ACE
Engineering Academy
Head Office : Sree Sindhi Guru Sangat Sabha Association, # 4-1-1236/1/A, King Koti, Abids, Hyderabad - 500001.
Ph: 040-23234418, 040-2324419, 040-2324420, 040-24750437
Hyderabad | Kukatpally | Kothapet | Delhi | Bhopal | Patna | Pune | Bhubaneswar | Lucknow | Bengaluru | Chennai | Vijayawada | Vizag | Tirupati | Kolkata | Ahmedabad

ESE- 2020 (Prelims) - Offline Test Series Test- 1

CIVIL ENGINEERING

SUBJECT: DESIGN OF CONCRETE AND MASONRY STRUCTURES AND BUILDING MATERIALS - SOLUTIONS

01. Ans: (c)

02. Ans: (b)

Sol: X is the minimum mean strength of sample

Y is the minimum individual sample strength

	Mean strength of the sample (N/mm^2) = [X]	Individual test N/mm^2 = [Y]
M25	$\geq f_{ck} + 0.825 \times \sigma$ (or) $(f_{ck} + 4)MPa$ } which ever is greater	$\geq (f_{ck} - 4)\ N/mm^2$

For concrete grade of M20 and above, to satisfy the acceptance criteria

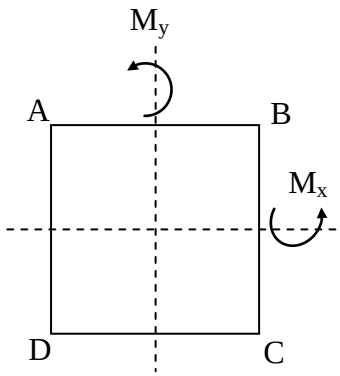
Individual sample test $\geq (f_{ck}\text{-}4)$ MPa = 21MPa

Mean strength of sample $\geq \max (f_{ck}+0.825\sigma, f_{ck}+4)$

$\geq \max(27.745, 29) = 29MPa$

03. Ans: (b)

Sol:



Axial load P = 400 kN

Biaxial moment = $M_x = M_y =$ 20 kNm

$A = 2\times 2 = 4\ m^2$

$$Z = \frac{2\times 2^2}{6} = \frac{4}{3} = 4/3\ m^3$$

Point A is subjected to compression due to loading and moments M_x, M_y.

Point C is subjected to compression due to loading and tension due to moments M_x, M_y.

Factored net maximum soil pressure occurs at

$A = q_{max}$

$$= \frac{P}{A} + \frac{M_x}{Z} + \frac{M_y}{Z} = \frac{400}{2\times 2} + \frac{6\times 20}{2\times 2^2} + \frac{6\times 20}{2\times 2^2}$$

$$= 100 + 15 + 15 = 130 \frac{kN}{m^2}$$

Factored net maximum soil pressure is at C

$$= q_{min} = \frac{P}{A} - \frac{M_x}{Z} - \frac{M_y}{Z}$$

$=100\text{-}15\text{-}15 = 70 kN/m^2$

04. Ans: (a) **05. Ans: (b)**

06. Ans: (a)

Sol: Minimum temperature and shrinkage reinforcement = 0.12% of gross c/s area is provided transverse to main reinforcement

$= 0.0012 \times 450 \times 1000 = 540 \text{ mm}^2/\text{m}$.

07. Ans: (b)

Sol: Since an under reinforced design always gives a larger concrete section and lesser area of steel than balanced section (As steel is costlier than concrete).

08. Ans: (b)

Sol: If column is braced i.e sidesway is prevented, then the value of effective length can range from 0.5L to L which is observed in the following cases .

- When both the ends are fixed: l_{eff}= 0.5L and 0.65L as per code
- When both the ends are hinged l_{eff}= L
- One end fixed and other end is pinned l_{eff} = 0.7L and 0.8L as per code

09. Ans: (a)

Sol: For tension steel

If excess cover provided then it leads to widers cracks and also increases the self weight.

For comp steel if excess cover provided than it leads to reduction in stress in steel as $\frac{d'}{d}$ increases then f_{sc} reduces.

10. Ans: (d)

Sol: As per cl.41.1 of IS 456, primary torsion must be considered in the design. In case of secondary torsion, it can be eliminated by releasing redundant restraints, no specific design for torsion is necessary.

11. Ans: (a)

Sol: The stress in the tendon of a post-tensioned member attains the prestress at the anchorage block. There is no requirement of transmission length or development length.

12. Ans: (b)

Sol: Height of water level = 5.3 – 0.3 = 5m

Hoop tension at any depth 'h' below water level = $\frac{WhD}{2}$

W = unit weight of water = 10000 N/m^3

Hoop tension at the bottom of the tank

$= \frac{10000\times 5\times 5}{2} = 125$ kN

Area of steel required

$= \frac{whD}{2\sigma} = \frac{125\times 10000}{150}$

$= 833.33 \text{ mm}^2$ per metre

$\simeq 834 \text{ mm}^2/\text{m}$

SSC-JE (Paper-II) MAINS 2018

OFFLINE TEST SERIES

Streams: Civil | Electrical | Mechanical

FULL LENGTH MOCK TEST-1

Exam Date: **01.12.2019**

Exam Timing: **6:00 pm to 8:00 pm**

FULL LENGTH MOCK TEST-2

Exam Date: **15.12.2019**

Exam Timing: **6:00 pm to 8:00 pm**

- ☑ All tests will be conducted in **Question Paper Booklet** format.
- ☑ Test Series will be conducted at all our centres.

Hyderabad | Delhi | Pune | Bhubaneswar | Bengaluru | Chennai | Vijayawada | Vizag | Tirupathi | Kukatpally | Kolkata | Ahmedaba

040 - 48539866 / 040 - 40136222 testseries@aceenggacademy.com

ISRO

इसरो isro

ONLINE TEST SERIES

No. of Tests : 15

Subject Wise Tests : 12 | Mock Tests : 3

Indian Space Research Organisation (ISRO)
Recruitment of Scientist/Engineer 'SC'

ELECTRONICS | MECHANICAL | COMPUTER SCIENCE

☑ Starts from **5th November 2019**

All tests will be available till 12-01-2020.

040 - 48539866 / 040 - 40136222 testseries@aceenggacademy.com

13. Ans: (c)

Sol:

- Increasing the compressive strength of concrete increases the ductility of the structure.
- Ductility can be measured based on the type of deformation like strain, curvature, rotation, deflection etc.
- Generally higher grade steels have high carbon content. Hence they are more brittle.

14. Ans: (a)

Sol: Irregularities in the building are of two types

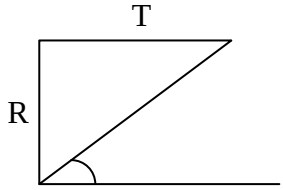
(a) Horizontal or plan irregularities like

- Re-entrant corners
- presence of structural wall on one side of buildings
- Torsion irregularities when centre of mass does not coincide with centre of rigidity.

(b) Vertical irregularities like Soft storey and wear storey.

15. Ans: (a)

Sol:

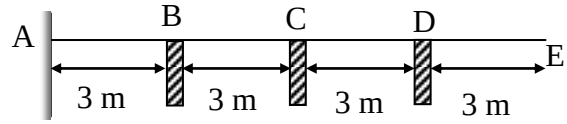


$$\tan\theta = \frac{R}{T}$$

$$\theta = \tan^{-1}\left(\frac{150}{300}\right) = \tan^{-1}\left(\frac{1}{2}\right)$$

16. Ans: (b)

Sol:



As per c*l*. 22.2 of IS456

If the supports are wider than $\frac{1}{12}$ of the clear span (or) 600 mm which ever is lesser.

(i) For end span with one fixed & other continuous (or) for intermediate span.

Effective span = clear span between supports.

Width of support = 260 mm

Clear span/12 = 3000/12 = 250 mm

Since Width of support > Clear span/12, as per cl.22.2 of IS456

Effective span of intermediate beams is clear distance between the supports = 3 m

17. Ans: (c)

Sol: For plain or reinforced concrete wall as per cl.32.4 of IS 456,

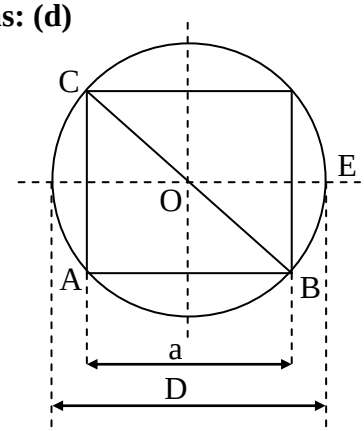
Minimum horizontal steel is = 0.2% A_g

$= 0.2/100 \times 200 \times 1000$

$= 400\text{mm}^2$ / metre.

18. Ans: (d)

Sol:



For a footing supporting a concrete column or pedestal, critical section for bending moment is at a distance 'd' from the face of the column. For a circular column or pedestal, the face of the column or pedestal shall be taken as the side of a square inscribed within the perimeter of the circular column or pedestal.

From triangle ABC, side of square 'a'

$= \frac{D}{\sqrt{2}} = \frac{400}{\sqrt{2}}$

Critical section for bending moment from centreline of column = OE = a/2

$= \frac{400}{2\sqrt{2}} = 141.42$ mm

19. Ans: (d)

Sol: All forces and moments acting at the base of the column must be transferred to the footing i.e. by compression in concrete, steel and tension in steel. Compression forces are transferred by bearing and tension forces transferred by developed reinforcement.

Bearing strength of concrete is $0.45f_{ck}$. Hence for column the same value is considered. But in case of footing, since the area of footing is much larger, this bearing stress of concrete in column is increased considering the dispersion of the concentrated load of column to footing.

The permissible bearing stress of concrete in footing as per cl. 34.4 of IS 456 is given by

$\sigma_{br} = 0.45f_{ck}\sqrt{\frac{A_1}{A_1}}$ such that $\sqrt{\frac{A_1}{A_1}}$ but not greater than 2

A_1 = area of footing supporting the column,

A_2= base area of the column

20. Ans: (c)

Sol: In the design of earthquake resistant buildings, design of the structure for elastic performance under seismic loads is not economical. Hence energy absorbing capacity of the structure along with limited damage is utilized for reducing the design force. This factor which is used to reduce the design base shear force is called Response reduction factor and is the ratio of seismic base shear for an elastic system to the base shear for which the structure is designed.

More is the redundancy of the structure, more is the redistribution enhancing the seismic capacity of the structure. Hence response reduction factor will be more.

21. Ans: (c)

Sol: As per cl. 26.5.3.1 of IS 456

Minimum compression reinforcement

$= 0.8\% A_g = 0.8/100 \times 300 \times 500 = 1200mm^2$

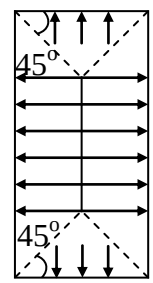
Maximum compression reinforcement when the bars are lapped is 4%

$= 0.04 \times 300 \times 500 = 6000mm^2$

22. Ans: D

Sol:

- Generally for the one way slabs $l_y/l_x \geq 2$. However if for a slab $l_y/l_x < 2$, and is supported only on opposite parallel edges, the slab one-way.
- Load distribution:



Since the triangular area is less than trapezoidal area, loads carried by beam along longer span is greater than that of beams along shorter Span.

23. Ans: (a)

Sol: As per cl.26.5.2.2, the maximum diameter of a reinforcing bar in a slab (either one way or two way) shall not exceed

$$= \frac{\text{total depth}}{8} = \frac{200}{8} = 25 \text{ mm}$$

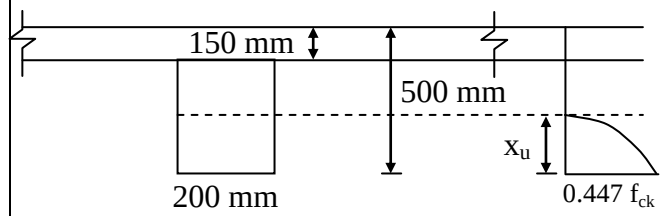
24. Ans: (a)

Sol:

- In a prestressed beam say simply supported, deflection will be in downward direction due to dead load and superimposed loads. Since the prestressing is done to balance the external loads, it induces deflections in the direction opposite to external loads. Thus net deflection reduces.
- Compression reinforcement reduces the shrinkage and creep deflection which are long term deflections.
- By increasing the depth of the member, stiffness increases Hence deflection decreases.
- In cracked section, Increasing the tensile reinforcement decreases short term and long term deflection

25. Ans: (c)

Sol:



Stress variation

The beam and slab act as continuous beams with beams as supports. Hence they are subjected to hogging bending moment. Hence the bottom of the beam is under compression. So tensile steel is placed at top.

Let x_u be the depth of neutral axis.

$0.36 \times 20 \times 300\, x_u = 0.87 \times 415 \times 1000$

$x_u = 167.15$ mm

i.e. location of neutral axis from the bottom is 167.15 mm and from top of the slab is 500-167.15 = 332.85 mm $\simeq$ 333 mm

26. Ans: (c)

Sol: Bending moment at midspan

$$= \frac{w\ell^2}{8} = \frac{5 \times 8^2}{8} = 40\text{kNm}$$

Shift of thrust line (or pressure line) from cable line $= \frac{M}{P} = \frac{40}{200} = 0.2\text{m} = 200\text{mm}$

Location of cable line from the soffit of the beam $= \left(\frac{400}{2}\right) - 100 = 100\text{mm}$

Location of thrust line from the soffit of the beam = 200+100 = 300mm

27. Ans: (b)

Sol: As per clause 26.2.5.1 of IS 456: 2000

28. Ans: (c)

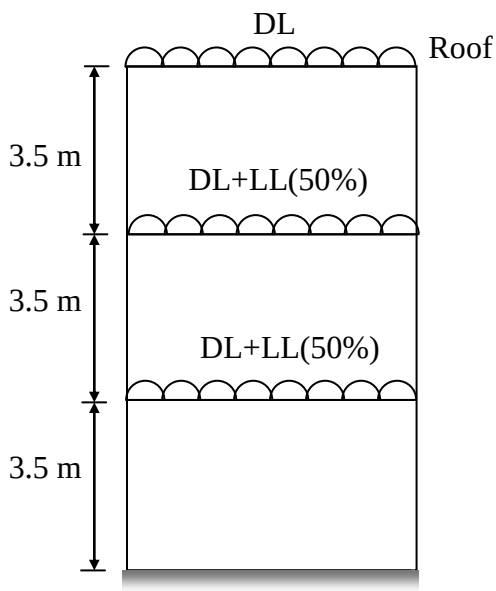
29. Ans: (d)

Sol:

- Natural periods of buildings increase with increase in mass.
- Increasing the stiffness reduces the natural period of the buildings
- Since the unreinforced masonry infill walls participate in the lateral response of the building , it affects the lateral stiffness of the buildings. Hence natural period of the buildings is affected by the unreinforced masonry infill walls

30. Ans: (b)

Sol:



Total Dead load = 3 × (12×300) = 10800 kN

Since the live load class > 3 kN/sq.m, only 50% of the live load is considered and on roof no live load is considered as per IS 1893.

Live load = 2(0.5 × 5 × 300) = 1500 kN

Total seismic weight = 10800+1500

= 12300 kN

31. Ans: (b)

Sol: As per IS 1893 cleared 6.4.2

$$\text{Base shear} = \frac{Z}{2}\frac{s_a}{g}\frac{I}{R}W$$

Z = 0.24,

Since it is a hospital

I = 1.5 (importance factor)

R = 3

W = 16000 kN

(S_a/g) = Design Acceleration Spectrum Value is 2.5

Base shear

$$= \frac{0.24}{2}\times 2.5\times\frac{1.5}{3}\times 16000 = 2400 \text{ kN}$$

32. Ans: (a)

Sol: As per IS13920-2016, cl 5.2, minimum grade of concrete shall be M20 and for building greater than 15m height in zone III,IV and V, minimum grade is M25

33. Ans: (d)

Sol: Due to its high heat of hydration, High Alumina Cement cannot be used for the construction of Mass Concrete structures.

The setting times of both Ordinary Portland Cement and Portland Pozzolana Cement are the same.

34. Ans: (d)

Sol: When carbon content is less than 1.5%, both tensile and compressive strength of steel increases with increase in carbon content. But when carbon content is more than 1.5%, due to the formation of graphite nodules, the compressive strength increases but the tensile strength decreases with increase in carbon content.

TEST YOUR PREP
IN A REAL TEST ENVIRONMENT
Pre GATE - 2020

Date of Exam : **18th January 2020**
Last Date to Apply : **31st December 2019**

Highlights:

- Get real-time experience of **GATE-20** test pattern and environment.
- Virtual calculator will be enabled.
- Post exam learning analytics and All India Rank will be provided.
- Post **GATE** guidance sessions by experts.
- Encouraging awards for **GATE-20** toppers.

PAN INDIA
PRESENCE AVAILABLE IN MORE THAN
30 CITIES

SSC-JE (Paper-I)
Online Test Series

Staff Selection Commission - Junior Engineer

No. of Tests : 20

Subject Wise Tests : 16 | Mock Tests - 4

Civil | Electrical | Mechanical

AVAILABLE NOW

All tests will be available till **SSC 2019 Examination**

040 - 48539866 / 040 - 40136222 testseries@aceenggacademy.com

35. Ans: (b)

Sol: In Sulphate attack, the sulphates present in cement or soil react with the $Ca(OH)_2$ produces by the hydration of C_3S and C_2S and form $CaSO_4$. This $CaSO_4$ further reacts with C_3A to cause expansion and deterioration. This whole phenomenon is called sulphate attack.

We can clearly see that C_3A directly takes part in sulphate attack, while C_3S and C_2S indirectly take part in sulphate attack.

36. Ans: (a)

Sol: Formation of curves is easy with header bond. Hence, Curved walls and Arches are generally constructed with Header bond.

37. Ans: (c)

38. Ans: (a)

Sol: As per IS code, for the manufacturing of Portland Pozzolana Cement, Fly ash or Fly ash + Calcined Clay must be used, not any other Pozzolana Material.

39. Ans: (d)

40. Ans: (b)

Sol: Insects like Beetles, Marine Bores, etc use timber for breeding and not as food.

41. Ans: (b)

Sol: Pure Aluminium is very reactive and immediately oxidizes when exposed to atmosphere. This oxide layer acts as a protective barrier against further oxidation, thus making aluminium highly non-corrosive.

Anodization is the process in which the thickness of this oxide layer is increased, which makes then aluminium more corrosion resistant.

42. Ans: (d)

Sol: As the size of the concrete cube increases, the strength results keep decreasing until the size of 450mm. This is considered in shape factor = 0.85.

43. Ans: (c)

Sol: Pozzolanic action reaction is slow and practically non-exothermic reaction. Hence the rate of evolution of heat of PCC is less than that of OPC.

44. Ans: (c)

Sol: Both hardwood and softwood exogenous trees are used as timber. Wood from endogenous trees is not used as timber.

45. Ans: (a)

Sol: Lime can absorb atmospheric carbon-di-oxide and convert back into calcium carbonate, thus lime cannot be stored for more than 1 week. But hydrated lime cannot absorb atmospheric carbon-di-oxide, hence if lime has to be stored for more than 1 week, it has to be converted into hydrated lime using the process called slaking.

46. Ans: (a)

Sol: As per IS 2386 Part-I, flakiness and elongation index test is done only for coarse aggregates.

Length gauge is used for Elongation index tests and thickness gauge is used for Flakiness index.

47. Ans: (d)

Sol: Gypsum addition is done in the manufacturing of cement just before the grinding of cement clinkers. Due to the high initial setting time of High Alumina Cement, gypsum need not be added during the manufacturing of this cement.

48. Ans: (b)

Sol: Compaction factor test is used to determine the workability of low workable concrete.

49. Ans: (b)

Sol: In tangential sawing, the saw cuts are tangential to the annular rings and they meet each other at right angles.

50. Ans: (a)

Sol: In Rapid Hardening Cement, the content of C_3S is more than that of Ordinary Portland Cement, this more $Ca(OH)_2$ is produced during the hydration process and thus changes of sulphate attack increases. Hence, Rapid Hardening Cement has less resistance against sulphate attack then ordinary Portland cement.

51. Ans: (d)

Sol: A free-standing wall is restrained at only one end. Hence, its effective height is 1.5H.

52. Ans: (b)

Sol: Quarrying by blasting will produce stones in large quantities, but of different shapes and sizes.

53. Ans: (b)

Sol: Ceramics don't have a free electron in their structure. Because of this, their thermal and electrical conductivity is very low.

54. Ans: (b)

Sol: Penetration and Pull-out test is a partial non-destructive test.

55. Ans: (a)

Sol: Due to rapid reduction of moisture content in Electrical seasoning, the timber experiences more shrinkage effects. Thus, this method produces poor quality timber compared to Natural or Air Seasoning.

56. Ans: (d)

Sol: UPVC stands for Unplasticized Poly Vinyl Chloride. In this plastic, plasticizers are not added which are usually added to make other plastics (PVC).

Generally, CPVC pipes are used for water supply pipes because they are strong and can handle pressure flow as well as flow of hot water. PVC pipes are used for sanitary pipes, because flow in these pipes is gravity flow. Hence, ordinary PVC pipes are sufficient.

57. Ans: (b)

Sol: Extra Rapid Hardening Cement is prepared by adding up to 2% calcium chloride to rapid hardening cement. Since, chemically both rapid hardening cement and extra rapid

hardening cement are the same, the heat of hydrations of these cements are the same.

58. Ans: (b)

Sol: Chromium is a very reactive compound. When the chromium inside stainless steel comes into contact with air, it forms a layer of chromium oxide. This chromium oxide layer acts as a protective barrier and protects the stainless steel against further oxidation / corrosion.

59. Ans: (d)

Sol: IS 2386 Part-I deals with Flakiness and elongation index test of aggregates.

IS 2386 Part-II deals with Aggregate Crushing Value test of aggregates.

IS 2386 Part-III deals with Aggregate Impact Value test of aggregates.

IS 2386 Part-IV deals with Aggregate Abrasion Value test of aggregates.

60. Ans: (b)

Sol: In concrete mix design as per IS 10262:2009, the impact of grade of cement on grade of concrete is not considered. As per the above code, grade of concrete depends only on water cement ratio.

61. Ans: (c)

Sol: All plasticizers and super-plasticizers have retarding action; hence, they can also be used as retarders. Rate of chemical reaction decreases with decrease in ambient temperature. Hence, rate of setting and hardening decreases with decrease in temperature.

62. Ans: (b)

Sol: Air-entrainment leads to increase in workability of fresh concrete or green concrete. Generally, any admixture which increases with workability of concrete has some retarding action. Hence, the initial strength decreases with Air-entrainment.

63. Ans: (a)

Sol: For compressive strength test of cement, 1:3 Cement Ennore sand is mixed with (P/4 + 3)% water by weight of mixture.

64. Ans: (a)

Sol: A lime saturation factor more than 1 leads to presence of free lime or unreacted lime in cement, which makes the cement unsound. For producing Rapid hardening cement, lime saturation factor is increased but it is kept below 1 so that the cement don't become unsound.

65. Ans: (c)

Sol: As per IS456

l_0 may be assumed as 0.7 times effective.

66. Ans: (b)

67. Ans: (b)

Sol: Addition of steel fibers is done to improve the tensile strength of concrete. This happens because the steel fibers prevent the formation of micro-cracks during the hydration of cement.

68. Ans: (a)

69. Ans: (c)

Sol: Smith's test is used to determine the presence of soluble matter in the stones. Acid test is used to determine the presence of calcium carbonate in the stones.

70. Ans: (d)

Sol: Type-C fly ash has both pozzolana and cementitious properties. Hence, this fly ash is generally used for improving the safe bearing capacity of poor-quality soil. Type-C fly ash is generally obtained by the combustion of sub-bituminous coal.

71. Ans: (a)

Sol: Recycling of Aluminium is cheaper compared to that of other metals because of its low melting point and high corrosion resistance. Hence, both the statements are correct and Statement (II) is the correct explanation for Statement (I).

72. Ans: (a)

Sol: AAC blocks are prepared using foam concrete, hence these blocks have very low density compared to ordinary bricks. To reduce the inertia, light weight bricks like AAC blocks are generally used in the construction of high-rise buildings.

Hence, both the statements are correct and statement (II) is the correct explanation of statement (I).

73. Ans: (d)

Sol: Heavy weight concrete has density more than 2600 kg/m^3, hence it is generally used for the construction of concrete gravity dam, concrete gravity retaining walls and nuclear power plants.

Heavy weight concrete is not preferred for the construction of high-rise buildings, as it increases the dead weight of the structure and thus earthquake forces also increase. Light weight concrete is generally used for the construction of high-rise buildings.

74. Ans: (d)

Sol: Inclined stirrups are provided in beam to resist the diagonal tension. Hence they are effective in case of beams with high axial tension where full depth transverse cracks are possible. However under reversal of shear force, the direction of diagonal tension changes. Hence it is ineffective in resisting shear force which leads to the failure of the beam.

75. Ans: (a)

Sol: Compressive reinforcement reduces differential shrinkage strains across reinforced concrete section and also reduces the creep strain in concrete. Thus it reduces the long term deflections in concrete. Hence, the modification factor is always greater than 1.

ACE Engineering Academy
Leading Institute for ESE/GATE/PSUs

HEARTY CONGRATULATIONS TO OUR ESE - 2019 TOP RANKERS

and many more...

TOTAL SELECTIONS in Top 10: 33

(EE: 9, E&T: 8, ME: 9, CE: 7) and many more...

Since 1995
ACE

DIGITAL CLASSES

for

ESE 2020/2021
General Studies &
Engineering Aptitude

GATE 2020/2021
Computer Science &
Information Technology

Access the Course at

www.deep-learn.in