UNIT – V

ROOF TRUSSES AND INDUSTRIAL STRUCTURES

Roof trusses – Roof and side coverings – Design loads, design of purlin and elements of truss; end bearing – Design of gantry girder

PART - A

TWO MARK QUESTIONS AND ANSWERS

1. What are main benefits of using composite floors with profiled steel decking?

i. Savings in steel weight are typically 30% to 50% over non-composite Construction

ii. Greater stiffness of composite beams results in shallower depths for the same span. Hence lower storey heights are adequate resulting in savings in cladding costs, reduction in wind loading and savings in foundation costs.

iii. Faster rate of construction.

2. Explain about the importance of steel decking.

• It supports loads during construction and acts as a working platform

• It develops adequate composite action with concrete to resist the imposed loading

• It transfers in-plane loading by diaphragm action to vertical bracing or shear walls

• It stabilizes the compression flanges of the beams against lateral buckling, until concrete hardens.

• It reduces the volume of concrete in tension zone

• It distributes shrinkage strains, thus preventing serious cracking of concrete

3. What is meant by Composite Beam Stage

The composite beam formed by employing the profiled steel sheeting is different from the one with a normal solid slab, as the profiling would influence its strength and

stiffness. This is termed 'composite beam stage'. In this case, the profiled deck, which is fixed transverse to the

beam, results in voids within the depth of the associated slab.

4. Write short notes on composite slab stage

The structural behaviour of the composite slab is similar to that of a reinforced concrete beam with no shear reinforcement. Steel sheeting provides adequate tensile capacity in order to act with the concrete in bending. However, the shear between the steel and concrete must be carried by friction and bond between the two materials. The mechanical keying action of the indents is important. This is especially so in open trapezoidal profiles, where the indents must also provide resistance to vertical separation.

5. What are economical considerations for industrial truss?

• Method of fabrication and erection to be followed, facility for shop fabrication available, transportation restrictions, field assembly facilities.

• Preferred practices and past experience.
• Availability of materials and sections to be used in fabrication.
• Erection technique to be followed and erection stresses.
• Method of connection preferred by the contractor and client (bolting, welding or riveting).
• Choice of as rolled or fabricated sections.
• Simple design with maximum repetition and minimum inventory of material.

6. Write about basics of plastic analysis?

In plastic analysis and design of a structure, the ultimate load of the structure as a whole is regarded as the design criterion. The term *plastic* has occurred due to the fact that the ultimate load is found from the strength of steel in the plastic range.

This method is rapid and provides a rational approach for the analysis of the structure. It also provides striking economy as regards the weight of steel since the

sections required by this method are smaller in size than those required by the method of elastic analysis.

7. What is meant by first yield moment?

As *W* is increased gradually, the bending moment at every section increases and the stresses also increase. At a section close to the support where the bending moment is maximum, the stresses in the extreme fibers reach the yield stress. The moment corresponding to this state is called the *first yield moment M_y*, of the cross section.

8. Write about Principles of plastic analysis

(i) Mechanism condition: The ultimate or collapse load is reached when a mechanism is formed. The number of plastic hinges developed should be just sufficient to form a mechanism.

(ii) Equilibrium condition: $\Sigma Fx = 0$, $\Sigma Fy = 0$, $\Sigma Mxy = 0$

(iii) Plastic moment condition: The bending moment at any section of the structure should not be more than the fully plastic moment of the section.

9. State that Uniqueness theorem

If both the above criteria are satisfied, then the resulting load factor corresponds to its value at rigid plastic collapse (λp).

10. Explain about Crane gantry girders

The function of the crane girders is to support the rails on which the traveling cranes move. These are subjected to vertical loads from crane, horizontal lateral loads due to surge of the crane, that is, the effect of acceleration and braking of the loaded crab and swinging of the suspended load in the transverse direction, and longitudinal force due to acceleration and braking of the crane as a whole.

11. What are the different types of floors used in steel-framed buildings?

 a) Concrete slabs supported by open-web joists?

b) One-way and two-way reinforced concrete slabs supported on steel beams

c) Concrete slab and steel beam composite floors

d) Profiled decking floors

e) Pre-cast concrete slab floors.

12. What are the advantages of steel-decking floors?

(i) They do not need form work

(ii) The lightweight concrete is used resulting in reduced dead weight

(iii) The decking distributes shrinkage strains, thus prevents serious cracking

(iv) The decking stabilizes the beam against lateral buckling, until the concrete

(v) The cells in decking are convenient for locating services.

13. Write about Pre-cast concrete floors

Pre-cast concrete floors offer speedy erection and require only minimal formwork.
Light-weight aggregates are generally used in the concrete, making the elements light
and easy to handle. Typical pre-cast concrete floor slab sections are shown in Fig. It
is necessary to use cast in place mortar topping of 25 to 50 mm before installing other
Floor coverings. Larger capacity cranes are required for this type of construction when
compared with those required for profiled decking. Usually pre-stressing of the pre-cast
elements is also done.
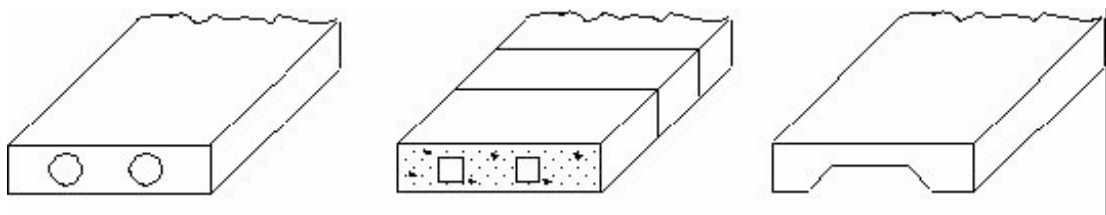
14. What are assumptions are made for arrangement of live load in the analysis of frames?

a) Consideration is limited to combination of:

    i) Design dead load on all spans with full design live load on two adjacent spans and

    ii) Design dead load on all spans with full design live load on alternate pans.

b) When design live load does not exceed three-fourths of the design dead load, the load arrangement of design dead load and design live load on all the spans can be used.

15. Explain about Drift Analysis

    Drift in building frames is a result of flexural and shear mode contributions, due to the column axial deformations and to the diagonal and girder deformations, respectively. In low-rise braced structures, the shear mode displacements are the most significant and, will largely determine the lateral stiffness of the structure.

    In medium to high-rise structures, the higher axial forces and deformations in the columns, and the accumulation of their effects over a greater height, cause the flexural component of displacement to become dominant.

PART - B
16 -MARK QUESTIONS

1.A roof truss- shed is to be built Jodhpur city area for an industrial use. Determine the basic wind pressure .The use of shed 18 m* 30 m

2. An industrial roof shed of size 20 m* 30 m is proposed to be constructed at Mangalore near a hillock of 160 m and slope is 1 in 2.8. The roof shed is to be built at a height of 120 m from the base of the hill. Determine the design wind pressure on the slope. The height of roof shed shall be 12m

3.A communications tower of 80 m height is proposed to be built hill top height 520 m with a gradient of 1in 5. The horizontal approach distance is 2.8 m km from the level ground .The tower

is proposed at Abu mount .Determine the design wind pressure.

4. Locate the principal axes of ISA 200 mm* 100 mm * 10 mm. Determine principal moment of inertia and radius of gyration about the principal axes for this angle section.

5. LB 200 @ 0.198 kN/m is subjected to bending moment 12 kN-m. The plate of loading passes through centroid of beam and it is inclined 8° with the YY-axis in the anti-clockwise direction. Locate the neutral axis. Determine maximum bending stress induced stress in the beam section.

PART - C
ASSIGNMENT QUESTIONS

1. Design a purlin for a roof truss having the following data:

Span of the truss   = 6.0m

Spacing of truss   = 3m c/c.

Inclinaion of roof   = 30°

Spacing of Purlin   = 2m c/c

Wind pressure   = 1.5 kN/m^2

Roof coverage   = A.C Sheeting weighing 200 N/m^2

Provide a channel section Purlin.   (Dec 2007).

2. Design a gantry girder to be used in an industrial building carrying an EOT crane for the following data:

Crane capacity   = 200 kN.

Total self weight of all components   = 240 kN.

Minimum approach at th carne hook of gantry girder = 1.2m

Wheel base   = 3.5m

C/C distance between gantry rails   = 16m

C/C distance between columns   = 8m

Self weight of rail section   = 300 N/m

Yield stress   = 250 N/mm^2

Design the main gantry section. Connection design not required. . (Dec 2007).

3. Design the angle purlin for the following specifications:

Span of truss   = 9m c/c.

Pitch   = 1/5 of span

Spacing of purlin   = 1.4 c/c.

Load from roofing material   = 200 N/m^2.

Wind load   = 1200 N/m^2.

4. Determine the dead load, live load and wind load on a FINK type truss for the following data and mark the loads on the nodes of the truss.

Span   = 12m

Pitch   = ¼ of span

Height at eves level   = 10m from the ground

Spacing of truss   = 5m c/c.

4. Design the step by step procedure for design of vertical and horizontal stiffeners in a plate girder. (Nov/Dec 2007)