

मौलाना आज़ाद राष्ट्रीय प्रौद्योगिकी संस्थान भोपाल
MAULANA AZAD NATIONAL INSTITUTE OF TECHNOLOGY BHOPAL

जब तक आपको यह प्रश्न पत्र खोलने को ना कहा जाये तब तक न खोले
DO NOT OPEN THIS QUESTION PAPER UNTIL YOU ARE TOLD TO DO SO

कार्यकारी अभियंता पद के लिए प्रश्न पत्र
QUESTION PAPER FOR THE POST OF EXECUTIVE ENGINEER

समय: 2 घंटा

अधिकतम अंक: 100

TIME ALLOWED: 2 HOURS

MAXIMUM MARKS: 100

अनुदेश (INSTRUCTIONS)

1. प्रश्न पत्र केवल कंप्यूटर स्क्रीन पर प्रदर्शित किया जाएगा।
The Question Paper will be displayed only on the Computer Screen.
 2. 80 अंकों के 80 बहु वकल्पीय प्रश्न होंगे और कुल 20 अंकों के वर्णनात्मक प्रश्न।
There shall be 80 Multiple Choice Based Questions of 80 marks and Descriptive Questions of total 20 marks
 3. प्रत्येक बहु वकल्पीय प्रश्न में चार प्रति क्रियाएँ (वकल्प) शामिल हैं। आप उस उत्तर का चयन करेंगे जिसे आप उत्तर पुस्तिका (ओ एम आर) पर अंकित करना चाहते हैं। किसी भी स्थिति में, प्रत्येक प्रश्न के लिए केवल एक उत्तर चुनें।
Each Multiple Choice Based Questions Question comprises four responses (options). You will select the response which you want to mark on the Answer Sheet (OMR). In any case, choose ONLY ONE response for each question.
 4. आपको अपने सभी बहु वकल्पीय प्रश्न के उत्तरों को उपलब्ध कराई गई उत्तर पुस्तिका (ओ एम आर) पर ही अंकित करना होगा। उम्मीदवार को वर्णनात्मक प्रश्नों का उत्तर परीक्षा केंद्र में प्रदान की जाने वाली अलग उत्तर पुस्तिका में देना होगा।
You must mark all your responses for Multiple Choice Based Questions only on the separate Answer Sheet (OMR) provided. Candidate must answer the descriptive questions on separate answer sheet to be provided in the Examination venue
 5. सभी बहु वकल्पीय प्रश्नों के अंक समान हैं।
All Multiple Choice Based Questions carry equal marks.
 6. इससे पहले कि आप उत्तर पुस्तिका (ओ एम आर) में वृत्त प्रश्नों के उत्तर और वर्णनात्मक प्रश्नों का उत्तर परीक्षा केंद्र में प्रदान की जाने वाली अलग उत्तर पुस्तिका के लिए आगे बढ़ें, आपको उत्तर पुस्तिका (ओ एम आर) में और वर्णनात्मक प्रश्नों के प्रदान की जाने वाली अलग उत्तर पुस्तिका में ववरण भरने होंगे।
Before you proceed to answer the various questions in the answer sheet (OMR) and the descriptive questions in the separate answer sheet provided at the examination centre, you must fill in the details in the answer sheet (OMR) and the separate answer sheet for the descriptive questions
 7. उत्तर पुस्तिका में अपने सभी उत्तर भरने के बाद और परीक्षा समाप्त होने पर, आपको उत्तर पुस्तिका (ओएमआर) और वर्णनात्मक प्रश्नों की उत्तर पुस्तिका परीक्षक को सौंपनी होगी।
After you have completed filling in all your responses on the Answer Sheet and on conclusion of the examination, you must handover the Answer Sheet (OMR) and Descriptive Question answer sheet to the invigilator.
 8. गलत उत्तर के लिए कोई नकारात्मक अंकन नहीं है।
There is no negative marking for wrong answer.
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CIVIL

1. A bank takes Rs. 100 from person A and promises him a simple interest of 12% per annum. At the same time, the bank lends the same Rs. 100 to person B at a compound interest of 10% per annum. How many years will it take before the compound interest received by the bank will be more than the simple interest paid by the bank?
 - a) 2 years
 - b) 3 years
 - c) 4 years
 - d) 5 years
2. A man has a deck of cards and some coins. He randomly draws a card from the deck. He tosses the coin thrice if it is a face card (J, Q, K). Otherwise, he tosses the coin only two times. What is the probability he will have at least two heads?
 - a) $16/52$
 - b) $13/52$
 - c) $12/52$
 - d) $18/52$
3. A boat travels upstream at full speed and crosses the river in 2 h. If the same boat travels upstream at half the speed, it crosses the river in 6 h. How long will the boat take to travel downstream if it travels at half its speed?
 - a) 6.0 h
 - b) 3.0 h
 - c) 2.0 h
 - d) 1.2 h
4. What is the ratio of the volume of a sphere of radius a to that of a cube of side a
 - a) $\pi/6$
 - b) $\pi/3$
 - c) $2\pi/3$
 - d) $4\pi/3$
5. What is the next number in the series 5,11,17,23,31,41, __
 - a) 43
 - b) 47
 - c) 53
 - d) 57
6. If BOY is written as ABC and GIRL is written as PQRS, how will you write YOUR
 - a) CQXS
 - b) BQXS
 - c) CBXR
 - d) BQXS
7. An institute has decided to promote female employment and ensure 50% of the employees are female. In the last hiring, the institute only recruited female candidates. Now the number of employees has increased from 160 to 200. Now, which of the following statements is true:
 - a) The institute has 40 female employees
 - b) The institute has more than 40 female employees but less than 100 female employees.
 - c) The institute has 100 female employees
 - d) Can not say with certainty

8. Read the given statement and say which of the following conclusions are true.

Statements:

1. Some keys are chains.
2. All chains are locks.
3. No lock is a rock.

Conclusions:

1. No rock is a key
2. At least some keys are locks

- a) Both conclusions are correct.
- b) Only conclusion 1 is correct.
- c) Only conclusion 2 is correct.
- d) None of the conclusions are correct.

9. What is the antonym for 'notorious'?

- a) Famous
- b) Clever
- c) Brilliant
- d) Beautiful

10. A sentence has been broken down into three parts. Identify which of the parts has an error.

If the sentence has no error, select option (d), i.e., No error.

- a) If I had known
- b) this yesterday
- c) I will have helped him
- d) No error

11. Select the correct spelling among the following

- a) Entrepreneur
- b) Enterpreneur
- c) Entreprenuer
- d) Enterprenuer

12. Select a proper sequence for the sentence.

It has been established that

P: Einstein was

Q: although a great scientist

R: weak in arithmetic

S: right from his school days

- a) SRPQ
- b) QPRS
- c) QPSR
- d) RQPS

13. Quit India Movement was started by Mahatma Gandhi in the year

- a) 1930
- b) 1931
- c) 1940
- d) 1942

14. A movie was released recently on Murlikant Petkar, India's first Paralympic gold medallist. He won his gold medal in
- Javelin throw
 - Swimming
 - Boxing
 - Table Tennis
15. Who is the current Vice president of India
- Jagdeep Dhankhar
 - Muppavarapu Venkaiah Naidu
 - Mohammad Hamid Ansari
 - Shankar Dayal Sharma
16. On which date did India become the first country to touch down near the lunar south pole with the landing of Chandrayaan-3?
- 14 July 2023
 - 05 August 2023
 - 23 August 2023
 - 03 September 2023
17. If Bcc is used when writing an email:
- Both recipients in 'To' and 'Bcc' will know about each other
 - The recipients in 'To' will not know about 'Bcc', but the recipient in 'Bcc' will know about recipients of 'To'
 - The recipients in 'To' will know about 'Bcc', but the recipient in 'Bcc' will not know about recipients of 'To'
 - The recipients in 'To' will not know about 'Bcc'; at the same time, the recipient in 'Bcc' will not know about recipients of 'To'
18. What is the shortcut command for typing subscript (example) text in MS Word
- Ctrl + Y
 - Ctrl + D
 - Ctrl + _
 - Ctrl + =
19. In MS Excel, a person wants to calculate the mean value of a column and find the highest number in a column. The person should use,
- MEAN and MAX
 - AVERAGE and CEILING
 - NORM and VLOOKUP
 - None of the above combinations will work
20. In the popular search engine Google, one can search by
- Typing text only
 - Typing text or using voice
 - Typing text, using voice or uploading a photo
 - Typing text, using voice, uploading a photo or uploading a video
21. The modulus of elasticity (E) of concrete is given by
- $E = 1000f_{ck}$
 - $E = 1000\sqrt{f_{ck}}$
 - $E = 5700\sqrt{f_{ck}}$
 - $E = 10,000\sqrt{f_{ck}}$

22. Which of the following aggregate gives maximum strength in concrete?
 (a) Rounded aggregate (b) Elongate aggregate
 (c) Flaky aggregate (d) Cubical aggregate
23. The specific gravity of commonly available ordinary Portland cement is
 (a) 4.92 (b) 3.15
 (c) 2.05 (d) 1.83
24. The bricks which are extensively used for basic refractories in furnace are
 (a) Chrome bricks (b) Sillimanite bricks
 (c) Magnesite bricks (d) Forsterite bricks
25. Lime mortar is generally made with
 (a) quick lime (b) fat lime
 (c) hydraulic lime (d) white lime
26. Given that for an in a body of homogeneous isotropic material subjected to plane stress; $\epsilon_x, \epsilon_y, \epsilon_z$ are normal strains in x,y,z directions respectively and μ is the poisson's ratio, the magnitude of unit volume change of the element is given by
 (a) $\epsilon_x + \epsilon_y + \epsilon_z$ (b) $\epsilon_x - \mu(\epsilon_y + \epsilon_z)$
 (c) $\mu(\epsilon_x + \epsilon_y + \epsilon_z)$ (d) $1/\epsilon_x + 1/\epsilon_y + 1/\epsilon_z$
27. The stress at which a material fractures under large number of reversals of stress is called
 (a) endurance limit (b) creep
 (c) ultimate strength (d) residual stress
28. A given material has Young's modulus E, modulus of rigidity G and poisson's ratio 0.25. The ratio of Young's modulus to modulus of rigidity of this material is
 (a) 3.75 (b) 3
 (c) 2.5 (d) 1.5
29. If 'A' be the area of cross section of a bar, the gauge length for the measurement of ductility will be
 (a) $5.65 \times A^{1/2}$ (b) $5.65 \times A$
 (c) $6.56 \times A^{1/2}$ (d) $6.56 \times A$

30. The deformation of a vertically held bar of length L and cross-section A is due to its self weight only. If young's modulus is E and the unit weight of the bar is γ , the elongation dL is
- (a) $\frac{\gamma L^3}{2E}$ (b) $\frac{EL^2}{2\gamma}$
(c) $\frac{\gamma L^2}{2E}$ (d) $\frac{\gamma L^2}{2AE}$
31. What is the allowable direct tensile stress in structural steel(approximately)?
- (a) $0.45f_y$ (b) $0.6f_y$
(c) $0.66f_y$ (d) $0.80f_y$
32. The best-suited rolled steel section for a tension member is
- (a) angle section (b) T-section
(c) channel section (d) flat section
33. What is the maximum slenderness ratio of lacing bars in built-up columns?
- (a) 120 (b) 145
(c) 180 (d) 200
34. A steel column pinned at both ends has buckling load of 200KN. If the column is restrained against lateral movement at its mid height, its buckling load will be
- (a) 200KN (b) 283KN
(c) 400KN (d) 800KN
35. The shape factors of a triangle section and a diamond section are respectively
- (a) 2.343 and 2.0 (b) 2.0 and 2.343
(c) 1.343 and 2.0 (d) 2.0 and 1.343
36. In limit state design of reinforced concrete, deflection is computed by using
- (a) Initial tangent modulus (b) secant modulus
(c) Tangent modulus (d) Short and long term values of young's modulus
37. In a reinforced concrete section, shear stress distribution is diagrammatically
- (a) wholly parabolic
(b) wholly rectangular
(c) Parabolic above NA and rectangular below NA
(d) Rectangular above NA and parabolic below NA

38. In limit state design, permissible bond stress in the case of deformed bars is more than that in plain bars

- (a) 60%
- (b) 50%
- (c) 40%
- (d) 25%

39. A beam of rectangular cross-section ($b \times d$) is subjected to a torque T . What is the maximum torsional stress induced in the beam?

- (a) $\frac{T}{ab^2d}$
- (b) $\frac{T}{abd^2}$
- (c) $\frac{T}{abd}$
- (d) $\frac{T}{bd}$

40. Yield line theory results in

- (a) elastic solution
- (b) lower bound solution
- (c) upper bound solution
- (d) unique solution

41. Grantt chart indicates

- (a) Comparison of actual progress with the scheduled progress
- (b) Balance of work to be done
- (c) Progressively costs of the project
- (d) Inventory costs

42. In a construction project, the cost slope of an activity is an indication of

- (a) extra time needed
- (b) extra cost needed
- (c) reduction of duration of critical activity
- (d) crashing of an activity

43. In resource levelling

- a. Total duration of project is reduced
- b. Total duration of project is increased
- c. Uniform demand of resources is achieved
- d. Cost of project is controlled

44. The most suitable type of equipment for compaction of cohesive soils is

- (a) smooth wheeled roller
- (b) vibratory roller
- (c) sheep foot roller
- (d) tamper

45. In compaction of clayey soils using sheep foot roller, compaction is achieved by

- (a) static action
- (b) vibration action
- (c) kneading action
- (d) impact action

46. The surface tension in a soap bubble of 50mm diameter with its inside pressure being 2.5N/mm^2 above atmospheric pressure is

- (a) 0.0125N/m (b) 0.0156N/m
- (c) 0.2N/m (d) 0.0312N/m

47. The dimension of the coefficient of viscosity is

- a) $M^1L^{-1}T^{-1}$
- b) $M^{-1}L^1T^{-1}$
- c) $M^{-1}L^1T^1$
- d) $M^{-1}L^{-1}T^1$

48. Which of the following statements is correct about the shear stress distribution in circular pipes with laminar flow?

- a) It is linear, with a maximum value at the centre
- b) It is parabolic with maximum value at the centre
- c) It is parabolic with zero value at the centre
- d) It is linear with zero value at the centre

49. 29. A pipe of diameter 200 mm carries water in a turbulent flow. The velocity of water at the centre of the pipe and 50 mm from the centre of the pipe are 3 m/s and 2 m/s, respectively. What is the shear stress at the wall of the pipe?

- a. 785 N/m^2
- b. 334 N/m^2
- c. 528 N/m^2
- d. 614 N/m^2

50. The velocity distribution for flow over a flat plate is given by $u = (y-y^2)$ in which u is velocity in metres per second at a distance y metres above the plate. What is the shear stress value at $y = 0.15\text{ m}$? The dynamic viscosity of fluid is 8.0 poise.

- a) 12.4 N/m^2
- b) 1.24 N/m^2
- c) 0.56 N/m^2
- d) 5.6 N/m^2

51. The vertical hydraulic conductivity of the top soil at a certain stage is 0.2 cm/h. A storm of intensity 0.5 cm/h occurs over the soil for an indefinite period. Assuming the surface drainage to be adequate, the infiltration rate after the storm has lasted for a very long time, shall be

- a. smaller than 0.2 cm/h
- b. 0.2 cm/h
- c. between 0.2 and 0.5 cm/h
- d. 0.5 cm/h

52. The total irrigation depth of water required by a certain crop in its entire growing period (150 days) is 25.92 cm. The culturable command area for a distributary channel is 100,000 hectares. The distributary channel shall be designed for a discharge.
- less than 2 cumecs
 - 2 cumecs
 - 20 cumecs
 - More than 20 cumecs
53. A sprinkler irrigation system is suitable when
- The land gradient is steep
 - The soil has low permeability
 - The water table is low
 - The crops to be grown have deep roots
54. On which of the canal systems, R.G. Kennedy, executive engineer in the Punjab Irrigation Department made his observations for proposing his theory on stable channels?
- Krishna Western Delta Canals
 - Lower Bari Doab Canals
 - Lower Chenab Canals
 - Upper Bari Doab canals
55. The rainfall during three successive 2 h periods are 0.5, 2.8 and 1.6 cm. The surface runoff resulting from this storm is 3.2 cm. The ϕ index value of this storm is
- 0.2 cm/h
 - 0.28 cm/h
 - 0.3cm/h
 - 0.8cm/h
56. Zero hardness of water is achieved by
- lime soda process
 - excess lime treatment
 - ion exchange treatment
 - excess alum and lime treatment
57. A portion of waste water sample was subjected to standard BOD test 5days, 20°C, yielding a value of 180mg/L. The reaction rate constant (to the base e) at 10 °C was taken as 0.18 per day. The reaction rate constant at other temperature may be estimated by $k_T = k_{20}(1.047)^{T-20}$. The temperature at which the other portion of the sample should be test to exert the same BOD in 2.5 days is
- 4.9 °C
 - 24.9 °C
 - 31.7 °C
 - 35.0 °C
58. A water sample has a pH of 9.25. The concentration of hydroxyl ions in the water sample is
- $10^{-9.25}$ moles/L
 - $10^{-4.75}$ moles/L
 - 0.302moles/L
 - 3.020moles/L

59. The reference pressure used in the determination of sound/pressure level is
- 20 MPa
 - 20 dB
 - 10 MPa
 - 40 dB
60. Particular matter (fly ash) carried in effluent gases from the furnaces burning fossil fuels are better removed by
- Cotton bag house filter
 - Electrostatic precipitator (ESP)
 - Cyclone
 - Wet scrubber
61. The design speed on a highway is 60 kmph; calculate the superelevation if the radius of the curve is 150m and the coefficient of friction is 0.15.
- 0.15
 - 0.04
 - 0.038
 - 0.07
62. An isochrone is the line
- Indicating the variation of excess pore water pressure at a given time
 - Indicating the variation of additional vertical stress for a given load
 - Joining all the points of same additional vertical stress
 - Joining all the points of same excess pore water pressure
63. Mohr- Coulomb's law is correctly represented as
- $\tau = C - \sigma \tan \phi$
 - $\tau = C - \sigma \cot \phi$
 - $\tau = C + \sigma \tan \phi$
 - $\tau = C + \sigma \cot \phi$
64. The function of a sand drain is to
- Decrease the rate of consolidation
 - Increase the rate of consolidation
 - Keep constant the rate of consolidation
 - None of these
65. The deviator stress, corresponding to tri-axial shear test is given by
- $(\sigma_1 + \sigma_3)$
 - $(\sigma_1 - \sigma_3)$
 - $(\sigma_1 + \sigma_3)/2$
 - $(\sigma_1 - \sigma_3)/2$
66. In Terzaghi's general bearing capacity equation N_c , N_q , N_r are termed as
- Bearing capacity factors
 - Dimensionless factors
 - Both (a) and (b)
 - None of these

67. The surface of the highway pavement should be designed to allow
- No rolling resistance
 - Very high rolling resistance
 - Low rolling resistance
 - High rolling resistance
68. The cross-drainage structure of a highway is considered in which aspect?
- Road user amenities
 - Maintenance aspects
 - Highway factors
 - Highway traffic factors
69. The speed and delay studies on a defined section of highway are conducted by
- Radar
 - Traffic counters
 - Moving car method
 - Enoscope
70. The road geometrics in India are designed for the
- 98th highest hourly traffic volume
 - 85th highest hourly traffic volume
 - 50th highest hourly traffic volume
 - 30th highest hourly traffic volume
71. Which of the following is a statically determinate structure?
- Two hinged arch
 - Fixed beam
 - Double overhanging
 - Continuous beam
72. A three-hinged parabolic arch ABC has a span of 20 m and a central rise of 4m. The arch has hinges at the ends and at the centre. A train of two point loads of 20 kN and 10 kN, 5 m apart, crosses this arch from left to right, with 20 kN load leading. The maximum thrust induced at the supports is
- 25.00 kN
 - 31.25 kN
 - 28.13 kN
 - 32.81 kN
73. For a linear elastic structural system, minimisation of potential energy yields
- compatibility conditions
 - Constitutive relations
 - equilibrium equations
 - Strain displacement relations
74. The symmetry of stress tensor at a point in the body under equilibrium is obtained from
- Conservation of mass
 - Force equilibrium equations
 - Moment equilibrium equations
 - Conservation of energy

75. A long shaft of diameter d is subjected to twisting moment T at its ends. The maximum normal stress acting at its cross-section is equal to
- Zero
 - $\frac{16T}{\pi d^3}$
 - $\frac{32T}{\pi d^3}$
 - $\frac{64T}{\pi d^3}$
76. Vicat's apparatus is used to perform the test of
- Fineness
 - Consistency
 - Soundness
 - Compressive strength
77. In a slab, the minimum reinforcement for Fe250 provided, is
- 0.10% of its gross sectional area
 - 0.12% of its gross sectional area
 - 0.15% of its gross sectional area
 - None of the above
78. Sampling is the process of determining the quality of
- Small part from a large group
 - Large group from a small part
 - Small group at random
 - Small group from a small part
79. Maximum pitch in any staircase is
- 25°
 - 35°
 - 40°
 - 50°
80. The minimum longitudinal reinforcement in a column is provided as a percentage of gross-sectional area of the column. This percentage is
- 0.6
 - 0.8
 - 1.0
 - None of these

Questions 81 to 84 carries 5 marks each. Exact calculations not required issued any data suitably.

81. Please explain the design steps for designing a propped cantilever Beam. Show the sketch of the reinforcements.
82. Please find out the amount of cement required in plaster of a room of size $4\text{m} \times 4\text{m} \times 3.5\text{m}$. Take suitable size of one window and one door to be provided in the room.
83. Explain why extra widening is provided to Road at horizontal curve and what is the recommendation of IRC?
84. A water tank is to be constructed in MANIT Bhopal having student population of 6000 and 400 family of faculty and non-faculty. How will you decide the capacity of the tank and height of the staging?