

GU-RET 2016

GAUHATI UNIVERSITY RESEARCH ELIGIBILITY TEST

CIVIL ENGINEERING

Booklet Series : **A**

Invigilator's Name and Signature

BOOKLET NO.

OMR SHEET NO.

ROLL NO.

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TIME : 2 HOURS 20 MINUTES

TOTAL MARKS : 80

Number of Pages in this Booklet : 22

Instructions for Candidates

1. Write your Roll No. and OMR Sheet No. in the boxes provided above.
2. This paper consists of two sections : **Section B** with 50 (fifty) multiple choice questions (MCQ) and **Section C** with 8 (eight) descriptive questions. Each MCQ has 4 (four) answers, out of which **ONLY** one is correct. You have to darken the circle (on the OMR Sheet) for the correct answer corresponding to the question given in this booklet.

Example : (A) (B) (C) (D)

where (C) is the correct answer. No marks will be given for markings made in this booklet. The descriptive questions in **Section C**, **MUST** be answered in the space provided in this booklet. **No extra pages will be provided in any case.**

3. Use a **BLACK** ball point pen in your OMR Sheet.
4. Read the instructions given inside this booklet before attempting to answer any questions.
5. **DO NOT** write your name, roll no, phone no, or anything, or put any marks anywhere in this booklet, otherwise your candidature will be disqualified.
6. If you are found to resort to any kind of unfair means such as carrying extra material other than pen, pencil, watch, eraser, and scale, or copying from somebody or from external material, your candidature will be disqualified.
7. Use of mobile phones, calculators, log tables or any other tables, wearable smart devices such as smart Android watches or objects of similar nature **CAN NOT** be used inside the examination hall.
8. At the end of the examination, you have to return this booklet and the OMR Sheet back to the invigilator.
9. There is no negative marks for incorrect answer.

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Section B (50 Marks)

1. If one end of a prismatic beam AB with fixed ends is given a transverse displacements Δ without any rotation, then the transverse reactions at A or B due to displacement is
 - (A) $6EI\Delta/L^2$
 - (B) $6EI\Delta/L^3$
 - (C) $12EI\Delta/L^2$
 - (D) $12EI\Delta/L^3$
2. Two bars of different materials are of the same size and are subjected to same tensile forces. If the bars have unit elongations in the ratio of 4 : 7, then the ratio of moduli of elasticity of the two materials is
 - (A) 7 : 4
 - (B) 4 : 7
 - (C) 49 : 16
 - (D) 16 : 49
3. Flexural strength of concrete as per IS 456-2000 (f_{ck} is the characteristic cube compressive strength of concrete in N/mm^2) is
 - (A) $0.9\sqrt{f_{ck}}$ N/mm^2
 - (B) $0.8\sqrt{f_{ck}}$ N/mm^2
 - (C) $0.7\sqrt{f_{ck}}$ N/mm^2
 - (D) $0.6\sqrt{f_{ck}}$ N/mm^2
4. A steel cube of volume 8000 cc is subjected to all round stress of 1330 kg/cm^2 . The bulk modulus of the material is $1.33 \times 10^6 \text{ kg/cm}^2$. The volumetric change is
 - (A) 8 cm^3
 - (B) 0.8 cm^3
 - (C) 6 cm^3
 - (D) 0.6 cm^3
5. The carryover factor in a prismatic member whose far end is hinged is
 - (A) 0
 - (B) 1/2
 - (C) 3/4
 - (D) 1
6. While using three moments equations, a fixed end of a continuous beam is replaced by an additional span of
 - (A) zero length
 - (B) infinite length
 - (C) zero moment of inertia
 - (D) unit moment of inertia
7. Economical depth of a plate girder corresponds to
 - (A) Minimum weight
 - (B) Minimum depth
 - (C) Maximum weight
 - (D) Minimum thickness of web
8. The shape factor of an isosceles triangle for bending about the axis parallel to the base is
 - (A) 1.5
 - (B) 1.7
 - (C) 2.0
 - (D) 2.34
9. A steel beam of rectangular cross-section is clamped at both ends. Plastic deformation is just observed when the udl on the beam is 10 kN/m. At the instant of collapse, the load on the beam is
 - (A) 10 kN/m
 - (B) 15 kN/m
 - (C) 20 kN/m
 - (D) 30 kN/m
10. A column of size $450 \times 600 \text{ mm}^2$ has unsupported length of 3.0 m and is braced against side sway in both directions. According to IS 456:2000, the minimum eccentricities (in mm) with respect to major and minor principal axes are
 - (A) 20.0 and 20.0
 - (B) 26.0 and 21.0
 - (C) 26.0 and 20.0
 - (D) 21.0 and 15.0

11. Workability of concrete is inversely proportional to
- time of transit
 - water-cement ratio
 - the air in the mix
 - size of aggregate
12. Which of the following losses of prestress occurs only in pre-tensioning and not in post-tensioning?
- Loss due to friction
 - Shrinkage of concrete
 - Creep of concrete
 - Elastic shortening of concrete
13. The Rankine's constant for a mild steel column with both ends hinged is
- 1/750
 - 1/1600
 - 1/7500
 - 1/9000
14. The compression index of soil
- increases with the increase in liquid limit
 - increases with the decrease in plastic limit
 - decreases with the increases in liquid limit
 - decreases with the increase in plastic limit
15. A pile is embedded quite deep in a clay stratum. If clay has a cohesion of 3.5 t/m^2 , then ultimate point resistance of the pile is
- 19.6 t/m^2
 - 24.5 t/m^2
 - 21.0 t/m^2
 - 31.5 t/m^2
16. Effective size of sand particles in slow sand filters is
- 0.25 to 0.35 mm
 - 0.35 to 0.60 mm
 - 0.60 to 1 mm
 - 1 to 1.80 mm
17. If distance between two points A and B is 1 km, then combined correction for curvature and refraction is
- 0.673 m
 - 0.0673 m
 - 1.0673 m
 - 1.673 m
18. What is the mechanical widening required for a pavement of width 7 m on a horizontal curve of radius 250 m, if the longest wheel base of vehicle expected on the road is 7.0 m
- 0.166 m
 - 0.176 m
 - 0.186 m
 - 0.196 m
19. Which of the following pressure units represents the least pressure
- Millibar
 - mm of mercury
 - N/mm^2
 - kgf/cm^2
20. If water required for 1 bag of cement is 30 litres, the water cement ratio is
- 0.40
 - 0.50
 - 0.60
 - 0.3
21. The minimum water content at which the soil just begins to crumble when rolled into threads 3 mm in diameter, is known as
- liquid limit
 - plastic limit
 - shrinkage limit
 - permeability limit
22. The ratio of settlement at any time ' t ' to the final settlement, is known as
- co-efficient of consolidation
 - degree of consolidation
 - consolidation index
 - consolidation of undisturbed soil

23. If the atmospheric pressure on the surface of an oil tank (sp. gr. 0.8) is 0.1 kg/cm^2 , the pressure at a depth of 2.5 m, is

- (A) 1 metre of water
- (B) 2 metres of water
- (C) 3 metres of water
- (D) 3.5 metres of water

24. In pipe lines, a surge tank is provided

- (A) to relieve the pressure due to water hammer
- (B) to provide additional water head
- (C) to overflow the pipe line when suddenly closed
- (D) to remove the frictional loss in pipe

25. Hydraulic radius is equal to

- (A) area divided by the square of wetted perimeter
- (B) area divided by wetted perimeter
- (C) wetted perimeter divided by area
- (D) square root of the area

26. The point of contraflexure is the point where

- (A) BM changes sign
- (B) BM is maximum
- (C) BM is minimum
- (D) SF is zero

27. International date line is located along

- (A) Standard meridian
- (B) Equator
- (C) 180° longitude
- (D) Greenwich meridian

28. If M, I, R, E, F , and Y are the bending moment, moment of inertia, radius of curvature, modulus of elasticity stress, and the depth of the neutral axis at section, then

- (A) $\frac{M}{I} = \frac{R}{E} = \frac{F}{Y}$
- (B) $\frac{I}{M} = \frac{R}{E} = \frac{F}{Y}$
- (C) $\frac{M}{I} = \frac{E}{R} = \frac{F}{Y}$
- (D) $\frac{M}{I} = \frac{E}{R} = \frac{Y}{F}$

29. Hydraulic jump is a

- (A) Steady uniform flow
- (B) Non-steady uniform flow
- (C) Non-steady non uniform flow
- (D) Steady non uniform flow

30. The total strain energy of a beam of length L , having moment of inertia of its section I , when subjected to a bending moment M , is

- (A) $\frac{M^2}{EI} dx$
- (B) $\frac{M^2}{2EI} dx$
- (C) $\int_0^L \frac{M^2}{2EI} dx$
- (D) $\int_0^L \frac{M^2}{EI} dx$

31. The maximum deflection due to a uniformly distributed load w /unit length over entire span of a cantilever of length l and of flexural rigidity EI , is

- (A) $\frac{wl^3}{2EI}$
- (B) $\frac{wl^4}{3EI}$
- (C) $\frac{wl^4}{8EI}$
- (D) $\frac{wl^4}{12EI}$

32. In a singly reinforced beam, if the permissible stress in concrete reaches earlier than that in steel, the beam section is called

- (A) under-reinforced section
- (B) over reinforced section
- (C) economic section
- (D) critical section

33. Side face reinforcement shall be provided in the beam when depth of the web in a beam exceeds

- (A) 500 mm
- (B) 750 mm
- (C) 1000 mm
- (D) 1200 mm

34. In which of the following types of flow the losses are maximum?
- (A) Laminar flow
 (B) Turbulent flow
 (C) Critical flow
 (D) Transition flow
35. The velocity in a 2 cm diameter pipe is 20 m/s. If the pipe enlarges to 5 cm in diameter the velocity, in m/s is
- (A) 8.0
 (B) 6.4
 (C) 5.2
 (D) 32
36. The maximum velocity through a circular channel takes place when the depth of flow is
- (A) 0.95 times the diameter
 (B) 0.81 times the diameter
 (C) 0.50 times the diameter
 (D) 0.37 times the diameter
37. In case the radius of curvature of a simple circular curve is 229.2 m, its degree of curvature is
- (A) 2°
 (B) 3°
 (C) 5°
 (D) 10°
38. If the observed fore-bearing of the line *RS* is S 59°18' W, the back bearing would be
- (A) N 59°18' E
 (B) N 30°42' E
 (C) S 59°18' E
 (D) S 30°42' E
39. At a speed of 80 km per hour, the stopping sight distance is approximately
- (A) 50 metres
 (B) 60-70 metres
 (C) 100-110 metres
 (D) 150-160 metres
40. The partial safety factor for concrete as per IS: 456-2000 is
- (A) 1.50
 (B) 1.15
 (C) 0.87
 (D) 0.446
41. As per IS: 456-2000, in the limit state design of a flexural member, the strain in reinforcing bars under tension at ultimate state should not be less than
- (A) $\frac{f_y}{E_s}$
 (B) $\frac{f_y}{E_s} + 0.002$
 (C) $\frac{f_y}{1.15E_s}$
 (D) $\frac{f_y}{1.15E_s} + 0.002$
42. Water chemically combined in the crystal structure of soil particles is called
- (A) adsorbed water
 (B) capillary water
 (C) structural water
 (D) free water
43. Amongst the clay minerals, the one having the maximum swelling tendency is
- (A) kaolinite
 (B) montmorillonite
 (C) halloysite
 (D) illite
44. A rod of uniform cross-section *A* and length *L* is deformed by δ , when subjected to a normal force *P*. The Young's Modulus *E* of the material, is
- (A) $E = \frac{P \cdot \delta}{A \cdot L}$
 (B) $E = \frac{A \cdot \delta}{P \cdot L}$
 (C) $E = \frac{P \cdot L}{A \cdot \delta}$
 (D) $E = \frac{P \cdot A}{L \cdot \delta}$

45. For a pipe of internal diameter d , wall thickness t and internal pressure P , the longitudinal stress is
- (A) $P \times d/t$
 - (B) $P \times d/2t$
 - (C) $P \times d/4t$
 - (D) $4P \times d/t$
46. The process of removing suspended and colloidal matter from (turbid) liquid or sewage is called
- (A) Purification
 - (B) Clarification
 - (C) Suspension
 - (D) Dewatering
47. If soil is dried beyond its shrinkage limit, it shows
- (A) large volume change
 - (B) moderate volume change
 - (C) low volume change
 - (D) no volume change
48. When the soil mass is in active Rankine state, two sets of failure planes develop, each inclined at an angle θ to the horizontal. The value of θ is
- (A) $90^\circ + \frac{\theta}{2}$
 - (B) $90^\circ - \frac{\theta}{2}$
 - (C) $45^\circ - \frac{\theta}{2}$
 - (D) $45^\circ + \frac{\theta}{2}$
49. The values of void ratio of a micaceous sand sample in the densest and loosest states are 0.4 and 1.2 respectively. The density index of the soil for in place void ratio 0.6 is
- (A) 60%
 - (B) 75%
 - (C) 65%
 - (D) 80%
50. When the product of rock weathering are not transported as sediment but remains in place, the soil is
- (A) alluvial soil
 - (B) residual soil
 - (C) glacial soil
 - (D) aeolian soil

Section C (30 Marks)

Answer any 5 (five) from the following

1. Distinguish between elastic and plastic modulus of section. Define Shape factor.
(Marks : 6)
2. What do you understand by basic wind pressure? How do you derive basic wind pressure from wind speed? Explain.
(Marks : 6)
3. What is Scour depth? What is the difference between normal and maximum scour depths?
(Marks : 6)
4. A two hinged parabolic arch of span 25 m and size 5 m carries uniformly distributed load of 50 kN/m over the left half of the span and a concentrated load of 100 kN at the crown. Find the vertical and horizontal reactions at each support. (Marks : 6)
5. Determine the moment of resistance of a reinforced concrete beam section of size 250 mm × 350 mm. The area of steel consists of 3 bars of 12 mm diameter having clear cover of 40 mm. Use M20 and Fe 415 steel. (Marks : 6)
6. A beam is simply supported and carries a uniformly distributed load of 40 kN/m run over the whole span. The section of the beam is rectangular having depth of 500 mm. If the maximum stress in the material of the beam is 120 N/mm² and moment of inertia of the section is $7 \times 10^8 \text{ mm}^4$, find the span of the beam. (Marks : 6)
7. A point load of 700 kN is applied on the surface of a thick layer of clay. Using Boussinesq's elastic analysis, estimate the vertical stress (σ_v) at a depth of 2 m and a radial distance of 1.0 m from the point of application of the load. (Marks : 6)
8. A single lane unidirectional highway has a design speed of 65 kmph. The perception brake reaction time of a driver is 2.5 s and the average length of the vehicle is 5 m. The coefficient of longitudinal friction of the pavement is 0.4. Determine the capacity of this road in terms of vehicles per hour per lane. (Marks : 6)

Space for Answers (Section C) : for Questions 1 to 8 (14 pages)

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