_{ux} = 125 KNm and M_{uy} = 88 KNm. The ends of the column are effectively held in position but not restrained against rotation. Design the column for longitudinal and transverse reinforcements, and sketch the details. Use M25 Concrete and Fe500 grade steel. [15]

4. a) Design a footing for a square column of size 350 mm × 350 mm reinforced with 8-16 mm dia. bars. The column is subjected to a factored axial load and moment of 1100 KN and 60 KN-m, respectively. The allowable bearing capacity of soil is 150 KN/m^2 at a depth of 1.5 m. Use M20 Concrete and Fe 500 steel for footing, and M30 Concrete and Fe 500 steel for column. Assume that the moment is reversible. Sketch the details (Plan and sections). [14]

   b) Draw the typical reinforcement drawing for a flight and a landing of RCC staircase. Also define the effective span for staircase. [5+1]

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02 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2073 Shrawan

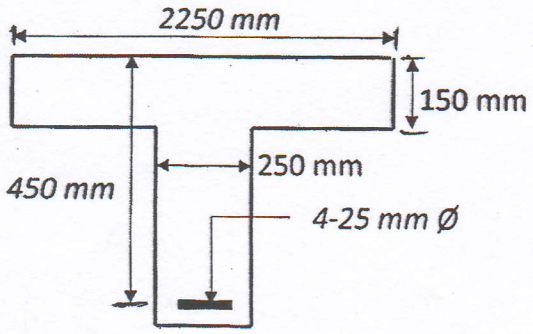
Exam.	New Back (2066 & Later Batch)		
Level	BE	Full Marks	80
Programme	BCE	Pass Marks	32
Year / Part	IV / I	Time	3 hrs.

Subject: - Design of RCC Structure *(CE702)*

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ *Attempt **All** questions.*
- ✓ *The figures in the margin indicate **Full Marks**.*
- ✓ *Design codes IS 456, IS 1893, IS 13920 and SP 16 are allowed to use.*
- ✓ *Assume suitable data if necessary.*

1. a) Find the moment of resistance of a RCC beam 250 mm wide and 500 mm effective depth if it is reinforced with 3-16 mm dia bars. The permissible stresses for concrete and steel are given as 7 MPa and 230 MPa. The value of modular ratio is taken as 13.33. [6]

   b) Find the ultimate moment resisting capacity of a beam as shown in figure. Consider M 20 and Fe415 grade of concrete and steel. [14]



2. a) Design and detail an interior pannel of a slab resting on RCC beams on all sides for a room having clear dimensions of 4.5m*6.5m. The slab is subjected to a super-imposed live load of4KN/m^2 and floor finishes load of 2.5 KN/m^2. Take M20 concrete and Fe415 steel. [15]

   b) What is ductility? What are the significances of ductility in RC structures? [2+3]

3. a) Design the longitudinal reinforcements to be provided for a short column 400×500 mm subjected to following forces: [15]

   P_u = 1600 KN

   M_{ux} = 20.0 KN-m

   M_{uy} = 150 KN-m

   Use M25 concrete and Fe415 steel Unsupported ~~de~~ length = 3 m

   b) Discuss the methods of crack control as per IS456-2000 in RC structures. [5]

4. a) Design an isolated footing for a square column 450 mm× 450 mm, reinforcement with 8-20 dia bars and carrying a service load of 1600 KN. Assume bearing capacity of soil as 250 KN/m^2 and depth of foundation as 1.5 m. Adopt M20 concrete and Fe 500 steel. Also check the development length and bearing stress in concrete. [14]

   b) What do you understand by idealized stress-strain diagram of concrete and steel bar? Draw idealized stress-strain diagrams. Define characteristics strength of concrete and steel. [2+2+2]

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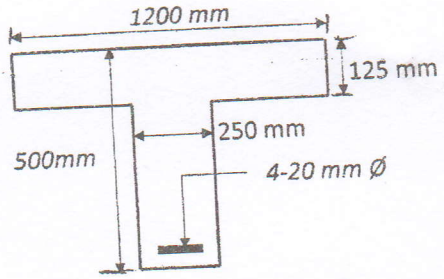
02 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2072 Chaitra

Exam.	Regular		
Level	BE	Full Marks	80
Programme	BCE	Pass Marks	32
Year / Part	IV / I	Time	3 hrs.

Subject: - Design of RCC Structure *(CE702)*

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ *Attempt **All** questions.*
- ✓ *The figures in the margin indicate **Full Marks**.*
- ✓ *Design codes IS 456, IS 1893, IS 13920 and SP 16 are allowed to use.*
- ✓ *Assume suitable data if necessary.*

1. a) Find shear reinforcement required for a beam as shown in figure below. Beam is subjected to design SF of 250KN. Consider M25 and Fe500 grade of concrete and steel. [6]



b) A simply supported RCC beam of effective span 5.5 meter and overall dimensions 230mm×550mm is subjected to superimposed load of 50 KN/m excluding its self weight. Design the beam for limit state of collapse in flexure. Also check whether the beam is safe in deflection or not. Adopt mild exposure condition and use Fe 415 steel. Take effective cover to re-bars as 50 mm. [14]

2. a) A rectangular slab panel 5.5m×4.0m (clear span) is continuous over three edges and discontinuous over one short edge. The slab is to rest on 250mm wide beam. The slab is subjected to live load of 5KN/m^2 and floor finishes load of 1.0 KN/m^2. Design the slab. Sketch the arrangement of reinforcement bars at support and mid span separately with torsional re-bars. Check whether the section satisfies the deflection criteria. (Check for shear and development length not necessary) [15]

b) Why limit state method is better than working stress method. Explain in brief. [5]

3. a) Design the longitudinal and transverse reinforcements to be provided for a short column of size 35cm×45cm subjected to the following forces. [15]

Factored axial load P_u = 1800 KN
Factored moment M_{ux} = 175 KN-m
Factored moment M_{uy} = 105 KN-m
Reinforcements are distributed equally on two sides. Use M25 concrete and Fe500 steel. Unsupported length = 3.1 m

b) Define the term ductility in RC design. Draw a neat sketch of a beam-column joint including ductile details. [1+4]

4. a) Explain how a RC structural member subjected torsion, shear force and bending moment is designed. [6]

b) Design an isolated rectangular footing for a column of size 300mm×400mm. The column is reinforced 8-20 mm dia bars with M25 concrete. The column is carrying a factored axial load of 1200 KN and the factored moment of 120 KN-m. Sketch the details of designed reinforcements in plan and sections. Also check the bearing stress and development length required. Adopt M20 grade concrete for footing. Grade of steel is Fe415. Assume bearing capacity of soil = 200 KN/m^2 at 1.25 below GL. [14]

02 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2072 Kartik

Exam.	New Back (2066 & Later Batch)		
Level	BE	Full Marks	80
Programme	BCE	Pass Marks	32
Year / Part	IV / I	Time	3 hrs.

Subject: - Design of RCC Structure *(CE702)*

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ *Attempt **All** questions.*
- ✓ *The figures in the margin indicate **Full Marks**.*
- ✓ *Assume suitable data if necessary.*
- ✓ *Use of IS: 456-2000; IS 1893 and SP16 are allowed. But, use of SP 16 is allowed only for column design.*

1. a) State all the possible safety and requirements of limit state and define limit state of strength and serviceability. [4]

   b) Design a rectangle footing to carry a column load of 1150 kN and BM of 250 kN-m from 600×600 mm square column with the 20 mm diameter longitudinal steel. The bearing capacity of soil is 200 kN/m^2. Consider depth of foundation as 1.5 m. Take unit weight of earth is 17 kN/m^3. Use M20 concrete and Fe 415 steel. [16]

2. a) How do you consider earthquake loads while designing RCC structures? Explain briefly. [4]

   b) Design a slab for a room of size 3.6 m × 4.2 m prevented uplifting by walls (230 mm thick) loads for a intermediate storey of a residential building. Use M20 grade of concrete and Fe 415 grade of steel. Sketch the reinforcements. Carry out all necessary checks require in slab design. Take live load = 3kN/m^2, floor finish = 1 kN/m^2. [16]

3. a) Derive the formula $L_d \le \frac{M_1}{V} + L_0$, where the symbols have their usual meanings. [4]

   b) Determine the longitudinal and transverse reinforcements in a short rectangular column subjected to a factored axial load of 2000 kN and factored moment M_{ux} about major axis of 190 kN-m and M_{uy} about minor axis of 95 kN-m. The size of the column is 300 mm×500mm and the unsupported length of 3 m. Adopt M30 concrete and Fe 500 grade steel. [16]

4. a) Explain with the help of sketches the requirements on reinforcement detailing in beams to ensure sufficient ductility. [6]

   b) A L-beam has a flange of effective width 900 mm and depth of 100 mm. The web below is 250 mm×500 mm. Determine the amount of reinforcement required for the cross-section if it has to carry a factored bending moment of 615 kN-m and SF of 50 kN. Adopt M20 concrete mix and Fe 500 grade steel. [14]

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02 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2071 Chaitra

Exam.	Regular		
Level	BE	Full Marks	80
Programme	BCE	Pass Marks	32
Year / Part	IV / I	Time	3 hrs.

Subject: - Design of RCC Structure *(CE702)*

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ *Attempt **All** questions.*
- ✓ *The figures in the margin indicate **Full Marks**.*
- ✓ *Assume suitable data if necessary.*
- ✓ *Use of IS: 456-2000; IS 1893 and SP16 are allowed. But, use of SP 16 is allowed only for column design.*

1. a) Using working stress method, design a rectangular section 300 mm width and 450 mm height carrying 30KN/m load in the effective span 3.6m. Use mild steel and M20 grade of concrete. [4]

   b) Enlist and make sketch of three kind of mechanical splices. [2]

   c) Design a short rectangular column of size 450mm×300mm and unsupported length 3 m subjected to an axial ultimate load of 1500KN and ultimate moments 150KNm and 80KNm a long major and minor axes respectively. Adopt M30 grade of concrete and Fe500 grade of steel. Sketch the final design. [14]

2. a) Write down the steps of design of a beam subjected to BM, SF and Torsion. [4]

   b) Design slab of a room of size 6.5m×4m for a live load of 4.5 KN/m^2 and floor finish of 1 KN/m^2 of slab are rigidly fixed with beam. Take width of beam 230 mm. Use M20 concrete and TMT bars. Draw top and bottom reinforcement detailing with sections. Carry out all checks required for slab design. [16]

3. a) Write provisions of ductile detailing of column with neat sketches. [6]

   b) Design an isolated footing to carry a column load of 1300 KN and BM of 100 KN-m from both axes of column. Column is 500 mm×500mm in size with 25 mm diameter longitudinal steel. The bearing capacity of soil is 220 KN/m^2. Consider depth of foundation as 1.70 m. Take unit weight of soil as 18.5 KN/m^3. Use M25 grade concrete and Fe415 steel. [14]

4. a) Discuss in detail the working stress method versus limit state method of design with their respective advantages and disadvantages. Compare balance, under reinforcement and over reinforced sections in limit state and working stress design methods. [8]

   b) A RC beam 300 mm× 500 mm is reinforced with 5-25 mm bars in tension and 5-12 mm bars in compression each at a clear cover of 25 mm. If effective span of the beam is 4.30 m. find the moment of resistance of the beam at ultimate state. Use M25 concrete and Fe 415 grade steel. [12]

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06 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2069 Chaitra

Exam.	Regular		
Level	BE	Full Marks	80
Programme	BCE	Pass Marks	32
Year / Part	IV / I	Time	3 hrs.

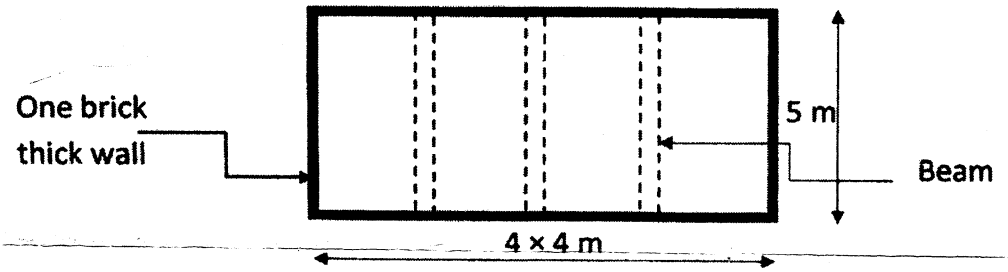
Subject: - Design of RCC Structure *(CE702)*

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ *Attempt **All** questions.*
- ✓ *The figures in the margin indicate **Full Marks**.*
- ✓ *Design codes IS 456, IS 1893, IS 13920 and SP 16 are allowed to use.*
- ✓ *Assume suitable data if necessary.*

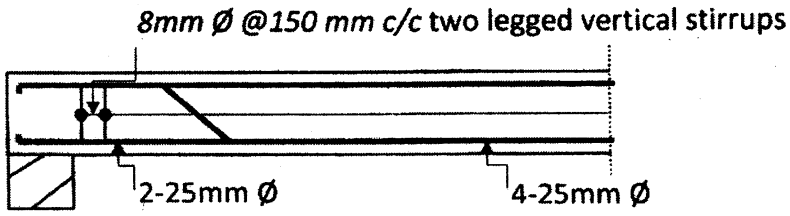
1. a) Explain different types of design methods used in Reinforced concrete structure design. [6]

   b) A column of 4 m length with both ends fixed and effectively held in position is subjected to a design axial load of 1000 KN and factored bending moment of 100 KN-m. Design the rectangular column with its longitudinal and transverse reinforcements. [14]

2. a) A floor consists of 125 mm thick RC slab, integrally connected with the beam as shown in figure below. Design an intermediate beam for BM and deflection if the floor is subjected to live load of 4 KN/m^2 and floor finishes of 0.7 KN/m^2. [10]

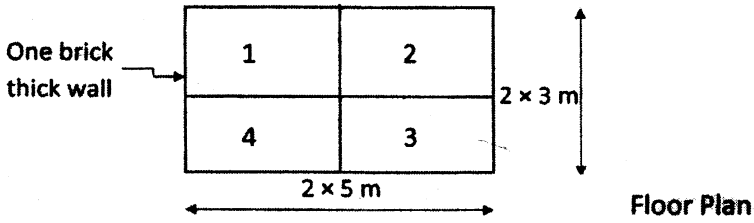


   b) Find the shear resisting capacity of a rectangular beam of 300 mm × 500 mm at the section of bent up bar. Angle of inclination of bent up bar is 45°. Consider M20 and Fe415 grade of concrete and steel. [10]



3. a) Explain in details all design steps of R.C.C mat foundation design. [6]

   b) RC slab of the floor of a residential building is subjected to live load of 3 KN/m^2 and floor finishes of 1 KN/m^2. Design the slab panel 2 for BM and SF. Draw neat sketches of slab showing top and bottom arrangements of reinforcing bars. [14]



4. a) Design the isolated footing of a column of 350 mm × 500 mm. Column is subjected to design axial load of 2000 KN and design BM of 80 KN-m. Allowable bearing capacity of soil is equal to 175 KN/m^2. [14]

   b) What are the ductility requirement for beam, column and joints of R.C.C structures? [6]

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01 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2068 Baishakh

Exam.	Regular / Back		
Level	BE	Full Marks	80
Programme	BCE	Pass Marks	32
Year / Part	IV / I	Time	3 hrs.

Subject: - Design of Reinforced Concrete Structures

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ *Attempt any **Four** questions.*
- ✓ *The figures in the margin indicate **Full Marks**.*
- ✓ *Assume suitable data if necessary.*

1. a) Prove that $S_V = \frac{087 f_y . A_{st} . d}{V_S}$ or $L_d = \frac{0.87 f_y . \phi}{4 \tau_{bd}}$. The symbols have their usual meanings. [5]

   b) A beam of 6m span is simply supported and carrying 24 kN/m live load and 3 kN/m dead loads excluding self weight. The beam is made of M20 concrete and Fe415 steel. Design the beam. Shear design is not required. [15]

2. a) Discuss briefly Limit State of Serviceability conditions. [5]

   b) Determine the reinforcement in a biaxially loaded column with the following parameters: [15]

   Size of column = 400mm × 600mm
   Factored load, P_u = 1500 kN
   Factored moment, M_{ux} = 300 kNm
   Factored moment, M_{uy} = 200 kNm

   Assume M25 concrete and Fe 415 steel.

3. a) Explain about detailing of reinforcement in staircases. [5]

   b) Design a reinforced concrete rectangular footing for a square column of size 450mm × 450mm, which is subjected to an axial load of 1650 kN and uni-axial moment of 240 kNm at service state. Consider allowable bearing capacity of soil as 120 kN/m^2. Show design summary and reinforcement detailing with neat sketch. [15]

4. a) What do you understand by splicing of bars? Write down the primary conditions for the application of splicing in reinforced concrete structures. [5]

   b) Design a two-way slab resting on RCC beams on all sides for a room having clear dimensions of 4m × 6m. The slab is subjected to a super-imposed live load of 2.5 kN/m^2 and floor finishes (screeds and flooring) load of 2.75 kN/m^2. Take M20 concrete grade and Fe415 steel grade. [15]

5. a) Draw idealized stress-strain curve for both steel and concrete and discuss on the design value of stresses. [5]

   b) A rectangular beam 180mm × 400mm is prestressed by a cable with an eccentricity of 75mm above the centroid at the supports and an eccentricity of 50mm below the centroid at the mid-span. Initial prestress is 900 N/mm^2 and area of the cable is 500mm^2. Calculate the prestressing force at the other end of the beam if its span is 10m. Assume μ = 0.50 and K = 0.0016/m. [15]

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03 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2066 Bhadra

Exam.	Regular / Back		
Level	BE	Full Marks	80
Programme	BCE	Pass Marks	32
Year / Part	IV / I	Time	3 hrs.

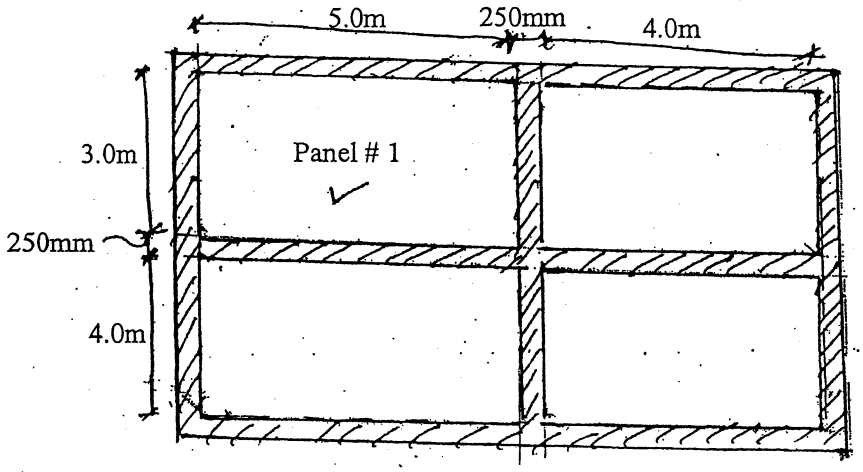
Subject: - Design of Reinforced Concrete Structures

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ *Attempt any **Four** questions.*
- ✓ *The figures in the margin indicate **Full Marks**.*
- ✓ *Use of IS: 456, IS 1343 are allowed. IS 456 SP-16 is allowed to design column only.*
- ✓ *Assume suitable data if necessary.*

1. a) What is the difference between working stress method and limit state method? Explain with stress and strain diagrams. [5]

   b) Design a simply supported rectangular beam with the effective span of 7m. The size of beam is required to be limited to 300mm × 700mm. Design shear reinforcement also. Take a live load of 70 kN/m. Use M20 concrete and Fe415 grade steel. [15]

2. The floor slab system of a two-storeyed building is shown in figure. The slab system is supported on 250mm wide beam as shown. Assuming a floor finish load of 1 KN/m^2 and a live load of 4 KN/m^2, design and detail the slab panel # 1 as indicated in the floor plan. Also check whether the section satisfies the deflection criteria. (Check for shear and development length not required). The torsional reinforcement should be designed. Use Fe415 steel. Assume mild exposure conditions. [12+4+4]



* The clear size of panel # 1 is 3.0x×5.0m as shown.

* Width of beam = 250mm

3. a) Explain the concept of design of a staircase. Show the detailing of reinforcement of straight flight in plan and section. [5]

   b) Determine the reinforcement equal in all sides of a biaxially loaded column with the following parameters. [15]

   Size of column = 400mm × 500mm
   Factored load, P_u = 1200 kN,
   Factored moment M_{ux} = 120 kNm,
   Factored moment M_{uy} = 100 kNm.
   M20 concrete and Fe 415 steel.
   d'/D = 0.15 for both axes.

4. a) Explain how an RC structural member subjected to torsion, shear force and bending moment is designed by IS code method. [6]

04 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2065 Shrawan

Exam.	Regular/Back		
Level	BE	Full Marks	80
Programme	BCE	Pass Marks	32
Year / Part	IV / I	Time	3 hrs.

Subject: - Design of Reinforced Concrete Structure

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ *Attempt any **Four** questions.*
- ✓ *The figures in the margin indicate **Full Marks**.*
- ✓ *Use of IS: 456, IS 1343 are allowed. IS 456 SP-16 is allowed to design column only.*
- ✓ *Assume suitable data if necessary.*

1. a) What is the difference between the limit state method fro working stress method of design. [7]

   b) A RC beam has an effective depth of 45cm and breadth of 30cm. It contains 5-20mm dia mild steel bars, out of which 2-20mm dia bars are curtailed at a section where shear force at service load is 100KN. Design the shear reinforcement if the concrete is M20. [13]

2. a) How the deflection can be controlled in a beam, explain it in brief. [7]

   b) A beam is simply supported on two walls of width 250mm with a clear span of 6m. If the beam have to support 150mm deep slab and live load of intensity 3 KN/m^2, design a T-beam. The beam is spaced at 4 m c/c. Take M20 concrete and Fe415 steel. Design for shear is not required. [13]

3. a) How the bent-up bars contribute in shear strength of beam, explain it. [4]

   b) Design a roof slab for a room 6m×3.5m restrained on all four sides by beams. It has to support super imposed load of 4 KN/m^2. Take M20 concrete and Fe250 steel. [16]

4. a) Describe the steps for design of a rectangular RC footing. Why shear reinforcement is not provided in footing? [7]

   b) Design a rectangular column supporting an axial load of 1200KN along with a bending moment of 150 KN-m at working loads. Use M25 concrete mix, Fe415 steel and the section reinforced equally distributed on two sides only. [13]

5. a) What are the differences between load balancing approach and homogeneous beam concept? Explain it. [4]

   b) Compute the net initial and final concrete stresses in the extreme top and bottom fibres at the mid span of a beam, which are 25cm wide and 30cm deep on a span of 8m. The beam is to support a dead load of 8 KN/m and live load of 6 KN/m. The beam is prestressed with a final force of 700 KN at an eccentricity of 7.5cm. Loss may be assumed as 15%. [16]

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64 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2065 Kartik

Exam.	Back		
Level	BE	Full Marks	80
Programme	BCE	Pass Marks	32
Year / Part	IV / I	Time	3 hrs.

Subject: - Design of Reinforced Concrete Structures

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ *Attempt any **Four** questions.*
- ✓ *The figures in the margin indicate **Full Marks**.*
- ✓ *IS 456, IS 1343 and SP16 are allowed to use.*
- ✓ *Notations given are of usual meaning.*
- ✓ *Assume suitable data if necessary.*

1. a) Write the characteristics of steel reinforcing bars used in the reinforced concrete structures. [5]

   b) Design a simply supported reinforced concrete beam of rectangular section at limit state of collapse in flexure and shear. The beam is subjected to a design load of 45 KN/m (including self weight). Clear span of the beam is 6m. Take M20 grade of concrete and Fe415 steel as the materials of beam. [15]

2. a) Show that $L_d \leq 1.3 M_1 / V_u + l_d$ [10]

   Where, L_d - Required development of reinforcement
   M_1 - Moment resisting capacity of flexure member
   V_u - Design shear force
   l_d - Additional anchorage length of reinforcing bar

   b) A reinforced concrete column of size 600mm×400mm with A_{st} = 8-28mm diameter is subjected to M_{ux} = 350 KN-m, M_{uy} = 50 KN-m and P_u = 2000KN. Check whether the column is safe for above combination of load and bending moments. Take M20 and Fe415 grades of concrete and steel respectively and the effective cover to reinforcing bar 60mm. [10]

3. a) What is the principle of sufficient stiffness method to control deflection? How the deflection of RC flexure member is controlled by this method. [6]

   b) Design a simply supported RC slab of 4m×6m at limit state of collapse in flexure. Arrange the designed reinforcing bars and draw a neat sketch of slab showing arrangement of top and bottom reinforcements. [14]

   Take, Live load = 4 KN/m2 Floor finish = 1 KN/m2
   Grade of concrete = M20 Grade of steel reinforcement = Fe500

4. a) Design a RC concrete spread footing of a RC wall having 4m length and 300mm width. Total load on wall is equal to 1000KN at service state. Take M20 and Fe415 grades of concrete and steel respectively, and safe bearing capacity of soil = 150KN/m^2. [12]

   b) Explain how a RC structural member subjected to torsion, shear force and bending moment is designed by IS code method. [8]

5. a) A rectangular beam of 200mm wide and 375mm deep has an effective span 9m. The prestressing cable has a triangular profile with zero eccentricity at ends and 75mm at mid span. The effective prestressing force is 800KN after all loss. Determine maximum value of concentrated load that the beam can support at mid span. [10]

   b) Write down design steps for the design of RL long column of unbraced frame. [10]

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04 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2067 Ashadh

Exam.	Regular/Back		
Level	BE	Full Marks	80
Programme	BCE	Pass Marks	32
Year / Part	IV / I	Time	3 hrs.

Subject: - Design of Reinforced Concrete Structures

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ *Attempt any **Four** questions.*
- ✓ *The figures in the margin indicate **Full Marks**.*
- ✓ *Assume missing data if necessary possibly complying to IS: 456-2000.*
- ✓ *Use of IS: 456-2000, IS: 1343 and SP 16 are allowed. But, use of SP-16 is allowed only for column design.*

1. a) A reinforced concrete column of a moment resisting frame has its cross section 400mm × 600mm and effective height 3.6m. The column has to carry loading combination of dead load, live load and moment due to wind load. The computed dead load and live load on column are 250 kN, and 100 kN respectively, whereas the induced horizontal load on column due to wind load is 5 kN/m. Calculate loading values for all possible loading combinations as per IS 456. [8]

   b) The moment of resistance of a rectangular reinforced concrete beam section having width b mm and overall depth D mm is $0.85bd^2$. The stresses in the extreme fiber of the concrete; and in the steel are not to exceed 7 N/mm^2 and 140 N/mm^2 respectively and the modular ratio equals to 18.33. Determine the ratio between the depth of neutral axis from the compression fiber and the effective depth of the beam. The beam is reinforced for tension side only. [12]

2. a) State all the possible safety and serviceability limit states to be considered in the design by Limit State Method. [5]

   b) Design an isolated square footing foundation of uniform thickness for a 400mm × 400mm column subjected to an axial load of 600 kN and a moment of 50 kNm at service state. Consider bearing capacity of soil as 150 kN/m^2 and concrete grade M20 and steel grade Fe415. [10]

   c) Draw idealized stress-strain curve for both steel and concrete and discuss on the design values of stresses. [5]

3. a) Write down the procedure for design of shear reinforcement. Also explain how the isolated footings are designed under punching shear? [8]

   b) Design the reinforcement required for a simple rectangular beam having effective span length of 6m. The beam is carrying 8 KN/m load from 120mm thick slab. Consider the width of beam 250mm and overall depth of beam to be 450mm. For loading calculation, consider live load on floor: 5 kN/m, floor finish: 3 kN/m, partition wall: 10 kN/m. M20 concrete and Fe415 steel are used. [12]

4. a) A concrete beam of 20m span, 200mm wide and 500mm deep is pre-stressed using a cable with cross sectional area of 250mm^2. The cable profile is parabolic with an eccentricity of 100mm above the centroid of the section at the end supports and 100mm below at the mid span. If the cable is tensioned from one end only, estimate the percentage loss of pre-stress in the cable due to the effects of friction. Consider m = 0.35 and k = 0.0015/m. Use the parabolic profile of the curve as $y = \frac{4e}{\ell^2} x(\ell - x)$. [12]

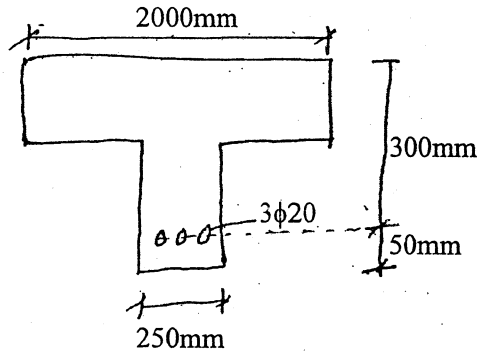
b) What do you understand by curtailment of tension steel in simple beams? Show by illustrating a neat sketch. [8]

5. a) Compare the factor of safety used in Working Stress Method and Partial Safety Factor used in Limit State Method for concrete and steel. [4]

b) Differentiate among the balanced, under reinforced and over reinforced section in a rectangular reinforced concrete section in limit state method with corresponding strain diagram. [8]

OR

Determine the moment of resistance of the section shown in figure below. Take $\sigma_{cbc} = 7$ N/mm^2 and $\sigma_{st} = 140$ N/mm^2. [8]



c) Design a square shaped reinforced concrete column that has to carry ultimate factored load of 800 kN inclusive of live load, at an eccentricity of 80mm in both X and Y directions. Use concrete grade M20 and steel grade Fe415. [8]

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