

THE MAHARAJA SAYAJIRAO UNIVERSITY OF BARODA, VADODARA

Ph. D. ENTRANCE TEST (PET) 2023

Signature of Invigilator

Paper - II
Applied Mechanics And
Structural Engineering

Roll.
No.

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Maximum Marks: 50

No. Of Printed Pages: 8

Instruction for the Candidate:

1. This paper consists of **FIFTY (50)** multiple choice type questions. Each Question carries **ONE (1)** mark.
2. There is no Negative Marking for Wrong Answer.
3. A separate OMR Answer Sheet has been provided to answer questions. Your answers will be evaluated based on your response in the OMR Sheet only. No credit will be given for any answering made in question booklet.
4. Defective question booklet or OMR if noticed may immediately replace by the concerned invigilator.
5. Write roll number, subject code, booklet type, category and other information correctly in the OMR Sheet else your OMR Sheet will not be evaluated by machine.
6. Select most appropriate answer to the question and darken appropriate oval on the OMR answer sheet, with black / blue ball pen only. DO NOT USE PENCIL for darkening. In case of over writing on any answer, the same will be treated as invalid. Each question has exactly one correct answer and has four alternative responses (A), (B), (C) and (D). You have to darken the circle as indicated below on the correct response against each item.
Example: (A) (B) (C) (D) where (B) is correct response.
7. Rough Work is to be done in the end of this booklet.
8. If you write your Name, Roll Number, Phone Number or put any mark on any part of the OMR Answer Sheet, except for the space allotted for the relevant entries, which may disclose your identity, or use abusive language or employ any other unfair means, such as change of response by scratching or using white fluid, you will render yourself liable to disqualification.
9. Calculators, Log tables any other calculating devices, mobiles, slide rule, text manuals etc are NOT allowed in the examination hall. If any of above is seized from the candidates during examination time; he/she will be immediately debarred from the examination and corresponding disciplinary action will be initiated by the Center Supervisor as deemed fit.
10. DO NOT FOLD or TEAR OMR Answer sheet as machine will not be able to recognize torn or folded OMR Answer sheet.
11. **You have to return the OMR Answer Sheet to the invigilator at the end of the examination compulsorily** and must not carry it with you outside the Examination Hall. You are however, allowed to carry original question booklet on conclusion of examination.

Paper - II
Applied Mechanics And Structural Engineering

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- | | |
|---|---|
| 01) Radial acceleration is
A) mv/r^2
B) v^2/r
C) v/r^2
D) $v.r^2$ | 08) Bolt in a butt joint with double straps fails by
A) Double shearing
B) Single shearing
C) Triple shearing
D) Torsion |
| 02) The value of elasticity increases when temperature
A) Increases
B) Decreases
C) Remains constant
D) None of the above | 09) In the thin cylindrical shell, the stress acting tangential to circumference is called
A) Hoop stress
B) Tangential stress
C) Longitudinal stress
D) Yield stress |
| 03) The elastic constants E and K can be related as
A) $E = 2K(1 - 2\mu)$
B) $E = 3K(1 - 2\mu)$
C) $E = 2K(1 - \mu)$
D) $E = K(1 - 2\mu)$ | 10) A solid shaft of circular cross section is subjected to torque (T) which produces maximum shear stress (f) in a shaft. The diameter of the shaft can be given as
A) $(16T/\pi f)^{1/3}$
B) $(16f/\pi T)^{1/3}$
C) $(16f/\pi)^{1/3}$
D) $(\pi T/16f)^{1/3}$ |
| 04) Ratio of shear stress to that of shear strain is known as
A) Modulus of rigidity
B) Sub grade modulus
C) Young's modulus
D) Bulk modulus | 11) Under torsion, hollow shaft is stronger and stiffer than solid shaft if,
A) Material of both shafts is same
B) Material & length of both shafts are same
C) Material, length & weight of both the shaft are same
D) Weight of both shaft is same |
| 05) In a simple bending of beam, the stress across the cross section varies
A) Linearly
B) Parabolically
C) Hyperbolically
D) Elliptically | 12) Condition to be satisfied to maintain same nature of stress across the section subjected to combination of direct and bending stress is
A) Direct stress < Bending stress
B) Bending stress $\leq$ Direct stress
C) Bending stress $\geq$ Direct stress
D) Direct stress > Bending stress |
| 06) The section modulus (Z) of a beam section is given by
A) I.Y
B) I/Y
C) Y/I
D) M/I | 13) Number of conditions of static equilibrium in a coplanar nonconcurrent force system are
A) 3
B) 2
C) 1
D) 4 |
| 07) A beam of a triangular section is placed with its base horizontal. The maximum shear stress across the section occurs at
A) Apex of the triangle
B) Mid height
C) Centre of gravity of the triangle
D) Base of the triangle | |

- 14) Modulus of elasticity of mild steel may be assumed as
 A) $2 \times 10^5 \text{ N/mm}^2$
 B) $2 \times 10^5 \text{ N/m}^2$
 C) $1 \times 10^5 \text{ N/mm}^2$
 D) $2 \times 10^4 \text{ N/mm}^2$
- 15) _____ are the internal forces developed at any section in a three hinged parabolic arch subjected to vertical loading.
 A) Radial shear, Bending moment and Normal thrust
 B) Radial shear, Axial force and torsional moment
 C) Radial shear, bending moment and torsional moment
 D) Normal thrust, Bending moment and torsional moment
- 16) _____ is the method of analysis for statically indeterminate structures.
 A) Stiffness method
 B) Conjugate beam method.
 C) Moment Area method
 D) Unit load method.
- 17) The statement “The partial derivative of total strain energy with respect to redundant is always minimum” is known as _____.
 A) Castigliano’s first theorem
 B) Castigliano’s second theorem.
 C) Castigliano’s third theorem.
 D) Three moment theorem
- 18) Drawing the restrained structure is one of the steps in structural analysis using _____.
 A) Flexibility method
 B) Stiffness method
 C) Unit load method
 D) Kani’s method
- 19) In analysis of unsymmetrical portal frame by using moment distribution method, we have to work out _____.
 A) Unbalanced virtual horizontal force developed at beam level
 B) Horizontal force at center of the column
 C) Horizontal reactions at both supports
 D) Bending moment diagram
- 20) Influence line diagram is drawn for analysis of _____.
 A) Beams under static loads
 B) Frames subjected to lateral loads
 C) Trusses subjected to wind forces
 D) Girders subjected to moving loads
- 21) Activities to be carried out chronologically in unbonded post tensioned prestressing system
 A) Laying the cables, concreting, stressing, anchoring
 B) Laying the cables, concreting, stressing, grouting
 C) Laying the ducts, concreting, inserting the cable, stressing, grouting
 D) Aligning cables, stressing, concreting, finishing
- 22) The main components of composite beam are the prestressed precast stem and _____.
 A) Cast in situ flange
 B) Cast in situ beam
 C) Precast slab
 D) Precast column
- 23) Which of the following may alter the mechanical properties of reinforced concrete composite.
 A) Constituent properties
 B) Fibre length
 C) Fibre orientation
 D) All of the above
- 24) Pessimistic time and optimistic time of completion of an activity are given as 10 days and 4 days respectively, the variance of the activity will be _____.
 A) 1
 B) 6
 C) 12
 D) 18
- 25) The crushing strength of first class bricks should be _____ N/mm^2 .
 A) 3
 B) 5.5
 C) 7.5
 D) 10.5

- 26) Bulking is a property associated with which civil engineering material?
- Bricks
 - Concrete
 - Aggregates
 - Sand
- 27) The time for which the activity completion time can be delayed without affecting the start of succeeding activities is known as _____.
 - Duration
 - Free float
 - Total float
 - Interfering float
- 28) A pert network is having 9 activities on its critical path. The standard deviation of each activity on the critical path is 3. The standard deviation of critical path is _____.
 - 3
 - 9
 - 81
 - 29
- 29) The contribution of bent up bars towards shear resistance shall not be more than ___ of the total shear reinforcement.
 - 50%
 - 40%
 - 20%
 - 30%
- 30) What is the minimum diameter of steel reinforcement required to be provided in RC columns?
 - 10 mm
 - 12 mm
 - 8 mm
 - 16 mm
- 31) As per IS 456, the nominal cover for reinforcements in RC structures to meet durability requirement for moderate exposure should not be less than _____.
 - 20 mm
 - 30 mm
 - 45 mm
 - 50 mm
- 32) As per IS 456, the design bond stress for bars in tension in limit state method for deformed bars confirming to IS 1786 may be increased by _____ as that for plain bars.
 - 25%
 - 60%
 - 75%
 - 80%
- 33) In RC design the effective span of a simply supported beam shall be considered as
 - The clear span plus effective depth of beam
 - The center to center distance between supports
 - Minimum of (a) and (b) above
 - Maximum of (a) and (b) above
- 34) In RC design of slabs, the minimum TMT reinforcement required to be provided in terms of % of cross sectional area in either directions shall not be less than
 - 0.12
 - 0.15
 - 2
 - 4
- 35) In RC design of columns, the maximum spacing of lateral ties allowed regardless of the diameter of the longitudinal reinforcement or the least lateral dimension of column is
 - 300 mm
 - 250 mm
 - 350 mm
 - 200 mm
- 36) Ductile detailing is required to be adopted in RC structures in order to resist
 - Earthquake forces
 - Wind forces
 - Gravity forces
 - Impact forces

- 37) Choose the correct statement from following
- A) Minimum grade of concrete to be used in prestressed member is M20
 - B) Grouting is done in a pretensioned member
 - C) Railway sleeper is a post tensioned member
 - D) Concrete electric pole is a pretensioned prestressed member
- 38) In RC design of rectangular columns, the minimum required number of steel reinforcement bars in longitudinal direction is
- A) 4
 - B) 6
 - C) 8
 - D) 10
- 39) In RC design of pre stressed girders, the tensile force to be applied in tendons is mainly to carry the _____ loads.
- A) Dead
 - B) Live
 - C) Wind
 - D) Earthquake
- 40) The factor of safety of infinite slope of cohesionless soil in dry condition is
- A) Double that of fully submerged slope
 - B) Same as that of fully submerged slope
 - C) Half that of fully submerged slope
 - D) None of the above
- 41) The stability analysis of homogeneous slope of $c - \phi$ soil using friction circle method with failure surface has radius R of circular arc then radius of friction circle would be
- A) $R \cos \phi_m$
 - B) $R \tan \phi_m$
 - C) $R \cot \phi_m$
 - D) $R \sin \phi_m$
- 42) When retaining wall with vertical back moves towards the dry cohesionless backfill having top surface horizontal, at the time of full Rankine passive state, the direction of Major principal plane is
- A) Vertical
 - B) Horizontal
 - C) At an angle of $45^\circ + \phi/2$ with horizontal
 - D) At an angle of $45^\circ - \phi/2$ with horizontal
- 43) Determine correct statement with respect to coefficient of lateral earth pressure for dry cohesionless backfill
- A) $K_a > K_0 > K_p$
 - B) $K_a < K_0 < K_p$
 - C) $K_a = K_0 > K_p$
 - D) $K_a = K_0 < K_p$
- 44) Theoretical unsupported vertical cut that can be made in cohesive soil equal to
- A) Depth of tension crack
 - B) Half the depth of tension crack
 - C) Double the depth of tension crack
 - D) Depth at which passive pressure generated
- 45) Soil design of foundation is based on
- A) Allowable bearing capacity
 - B) Ultimate bearing capacity
 - C) Net ultimate bearing capacity
 - D) Safe bearing capacity
- 46) Minimum size of plate in a plate load test for determining bearing capacity of soil is
- A) 20 cm
 - B) 30 cm
 - C) 40 cm
 - D) 50 cm
- 47) Theoretical derivation of bearing capacity made by Terzaghi ignores the effect of
- A) Concentric vertical load
 - B) Plane strain condition
 - C) Roughness of foundation base
 - D) Shear resistance above foundation base
- 48) Immediate settlement of rigid footing is about _____ times the maximum settlement of equal flexible footing
- A) 0.6
 - B) 0.7
 - C) 0.8
 - D) 0.9

- 49) When chances of large lateral load, deep scouring, large uplift pressure is encountered then suitable foundation type is
- A) Isolated footing
 - B) Combined footing
 - C) Raft foundation
 - D) Pile foundation
- 50) The limitation of direct shear test on soil is
- A) Applicable to cohesionless soil only
 - B) Proper shear force measurement on failure plane is not possible
 - C) Failure plane is not necessary to be the weakest plane
 - D) Application of normal stress causes bulging of the soil

Rough Work: