

## 2 MARKS QUESTION AND ANSWERS - R2013

DEPARTMENT OF CIVIL ENGINEERING

CE6016 - PREFABRICATED STRUCTURES

UNIT - I : INTRODUCTION

PART – A (2 Marks)

**1. Write the advantages of prefabrication.**

(N -13)

- In precast construction, similar components are produced repeatedly, resulting in increased productivity and economy in cost too.
- The work at the site is reduced to a minimum and therefore work is qualitatively better, more reliable and cleaner.

**2. What are the types of prefabrication?**

(M-14)

Depending on the shape of prefabricates they are known as blocks, panels, frames etc.,,

- Blocks: these are the units with preparation as a rule very stable during erection.
- Panels: walls or slab units.
- Frames: Beams and columns

**3. Write the disadvantages of pre fabrication.**

- Careful handling of materials is required
- Requires heavy duty cranes, precision measurement and handling is required.

**4. Define – Modular Coordination.**

(M-13)

The basic module is to be adopted. Basic module is the fundamental module used in modular coordination, the size of which is selected for general application to building and its components.

**5. Write the systems of prefabrication.**

The word system refers to particular method of buildings using prefabricated components which are inter related in functions and are produced to a set of instructions.

**6. Mention the types of production techniques.**

- Stand system
- Conveyor belt
- Aggregate system

**7. List out the precautions taken while erecting the precast elements.**

- Careful handling of prefabricated components such as concrete panels or steel and glass panel is required.
- Attention to be paid to the strength and corrosion resistance of the joining.
- Large sections required heavy duty cranes for handling.

8. State any two principles of prefabrication.

- Design for prefabrication, preassembly and modular coordination.
- Simplify and standardize connection details.
- Simplify and separate building systems.
- Minimizing building components and materials.

9. What are the characteristics of materials used for construction of PFS?

- The materials should protect the building against corrosion, rust and fire.
- It provides a sturdy and protective covering to the prefabricated building almost all components of metal building.

10. What are the advantages of standardization?

(D-12)

- Easier design
- Easier manufacture
- Easier erection and completion.

11. What are the methods for manufacturing precast concrete elements?

- Factory prefabrication
- Site prefabrication.

12. Write short note on production process.

- Mixing
- Moulding
- Curing
- Cubing

13. Define – Off Site Fabrication.

(J-13)

It is the process that incorporates prefabrication and preassembles the process involves the design and manufacture of units usually remote from the work site and installation at the site to form the permanent work at site.

14. Give the different types of modular grids.

- Continuous grid
- Displacement grid
- Super imposed grid
- Interrupted grid
- Axial reference
- Boundary reference.

15. What are all the prefab materials?

(J-14)

- Structure insulated panels
- Steel framing
- Prefab foundation system
- Insulating concrete forms

## PART – B (16 Marks)

1. What are the types and needs of Prefabricates? (J-14)
2. What are the Production techniques (M-14)
3. What are the methods for Manufacture of precast concrete elements. and explain briefly
4. What is the process involved in manufacture of PFS? (J-12)
5. What are erection stresses? How are they reduced or eliminated?
6. What are the importance aspects considered during hoisting, erection and transportation of precast element?
7. Explain the need for prefabrication systems.
8. Explain the production process of prefabricated structural elements. (D-13)
9. Explain necessity of prefabrication in India
10. Discuss in detail the concept of modular coordination .State its significance in prefabricated structures.
11. Discuss the concept of production techniques.
12. List out the principles of prefabricated design.
13. Explain Modular Coordination in detail.
14. Explain with neat sketches of Different systems of Prefabrication and their merits & Demerits. (D-12)
15. Briefly in details of Transporting and hoisting of Prefabrication.
16. Enumerate the process of product of Prefabrication.
17. What is the procedure in making a Prefabrication Components.
18. Write short notes on. (J-13)
  - i. Prefabrication.
  - ii. Standardization.
  - iii. Advantages and Disadvantages.
  - iv. Erection process.

## UNIT- II : PREFABRICATED COMPONENTS

## PART – A (2 Marks)

1. What are the types of prefabricated components? (J-12)

The following are the main components which are frequently used,

- Roof / slab
- Slab
- Joist
- Beams
- Wall panels
- Columns

2. Explain the term lift slab construction.

All precast structural elements are assembled by means of special joints. Reinforced concrete slabs are poured on the ground in forms, one on top of the other. Precast concrete floor slabs are lifted from the ground up to the final height by lifting cranes.

3. Give the classification of wall panels. (D-13)

- Cross wall system
- Longitudinal wall system.

4. What is shear wall?

A wall designed to carry horizontal forces acting in its plane with or without vertical imposed loads thus assuring the stability of the building.

5. Write the dimensional tolerances.

- Length: +20mm to -20mm
- Width: +10mm to - 5mm
- Depth:+12mm to - 5mm
- Bearing plates: +12mm to -12mm

6. Give the classification of floor slab. (J-13)

- Flagging panels
- Composite floor panels
- Large panel floor slabs

7. What are the lateral load resisting elements in buildings? (D-14)

- RC shear wall
- Plywood shear wall
- RC hollow concrete block masonries wall
- Steel plate shear wall.

8. What are the loads acting on wall panels? (J-13)
- Shear forces
  - Uplift forces
9. What types are of cross wall system? (D-14)
- Longitudinal wall system
  - Homogenous walls
  - Non homogenous walls
10. What is meant by box type construction?
- In this system room size units are prefabricated and erected at site.
  - This system derives its stability and stiffness from the box units which are formed by four adjacent walls.
11. What are the types of precast floors?
- Depending on the composition of units, precast flooring units could be homogenous or non homogenous
  - Homogenous floors could be solid slabs, ribbed or waffle slabs.
  - Non homogenous floors could be multilayered ones with combinations of light weight concrete with filler blocks.
12. Write about Prefabricated Roofing and flooring elements. (M-13)
- Prefabricated reinforced concrete battens and plain concrete tiles can be used for roofing and flooring for flat roofs, instead of wooden section
  - For sloping roof, precast reinforced and pre stressed concrete triangulated trusses can be used.
  - Plain concrete or lightly reinforced concrete can be used in the form of precast shells.
13. Define – Long wall system (J- 14)
- The main beam or load bearing wall are placed to the long axis of building. It is applied to the building with large prefabricated and similar to traditional brickwork.
14. What is the space bordering?
- These members are used to give spaces like walls both load carrying and partition walls this may or may not contain doors and windows the same provision for the same is as per the requirement.
15. Differentiate between Synclastic and Anticlastic.
- In the case the synclastic the curve of the shell in the same side where as in the case of anticlastic the curvature of the shell is in opposite direction.
16. Write a short note on Dome structures.
- A dome is a space structure covering more or less square or irregular areas. The best known example is the dome of revolution.
17. What is ring system?
- Load bearing walls and beams are placed in both ways longitudinally and transversely. In the building with ring system of support floors are normally supported on all four sides and span in two direction.

## PART – B (16 Mark)

1. Classify the Structure of building based on the load distribution and briefly explain the different types of such prefabricated building (N-13, J-14)
2. Explain the methods of construction of roof and floor slab. Also explain the precautions taken during the manufacturing process. (J-13)
3. What is the necessity of providing shear walls in the precast structures? Also discuss the different types of shear walls (D -14)
4. Write briefly about types of wall panels
5. Write briefly about precast concrete columns
6. Write about the structural behavior of precast structure
7. Write briefly large panel construction with neat sketches?
8. Explain the merits and demerits of large panel constructions.
9. Explain the behavior of prefabricated roofs and floor slabs.
10. Differentiate the behavior of frame and large panel construction in precast structures.
11. Discuss about behavior of columns in prefabricated structures. (M-12)
12. Explain about roofing members in details.
13. Write a detail notes on Shear walls.
14. Write a brief notes on shell structures.
15. Discuss about the Domes in details.
16. Explain about the warped surface in details
17. Write detailed notes on different Wall systems.
18. What is meant by prefabricated components? Explain.

## UNIT - III : DESIGN PRINCIPLES

## PART – A (2 Marks)

**1. Explain briefly the disuniting of structures.** (J-13)

The solution for the problems connected with the transportation and placing of structures demands the disuniting the larger member into smaller members.

**2. Write the advantages of disuniting of structures.** (M-14)

Easy to transport the members from casting yard to site. Ease in placing in required position.

**3. How do the materials used in construction affect the design of structural element?**

In the production of prefabrication structures we can have strict quality control, so we can utilize the entire strength of materials with minimum factor of safety. It will lead to economical design and dimension of structures. But while design, allowance should be given for stresses developed during handling of structures.

**4. Explain Joint deformation.** (D- 13)

Since joints in the structure of disunited members are flexible some deformations is allowed at the joints. Joint deformation is allowed at joints. Joints deformation refers to have the joint behaves in regard to the far field stresses.

**5. Mention some important requirements of joint flexibility.**

- The constant of joint should be easy
- The joint should require minimum material
- The cast should be minimum
- Joint should not take more labour

**6. Differentiate between rigid joint and hinged joint in prefabricated construction.**

The rigid joints are generally used for joining individual members to another but for rigid joint considerable man power is required.

The hinged joints are executed simply and require less time than the rigid joint. The hinge joints are those which can transmit forces passing through the hinge itself allow sudden motion and rotation.

**7. Explain joint flexibility.** (D-14)

While disuniting structures the members is designed as semi rigid frame, in which the columns and beams are connected in such a way that there is some flexibility at the joints. Joints that hold two parts together so that, one can swing relative to other.

**8. List the disadvantages of precast construction.**

- Careful handling of prefabricated components such as concrete panels or steel and glass panels is required.
- Attention has to be paid to the strength and corrosion resistance of joining of prefabricated sections of avoid failure of joint

**9. At what point in the members disuniting should be done?**

Disuniting can be done at corners or points of maximum moments, to make the hoisting of these smaller members possible using simpler equipments.

**10. Write the disadvantages of disuniting the structures.**

- The identifying joint location is a problem in disuniting the structures
- In frames it is easy to disunite at corners but it is the point of maximum bending moments.

**11. What are dry joint and wet joint?**

Dry joint: The dry joint used for simply placing of two members on each other and connecting them.

This kind of joint which requires not only a casting with cement mortar but also a continuous or subsequent.

Wet joint: Wet joint are more adequate to bear the forces and less sensitive to be inaccuracy than by joint.

**12. What is the advantage of Scaffolding?**

- Hoisting or lifting method is very simple
- Auxiliary scaffolding is not necessary.

**13. What are the important requirements of joints?**

(D- 14)

- The constant of joint should be easy
- The joint should required little material
- Joints should not consume more labour
- The cast should be minimum

**14. What are the problems involving in design due to joint flexibility?**

There are difficulties and problem if the joints of various elements are not proper. If joints not strong then the failure will occur in the structure.

**15. Write down the rectangular section formula.**

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## PART – B (16 Marks)

1. Discuss the necessity of disuniting of structures and explain in detail with sketch (D -13)
2. Explain the problems in design because of joint flexibility. Discuss with regard to various location.
3. Why should we give allowance for joint deformation and explain in detail
4. What are the precautions taken during the disuniting the structures?
5. Explain the steps involved in the process of disuniting of prefabricated structures.
6. Explain the steps involved in the design of prefabricated columns based on the efficiency of materials used. (J-13)
7. What is significance of providing tolerances in precast buildings? Explain the different types of tolerances adopted in precast construction (M-14)
8. Explain how the material selection impacts the design efficiency of a precast element.

## UNIT- IV : JOINT IN STRUCTURAL MEMBERS

## PART –A (2 Marks)

1. What is the importance of joints in precast structures when compared to cast in situ structures? (N- 13)

In cast insitu structures the joints are provided to relieve the stresses due to temperature and shrinkage and also to accommodate the construction sequence for the placement of concrete.

2. What is the need for expansion joint in precast structures? (D- 14)

Expansion joints allow expansion and contraction of a member without generating potentially damaging forces within the member itself.

3. What are connections?

In a precast member to overcome operational difficulties the members are disunited into smaller elements. Connections are used to get required structures by joining the separate smaller elements.

4. What are the different types of connections? (J-13)

- Wet connection
- Dry connection

5. What are the points to be considered while designing the connections?

- Loading under working conditions
- Stability of structures
- Load conditions during construction
- Effects of shrinkage creep and temperature.

6. What are the different connections made in prefabricated structures? (M-13)

- Column to column connection
- Beam to beam connection
- Main beam to secondary beam connection

7. What are the different types of joints? (D- 13)

- Expansion joint
- Contraction joint
- Crack control joint

8. What are the materials used for concrete joints?

- Flexible board
- Dowels
- Sealants

9. Based on the location within a building how connections can be classified.

- Vertical
- Horizontal joints

**10. What are the functions of joints? (N- 14)**

Joints between internal and external wall panels shall be designed to resist the forces acting on them without excessive deformation and cracking. They shall also be able to accommodate the deviations in the dimensions of the wall panels during production and erection.

**11. Write note on Expansion joint.**

Expansion joints are usually a complete gap between adjacent bases. i.e, there is a definite break in the concrete and any reinforcing steel that maybe present.

**12. Define – Contraction Joint.**

It is also known as shrinkage *joint*. These types of joints allow only for contraction or shrinkage of the slab as can be anticipated during the curing process.

**13. What is flexible board? (J-14)**

A fibrous, compressible, flexible biard such as flexcell, it is cheap and readily available from builder's merchants in precut strips of the required depth especially for creating expansion joints.

**14. Define – Sealants.**

The sealants tend to bond dry joint and throughout to be kept free from traffic for the first 24 hours. The temporary cover maybe placed over the joint to prevent accidental trafficking.

**15. What are the types of sealants?**

- Hot poured
- Cold applied
- Performed elasto metric

**16. What are the advantages of main beam to secondary beam connection?**

- No insitu concrete is required
- The connections leads to fastest possible erection
- Maintenance cost is nil.

**17. What are the advantages of beam to beam connection? (J-14)**

- It provides good accessibility for proper welding and also to erect columns.
- Maintenance cost is nil.
- This connection provides the permanent protection against connection.

## PART – B (16 Marks)

1. Explain expansion and contraction joint in retaining wall. (N -13, J-13)
2. What are the essential requirements of joints in precast construction? (D -14)
3. What are the recommendations for the design of an expansion joint?
4. Give the recommendations for the detailing the precast element in respect of the connections and erection (J-14)
5. Explain the merits and demerits of expansion joints in prefabricated structures.
6. Explain any two types of beam column joints in prefabricated structures with neat sketches.
7. Give the guidelines recommended for expansion joint design and location. (N -13)
8. Explain in detail the different structural connection adopted in a framed precast building with sketches. (J-13)
9. What is the importance of joints in precast structures when compared to cast in situ structures?
10. What is the need for an expansion joint in precast structures?
11. What is the requirement of ideal structural joints? Explain different joint of structures.
12. Explain the joint Techniques and materials used in details. (J-12)
13. Explain in details of Expansion joints.
14. Explain about column to column connection & beam to beam connection.
15. Explain about lengthening of column & joining of beams.
16. Discuss about different types of joints.
17. Write a detailed note on post tensioned structures.
18. Write a brief note on monolithic construction. (J-14)
19. Write a detailed note on Dimensioning and Detailing

## UNIT - V : DESIGN FOR ABNORMAL LOADS

## PART – A (2 Marks)

**1. Explain equivalent design loads.**

(J-14)

In the arrangement the bearing is subjected to generally acting forces in various magnitudes, at various rotational speeds and with different acting speed. From the point of view of calculating methodology the acting forces should be recalculated into constant load, by which the bearing load will have the same life as it reaches in the conditions of actual load.

**2. What is meant by progressive collapse?**

(M-13)

Progressive collapse is a situation where local failure of a primary structural component leads to the collapse of adjoining members which in terms leads to additional collapse.

**3. Explain the importance factor and response reduction factor used in static analysis for calculating seismic forces design.**

The importance factor originated with the seismic shear base equation in uniform building code. The concept at that time the importance factor increased the design seismic forces in order to provide additional seismic resistance.

**4. What are the advantages of progressive collapse?**

- The plastic hinges are not assumed; rather, automatically calculated and generated without any user intervention.
- Collapses are not assumed;
- Automatic mesh adjustment
- Automatic spring generation.
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**5. Define – Abnormal loads.**

(J-14)

Loads other than conventional design loads for structures such as air blast pressures generated by an explosion or by impact of vehicles etc.,

**6. Explain non linear dynamic analysis.**

Non linear static procedures use equivalent SDOF structural models and represent seismic ground motion with response spectra. Storey drifts and component actions are related subsequently to global demand parameter.

**7. What are the approaches to avoid progressive collapse?**

- Redundancy
- Local resistance
- Inter connection

**8. Define – Degree of Progressivity.**

(J-13)

It is defined as the ratio of total collapsed area or volume damaged directly by the triggering event.

9. List the codes and standards for progressive collapse.
  - ASCE7 – 02
  - ACI 319 – 02
  - GSA PBS facilities and standard 2003
  
10. How to achieve structural integrity in structures?
  - Connection between structural components should be ductile.
  - Good plan layout.
  - By changing the direction of span of floor slab.
  
11. Write the assumptions for dynamic analysis procedure. (D- 14)
  - The structure is modelled as two dimensional
  - Effects of large deflections are neglected.
  - Elastic perfectly plastic moment rotation relationship used.
  
12. What are the special requirements for buildings in high seismic zone?
  - Large panel building in high seismic zones are recommended to be constructed with closed symmetrical lay out
  - The height of building shall generally restricted to 10 storey in zone 4 and 7 storey in zone 5
  - The vertical and horizontal joints for wall panels shall be defined as keyed joints
  
13. What are the requirements to increase resistance to progressive collapse?
  - All perimeter columns must have sufficient shear capacity to develop the full plastic flexural moment.
  - All floors and roofs must be able to withstand a prescribed net upward load applied to each bay. The uplift forces not applied to all bays simultaneously.
  
14. What are the features of progressive collapse? (D- 14)
  - Structural components can be removed either simultaneously or at custom intervals.
  - Through the true modelling of structural components centenary action and other structural response are considered
  
15. What is meant by progressive collapse analysis?  
 Extreme loading for structure software allows structural engineers to accurately analyse and visualize progressive collapse resulting from combinations like severe wind load, blast load, dynamic load and impact load.
  
16. Define – Response Spectrum Analysis. (D- 13)  
 This approach takes the multiple modes of response of building into account. This is required in many building codes for all except very simple or very complex structures. It is defined as combination of many shapes.
  
17. Define – Linear Dynamic Analysis.  
 Static procedures are appropriate when higher mode effects are not significant. This is generally true for short regular buildings; therefore for all tall buildings, buildings with tensional rigidities or non orthogonal systems, a dynamic procedure is required.

18. What is strong column weak beam concept? (N- 13)

In a building a column is more important than a beam because it supports the load till the foundation. If a beam breaks it will result in a partial collapse. But if column breaks it will result in catastrophic failure.

19. What are the provisions made in prefabricated RC floors in a cyclone prone zone?

- Prefabricated RC elements of various designs placed side by side whereas RC slabs are rigid in their own planes, the other types will require their integration through diagonal bracing or topping RC screed.
- Structure deck concrete is grade not leaner than M20 should be provided over precast components to act monolithic component.

20. What are the causes of abnormal loads?

- Accidental impact
- Faulty construction
- Foundation failure
- Violent changes in air pressure

## PART – B (16 Marks)

1. Mention in detail the codal provision for considering the effect of earthquake and cyclones.
2. Explain strong column and weak beam
3. When a progressive collapse does occur? Why is it very critical to avoid progressive collapse of structures? (D -14)
4. Explain the procedure for calculating equivalent design loads when the structure is subjected to earthquake loading.
5. What are the methods to avoid the progressive collapse? (D -14)
6. Discuss the codal provisions for the design of prefabricated elements subjected to abnormal effects
7. How are explosive loads different from loads typically used in building design?
8. Explain the equivalent design loads for considering abnormal effects.
9. Explain the codal provisions for progressive collapse and detail.
10. Enumerate the details of the Importance Avoidance of progressive collapse.
11. What do you mean by abnormal loads? Explain the effects.
12. Discuss about floor system & roof system. (N -13)
13. Compare between exterior frames & interior frames.
14. Write a detailed note on preventing connection device for building structures. (N -13)
15. Explain the term resilience and redundancy.