

Section – Mathematics

1. $\lim_{n \rightarrow 0} (1 + 3x)^{1/x}$
 - A) e
 - B) e^3
 - C) 3^{-3}
 - D) $\frac{1}{e}$
2. If $y = \log(\tan x)$ then $\frac{dy}{dx}$ at $x = \frac{\pi}{4}$
 - A) 6
 - B) $\frac{\sqrt{3}}{2}$
 - C) 2
 - D) 0
3. If $f(x) = x \sin \frac{1}{x}$ for $x \neq 0$, $f(0) = 0$ then at $x = 0$, $f(x)$ is
 - A) Continuous
 - B) Discontinuous
 - C) Not determined
 - D) Discontinuity
4. The tangent to the hyperbola $4x^2 - 5y^2 = 16$ at the point (3, -2) is
 - A) $6x - 5y = 28$
 - B) $6x + 5y = 8$
 - C) $5y - 6x = 28$
 - D) $5x + 6y = 4$
5. If (1,2) (K,-1) are conjugate points with respect to the ellipse $2x^2 + 3y^2 = 6$ then K is
 - A) 2
 - B) 4
 - C) 6
 - D) 8
6. Axis of the parabola $x^2 - 3y - 6x + 6 = 0$ is
 - A) $x = -3$
 - B) $y = -1$
 - C) $x = 3$
 - D) $y = 1$
7. If A is orthogonal matrix then $|A| =$
 - A) 1
 - B) -1
 - C) ± 1
 - D) 0
8. Class marks are given 9, 16, 23, 30, 37, 44; then the 4th class limits are
 - A) 23-30
 - B) 26.5-33.5
 - C) 26.5-33
 - D) 26-33.5
9. $\int_0^{\pi/2} \sin^4 x dx =$
 - A) $\frac{3\pi}{16}$
 - B) $\frac{3}{16}$
 - C) $\frac{\pi}{16}$
 - D) $\frac{1}{16}$
10. $\sqrt{2x+1} + \sqrt{x+5} = 6$ then $x =$
 - A) ± 4
 - B) 4
 - C) -4
 - D) ± 5
11. If ω is complex cube root of unity, then $(1 - \omega + \omega^2)^6 + (1 - \omega + \omega)^6 =$
 - A) 16
 - B) 32
 - C) 64
 - D) 128

12. $1 + \tan 75^\circ + \tan 15^\circ =$

A) 5

C) 3

B) 4

D) 2

13. The solution of $(x^2 + y^2)dx = 2xydy$

A) $c(x^2 - y^2) = x$

C) $c(x^2 - y^2) = y$

B) $c(x^2 + y^2) = x$

D) $c(x^2 + y^2) = y$

14. The number of distinct solutions in R of the equation $|x - |2x + 1|| = 3$ is

A) 0

C) 2

B) 1

D) 4

15. The modulus of the complex number $\frac{3+5i}{1-2i}$ is

A) $\sqrt{5}$

C) $\sqrt{\frac{34}{5}}$

B) 5

D) $\sqrt{2}$

16. $\tan 18^\circ + \tan 42^\circ + \sqrt{3} \tan 18^\circ \tan 42^\circ =$

A) 0

C) $\sqrt{3}$

B) $\frac{1}{\sqrt{3}}$

D) 3

17. $\cos 1^\circ, \cos 2^\circ, \cos 3^\circ \dots \cos 179^\circ =$

A) 3

C) 1

B) 2

D) 0

18. If 8 and 2 are roots of the equation $x^2 + ax + p = 0$ and 3, 3 are the roots of the equation $x^2 + qx + b = 0$, then the roots of the equation $x^2 + ax + b = 0$ are

A) 1, 0

C) -8, -2

B) 9, 1

D) 1, -1

19. In the expansion $(\sqrt{x} - \frac{2}{x})^{18}$, the term independent of x is

A) ${}^{18}C_6 2^6$

C) ${}^{18}C_6 3^6$

B) ${}^{18}C_4 2^5$

D) ${}^{18}C_5 2^6$

20. One side of a rectangular field is 5 m and one of its diagonals is 13 m. The area of the field is

A) 50 m²

C) 70 m²

B) 60 m²

D) 90 m²

21. The length of a room is $1\frac{1}{2}$ times its breadth, the cost of carpeting the room at Rs. 18 per m² is Rs. 972, the dimensions of the room are

A) 9m, 6m

C) 20m, 30m

B) 15m, 16m

D) 21m, 15m

22. The roots of $12x^2 + kx + 5 = 0$ are in the ratio 3:2 then K =

A) ± 5

C) $\pm 5\sqrt{10}$

B) $\pm \sqrt{10}$

D) $\pm 2\sqrt{10}$

23. The area bounded by the parabola $y = 2x - x^2$ and X – axis is

A) $\frac{4}{3}$

C) 2

B) $\frac{1}{3}$

D) 4

24. The sides of a triangle are in the ratio 5 : 12 : 13 and its perimeter is 300 m. Its area is

A) 3000 sqm

C) 3225 sqm

B) 3127 sqm

D) 3750 sqm

25. The sides of two cubes are in the ratio 3 : 1 then the ratio of their total surface

A) 3 : 1

C) 9 : 1

B) 8 : 1

D) 12 : 1

26. The co-efficient of x^{15} in the product of $(x-1)(x-2)(x-3)\dots(x-16)$ is

A) 16!

C) -136

B) 136

D) -16!

27. If the matrices $\begin{pmatrix} 2a+b & a-2b \\ 5c-d & 4c+3d \end{pmatrix}$ and $\begin{pmatrix} 4 & -3 \\ 11 & 24 \end{pmatrix}$ are equal, then the values of a, b, c, d are in

A) A.P.

C) H.P.

B) G.P.

D) A.P. and G.P.

28. The number of 5 digit numbers that can be formed using 2, 3, 4, 5, 6, 7 digits which are divisible by 25 without repetition is

A) 24

C) 48

B) 64

D) 84

29. The number of positive divisors of $2^5 \cdot 3^6 \cdot 7^3$ is

A) 144

C) 169

B) 168

D) 167

30. $(2 + \sqrt{3})^7 + (2 - \sqrt{3})^7 =$

A) 10080

C) 10086

B) 10082

C) 10084

Section – Engineering Graphics

41. As per BIS the standard A0 size sheet area is approximately equal to _____square meter.

- A) 5
C) 2
- B) 1
D) 4

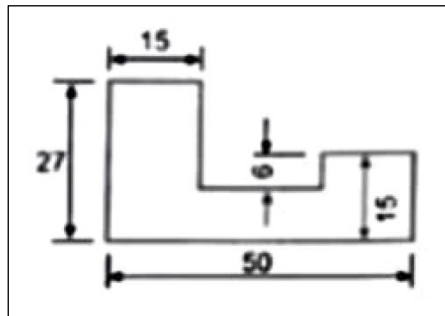
42. The following labels are drawn with different scales as given below

Label	Scale
L1	1:25
L2	2:1
L3	1:1
L4	5:1

Choose the correct Answer

- A) L1 and L2 are enlarging scales and L3 is -full scale
B) L2 and L4 are reducing scales; L1 is enlarging scales and L3 is full scale
C) L2 and L4 are enlarging scales; L1 is reducing scales and L3 is full scale
D) L3 is full scale and L1, L2, L4 are reducing scales

43. For the figure shown below identify the correct reason for incorrect representation of dimensions.



Reasons:

- I) Dimension 27 and 50 not written according to aligned system.
- II) Dimensions lines are placed inside the view
- III) Dimensions lines used as extension

Choose the correct choice.

- A) Only I) and II) are correct statements
B) All three reasons are correct statements
C) Only II) and III) are correct statements
D) Only I) is correct statement

44. Identify the type of line

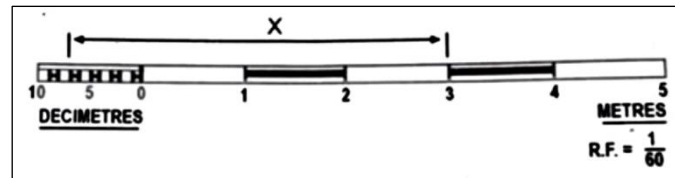
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- A) Dashed thin narrow line
- B) Dashed thick narrow line
- C) Continues thin line
- D) Chain thin long-dashed dotted line

45. Consider the R.F of a map is 1: 4000, the actual length of the object is 500 m, and then the length to be drawn in cm is

- A) 125
B) 12.5
C) 200
D) 20

46. For the plane scale shown in the figure below, what is the value of X in meters?



- A) 3.7
B) 3.6
C) 5.7
D) 5.6

47. Four curves are represented by C1, C2, C3, C4 whose eccentricity ratios are %, Yh, 1, 5/3 respectively. Choose the correct statements

- A) C1 and C2 curves are Ellipse and C3 and C4 are parabola
B) C3 is parabola; C4 is Hyperbola and C1 and C2 curves are ellipse
C) C3 curve is parabola, C4 curve is Hyperbola, C1 is circle and C2 ellipse
D) C1 and C2 curves are Ellipse and C3 and C4 are Hyperbola

48. The distance between fixed point and vertex is VF and the distance from vertex to the fixed line is VD. If VD is greater than VF then the curve generated is

- A) Parabola
B) Hyperbola
C) Ellipse
D) Data is insufficient to name the curve

49. When a line PQ is inclined to HP and parallel to VP and the line is in the first quadrant, which of the following statements is true.

- I) No vertical traces to the line PQ
II) Line in the front view is true length
III) Line in the top view is true length

- A) All three statements are correct
B) Only (iii) is correct
C) Only (i) and (ii) are correct
D) Only (ii) is correct

50. In orthographic projection, each projection view represents how many dimensions of an object?

- A) 1
B) 2
C) 3
D) 4

Section – Electrical Engineering

51. Which one of the following materials cannot be used for permanent magnets?
- | | |
|-------------------|----------------------|
| A) Carbon-steel | B) Alnico |
| C) Barium Ferrite | D) Iron-Cobalt alloy |
52. Which one of the following materials has the highest dielectric strength?
- | | |
|----------------|--------------------|
| A) Polystyrene | B) Marble |
| C) Cotton | D) Transformer oil |
53. A DC shunt generator is supplying a load of 15 kW at 200 V. The armature and shunt field resistances are 0.1 Ω and 100 Ω respectively. The induced e.m.f of the generator is
- | | |
|------------|------------|
| A) 192.3 V | B) 207.7 V |
| C) 210 V | D) 187 V |
54. For doubling the torque developed by a D.C. Series motor, its armature current has to be increased by
- | | |
|---------|----------|
| A) 100% | B) 200% |
| C) 50% | D) 41.4% |
55. In a digital frequency meter, the Schmitt trigger is used for
- A) Converting sinusoidal waveforms into rectangular pulses
 - B) Scaling of sinusoidal waveforms
 - C) Providing time base
 - D) Triggering a start pulse
56. Power electronics essentially deals with control of a.c. power at
- | | |
|-----------------------------|--------------------------------|
| A) Frequencies above 20 kHz | B) Frequencies above 1000 kHz |
| C) 50 Hz frequency | D) Frequencies less than 10 Hz |
57. A 0-10 mA PMMC ammeter reads 4mA in a circuit. Its bottom control-Spring snaps suddenly. The meter will now read nearly
- | | |
|----------|---------|
| A) 10 mA | B) 8 mA |
| C) 2 mA | D) zero |
58. The type of DC generator used for arc welding purposes is
- | | |
|--|---------------------------------|
| A) series generator | B) shunt generator |
| C) differentially compounded generator | D) separately excited generator |
59. A star-connected synchronous generator has synchronous impedance of $(0+j5.0) \Omega$. It delivers a zero-pf leading current of 20 A at 400 V. Its excitation emf is
- | | |
|---------------------------------|---------------------------------|
| A) $400 + j\sqrt{3} \times 100$ | B) $400 - j\sqrt{3} \times 100$ |
| C) $400 - \sqrt{3} \times 100$ | D) $400 + \sqrt{3} \times 100$ |
60. Two DC generators having equal open-circuit emfs but slightly different load characteristics are operating in parallel, then
- A) The machine will share load equally
 - B) The machine with more drooping characteristic will supply more load
 - C) The machine with more drooping characteristic will supply less load

D) None of above

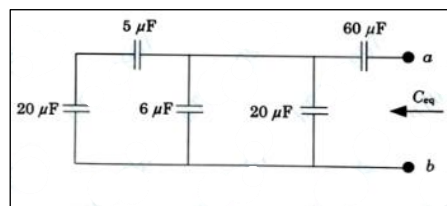
61. The inductance for the impedance $12 + j130$ ohms at 60Hz frequency is

- A) 44.209 mH
B) 45.9 mH
C) 73.53 mH
D) 79.58 mH

62. A 24 V battery of internal resistance $r = 4$ ohm is connected to a variable resistance R . The rate of heat dissipated in the resistor R is maximum when the current drawn from the battery is I . The current drawn from the battery will be $(1/2)$ when R is equal to

- A) 12Ω
B) 40Ω
C) 16Ω
D) 20Ω

63. The equivalent capacitance seen between terminals a and b of the circuit shown below is



- A) $30 \mu F$
B) $4 \mu F$
C) $20 \mu F$
D) $10 \mu F$

64. Capacitive transducer is used for

- A) Static measurement
B) Dynamic measurement
C) Transient measurement
D) Both static and dynamic

65. Which process explains the energy extraction from a sea wave?

- A) using the kinetic energy of the waves to produce electricity
B) using the thermal energy of the waves to produce electricity
C) using chemical energy of the waves to generate electricity
D) using electrical energy of the waves to generate electricity

66. The major heat loss in a steam power station occurs in

- A) Air preheater
B) Condenser
C) Economizer
D) Super heater

67. A generating station has a connected load of 43MW and a maximum demand of 20 MW; the units generated being 61.5×10^6 per annum. The demand factor is

- A) 0.465
B) 0.855
C) 0.225
D) 1.265

68. Plug setting of a relay can be changed by changing

- A) Air gap
B) Back up stop
C) Number of ampere turns
D) All of these

69. A low frequency induction furnace has a secondary voltage of 15 V and takes 500 KW at 0.6 power factor when the hearth is full. If the secondary voltage is maintained at 15 V. Assume the resistance of the

secondary circuit to be thereby doubled and the reactance to remain the same. The power absorbed when the hearth is half full is

- A) 385 KW
B) 785 KW
C) 483 KW
D) 620 KW

70. A factory has an average demand of 50 kW and an annual load factor of 0.5. The power factor is 0.75 lagging. The tariff is Rs. 100 per kVA of maximum demand per annum plus 5 paise per kWh. If loss free capacitors costing Rs. 600 per kVAR are to be utilised, find the value of power factor at which maximum saving will result. The interest and depreciation together amount to 10%.

- A) 0.6 lag
B) 0.65 lag
C) 0.7 lag
D) 0.8 lag

71. With the increase in the values of voltage and power factor, the cost of transmission line conductor

- A) decreases
B) increases
C) is unaffected
D) increases exponentially

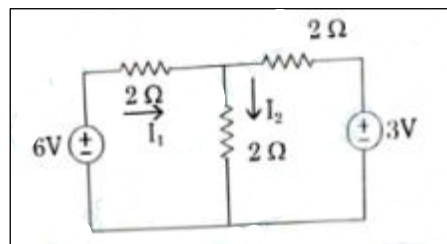
72. The arc voltage in a circuit breaker

- A) is in phase with arc current B) lags arc current by 90°
C) leads arc current by 90° D) lags arc current by 180°

73. An alternator is supplying a load of 300 kW at a power factor of 0.6 lagging. If the power factor is raised to unity how many more kilo watts can alternator supply for the same kVA loading?

- A) 100 KW B) 200 KW
C) 150 KW D) 250 KW

74. In the circuit shown in Figure below. if $I_1 = 1.5 \text{ A}$ then I_2 will be



- A) 0.5 A
B) 1.5 A
C) 2.5 A
D) 3 A

75. The voltages of a balanced 3ϕ system are given as V_{RN} 20, $V_{YN} +120^\circ$ and $V_{BN} -120^\circ$, then the phase sequence of the system is

- [illegible]

76. Which of the following is the electrolyte used in a lead-acid battery?

- A) Nitric acid
B) Sulphuric acid
C) Lead-acid
D) Hydrochloric acid

77. When a pentavalent impurity is added to a pure semiconductor, it becomes

- A) an insulator

- B) an intrinsic semiconductor
- C) p-type semiconductor
- D) n-type semiconductor

78. Which of the following conductor is needed to use with shortest span?

- A) ACSR Conductors
- B) All Aluminium Conductors
- C) Hard Drawn Copper Conductors
- D) Cadmium Copper Conductors

79. A fuse wire of circular cross-section has a radius of 0.8mm. The wire blows off at a current of 8A. The radius of the wire that will blow off at a current of 1 A is

- A) 0.64mm
- B) 1 mm
- C) 0.1 mm
- D) 0.2 mm

80. The minimum oil circuit breaker has less volume of oil because:

- A) There is insulation between contacts
- B) The oil between the breaker contacts has greater strength
- C) Solid insulation is provided for insulating the contacts from earth
- D) Both (A) and (B)

81. The function of steel wire in the ACSR conductors is to:

- A) Compensate for Skin Effect
- B) Provide additional mechanical strength
- C) Carry large currents
- D) To Reduce Inductance

82. Given $v(t) = 120 \cos(377t + 45^\circ)$ V and $i(t) = 10 \cos(377t - 10^\circ)$ A. The instantaneous power in watts is

- A) $600 \cos(754t + 35^\circ)$
- B) $344.2 + 600 \sin(754t + 35^\circ)$
- C) $600 \sin(754t + 35^\circ)$
- D) $344.2 + 600 \cos(754t + 35^\circ)$

83. What is a solar collector?

- A) A system to collect heat by absorbing sunlight
- B) A system to collect rainwater using sunlight
- C) A system to collect electricity by using sunlight
- D) A device to reflect sunlight back.

84. Energy produced due to gravitational force of attraction between earth and moon or sun and earth is

- A) Micro-hydel Energy
- B) Fusion Energy
- C) Tidal Energy
- D) Geothermal Energy

85. What does section 44 Indian Electricity Rules refer to?

- A) Penalty for interference with meters
- B) Penalty for illegal transmission or use of energy
- C) Penalty for maliciously wasting energy
- D) Theft of energy

86. Which of the following is the main field of application of pin type insulator?

- A) EHV transmission system
- B) Transmission and distribution system
- C) Transmission system

D) 1 net of energy

87. The device that exhibits negative resistance region is

- | | |
|---------------|----------|
| A) Diac | B) Triac |
| C) Transistor | D) UJT |

88. Torque / Weight ratio of moving part of an instrument indicates

- | | |
|----------------|----------------|
| A) Selectivity | B) Accuracy |
| C) Fidelity | D) Sensitivity |

89. The Kelvin's double bridge is used for measuring low resistances because

- A) It takes into account the contact resistance
- B) It accounts thermo emfs
- C) It eliminates the errors due to contact and lead resistances
- D) It will not require any current for measurement

90. Which of the following statements about a three-phase squirrel-cage induction motor is false?

- A) It has no external electrical connections to its rotor
- B) A three-phase supply is connected to its stator
- C) A magnetic flux which alternates is produced
- D) It is cheap, robust and requires little or no skilled maintenance

91. The full-load efficiency of a transformer at 0.85 p.f. lag is 97 percent. Its efficiency at full load 0.85 power factor lead will be

- | | |
|--------|--------|
| A) 99% | B) 96% |
| C) 97% | D) 98% |

92. A 3-phase, 4-pole, 400V, 50Hz squirrel cage induction motor is operating at a slip of 0.02. The speed of the rotor flux in mechanical rad/sec, sensed by a stationary observer, is closest to

- | | |
|---------|--------|
| A) 1500 | B) 157 |
| C) 1470 | D) 154 |

93. Which of the following soldering method is simple, inexpensive and widely used for soft soldering work?

- | | |
|----------------------|-------------------------------------|
| A) Machine soldering | B) Soldering with a soldering iron |
| C) Dip soldering | D) Temperature controlled soldering |

94. AQ meter is best suited for measurement of

- A) Quality factor of a capacitance
- B) Distributed capacitance of a coil
- C) Quality factor of piezoelectric sensor
- D) Turns ratio of transformer

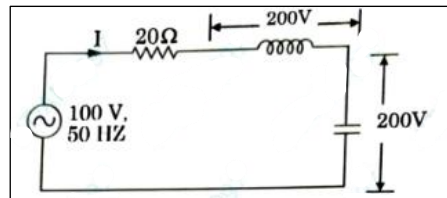
95. To the y-input of a CRO a signal defined by $10 \sin 100t$ is applied. To the x-input the signal $10 \cos 100t$ is fed. The gain for both x-channel and y-channel is the same. The screen shows.

- | | |
|---------------|--------------------|
| A) sinusoidal | B) a straight line |
| C) an ellipse | D) a circle |

96. The resistance between the opposite faces of 1 metre-cube is found to be 1 Ω . If its length is increased to 2 metres, its volume remaining unchanged, then resistance between the opposite faces of its length is

- A) 2Ω
B) 4Ω
C) 8Ω
D) 1Ω

97. The current in the circuit of Figure below is



- A) 5 A
B) 10 A
C) 15 A
D) 50A

98. R.M.S. value and mean value are same in case of

- A) Sinusoidal wave
B) triangular wave
C) full wave rectified sine wave
D) square wave

99. A power supply A delivers 10 V de with a ripple of 0.5 V r.m.s. while the power supply B delivers 25 V de with a ripple of 1 mV r.m.s, the power supply C delivers 15 V de with a ripple of 10 mV r.m.s, the power supply D delivers 20 V de with a ripple of 100 mV r.m.s. Which is better power supply?

- A) power supply A B) power supply B
C) power supply C D) power supply D

100. A zener diode is used as

- A) an amplifier
B) multivibrator
C) a rectifier
D) a voltage regulator