Scheme – I

Sample Question Paper

Program Name : **Civil Engineering Program Group**

Program Code : **CE/CR/CS**

Semester : **Fifth**

22502

Course Title : **Design of Steel and RCC Structures**

Max. Marks : **70** **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 MPa and f_u = 410 MPa.

c) (i) Define cover provided for reinforcement in RC section and state it's 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 = ½ 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 ζ_c = 0.57 N/mm^2 and $\zeta_{c\,max}$ = 3.1 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 α_x = 0.104 and α_y = 0.046. 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**

22502

Semester : **Fifth**

Course Title : **Design of Steel and RCC Structures**

Max. Marks : **20** **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 it's 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**

22502

Semester : **Fifth**

Course Title : **Design of Steel and RCC Structures**

Max. Marks : **20** **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.
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 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/m^2, floor finish = 1 kN/m^2. 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/m^2. 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.