

मौलाना आज़ाद राष्ट्रीय प्रोद्योगिकी 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 बहुविकल्पीय 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 बहुविकल्पीय प्रश्न में चार प्रति क्रियाएँ (विकल्प) 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 बहुविकल्पीय 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 बहुविकल्पीय 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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Electrical

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:
- The institute has 40 female employees
 - The institute has more than 40 female employees but less than 100 female employees.
 - The institute has 100 female employees
 - Can not say with certainty
8. Read the given statement and say which of the following conclusions are true.
- Statements:
- Some keys are chains.
 - All chains are locks.
 - No lock is a rock.
- Conclusions:
- No rock is a key
 - At least some keys are locks
- Both conclusions are correct.
 - Only conclusion 1 is correct.
 - Only conclusion 2 is correct.
 - None of the conclusions are correct.
9. What is the antonym for 'notorious'
- Famous
 - Clever
 - Brilliant
 - 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.
- If I had known
 - this yesterday
 - I will have helped him
 - No error
11. Select the correct spelling among the following
- Entrepreneur
 - Enterpreneur
 - Entreprenuer
 - 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

- a) Javelin throw
- b) Swimming
- c) Boxing
- d) Table Tennis

15. Who is the current Vice president of India

- a) Jagdeep Dhankhar
- b) Muppavarapu Venkaiah Naidu
- c) Mohammad Hamid Ansari
- d) 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?

- a) 14 July 2023
- b) 05 August 2023
- c) 23 August 2023
- d) 03 September 2023

17. If Bcc is used when writing an email:

- a) Both recipients in 'To' and 'Bcc' will know about each other
- b) The recipients in 'To' will not know about 'Bcc', but the recipient in 'Bcc' will know about recipients of 'To'
- c) The recipients in 'To' will know about 'Bcc', but the recipient in 'Bcc' will not know about recipients of 'To'
- d) 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

- a) Ctrl + Y
- b) Ctrl + D
- c) Ctrl + _
- d) 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,

- a) MEAN and MAX
- b) AVERAGE and CEILING
- c) NORM and VLOOKUP
- d) None of the above combinations will work

20. In the popular search engine Google, one can search by

- a) Typing text only
- b) Typing text or using voice
- c) Typing text, using voice or uploading a photo
- d) Typing text, using voice, uploading a photo or uploading a video

21. A square matrix all of whose elements except the main diagonal are zeros is called a :

- (a) null matrix
- (b) singular matrix
- (c) diagonal matrix
- (d) symmetric matrix

22. Square matrix A for which $[A]^T = -A$ is called a :

- (a) row matrix
- (b) column matrix
- (c) symmetric matrix
- (d) skew-symmetric matrix

23. Bundled conductors are used in transmission lines in order to:

- a) Reduce corona loss and to increase the inductance of line
- b) Reduce corona loss and to decrease the inductance of lines
- c) Decrease the GMD (mutual) of line
- d) Decrease the GMD (self) of lines

24. If , $\arg(z) < 0$, then $\arg(-z) - \arg(z) =$

- (a) π
- (b) $-\pi/4$
- (c) $-\pi/2$
- (d) $\pi/2$

25. A 1-phase transmission line has an impedance $(3+4j) \Omega$. Find the power factor of the load for achieving maximum voltage regulation?

- a) 0.6 lag
- b) 0.8 lag
- c) 0.6 lead
- d) 0.8 lead

26. Value of $\omega^{1999} + \omega^{299} + 1$ is :

- (a) 0
- (b) 1
- (c) -1
- (d) 2

27. The first-three non-zero terms in the expansion of $e^x \tan x$ is :

- (a) $x + x^2 + (1/3)x^3$
- (b) $x + (x^3/3) + (2/5)x^5$
- (c) $x + x^2 + (5/6)x^3$
- (d) $x + (x^3/3) + (1/6)x^5$

28. Two balls are drawn at random with replacement from a box containing 10 black and 8 red balls. Find the probability that both balls are red ?

- (a) 8/81
- (b) 16/81
- (c) 20/81
- (d) 40/81

29. A die is tossed thrice. Find the probability of getting an odd number at least once ?

- (a) 7/5
- (b) 6/5
- (c) 7/8
- (d) 2/8

30. The following expression can give the average output voltage V_{dc} of a half-wave rectifier with resistive load, where V_m is the maximum or peak voltage of the AC sinusoidal supply.

- a) V_m/π
- b) $2V_m/\pi$
- c) $V_m/2\pi$
- d) $4V_m/\pi$

31. Phenol and Formaldehyde are polymerised to a resultant product known as:

- (a) PVC
- (b) Bakelite
- (c) Polyester
- (d) Teflon

32. Manganin is an alloy of

- (a) copper, manganese and nickel
- (b) copper and manganese.
- (c) manganese and nickel.
- (d) manganese, aluminium and nickel.

33. In a ferromagnetic material the state of flux density is as follows when external magnetic field is applied to it:

- (a) Increased
- (b) Decreased
- (c) Remains unchanged
- (d) Becomes zero

34. Hysteresis loss least depends on:

- (a) Frequency
- (b) Magnetic field intensity
- (c) Volume of the material.
- (d) Grain orientation of material.

35. Schottky defect is an example of:

- (a) Point defect
- (b) Line defect
- (c) Surface defect
- (d) Volume defect

36. For simple cubic crystal structure, packing efficiency is:

- (a) 52
- (b) 74.4
- (c) 64
- (d) None of the above

37. In a sine wave AC Circuit with a resistive branch and inductive branch in parallel, the :

- a) Voltage across the inductor leads the voltage across the reactance by 90°
- b) Resistance branch current is 90° out of phase with the inductive branch current
- c) Resistive and inductive branch current are 180° out of phase
- d) Inductive and resistive branch currents are in phase

38. A single-phase full-wave uncontrolled bridge rectifier supplies a highly inductive load (L/R ratio is very large), and the load current is assumed to be smooth and ripple-free. If the supply voltage is 230V, 50Hz, and the inductor load resistance $R = 20 \Omega$, Calculate the average output current.

- a) 20.70 A
- b) 10.35 A
- c) 15.65 A
- d) 5.17 A

39. Which of the following statements is true?

- a) Iron core has maximum eddy-current losses
- b) Laminated iron core has minimum eddy-current losses
- c) Power-iron core has the maximum eddy-current losses
- d) Air core has the minimum eddy-current

40. In sine wave a.c. Circuit with X_c and R in series, the

- a) Voltages across R and X_c are in phase
- b) Voltages across R and X_c are 180° out of phase
- c) Voltages across R leads the voltages across X_c by 90°
- d) Voltage across R lags the voltage across X_c by 90°

41. In a series L-C circuit at the resonant frequency the

- a) Current is minimum
- b) Voltage across C is minimum
- c) Impedance is maximum
- d) Current is maximum

42. The total electric flux through any closed surface surrounding charges is equal to the amount of charge enclosed. The above illustration is known as

- a) Maxwell's First Law
- b) Maxwell's Second Law
- c) Gauss's Law
- d) Coulomb's Square Law

43. If $\mathbf{A}$ is the vector which of the following statements is true?

- a) $\text{Div curl } \mathbf{A} = \mathbf{A}$
- b) $\text{Div curl } \mathbf{A} = \text{curl } \mathbf{A}$
- c) $\text{Div curl } \mathbf{A} = 0$
- d) $\text{Div curl } \mathbf{A} = \text{curl div } \mathbf{A}$

44. Which of the following statements is true?

- a) The magnetomotive force around a closed path is equal to the conduction current plus electric displacement through any surface bounded by the path
- b) The electromotive force around a closed path is equal to the time derivative of the electric displacement through any surface bounded by the path
- c) The total electric displacement through the surface enclosing a volume is not equal to total charge within the volume
- d) The net magnetic flux emerging through any closed surface is zero

45. A 100 watt, 250 V bulb will have more resistance than 60 watt, 250 V bulb.

- a) True
- b) False
- c) can't decide
- d) both have same resistance.

46. In reverse blocking mode of a thyristor

- a) Junction J_1 , J_3 is in reverse bias and J_2 is in forward bias.
- b) Junction J_1 and J_2 is in forward bias and J_3 is in reverse bias.
- c) Junction J_2 is in reverse bias and J_1 , J_3 is in forward bias.
- d) Junction J_3 is in forward bias and J_1 , J_2 in reverse bias.

47. If two meters X and Y require 40 mA and 50 mA, respectively, to give full-scale deflection, then:

- (a) X is more sensitive
- (b) Y is more sensitive
- (c) Both X and Y are equally sensitive
- (d) It would not be possible to access the sensitivity based on the given data

48. If a voltmeter is connected, like an ammeter in series to the load:

- a) The measurement reading will be too high
- b) Almost no current will flow in the circuit
- c) The meter will burn
- d) An instantaneously high current will flow

49. For eliminating the effect of earth capacitance from the bridge network we use:

- a) Wagner's earthing device
- b) High voltage at low frequency
- c) Low voltage at high frequency
- d) Campbell-maxwell device

50. Which of the following is not an absolute instrument:

- a) Tangent galvanometer
- b) Rayleigh current balance
- c) D'Arsonval galvanometer
- d) Absolute electrometer

51. In the context of computing, what is the full form of URL?

- a) Undistributed Resource Locator
- b) Unified Resource Locator
- c) Uniform Resource Locator
- d) Uniform Region Locator

52. Microprocessor was introduced in which generation of computer ?

- a) Second Generation
- b) Fourth Generation
- c) Both (a) and (b)
- d) Fourth Generation

53. The first supercomputer developed in India is ?

- a) PARAM
- b) ARYA Bhatt
- c) BUDDHA
- d) SHIVA

54. The first computers were programmed using ?

- a) Assembly language
- b) Machine language
- c) Spaghetti tails
- d) Source code

55. Current flow in semiconductors depends on the phenomenon of

- a) Drift
- b) Diffusion
- c) Recombination
- d) All of these

56. The main reason why electrons can tunnel through a P-N junction is that

- a) They have high energy.
- b) Barrier potential is very low
- c) Depletion layer is extremely thin.
- d) Impurity level is low.

57. Introducing a resistor in the emitter of a common emitter amplifier stabilizes the dc operating point against variations in

- a) Only temperature
- b) Only the β of the transistor
- c) Both temperature and β
- d) None of the above

58. Which of the following is NOT true for a common collector transistor?

- a) Input impedance is high
- b) It can be used for impedance matching
- c) Output impedance is low
- d) Power gain is high

59. FET can be used as a

- a) Variable capacitor
- b) Variable register
- c) Constant voltage source
- d) Negative resistance

60. Which of the following circuits is used as a comparator?

- a) Astable multivibrator
- b) Bistable multivibrator
- c) Monostable multivibrator
- d) Schmitt trigger

61. The value of 110111 in decimal system is

- a) 33
- b) 22
- c) 55
- d) 11

62. The logical expression $y = A + A' B$ is equivalent to

- a) $Y = AB$
- d) $Y = A'B$
- c) $Y = A' + B$
- d) $Y = A + B$

63. JK flip-flop can be used as Toggle switch when

- a) J and K connected to ground
- b) J connected to ground and K connected to $+V_{oc}$
- c) J and K connected to $+V_{oc}$
- d) None of these

64. The Fourier series expansion of periodic function with half wave symmetry contains only

- a) Sine terms
- b) Cosine terms
- c) Odd harmonics
- d) Even harmonics

65. The region of convergence of the Z-transform of a unit step function is

- a) $|Z| > 1$
- b) $|Z| < 1$
- c) (Real part of Z) > 0
- d) (Real part of Z) < 0

66. If the frequency spectrum of a function is discrete, then the function is

- a) Discrete
- b) Aperiodic
- c) Periodic
- d) Random

67. A band-limited signal with a maximum frequency of 5 kHz is to be sampled. According to the sampling theorem, the sampling frequency in kHz which is not valid is

- a) 5
- b) 12
- c) 15
- d) 20

68. State whether the integrator system is stable or not.

- a) Unstable
- b) Stable
- c) Partially Stable
- d) All of the mentioned

69. A second order control system has a transfer function $16/(s^2 + 4s + 16)$ Find the settling time for 2% tolerance?

- a) 10 sec
- b) 4 sec
- c) 5 sec
- d) 2 sec

70. If poles are added to the system, where will the system tend to shift the root locus?

- a) To the left of an imaginary axis
- b) At the center
- c) No shifting takes place
- d) To the right of an imaginary axis.

71. When a 440/220V transformer is connected to 400 V D.C. supply

- a) The output will be 0 V
- b) The transformer may burn
- c) The output will be 220 V
- d) The output will be less than 230 V

72. A 3-phase voltage source inverter is operated in 180° conduction mode. Which one of the following statements is true?

- a) Both pole-voltage and line-voltage will have 3rd harmonic components
- b) Pole-voltage will have 3rd harmonic component but line-voltage will be free from 3rd harmonic
- c) Line-voltage will have 3rd harmonic component but pole-voltage will be free from 3rd harmonic
- d) Both pole-voltage and line-voltage will be free from 3rd harmonic components

73. The open circuit test of a transformer gives information about

- a) Hysteresis loss
- b) Eddy current loss
- c) Copper loss
- d) Both hysteresis & eddy current losses

74. The single phase induction motor that can be used on both DC and AC circuits is

- a) Hysteresis motor.
- b) Universal motor.
- c) Reluctance induction motor.
- d) Repulsion induction motor.

75. When supply voltage of induction motor is reduced by 10%, the maximum torque will decrease by

- a) 5%
- b) 10%
- c) 20%
- d) 40%

76. While starting a synchronous motor its field winding should be

- a) Kept open
- b) Short circuited
- c) Connected to DC source
- d) None of above

77. Slip test is performed to determine

- a) Slip
- b) Direct axis and quadrature axis reactances
- c) Positive and negative sequence reactances
- d) Sub transient reactance

78. As load factor of plant increases cost of energy generation

- a) Increases
- b) Decrease
- c) May increase or decrease
- d) Remains same

79. Power Factor correcting element is generally connected in....

- a) Series with load
- b) Parallel to the load
- c) Series with source
- d) Parallel to source

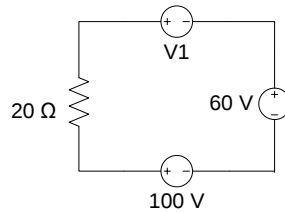
80. For a transmission line with resistance 'R' and reactance 'X' and negligible capacitance generalized constant 'A' is:

- a) 1
- b) $R - jX$
- c) $R + jX$
- d) 0

Questions 81 to 84 carries 5 marks each. Exact calculations not required.

81. An analog circuit require $\pm 12\text{V}$ for its operation. Design, draw and discuss the construction of a Regulated Power Supply. Input is 230 V AC and Output is $\pm 12\text{V}$.

82. In the given circuit, a charge of 1200 C is delivered to the 100 V source in 1 min . Find the value of voltage V_1 .



83. Draw the circuit diagram to connect the two lamps in such a way that -

- (i) Both bright full
- (ii) Both in series
- (iii) Only 1 ON
- (iv) Both OFF

84.

(a) Find the equivalent resistance with following color codes when they are connected in series and in parallel:

- i. Red, Red, Orange, Silver,
- ii. Blue, Grey Red, Gold
- iii. Yellow, Violet, Red, Gold

(b) Give at least 3 reasons for following defects in an Electric Iron

- (i) No heat
- (ii) Iron gives shock