

Scheme – I
Sample Question Paper

Program Name : Civil Engineering Program Group
Program Code : CE/CR/CS
Semester : Fifth
Course Title : Design of Steel and RCC Structures
Max. Marks : 70

22502

Time : 4 Hrs.

Instructions:

- 1) All questions are compulsory.
- 2) Illustrate your answers with neat sketches wherever necessary.
- 3) Figures to the right indicate full marks.
- 4) Assume suitable data, if necessary.
- 5) Preferably, write the answers in sequential order.
- 6) Use of non-programmable electronic pocket calculator is permissible.
- 7) Mobile phone, pager and any other electronic communication devices are not permissible in examination hall.

Q.1 Attempt Five of the following.

10 Marks

- a) Define the Limit state and state its types.
- b) Enlist two loads to be considered as per IS 875:1987 while designing steel structures.
- c) Explain the term – Pitch and Gauge related to bolted connection.
- d) Define the terms - Characteristic Load and Characteristic Strength.
- e) State two forms of shear reinforcement.
- f) Define aspect ratio in case of slab and state its importance.
- g) Write an expression for minimum eccentricity of axially loaded short column along with meaning of each term used in it.

Q.2 Attempt Three of the following.

12 Marks

- a) Write names of four steel structures along with their functions.
- b) Draw stress and strain distribution diagram for a singly reinforced balanced section showing all important variables along with their meanings.
- c) Define development length and enlist three factors affecting it.
- d) Calculate the development length, if a 16 mm diameter bar of grade Fe 500 is used for resisting compression. Take the design bond stress (ζ_{bd}) is 1.2 N/mm^2 for plain bars in tension.

Q.3 Attempt Two of the following.

12 Marks

- a) Design suitable bolted connection for a single angle strut made up of ISA 100 x 100 x 10 mm using 12 mm gusset plate for a factored compressive load of 175 kN. Assume 20 mm bolts of grade 4.6. Draw connection details.
- b) Design fillet weld to connect plates 60 mm x 10 mm and 150 mm x 12 mm thick for its full strength. Assume welding is on three sides. Take, shop weld, $f_y = 250 \text{ MPa}$ and $f_u = 410 \text{ MPa}$.

- c) (i) Define cover provided for reinforcement in RC section and state its recommendations as per IS 456:2000.
(ii) Define over reinforced section and state two reasons due to which they are avoided in actual practice.

Q.4 Attempt Two of the following.

12 Marks

- a) Calculate ultimate moment of resistance for a cantilever beam having effective span of 2.5 m and of size 230 mm x 450 mm deep effective. It is reinforced with 6 bars of 12 mm diameter bar on tension side only. Use M 20 concrete and Fe 500 steel. Also determine safe uniformly distributed load the beam can sustain.
- b) Calculate depth and area of steel at mid span of a simply supported beam having a span of 6 m. The beam is carrying a udl of 20 kN/m including self weight. Use M 20 concrete and Fe 415 steel. Assume $b = \frac{1}{2} d$.
- c) Design the shear reinforcement for a simply supported beam of span 5.0 m having size 230 x 450 mm effective. It carries a central point load of 30 kN. It is reinforced with 4 bars of 16 mm diameter out of which one bar is bent having grade of Fe 415. Use two legged vertical stirrups of 8 mm diameter. Take $\zeta_c = 0.57 \text{ N/mm}^2$ and $\zeta_{c \text{ max}} = 3.1 \text{ N/mm}^2$.

Q.5 Attempt Two of the following.

12 Marks

- a) Design the suitable slab for a 3 m wide passage, supported on 230 mm thick side walls. It carries a superimposed load of 3.75 kN/m^2 including floor finish. Take M.F.= 1.4. Use effective cover of 20 mm, M 20 concrete and Fe 415 steel. Do not apply check for shear and bond. Sketch the cross-section along shorter span.
- b) Design a slab having internal room size 3 x 4.5 m. Take live load of 2 kN/m^2 , floor finish of 1 kN/m^2 . Assume width of support = 230 mm. Take BM coefficients as $\alpha_x = 0.089$ and $\alpha_y = 0.056$. Use M 20 concrete and Fe 415 steel. Draw the reinforcement details along longer span. Do not apply checks for shear, bond and deflection.
- c) Design a chajja for a span of 1.5 m. Take L.L. = 2.2 kN/m^2 and F.F. = 0.5 kN/m^2 . Size of support lintel is 230 x 230 mm. Use M 20 concrete and deformed steel of grade Fe 415. Sketch the c/s of chajja. (No checks required.)

Q.6 Attempt Two of the following.

12 Marks

- a) Design a square column to carry an axial load of 1200 kN. The unsupported length of column is 3.5 m. Use M20 concrete and 1 % steel of grade Fe 415 as longitudinal reinforcement. Apply the check for minimum eccentricity and for short column.
- b) Design a RC column square footing for a column of size 400 mm x 400 mm. Load on column is 1200 kN. Take safe bearing capacity of soil = 200 kN/m^2 . Use M20 concrete and Fe 415 steel. Check for punching shear and one way action need not be given. Also, draw the c/s of footing showing reinforcement details.
- c) Write IS 456: 2000 requirements for RC column and footing –
(i) Percentage, spacing and diameter of longitudinal steel
(ii) Diameter and pitch of transverse steel

Scheme – I

Sample Test Paper - I

Program Name : Civil Engineering Program Group
Program Code : CE/CR/CS
Semester : Fifth
Course Title : Design of Steel and RCC Structures
Max. Marks : 20

22502

Time : 1.15 Hrs.

Instructions:

- 1) All questions are compulsory.
- 2) Illustrate your answers with neat sketches wherever necessary.
- 3) Figures to the right indicate full marks.
- 4) Assume suitable data, if necessary.
- 5) Preferably, write the answers in sequential order.
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Q.1 Attempt Four of the following.

08 Marks

- a) Define Partial safety factor and write its values for load and material.
- b) State the meaning of – ISNT, ISMB, ISSC and ISLC.
- c) Write two advantages and two disadvantages of steel as a construction material.
- d) Write four advantages of bolted connection over welded connection.
- e) Write four assumptions made in Limit state of collapse (flexure).
- f) State two differentiations between Under reinforced and Balanced section.

Q.2 Attempt Two of the following.

12 Marks

- a) Design the bolted joint to transfer a design force of 750 kN. An inclined truss member consists of 2 ISA 100 x 75 x 10 mm connected back to back with longer leg connected to a gusset plate 12 mm thick. Use bolts of grade 4.6 and steel of grade Fe 410.
- b) (i) Define bolt value and state its criteria to decide it. Also state its use in case of design of joint.
(ii) Calculate the weld length for a fillet joint of two plates having 120 x 10 mm each is subjected to a factored axial load of 250 kN. Use shop weld of size 6 mm using design weld strength equal to 410 MPa.
- c) Design the smallest reinforced concrete section for a simply supported beam of 4 m clear span with bearing support of 300 mm. It carries a udl of 30 kN/m including self weight. The width of the beam is 250 mm and reinforced on tension side only. The materials used are M 20 concrete and Fe 415 steel.

Scheme – I

Sample Test Paper - II

Program Name : Civil Engineering Program Group
Program Code : CE/CR/CS
Semester : Fifth
Course Title : Design of Steel and RCC Structures
Max. Marks : 20

22502

Time : 1.15 Hrs.

Instructions:

- 1) All questions are compulsory.
- 2) Illustrate your answers with neat sketches wherever necessary.
- 3) Figures to the right indicate full marks.
- 4) Assume suitable data, if necessary.
- 5) Preferably, write the answers in sequential order.
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- 7) Mobile phone, pager and any other electronic communication devices are not permissible in examination hall.

Q.1 Attempt Four of the following.

08 Marks

- a) State two functions of bent up bars provided in flexure section.
- b) State four factors affecting development length in RC design.
- c) Define development length and anchorage length used in the theory of bond.
- d) Differentiate between one way slab and two way slab with respect to aspect ratio, spanning direction, bending curvature and placing of steel.
- e) Write an expression for design strength of axially loaded short column as per IS 456:2000 along with meaning of each term.
- f) Enlist two different criteria to be considered while deciding depth of footing as per IS 456:2000.

Q.2 Attempt Two of the following.

12 Marks

- a) Design verandah slab supported along two longer edges having effective span of 3.0 m. Take live load = 4 kN/m², floor finish = 1 kN/m². Use M 20 concrete and Fe 415 steel. Take M. F. = 1.4. Also sketch c/s of slab along longer span showing reinforcement details. (No checks required.)
- b) An axially loaded column of size 500 x 500 mm is carrying factored load of 1500 kN. Design a RC square footing supported by foundation strata having its safe bearing capacity as 200 kN/m². Use M20 concrete and Fe 415 steel. Decide footing depth using bending moment criteria only. Also, draw the c/s of footing showing reinforcement details.
- c) (i) Calculate anchorage length of 45° and 90° bend for 20 mm diameter bar.
(ii) Draw the cross section of cantilever slab with supporting end beam showing reinforcement details.