DESIGN OF STEEL CONCRETE COMPOSITE STRUCTURES - QUESTION BANK

UNIT I

PART A

1) Write the two important limit states?

2) Define transformed sections?

3) What is slip strain?

4) Draw the graphical representation of the interaction between the moments in the design of continuous beams?

5) List the various limit states in limit state approach?

6) What is sectional classification?

7) List the various considered in IS: 11384 code of practice for composite construction?

8) Write any one application of steel concrete steel sandwich construction?

9) Write any two role of profiled metal decking

10) Write the advantages of steel concrete composite construction

11) Draw the curves for slip strain and slip

12) Explain the role of steel decking in composite deck slab

13) Explain the composite beam stage

14) Explain the composite slab stage

15) Write the failure modes of composite beams

16) State the principal advantages of composite construction for civil engineering structures.

17) What do you understand by shored and unshored methods of construction?

18) What is the essential difference between RCC and steel concrete composite structures?

19) Define a) Modular ratio b) Transformed section

20) What are the means through which the composite action between steel and concrete is ensured?

PART B

1) Compare NO INTERACTION case with FULL INTERACTION case

2) i) Explain with neat sketches the various types of steel concrete composite members.

ii) How do you go about the proportioning of composite members?

3) Discuss about the determination of ultimate moment capacity of a composite section with profile sheeting

DESIGN OF STEEL CONCRETE COMPOSITE STRUCTURES - QUESTION BANK

4) Explain the failure mode of the steel concrete steel sandwich elements

5) a)What is a steel concrete composite structure? b) Write the advantages of steel concrete composite connection

6) Design a simple supported composite beam with 8m span spaced at 3m c/c. thickness of slab = 100mm. The floor has to carry an imposed load of 2kN/m^2, a construction load of 0.75kN/m^2 and a floor finish load of 0.5kN/m^2. Floor will not be propped during Construction. Check the adequacy of section at construction stage and composite stage. Calculate deflection and stresses. Use M30 grade concrete.

7) A composite floor slab is supported on three span continuous composite beams spaced at 4m c/c. The effective length of each span is 7.5m. Thickness of composite slab is 150mm. The floor has to carry an imposed load of 4kN/m^2 And dead load of 1.5kN/$m^{2.}$ .Design the continuous beam. Use M30 grade concrete.

8) a)Explain the composite beam stage and composite slab stage

b)Explain the role of steel decking in composite deck slab

9)A two span continuous beam composite beam with 6m span each and are spaced at distance of about 3m.The thickness of slab is 125mm.The floor has to carry an imposed load of 2.5kN/m^2 partial load1.5 kN/m^2 and floor finish load of 0.75 kN/m^2.Assume the construction load as 1kN/m^2. Use M30 concrete and yield stress of steel 250 N/mm^2. Design the continuous beam

10) Explain the behavior of steel and concrete under uniaxial stress and also explain the behavior of composite material.

11)a)What is transformed section?

b)Discuss the determination of ultimate moment capacity of a composite section.

UNIT 2

PART A

1) List the main functions of shear connectors?

2) How the load transfer taken place in fixed shear connections?

3) Define effective flexural stiffness

4) What are the different types of shear connectors

5) Write the empirical formula for design resistance of shear studs

DESIGN OF STEEL CONCRETE COMPOSITE STRUCTURES - QUESTION BANK

6) Draw the load slip curve

7) Write the assumptions made for the analysis of ultimate moment capacity of the section

8) What is partial shear connection

9) What are the functions of connectors?

10) What is full shear connection

11) What is the moment of resistance of the composite steel concrete section as per IS 11384-1985

12) What is the purpose of shear connectors

13) What is the load bearing mechanism of shear connectors

14) What is the principle of design of shear connectors?

15) Distinguish between flexible and rigid type shear connectors?

16) Differentiate vertical and longitudinal shear?

17) What is the limiting stud diameter required for a composite construction?

18) What is shear lag effect?

19) What is the maximum spacing of shear studs in SCS sandwich construction?

20)Define strength of connectors.

PART B

1 i) Discuss the load carrying mechanisms of shear connectors.
ii)Discuss in detail about the various types of shear connections along with the need sketch

2)i)Describe the load carrying behavior of the stud connector

ii) How shear connecters are designed?

iii)Describe about the push out test?

3) A composite beam of 8 m span is spaced at 3m c/thickness of RC slab is 125 mm. The floor has to carry an imposed load of 3 kN/m^2, partition load of 1.5 kN/m^2 and a floor finish load of 0.5 kN/m^2. The floor will not be propped during construction. Check the adequacy of the section at preconstruction stage and also design the shear connection

4) i)Define shear connectors and explain its types with neat sketches

ii)Explain the characteristic strength of shear connectors

5) a)Elaborate the step by step procedure of connection in composite structures.

b) Discuss partial shear connection.

DESIGN OF STEEL CONCRETE COMPOSITE STRUCTURES - QUESTION BANK

6) What are shear connectors? Mention different types of shear connections.

7) Explain beam and column connections in composite structures.

8) Design the shear connection at the interface of a composite RC slab and steel beam for the following data:

Span of the beam =9m

Spacing of the beam = 3m

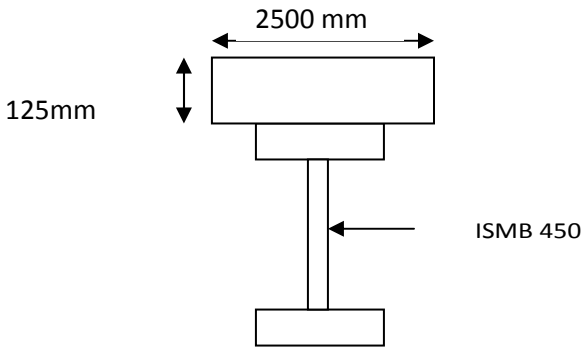
Thickness of slab= 100mm

Steel beam section = ISHB 400

Concrete strength = 25MPa

9) An ISMB 250 is supporting a slab of thickness 120mm.the steel beam of 5.5m span are spaced at 4m interval. The slab is subjected to a super imposed load of 2 kN/m^2. Design the suitable connectors between steel beam and RC Slab to ensure full interaction.

10) A simply supported composite beam of span 10m is subjected to an imposed load of 3 kN/m^2, partion load of 1.5 kN/m^2 and floor finishes of 0.5 kN/m^2 .The beams are spaced at 3m centers. The adequate section in composite stage under above loading is given in fig. design the shear connectors for the beam. Take the grade of concrete as M30 and the 100mm headed shear connected.



UNIT 3

PART A

1) List any two application of composite truss?

2)Draw the interaction curve for the uniaxial bending column?

3)Why the circular tubular column is better than other one?

4)Which type of composite column is suitable in seismic region?

5)Why column web stiffeners are provided in a beam column connection?

DESIGN OF STEEL CONCRETE COMPOSITE STRUCTURES - QUESTION BANK

6)How the effective breadth of the composite beam is considered? Why?

7)Draw the bending stress diagram of a composite beam (with the provision of profile sheeting) when the neutral axis is within the concrete slab.

8)Write the serviceability limit state of composite beam

9)List any two applications of composite trusses

10)Draw the interaction curve of a composite column subjected to compression and uniaxial bending

11)How to calculate the plastic resistance of concrete filled tubular composite column

12)List the various forces at a composite beam column connection.

13)How the effective breadth of the composite beam is considered? Why?

14)Draw the bending stress diagram of a composite slab (with the provision of profile sheeting) when the neutral axis is within the concrete slab?

15)Why the circular tubular column is better than the other ones

16)What are the two types of profile deck

17)How the effective span is calculated, if profiled decking sheets are used in composite floor?

18)What is the serviceability criteria as per EC4

19)What are the structural elements in composite floor

20)What is the deflection limit of profiled sheeting as per EC4

21)What is the significance of non-dimensional slenderness with respect to composite columns?

22)State the suitability of composite trusses

23)Sketch some typical connections adopted in composite trusses.

PART B

1) Check the adequacy of the continuous composite profile deck slab of 130mm deep, spanning 3m.The cross section of the profiled sheeting is as shown in fig.2. The live load of the slab is 3kN/m^2.The slab is propped at the center during construction stage. Use M20 concrete. Consider the construction load as 0.75kN/m^2.

Decking sheet data

Yield strength of steel = 280N/mm^2

Design thickness = 1.2mm

Effective area of cross section – 1231mm^2/m

Moment of inertia – 0.605x106 mm^4/m

Plastic moment of resistance – 3.1 kNm/m

DESIGN OF STEEL CONCRETE COMPOSITE STRUCTURES - QUESTION BANK

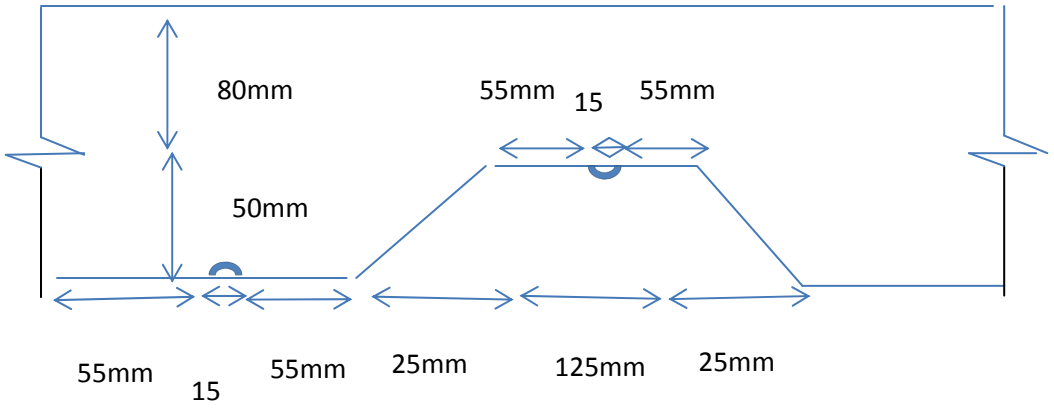
Distance of centroid above base = 22.5mm

Distance of plastic neutral axis above base =25mm

Resistance to vertical shear – 30 kN/m

Resistance to longitudinal shear m-184 N/mm^2

Modulus of elasticity of steel = $2x10^5$ N/mm^2



2)Obtain plastic resistance of a steel section made of ISHB300 encased in M30 concrete. The height of the column is 3.5 m and is pinned ended. The details of the section are given as

The dimension of the column is 400mm x 400mm
Reinforcing steel Fe 415 – 0.5% of gross concrete area.

3)Design a composite section without shores, for use as an interior floor beam.
Span of the beam =8.5m
Spacing of beam = 2.5m
Thickness of slab = 100mm
Dead load = $2.5kN/m^2$
Live load = $7.5kN/m^2$
Concrete strength = 20 MPa
Modular ratio = 9

4) Check the adequacy of concrete encased composite section for biaxial bending. The details of the section are given as
The height of the column is 3m and pinned ended. The dimension of the column is 500mm x500mm
Use M30 grade of concrete
Use ISHB 350RSJ section
Reinforcing steel Fe 415 of 4no of 14mm diameter. Design axial load is 1200Kn.

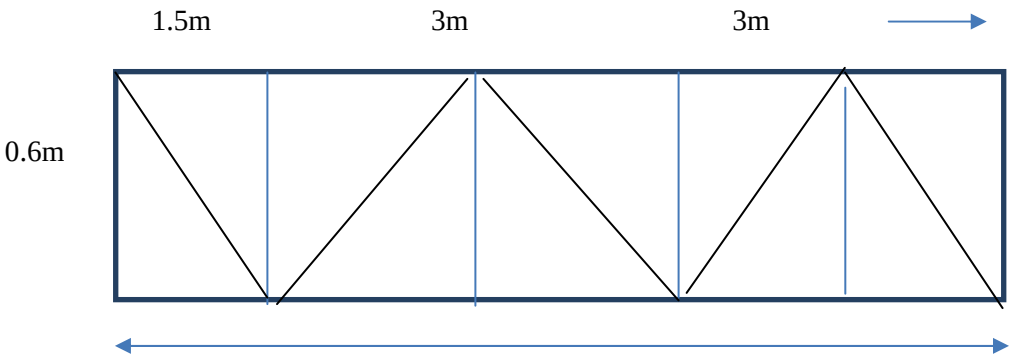
DESIGN OF STEEL CONCRETE COMPOSITE STRUCTURES - QUESTION BANK

The design bending moment about xx axis is 120knm.
The design bending moment about yy axis is 100kNm.

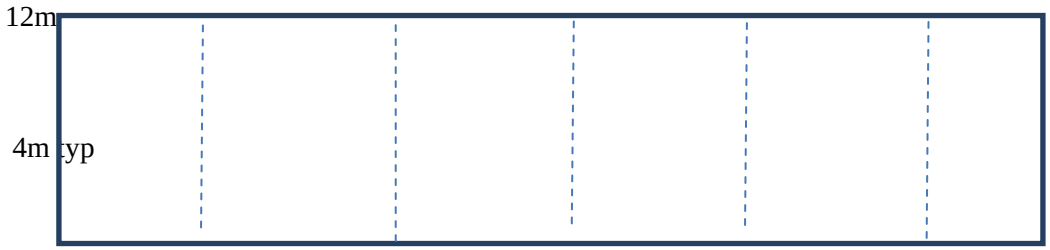
5) Obtain plastic resistance of a steel section made of ISHB300 encased in M25concrete. The height of the column is 3.5 m and is fixed ended. The details of the section are given as

The dimension of the column is 400mm x 400mm
Reinforcing steel Fe 415 – 0.5% of gross concrete area. The cover to the flanges will be 50mm.

6)A composite truss of span 12m as shown in fig 1 with following data.
i) Slab thickness-120mm
ii) Profile depth – 75mm
iii) Self-weight of the slab – 2.8kN/m^2
iv)spacing of truss- 2.5m c/c
v) Construction load – 1 kN/m^2
vi) Live load – 2.5kN/m^2
vii) Maximum laterally unrestrained length in top chord is 1.5m
viii) Grade of concrete M30
Design the top and bottom chord of the composite truss.



7) Design the simply supported composite beam of span 12m as shown in the figure.1 for its construction stage. The thickness of slab is 135mm. the expected construction load on the slab is 1kN/m^2. Assume the grade of concrete as M30, yield stress of structural steel is 250KN/m^2 and density of concrete is 24kN/m^2. Use partial safety for both live load and dead load as 1.5.



DESIGN OF STEEL CONCRETE COMPOSITE STRUCTURES - QUESTION BANK

8) Discuss about the determination of ultimate moment capacity of a composite beam section with the provision of profile sheeting and compare with the ultimate capacity of IS11384 provision

9) Obtain plastic resistance of a steel tubular section 380 mm external diameter and 360mm internal diameter in- filed with M30 concrete. The height of the column is 3.5m and is pinned at one end and fixed on the other end.

10) Design a concrete encased composite construction subjected to a biaxial bending. The details of the section are given as

i. the height of the column is 3.25m and pinned ended.

ii. the dimension of the column is 400mm x 400mm

iii Use M30 grade of concrete

iv. Reinforcing steel Fe 415- 0.5%of gross cross sectional area

Design axial load is 850kN

vi. The design bending moment about xx axis is 90 kNm

the design bending moment about yy axis is 75 kNm

Use ISHB 250RSJ section.

11) The composite column of size 400X400X400 mm under the design axial load of 1500

KN and bending moment about XX axis is of 200 kNm with steel section ISMB 250 is

at the center. Steel reinforcement is 4 Nos of 12 mm dia bars. Check the adequacy of the

Section for uniaxial bending. Adopt M30 and Fe 415 steel

12)Obtain the plastic resistance of a concrete filled circular tubular composite column having an external diameter as 300 mm and internal diameter as 280 mm. the height of the column is pin ended.Assume M30 Concrete.

13) Design a tension member of a composite truss to transmit axial load of 120Kn. Also design the end connectivity length of the member is 3.2m.

DESIGN OF STEEL CONCRETE COMPOSITE STRUCTURES - QUESTION BANK

UNIT 4

PART A

1)List the various forces acting in any composite connection

2)What is box girder bridges

3)What are the advantages of box girder bridges

4)What are the design concepts in box girder bridges

5)What are trusses?

6)Write short notes on composite trusses

7)Under what circumstance composite box girders are favored?

8)How composite construction proves to be more advantageous for bridges?

9)What is shear span?

10)Explain behavior of composite bridge.

PART B

1) i)Discuss in detail the local buckling and section classification
   ii)Explain the design concepts for the checking the adequacy of concrete encased
   Composite section for biaxial bending

2) Design a composite truss of span 10 m with following data:

Truss spacing = 10 m

Slab thickness = 150 mm

Profile depth = 75 mm

Self-weight of deck slab = 2.8 kN/m^2

Maximum laterally unrestrained length on top chord = 1.5 m

Adopt M 30 grade concrete

3)Explain general principles for design of composite frames

4) Explain the behavior of box girder bridge under bending, torsion, torsional warping and Distortion

5)Briefly describe the following

i) Initial design criteria of composite girder bridges

ii)Cross-section arrangement

iii) section depth

iv)Economic and practical consideration

6) Briefly discuss about the ultimate limit state design of box section beams with and without longitudinal stiffeners.

7) Explain step by step procedure for design of box Girder Bridge.

8) i) Discuss the advantages of composite construction in bridges.

ii) Detail the AASHTO specification with regard to the design of composite bridges.

9) Design the composite box girder to suit the following data.

Span of the girder = 10 m

Dead load moment = 370 kNm

Live load moment = 725 kNm

Thickness of slab = 100mm

Concrete strength = 25 MPa

Modular ratio = 9

10) Explain the various forms of composite box girder bridges with neat sketches. What are the advantages of box Girder Bridge?

UNIT 5

PART A

1)What is the second order effect?

2) Which type of composite column is suitable in seismic region?

3) Write the seismic behavior of slab

4) Write the seismic behavior of beam

5)Write the seismic behavior of column

6) Write the seismic behavior of connections

7) What is the response of composite structures to seismic effects?

8) What additional precautions are to be taken for composite structure to resist seismic forces?

9) Give two classical examples of composite structures.

10)What is second order effect?

DESIGN OF STEEL CONCRETE COMPOSITE STRUCTURES - QUESTION BANK

PART B

1)Discuss a case study on steel concrete composite construction in buildings

2)Explain the seismic behavior of composite beams and columns

3)Describe in detail about the steel concrete steel sandwich construction design criteria and possible failure modes. Also discuss the various applications

4) Discuss a cost effective study of steel concrete composite construction over conventional construction in building sector

5) Explain the factors to be considered while the designing the composite structure under

Seismic loads. Also explain the seismic behavior of composite beams.

6)Write notes on seismic behavior of:

i. Composite columns (8 Marks)

ii. Composite slabs (8 Marks)

7)Write notes on seismic behavior of Composite connections

8)Discuss the common construction methods in composite design in respect of buildings.

9) i)How are composite structures made seismic resistant.

ii) Detail the codal provision relating to the design of composite structure for seismic loads.

10)Explain the effect of rigid and semi rigid connectivity between column and beams when frames are subjected to seismic forces. Discuss the codal provisions.

11)Justify that steel concrete composite construction for buildings are an efficient and cost effective with a case study

.