100/2024

Maximum : 100 marks

Time : 1 hour and 30 minutes

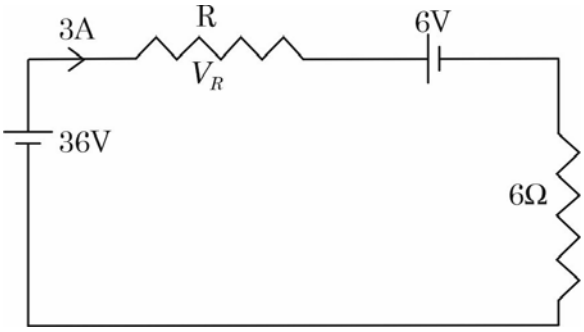
1. 

Fig. 1

For the circuit shown in Fig. 1, the voltage V_R is :

(A) 22V (B) 18V

(C) 12V (D) 10V

2. For the circuit shown in Fig. 1, the resistance R is :

(A) 4.5 Ω (B) 4 Ω

(C) 3.5 Ω (D) 2 Ω

3. Three resistances are connected from three terminals A, B, and C to a common point N. The resistances between A and N, B and N, and C and N are respectively 6 Ω, 3 Ω and 2 Ω. The equivalent resistance between A and B if the circuit is converted to delta is :

(A) 9 Ω (B) 2 Ω

(C) 4 Ω (D) 18 Ω

4. A circuit consists of a diode and a resistor connected in series. An alternating voltage $v = 100 \sin 314t$ is applied to this circuit. The rms and average values of the voltage across the resistor are :

(A) 70.7, 0 (B) 141.4, 31.85

(C) 100, 63.7 (D) 50, 31.85

5. The average power delivered to a load impedance $4 + j3\Omega$ by a current $8\sin(314t + 30)$ is :

(A) 128 W (B) 160 W

(C) 200 W (D) 500 W

6. The voltage and current of an ac circuit are given by $v=100\cos(314t-30)$ and $i=10\sin(314t-15)$. The power drawn from the source is :

(A) 1000 W (B) 707 W

(C) 353.5 W (D) 250 W

7. While analyzing a.c circuits using Thevenin theorem, the two basic components of the equivalent circuit are :

(A) Equivalent voltage source and equivalent series resistance

(B) Equivalent voltage source and equivalent series impedance

(C) Equivalent current source and equivalent parallel resistance

(D) Equivalent current source and equivalent parallel impedance

8.

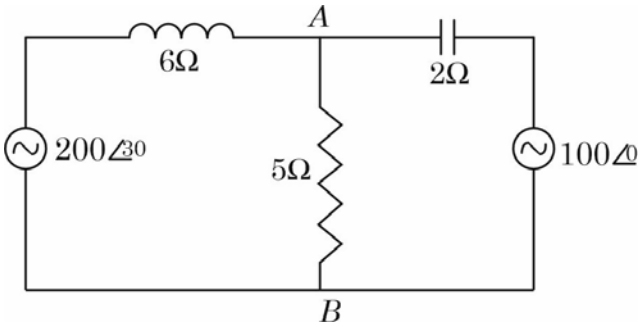


Fig. 2

What is the Norton's equivalent impedance between terminals A and B?

(A) $j\,3\,\Omega$ (B) $j\,8\,\Omega$

(C) $j\,4\,\Omega$ (D) $j\,1.5\,\Omega$

9. For a balanced three-phase star-connected load with phase sequence ABC, the voltage from line A to neutral is $100\ \angle 30$. The voltage of line B in relation to line C is given by :

(A) $100\sqrt{3}\angle 150$ (B) $100\angle -90$

(C) $100\sqrt{3}\angle -60$ (D) $100\angle 0$

10. A resistance of $10\,\Omega$ and an inductance of $x\,mH$ are connected in series to a voltage source of $v=100\ \sin 100t$. What is the value x if the power factor is 0.7071?

(A) 7.07 (B) 10

(C) 22.5 (D) 100

11. The critical speed of a DC generator is defined as the speed at which :

(A) No voltage is induced in the armature

(B) The generated voltage is maximum

(C) The generated voltage drops to zero

(D) The commutation becomes ineffective

12. The function of the commutator in a DC generator is to :

(A) Convert AC voltage to DC voltage

(B) Control the speed of the generator

(C) Change the direction of the induced current

(D) Maintain constant voltage output

13. A DC generator is said to be over compounded when :

(A) Its generated voltage is greater than its terminal voltage

(B) Its terminal voltage is greater than its generated voltage

(C) Its speed is greater than its rated speed

(D) Its efficiency is maximum

14. Which parameter does not affect the regulation of a transformer?

(A) Load power factor

(B) Transformer core material

(C) Frequency of the supply

(D) Transformer winding resistance

15. The leakage reactance of a transformer depends primarily on :

(A) Core material

(B) Number of turns in the windings

(C) Frequency of the supply

(D) Size of the transformer

16. Which type of transformer core material exhibits the highest permeability?

(A) Silicon steel

(B) Ferrite

(C) Cast iron

(D) Aluminum

17. All-day efficiency is affected by :

(A) Load fluctuations during the day

(B) Temperature variations during the day

(C) Neither (A) nor (B)

(D) Both (A) and (B)

18. The primary advantage of a salient-pole rotor in alternators is :

(A) Higher stability during load changes

(B) Higher efficiency at high speeds

(C) Ease of manufacture and maintenance

(D) Lower mechanical stresses

19. The power factor of an alternator can be improved by :

(A) Adjusting the excitation

(B) Adjusting load current phase difference

(C) Adjusting the speed of rotation

(D) Both (A) and (B)

20. The pitch factor in an alternator winding refers to :

(A) The ratio of conductor length to pole pitch

(B) The ratio of pole pitch to pole arc

(C) The ratio of distribution factor to winding factor

(D) The ratio of turns per coil to total turns in the winding

21. A transmission line with a characteristic impedance 380 Ω is terminated with an impedance of 570 Ω. What is the magnitude of the coefficient of reflection?

(A) 0.2 (B) 5

(C) 1.5 (D) 2/3

22. For a transmission line exhibiting significant Ferranti effect, what type of compensation would be most effective in mitigating it?

(A) Series capacitive compensation (B) Series inductive compensation

(C) Shunt capacitive compensation (D) Shunt inductive compensation

23. In the context of pollution performance of insulators, which parameter is most critical for evaluating the flashover voltage of a contaminated insulator?

(A) Specific creepage distance

(B) Dielectric strength of the insulator material

(C) Surface roughness

(D) Mechanical tensile strength

24. Which of the following is a factor of critical consideration when designing an SF6 circuit breaker to ensure reliable operation at extreme temperatures?

(A) The thickness of the insulator materials

(B) The dielectric strength of the SF6 gas under varying pressure

(C) The mechanical strength of the moving contacts

(D) The heating effect of the circuit breaker during operation

25. What harmonic component is used to provide restraining torque in an over current relay to avoid false tripping during transformer inrush current?

(A) Fundamental

(B) Second harmonic

(C) Fifth harmonics

(D) Seventh harmonics

26. Choose the correct option. Given :

Assertion [A] : Arcing ground faults are often more challenging to detect compared to solid ground faults.

Reason [R] : Arcing ground faults have higher impedance and produce less fault current, making detection by conventional protection schemes more difficult.

(A) Both Assertion and Reason are correct, and the Reason is the correct explanation for the Assertion

(B) Both Assertion and Reason are correct, but the Reason is not the correct explanation for the Assertion.

(C) Assertion is correct, but the Reason is incorrect

(D) Both Assertion and Reason are incorrect

27. Choose the correct option. Given :

Assertion [A] : A higher power angle increases the critical clearing time of a transmission line.

Reason [R] : The critical clearing time is the time interval within which a fault must be cleared to maintain system stability.

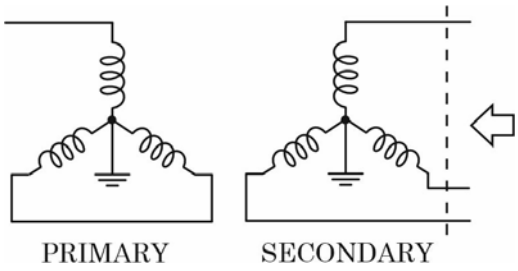
(A) Both Assertion and Reason are correct, and the Reason is the correct explanation for the Assertion

(B) Both Assertion and Reason are correct, but the Reason is not the correct explanation for the Assertion

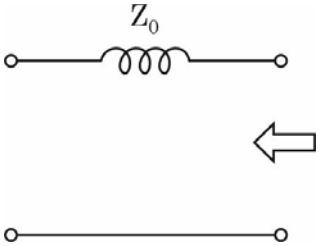
(C) Assertion is correct, but Reason is incorrect

(D) Assertion is incorrect, but Reason is correct

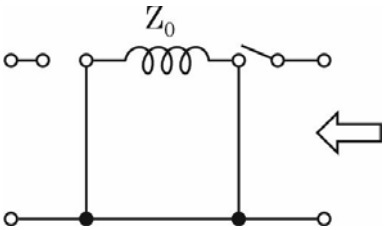
28. The zero sequence equivalent circuit of a 3 phase transformer star connected on both sides with neutral earthed on both sides as shown in figure :



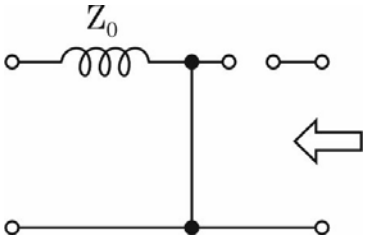
(A)



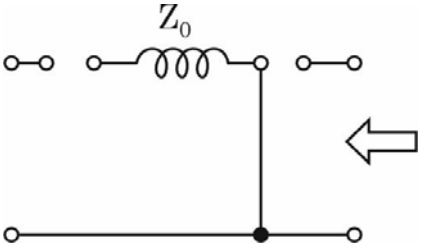
(B)



(C)



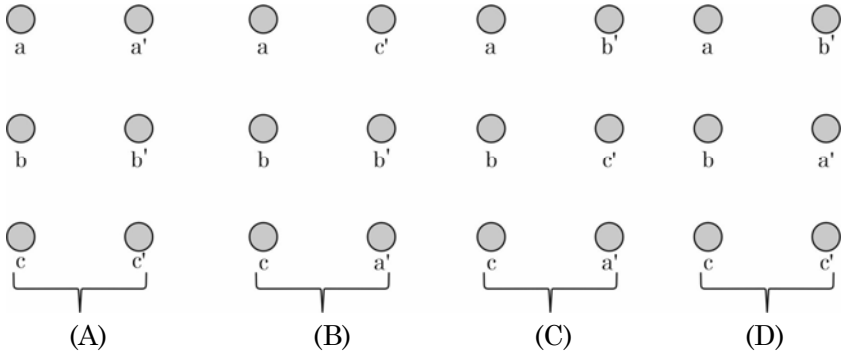
(D)



29. Why is a relay coordination study crucial in a power system?

(A) To ensure all relays operate simultaneously
(B) To minimize the number of relays in the system
(C) To ensure selective isolation of the faulty section while maintaining system stability
(D) To reduce the cost of relay installation

30. A double circuit line consists of three conductors in each circuit. The three conductors correspond to three phases, a, b, c and a', b' and c'. Conductors a and a' are electrically parallel and constitute one phase. Similarly conductors b, b' and c, c' form other phases. Which configuration will give lowest inductance per phase :



31. Assertion [A] : Eddy current damping cannot be used in moving iron instruments.

Reason [R] : Moving iron instruments have a very weak operating magnetic field, and the introduction of a permanent magnet required for eddy current damping would distort the operating magnetic field.

(A) Both [A] and [R] are individually true but [R] is not the correct explanation of [A]

(B) Both [A] and [R] are true and [R] is the correct explanation of [A]

(C) [A] is true, [R] is false

(D) [A] is false, [R] is true

32. Two wattmeters are connected to measure the total power in a three-phase system supplying a balanced load. The readings are 10.2 kW and –2.5 kW, respectively. It can be concluded that the power factor of the circuit is :

(A) unity (B) zero

(C) 0.5 (lagging) (D) less than 0.5 (lagging)

33. In an electrodynamometer type wattmeter, the inductance of pressure coil circuit produces error and the instrument gives :

(A) high reading on lagging power factor and low reading on leading power factor

(B) low reading on lagging power factor and high reading on leading power factor

(C) low reading on lagging power factor and zero reading on leading power factor

(D) indication of wattmeter is not affected by the effect of pressure coil inductance

34. A moving coil milli ammeter having a resistance of 0.99 ohms gives full-scale deflection when a current of 10 mA is passed through it. The value of small resistance connected to measure current upto 1 A is :

(A) 0.001 Ω (B) 0.01 Ω

(C) 0.02 Ω (D) 0.002 Ω

35. A moving iron voltmeter reads accurately on 250V DC. The instrument coil has a resistance of 500 Ω and an inductance of 1 H and series non-inductive resistance of 2kΩ . If 250V, 50Hz AC is applied to it, what will be the reading of the voltmeter?

(A) 250V (B) less than 250V

(C) more than 250V (D) no reading

36. In measurement systems, errors arising from the pointer and the scale not being on the same plane are called :

(A) random error
(B) backlash
(C) hysteresis
(D) parallax error

37. A wattmeter and an ammeter are used to measure the resistance of an unknown resistor. The limiting errors in the power and current measurement are ±1.2 % and 0.8%, respectively. What is the limiting error in the measurement of resistance?

(A) ±1.4%
(B) ±3.1%
(C) ±2.8%
(D) ±1.8%

38. The phase error in a single-phase energy meter is compensated by :

(A) adjustable copper band placed over the central limb of the shunt magnet
(B) lag adjustment
(C) self-braking action
(D) preliminary light load adjustment

39. Which of the following quantity cannot be measured/determined using hall effect?

(A) Magnetic field strength
(B) Displacement
(C) Type of semiconductor
(D) Diffusion constant

40. The horizontal deflection plates in a CRT are 20 mm long and 5 mm apart. The centre of the plates is 20 cm from the screen. The deflection sensitivity for an accelerating voltage of 1000V is :

(A) 0.2 mm/V
(B) 0.8 mm/V
(C) 0.4 mm/V
(D) 0.1 mm/V

41. Two thyristors of same rating and same specifications :

(A) will have equal turn-on and turn-off periods
(B) will have equal turn-on, but unequal turn-off periods
(C) may have equal or unequal turn-on and turn-off periods
(D) will have unequal turn-on and turn-off periods

42. An SCR has a turn on time of 4 μs. An ideal trigger pulse should have :

(A) short rise time with a pulse width of 2.5 μs
(B) short rise time with a pulse width of 5 μs
(C) long rise time with a pulse width of 2.5 μs
(D) long rise time with a pulse width of 5 μs

43. A single phase half wave controlled rectifier with resistive load is energised from a source of 400 sin (314 t) V supply. If the thyristor is fired at 60°, the average output voltage of the rectifier will be :

(A) $400/\pi$ V (B) $300/\pi$ V

(C) $240/\pi$ V (D) $120/\pi$ V

44. A single phase full bridge inverter can operate in load commutation mode if the load type is :

(A) RL (B) Critically damped RLC

(C) Under damped RLC (D) Over damped RLC

45. In a DC chopper, V_S is the source voltage, T_{ON}, is the on time, and f is the chopping frequency. The output voltage of the chopper will be :

(A) $V_S (T_{ON} / f)$ (B) $V_S T_{ON} f$

(C) $V_S (f / T_{ON})$ (D) $V_S / (f T_{ON})$

46. The di/dt rating of an SCR is specified for its :

(A) rising gate current (B) decaying anode current

(C) rising anode current (D) decaying gate current

47. A differential amplifier has a differential gain of 20,000 and CMRR of 80dB. The common mode gain of the amplifier will be :

(A) 250 (B) 2

(C) 0.5 (D) 0.004

48. An op-amp has a slew rate of 10 V/μs. The maximum sinusoidal output voltage possible at a frequency of 1 MHz is :

(A) $5/(2\pi)$ V (B) $5/\pi$ V

(C) 5π V (D) 10π V

49. An op-amp in open loop has a gain of 10^6 and an upper cut-off frequency of 10 Hz. If the op-amp is connected as an amplifier with a closed loop gain of 100, the new upper cutoff frequency will be :

(A) 10 Hz (B) 100 Hz

(C) 10 kHz (D) 100 kHz

50. The turn on time of an SCR in series with an RL circuit can be reduced by :

(A) increasing R (B) increasing L

(C) decreasing L (D) decreasing R

51. The distribution that offers an appropriate framework for representing the inherent uncertainty and variability in activity durations within a PERT chart.

(A) Beta
(B) Binomial
(C) Poisson
(D) Normal

52. If the pessimistic completion time for an activity is 10 days and the optimistic completion time is 4 days, the variance of the activity's duration will be :

(A) 1
(B) 3
(C) 4
(D) 5

53. An initial feasible solution for a transportation problem can be obtained using :

(A) Optimal solution
(B) North-west corner rule
(C) Vogels's approximate solution
(D) Minimal Cost Solution

54. EOQ formula is taken using :

(A) Integral Calculus
(B) Matrix Algebra
(C) Multi variance analysis
(D) Differential Calculus

55. Which of the following principles is most commonly applied in material handling?

(A) Unit Load Principle
(B) Ohm's Principle
(C) Newton's Principle
(D) Gravitation Principle

56. In micro motion study SIMO stands for :

(A) Standard Industrial Motion
(B) Sequential and Intermittent Motion
(C) Simultaneous Motion Cycle
(D) Standardized Input and Output Motion

57. The shift of the mean describes the process where the mean moves from its current value to a new value and stays constant thereafter is called :

(A) Continuous
(B) Abrupt
(C) Random
(D) Sustained

58. OC curve is used to determine the probability of :

(A) Type I error
(B) Type II error
(C) Both (A) and (B)
(D) None of the above

59. If the standard deviation of 0, 1, 2, 3, ... 9 is K, then the standard deviation of 10, 11, 12, ... 19 will be :

(A) K (B) $K+1$

(C) $K-1$ (D) $K+2$

60. Standard normal distribution has following properties :

(A) Both Mean and variance is same and equal to 1

(B) Both standard deviation and variance is same and equal to zero

(C) Mean value zero and variance value one

(D) Both Mean and standard deviation is same

61. Which crystal structure is most commonly found in pure iron at room temperature ?

(A) BCC (B) FCC

(C) HCP (D) None of the above

62. Which furnace is primarily used for the manufacturing of pig iron ?

(A) Cupola furnace (B) Blast furnace

(C) Electric arc furnace (D) Induction furnace

63. Which welding process uses a flux-coated electrode to generate heat?

(A) TIG welding (B) MIG welding

(C) Arc welding (D) Gas welding

64. What is the function of electrode coating in arc welding?

(A) Improves electrical conductivity

(B) Protects the weld from oxidation

(C) Increases hardness of the weld

(D) Acts as a heat insulator

65. Which type of welding is suitable for joining thick sections of metal in a single pass?

(A) Gas welding (B) TIG welding

(C) MIG welding (D) Thermit welding

66. What is the primary cause of porosity in welds?

(A) Inadequate shielding gas (B) Too high welding current

(C) Insufficient filler metal (D) Excessive welding speed

67. Which type of cutting involves the tool being fed at an angle to the direction of the workpiece's rotation?

(A) Orthogonal cutting
(B) Oblique cutting
(C) Parallel cutting
(D) Conventional cutting

68. Which machine tool is used primarily for producing flat surfaces in metalworking?

(A) Lathe
(B) Milling machine
(C) Shaper
(D) Drilling machine

69. What is the main purpose of indexing in milling operations?

(A) To rotate the workpiece
(B) To align the cutting tool
(C) To move the workpiece longitudinally
(D) To divide the workpiece for angular cuts

70. Which property of materials describes the ability to resist permanent deformation under load?

(A) Toughness
(B) Ductility
(C) Hardness
(D) Elasticity

71. The angle of contact made by pure water having capillary rise in a glass capillary tube of 1cm diameter is approximately :

(A) 0°
(B) 5°
(C) 12°
(D) 16°

72. Tooth paste is an example of :

(A) Pseudo plastic fluid
(B) Dialatant fluid
(C) Bingham plastic fluid
(D) Visco elastic fluid

73. Which type of blades are used for getting high pressure ratio in centrifugal pumps?

(A) radial blades
(B) forward curved blades
(C) backward curved blades
(D) does not depend on blade curvature

74. A negative slip will occur in a reciprocating pump when :

(A) suction pipe is long
(B) delivery pipe is short
(C) pump is running at high speed
(D) all the above

75. The angle of deflection of the jet after hitting the bucket of a Pelton wheel is approximately :

(A) 135°
(B) 150°
(C) 165°
(D) 185°

76. The characteristic length for calculating the Reynold's number of water flowing in a channel of height 4 m and width 8 m is :

(A) 6 m
(B) 8 m
(C) 10 m
(D) 12 m

77. One torr is approximately equal to ———— Pascal.

(A) 33.33 pascal
(B) 66.66 pascal
(C) 133.33 pascal
(D) 760 pascal

78. In the case of free vortex flow, as the radius increases the velocity :

(A) Decreases
(B) Increases
(C) Remains constant
(D) Follows a sinusoidal trend

79. Water is subjected to a pressure of 50 Mpa. The fractional decrease in volume will be (compressibility of water $5\times10^{-10}\,Pa^{-1}$) :

(A) 1×10^{-4}
(B) 2.5×10^{-2}
(C) 2.5×10^{-4}
(D) 1×10^{-2}

80. Water flows through a horizontal convergent pipe having 6 cm diameter at the inlet and 4 cm diameter at the outlet, if a pressure drop of 100 pa occurs while flowing from inlet to exit. What is the velocity of water at pipe exit?

(A) 0.2 m/s
(B) 0.4 m/s
(C) 0.6 m/s
(D) 0.8 m/s

81. Which one of the following is an inversion of double slider crank mechanism?

(A) Skotch Yoke mechanism
(B) Peaucellier mechanism
(C) Watt's indicator
(D) Reciprocating engine

82. A conical rod of length 2 m and base diameter 25 cm hangs vertically with its base fixed rigidly to the ceiling. If its weight per unit volume is 6 kg/m^3, the total extension produced due to its own weight in terms of its Young's modulus E will be :

(A) $4\,E$ (B) $\frac{4}{E}$

(C) $\frac{1}{6E}$ (D) $\frac{E}{6}$

83. The distance from the centre to the points of contra flexure in the case of a beam with a uniformly distributed load 'w' per unit length over its span 'l' and fixed at both ends is given by :

(A) $\frac{2l}{\sqrt{3}}$ (B) $\sqrt{3}\,l$

(C) $\frac{3l}{\sqrt{2}}$ (D) $\frac{l}{2\sqrt{3}}$

84. Two Involute gears are in mesh. The number of teeth on pinion is 20 and the gear ratio is 2. The pitch is 5 mm with the pitch line velocity 1.5 m/s. What is the length of the path of approach if it is greater than the length of path of recess and if the maximum velocity of sliding is 0.45 m/s?

(A) 15 mm (B) 10 mm

(C) 12 mm (D) 12.5 mm

85. In the case of a flywheel, the ratio of maximum fluctuation of energy to the rotational kinetic energy is :

(A) coefficient of fluctuation of speed

(B) half the coefficient of fluctuation of speed

(C) double the coefficient of fluctuation of speed

(D) one-fourth the coefficient of fluctuation of speed

86. The strain energy stored per unit volume for a homogeneous linear elastic isotropic material with Young's modulus E and Poisson's ratio ν when it is subjected to a state of pure shear τ is given by :

(A) $\frac{\tau(1+\nu)}{E}$ (B) $\frac{\tau^2(1+\nu)}{E}$

(C) $\frac{\tau(1+2\nu)}{E}$ (D) $\frac{\tau^2(1+2\nu)}{E}$

87. If the diameter of a long column is reduced by 80% the percentage reduction in Euler's buckling load will be :

(A) 99.84% (B) 98.84%

(C) 20% (D) 96.84%

88. According to Unwin's empirical formula, the nominal diameter 'd' of the rivet and the thickness 't' of the plate are related as :

(A) $d = 6.04\sqrt{t}$ in cm (B) $d = 1.09\sqrt{t}$ in mm

(C) $d = 1.91\sqrt{t}$ in cm (D) $d = 1.69\sqrt{t}$ in mm

89. Which of the following statements are true with regard to friction?

(i) Angle of repose is twice the semi-vertex angle of cone of friction

(ii) The minimum angle of inclination of the surface at which the object starts to slide down on its own is same as the semi-vertex angle of the cone of friction

(iii) The cone of friction is generated by the resultant of normal reaction and the applied force that is just enough to initiate motion on a horizontal surface

(iv) Coefficient of static friction $\mu = \tan\phi$ where ϕ is angle of repose

(A) only statement (iii) (B) only statements (ii), (iii) and (iv)

(C) only statements (i) and (iii) (D) all four statements

90. The torsional rigidity of a hollow cylindrical shaft having inner radius 'r', outer radius R modulus of rigidity C and length l is given by :

(A) $\frac{C\pi(R^4 - r^4)}{2l}$ (B) $\frac{C\pi(R^4 - r^4)}{l^2}$

(C) $\frac{2\pi C(R^4 - r^4)}{2l}$ (D) $\frac{2\pi C(R^4 - r^4)}{l^2}$

91. In Otto cycle the heat addition takes place at :

(A) Constant Pressure (B) Constant Volume

(C) Constant Entropy (D) None of the above

92. Among the following fuels which has the highest calorific value?

(A) Kerosene (B) Petrol

(C) Methane (D) LPG

93. The unit of thermal conductivity is :

(A) $Wm\ K^{-1}$ (B) Wm K

(C) $Wm^{-1}K^{-1}$ (D) $Wm^{-1}K$

94. The heat transfer in natural convection is significantly affected by :

(A) Grashoff Number (B) Stanton Number

(C) Prandtl Number (D) Reynolds Number

95. The position of cooling fan in an automobile is ———— the radiator.

(A) In front of (B) At the top of

(C) By the side of (D) Behind

96. Efficiency of a refrigerator ———— COP.

(A) Is directly proportional to (B) Independent of

(C) Equal to (D) Inversely proportional to

97. The lowest temperature component in a vapour compression cycle is :

(A) Condenser (B) Compressor

(C) Evaporator (D) Expansion valve

98. Which of the following is not a desirable property of a refrigerant?

(A) Low freezing point (B) High thermal conductivity

(C) Low specific volume (D) Low latent heat of vaporisation

99. The difference between dry bulb temperature and wet bulb temperature is :

(A) Wet bulb depression (B) Dew point depression

(C) Dry bulb depression (D) Degree of saturation

100. Which lines indicate wet bulb temperature in the psychometric chart?

(A) Vertical lines (B) Diagonal lines

(C) Curves (D) Horizontal lines

———————

SPACE FOR ROUGH WORK

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