



# INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal, Hyderabad - 500 043

## CIVIL ENGINEERING

### DEFINITIONS AND TERMINOLOGY QUESTION BANK

Course Name	:	REINFORCED CONCRETE STRUCTURES DESIGN AND DRAWING
Course Code	:	ACE009
Program	:	B.Tech
Semester	:	V
Branch	:	Civil Engineering
Section	:	A & B
Academic Year	:	2019 - 2020
Course Faculty	:	P. Vinay Kumar, Assistant Professor

#### COURSE OBJECTIVES:

<b>The course should enable the students to:</b>	
I	Identify, formulate and solve engineering problems of RC elements.
II	Differentiate between working stress design and limit state design.
III	Understand the importance of limit state design in reinforced concrete structures.
IV	Design of different structural members like beam, slab, column, footing and stair case.

#### DEFINITIONS AND TERMINOLOGY QUESTION BANK

S. No	QUESTION	ANSWER	Blooms Level	CO	CLO	CLO Code
<b>MODULE-I</b>						
1	What is Ultimate Limit State (ULS)?	ULS is concerned with the maximum load – carrying capacity of the structure within the limits of strength of the materials used.	Understand	CO 1	CLO 1	ACE009.01
2	What is characteristic load?	Generally, load on any structural members cannot be determined accurately. For most structures, it is uneconomical to design using anticipated maximum load. Therefore, in normal design practice, the load to be used is based on the characteristic load.	Remember	CO 1	CLO 2	ACE009.02
3	State the 3 types of load.	a) Dead load b) Imposed load c) Wind load	Remember	CO 1	CLO 1	ACE009.01

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4	State four objectives of the design of reinforced concrete structure.	1. Have acceptable probability of performing satisfactorily during their intended life, 2. Sustain all loads with limited deformations during construction and use, 3. Be durable, 4. Adequately resist the effects of misuse and fire.	Remember	CO 1	CLO 3	ACE009.03
5	What are the three methods of design of reinforced concrete structural elements?	The three methods are: 1. Limit state method, 2. Working stress method, 3. Method based on experimental approach	Remember	CO 1	CLO 3	ACE009.03
6	How to estimate the design loads in limit state method?	In limit state method, Design loads = Characteristic loads multiplied by the partial safety factor for loads	Understand	CO 1	CLO 2	ACE009.02
7	How to estimate the design loads in working stress method?	In working stress method, Design loads = Characteristic loads.	Understand	CO 1	CLO 4	ACE009.04
8	Write a short note on limit state of durability.	The acceptable limit for safety and serviceability requirements before failure occurs is called a limit state. The aim of design is to achieve acceptable probabilities that the structure will not become unfit for the use for which it is intended, that is, that it will not reach a limit state.	Remember	CO 1	CLO 2	ACE009.02
9	What is partial safety factor?	Factors of safety (FoS), also known as (and used interchangeably with) safety factor (SF), is a term describing the load carrying capacity of a system beyond the expected or actual loads. Essentially, the factor of safety is how much stronger the system is than it usually needs to be for an intended load.	Understand	CO 1	CLO 3	ACE009.03
10	Write any two assumptions are made in elastic theory methods.	The following are the assumptions made in working stress method: a) At any cross-section, plane sections before bending remain plain after bending b) All tensile stresses are taken up by reinforcement and none by concrete, except as otherwise specifically permitted		CO 1	CLO 4	ACE009.04
11	What is the formula to find the critical neutral axis in working stress method?	$n_c = 1 / (1 + (\sigma_{st} / m \cdot \sigma_{bc}))$ where, $\sigma_{bc}$ is permissible stress in concrete. $\sigma_{st}$ is permissible stress in steel m is modular ratio	Understand	CO 1	CLO 4	ACE009.04

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12	Write any two advantages of limit state over other methods.	<ul style="list-style-type: none"> <li>Hence the design by limit state method is found to be more economical.</li> <li>In the limit state method of analysis, the principles of both elastic as well as plastic theories used and hence suitable for concrete structures</li> </ul>		CO 1	CLO 5	ACE009.05
13	What is meant by balanced section?	When the maximum stress in steel and concrete simultaneously reach their allowable values, the section is said to be balanced section. In this section the actual neutral axis depth is equal to the critical neutral axis.	Remember	CO 1	CLO 5	ACE009.05
14	Define Limit state.	The acceptable limit for the safety and serviceability requirements before failure occurs is called a limit state.	Understand	CO 1	CLO 5	ACE009.05
15	Define collapse load.	The load that causes the $(n + 1)^{th}$ hinge to form a mechanism is called collapse load where n is the degree of statically indeterminacy. Once the structure becomes a mechanism.	Understand	CO 1	CLO 6	ACE009.06

### MODULE-II

1	Define anchorage bond.	Development bond: It arises over the length of anchorage provided for a bar or near the end of reinforcing bar. This bond resists the pulling out of bar if it is in tension or conversely, the pushing in of the bar if it is in compression.	Remember	CO 2	CLO 9	ACE009.09
2	Name various types of shear reinforcements?	a) Vertical stirrups b) Bent up bars with stirrups c) Inclined stirrups	Remember	CO 2	CLO 7	ACE009.07
3	What are the types of shear failure in reinforced concrete beam?	a) Shear tension b) Flexure shear c) Shear compression d) Shear bond	Understand	CO 2	CLO 7	ACE009.07
4	Define bond.	Bond is defined as grip between concrete and steel. (Or) The force that prevents the relative movement between concrete and steel is known as bond.	Understand	CO 2	CLO 9	ACE009.09
5	List out the different types of bond.	The different types of bond are Flexure bond, Anchorage bond	Understand	CO 2	CLO 9	ACE009.09
6	What is meant by punching shear?	Punching shear is a type of failure of reinforced concrete slabs subjected to high localized forces. In flat slab structures, this occurs at column support points.	Remember	CO 2	CLO 7	ACE009.07

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7	What are hanger bars in beams?	Hanger bars, are provided in a beam to keep the Main Reinforcement (which takes care of tension at bottom fibers in simply supported beam, top fibers in cantilever beam) and stirrups (who take care of shear stresses and diagonal tension in beam) in position as the name indicated for them.	Remember	CO 2	CLO 10	ACE009.10
8	What is nominal shear stress?	Nominal shear stress is the shear force generated on the structure due to the force imposed on a given cross-sectional area.	Remember	CO 2	CLO 7	ACE009.07
9	Define serviceability of limit states.	For serviceability limit states <ul style="list-style-type: none"> <li>• <math>SL = 1.0 (DL+LL)</math></li> <li>• <math>SL = 1.0 (DL+QL)</math></li> <li>• <math>SL = 1.0DL+0.8LL+ 0.8 QL</math></li> </ul>	Understand	CO 2	CLO 10	ACE009.10
10	Define shear strength.	The resistance to sliding offered by the material of beam is called shear strength.	Remember	CO 2	CLO 7	ACE009.07
11	What is meant by Lap length?	Lap length is the minimum length of overlap required between two serial rebar's placed in concrete to transfer tension or compression from one bar to the other.	Understand	CO 2	CLO 10	ACE009.10
12	What is the hook formula in stirrups?	Hook length is calculated by a formula that is $6db$ (dia of bar). So the hook length for $10\text{mm}\varnothing$ bar is, $6 \times 10 = 60$ mm. But length of hook should not be less than 75mm (as per code).	Understand	CO 2	CLO 10	ACE009.11
13	What is short term and long term deflection?	Short-term deflection means the immediate deflection after casting and application of partial or full service loads, while the long-term deflection occurs over a long period of time largely due to shrinkage and creep of the materials.	Remember	CO 2	CLO 11	ACE009.11
14	What is meant by end anchorage?	Mild steel bars embedded in concrete are sometimes hooked so as to have proper anchorage with concrete. If bars are provided with hooks, the necessary grip or bond length can be reduced. The anchorage value of the hook alone is considered as $16d$ where $d$ is the diameter of the bar.	Remember	CO 2	CLO 9	ACE009.09
15	Define Torsion.	Equal and opposite moments applied at both ends of structural element (Member) or its part about its longitudinal axis is called Torsion. Also termed as torsional moment or twist or torque.	Remember	CO 2	CLO 8	ACE009.08

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<b>MODULE-III</b>						
1	What is simply supported slab?	Simply supported slabs are supported on columns or stanchions. They have support on all four sides of Simply Supported Slab	Understand	CO 3	CLO 12	ACE009.12
2	Why distribution bars are provided in slab?	Distribution bars placed on top of the main bar. Main Reinforcement Bars are used to transfer the bending moment developed at the bottom of the slab. Distribution Bars are used to hold the slabs.	Remember	CO 3	CLO 12	ACE009.12
3	What is the minimum diameter of stirrups?	Minimum diameter for lengthwise reinforcement bars is 10 mm (3/8"). Rebars have to be deformed. If deformed steel cannot be found, the minimum diameter must be increased to 12 mm (1/2"). Stirrup diameter is 6 mm (1/4").	Remember	CO 3	CLO 12	ACE009.12
4	What is one way continuous slab?	The slabs spanning in one direction and continuous over supports are called one-way continuous slabs.	Remember	CO 3	CLO 12	ACE009.12
5	What are stirrups reinforcement?	A stirrup is a closed loop of reinforcement bar that is used to hold the main reinforcement bars together in an RCC structure. In a column, the stirrups provide the lateral support to the main bars.	Remember	CO 3	CLO 13	ACE009.13
6	What are main bars?	The main bar in reinforced concrete structures is the reinforcement provided in the direction in which moment is very high or dominates. only minimum reinforcement or 20 percent of the shorter direction bars (called main bars) would be placed in the longer direction (which are secondary bars or distribution bars).	Understand	CO 3	CLO 12	ACE009.12
7	What is slab structure?	A slab is a structural element, usually made up of reinforced concrete. They help in transferring the loads further to beams. Slabs are of two types one-way or two-way.	Remember	CO 3	CLO 12	ACE009.12
8	What is cantilever strength?	A cantilever is a rigid structural element, such as a beam or a plate, anchored at one end to a support from which it protrudes; this connection could also be perpendicular to a flat, vertical surface such as a wall. Cantilevers can also be constructed with trusses, slabs.	Understand	CO 3	CLO 15	ACE009.15

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9	What is the minimum thickness of slab?	The minimum thickness of slab used in RCC construction is 150mm. But it varies depending upon the type of slab to be used.	Remember	CO 3	CLO 12	ACE009.12
10	What is the value of minimum reinforcement in a slab?	Minimum reinforcement is 0.12% for HYSD bars and 0.15% for mild steel bars. The diameter of bar generally used in slabs are: 6 mm, 8 mm, 10 mm, 12mm and 16mm. The maximum diameter of bar used in slab should not exceed 1/8 of the total thickness of slab.	Remember	CO 3	CLO 12	ACE009.12
11	Why slabs are not designed for shear?	Shear reinforcement is usually not required in slabs supported on beams or walls because the depth is small and the span therefore fairly slender so bending and deflection will nearly always govern the design.	Remember	CO 3	CLO 13	ACE009.13
12	What is a two way concrete slab?	TWO WAY SLAB: When a reinforced concrete slab is supported by beams on all the four sides and the loads are carried to the supports along both directions, it is known as two way slab. In two way slab the ratio of longer span (l) to shorter span (b) is less than 2.	Remember	CO 3	CLO 13	ACE009.13
13	What type of concrete is used for slabs?	A concrete mix of 1 part cement :2 parts sand : 4 parts coarse aggregate should be used for a concrete slab.	Remember	CO 3	CLO 12	ACE009.12
14	What is the use of crank bar in slab?	Bent-up bars or known as Crank bars. Which we provide in the ends on the top of the slab or also in the top of the mid supports to counter the negative moment called (Hogging) which produce at that sections of the slabs and beams.	Remember	CO 3	CLO 12	ACE009.12
15	What is negative bar in slab?	Positive slabs are usually provided on the lower side of the slab and negative on the upper. We should know that, positive moment bars resist maximum moment in between the to adjacent columns, so the lap between the two steel bars should never be provided at that point that is mid.	Remember	CO 3	CLO 13	ACE009.13

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<b>MODULE-IV</b>						
1	What is column and its type?	Column is a vertical structural member. It transmits the load from ceiling/roof slab and beam, including its self-weight to the foundation. Columns may be subjected to a pure compressive load.	Remember	CO 4	CLO 17	ACE009.17
2	What is column in construction?	A column or pillar in architecture and structural engineering is a structural element that transmits, through compression, the weight of the structure above to other structural elements below. In other words, a column is a compression member.	Remember	CO 4	CLO 17	ACE009.17
3	What is meant by braced column?	A column may be considered braced in a given plane if lateral stability to the structure as a whole is provided by walls or bracing or buttressing designed to resist all lateral forces.	Remember	CO 4	CLO 18	ACE009.18
4	What is slenderness ratio in civil engineering?	The slenderness ratio is the ratio between the height or length of a structural element (such as a column, or strut) and the width or thickness of the element.	Remember	CO 4	CLO 17	ACE009.17
5	What is radius of gyration formula?	It is denoted by 'K'. If M is mass of the body, the moment of inertia is given as, Moment of inertia (I) = mass of the body (M) × (radius of gyration) <sup>2</sup> . So, the formula for radius of gyration (K) is given as, where K = radius of gyration, I = Moment of inertia and M = mass of the body.	Remember	CO 4	CLO 17	ACE009.17
6	How the compression failures occur in columns?	i. The maximum compressive strain in concrete in axial compression is 0.002 ii. Plane sections remain plane in compression iii. The design stress strain curve is taken to be the same as in tension.	Remember	CO 4	CLO 17	ACE009.17
7	Write any two reinforcement provision in columns	As per IS 456-2000 a reinforced concrete column shall have longitudinal steel reinforcement and cross sectional area of such reinforcement shall not be less than 0.8% nor more than 6% of cross sectional area of column required to transmit all the loading.	Remember	CO 4	CLO 20	ACE009.20

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8	What are the important limitations of slender columns?	A short concrete column is one having a ratio of unsupported length to least dimension of the cross section equal to or less than 10. If the ratio is greater than 10, it is considered a long column (sometimes referred to as a slender column).	Remember	CO 4	CLO 17	ACE009.17
9	Write any two salient assumptions are made in the limit state design of columns.	The following assumptions are made for column failing under pure compression: i. The maximum compressive strain in concrete in axial compression is 0.002 ii. Plane sections remain plane in compression iii. The design stress strain curve for steel in compression is taken to be the same as in tension	Remember	CO 4	CLO 19	ACE009.19
10	What is the salient condition for minimum eccentricity of column?	All axially loaded columns should be designed considering the minimum eccentricity $e_{x \min} \geq \text{greater of } l/500 + D/30 \text{ or } 20 \text{ mm}$ $e_{y \min} \geq \text{greater of } l/500 + b/30 \text{ or } 20 \text{ mm}$ where l, D and b are the unsupported length, larger lateral dimension and least .	Remember	CO 4	CLO 17	ACE009.17
11	What is pedestal?	A concrete pedestal is a compression element provided to carry the loads from supported elements like columns, statues etc. to footing below the ground.	Remember	CO 4	CLO 17	ACE009.17
12	What are the mode of failure of a column?	Compression failure, Tension failure	Remember	CO 4	CLO 17	ACE009.17
13	What is the loading the condition for short column?	Short axially loaded members in axial compression. Short axially loaded column with minimum eccentricity.	Remember	CO 4	CLO 20	ACE009.20
14	What is the formula of slenderness ratio?	Slenderness ratio is the ratio of the effective length of a column ( $L_e$ ) and the least radius of gyration ( $r$ ) about the axis under consideration. It is given by the symbol " $\lambda$ " (lambda). Effective slenderness ratio of the section about the minor axis of cross-section = $L_e/r_y$ .	Remember	CO 4	CLO 20	ACE009.20
15	What is buckling or crippling load?	Crippling is just like buckling, but it happens in the web of a beam when it is being compressed. It occurs at the supports of a beam, where the bottom flange is resting on a support, and the top flange is holding up the load.	Remember	CO 4	CLO 19	ACE009.19



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<b>MODULE-V</b>						
1	What is the main purpose of foundation?	The main purpose of the foundation is to distribute the structural load over a large bearing area without causing bearing capacity failure and excessive settlement to obtain a level and hard strata or bed for building operations to increase the stability of the structure.	Remember	CO 5	CLO 21	ACE009.21
2	What is the purpose of footings?	Footings are an important part of foundation construction. They are typically made of concrete with rebar reinforcement that has been poured into an excavated trench. The purpose of footings is to support the foundation and prevent settling.	Remember	CO 5	CLO 21	ACE009.21
3	What is difference between footing and foundation?	A footing is a foundation unit constructed in brick work, masonry or concrete under the base of a wall or a column for the purpose of distributing the load over a large area. A footing or a shallow foundation is placed immediately below the lowest part of the Superstructure supported by it.	Remember	CO 5	CLO 21	ACE009.21
4	What are footings used for?	Footings are an important part of foundation construction. They are typically made of concrete with rebar reinforcement that has been poured into an excavated trench. The purpose of footings is to support the foundation and prevent settling..	Remember	CO 5	CLO 22	ACE009.22
5	What is strip footing?	A wall footing or strip footing is a continuous strip of concrete that serves to spread the weight of a load-bearing wall across an area of soil. It is the component of a shallow foundation.	Understand	CO 5	CLO 21	ACE009.21
6	How many types of foundation are there?	There are two types of pile foundations, each of which works in its own way. In end bearing piles, the bottom end of the pile rests on a layer of especially strong soil or rock.	Understand	CO 5	CLO 21	ACE009.21
7	What is waist slab in staircase?	Waist Slab for a staircase is probably more used as a slang not as a professional technical word. This term refers to a slab of the stair that is slanting from the floor slab to the landing slab.	Understand	CO 5	CLO 23	ACE009.23

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8	What is the tread measurement of a RCC stair in public building?	The horizontal top portion of a step where foot rests is known as tread. The dimension ranges from 270 mm for residential buildings and factories to 300 mm for public buildings where large number of persons use the staircase.	Understand	CO 5	CLO 23	ACE009.23
9	What is the minimum width of stairs?	Staircase Width: 36 Inches, Minimum. Staircase width refers to the side-to-side distance if you were walking up or down the stairs. This distance must be at least 36 inches and does not include handrails.	Understand	CO 5	CLO 23	ACE009.23
10	At what height are stairs required?	Stair riser heights shall be 7 inches (178 mm) maximum and 4 inches (102 mm) minimum. Stair tread depths shall be 11 inches (279 mm) minimum. The riser height shall be measured vertically between the leading edges of adjacent treads.	Understand	CO 5	CLO 23	ACE009.23
11	How many types of staircase are there?	In these type of stairs the flight of stair turns 90 degrees at landing as it rises to connect two different levels. So it is also called as L-stair. Again these quarter turn stairs are two types.	Remember	CO 5	CLO 23	ACE009.23
12	What is straight stair?	A straight staircase can be defined as one having a single, straight flight of stairs like a ladder that connects two levels or floors in a building.	Remember	CO 5	CLO 23	ACE009.23
13	What are the types of deep foundation?	Basements, buoyancy rafts, caissons, cylinders, shaft, foundations, Pile foundations	Remember	CO 5	CLO 21	ACE009.21
14	How many types of footing are there?	Pile foundations are capable of taking higher loads than spread footings. There are two types of pile foundations, each of which works in its own way. In end bearing piles, the bottom end of the pile rests on a layer of especially strong soil or rock.	Remember	CO 5	CLO 21	ACE009.21
15	What are the 3 types of foundations?	<ul style="list-style-type: none"> <li>• Shallow foundation. Individual footing or isolated footing. Combined footing. Strip foundation. Raft or mat foundation.</li> <li>• Deep Foundation. Pile foundation. Drilled Shafts or caissons.</li> </ul>	Remember	CO 5	CLO 21	ACE009.21

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