

**ANSWERS AND EXPLANATIONS**1. **Ans. (b)**

$$V_s = 10V$$

$$V_L = 6V$$

$$R = 2\Omega$$

$$V_s^2 = V_R^2 + V_L^2$$

$$V_R^2 = V_s^2 - V_L^2 = 100 - 36 = 64$$

$$\Rightarrow V_R = 8V$$

$$\Rightarrow I_R = \frac{V_R}{R} = \frac{8}{2} = 4A$$

2. **Ans. (a)**3. **Ans. (b)**4. **Ans. (a)**

Power factor of squirrel cage induction motor is low at light load.

5. **Ans. (d)**

Synchronous generator is a source of both active and reactive power.

6. **Ans. (d)**

If supply voltage is reduced in case of DC shunt motor then armature voltage and field current both reduces. Hence speed remains constant.

7. **Ans. (b)**

Overall bandwidth

$$BW' = BW\sqrt{2^{1/2} - 1}$$

$$= 20\sqrt{2^{1/2} - 1} = 20 \times 0.64$$

$$= 12.9 \text{ kHz}$$

8. **Ans. (d)**

<b>Feedback</b>	<b>Input</b>	<b>Output</b>
<b>Topology</b>	<b>Impedance</b>	<b>Impedance</b>
Voltage Series	Increases	Decreases
Voltage Shunt	Decreases	Decreases
Current Series	Increases	Increases
Current Shunt	Decreases	Increases

9. **Ans. (b)**10. **Ans. (c)**11. **Ans. (b)**12. **Ans. (b)**13. **Ans. (c)**14. **Ans. (c)**15. **Ans. (d)**16. **Ans. (b)**17. **Ans. (a)**18. **Ans. (c)**19. **Ans. (b)**20. **Ans. (c)**21. **Ans. (a)**22. **Ans. (c)**

Air vessel is used in reciprocating pump to obtain continuous supply of water at uniform rate.

23. **Ans. (a)**

$$\nabla \times \mathbf{q} = 0$$

Valid for steady, incompressible flow.

24. **Ans. (c)**

Shear stress is proportional to velocity gradient. So shear stress profile will be linear.

25. **Ans. (a)**

$$\sqrt{\frac{L^2 - b^2}{3}} \text{ from A}$$

26. **Ans. (d)**

$$\text{Energy} = \frac{1}{2} \times \text{stress} \times \text{strain}$$

$$\text{Strain} \propto \text{Deflection}(y)$$

$$\text{Deflection} \propto \frac{L}{I}$$

$$\text{For rectangle } I = \frac{bd^3}{12}$$

$$I \propto d^3$$

$$\frac{y_1}{y_2} = \left( \frac{d_2}{d_1} \right)^2 = \frac{1}{8}$$

$$y_2 = 8y_1$$

Hence strain becomes 8 times.

27. Ans. (d)

$$\frac{\text{Longitudinal stress}}{\text{Hoop stress}} = \frac{Pd/4t}{Pd/2t} = \frac{1}{2}$$

28. Ans. (b)

29. Ans. (d)

30. Ans. (b)

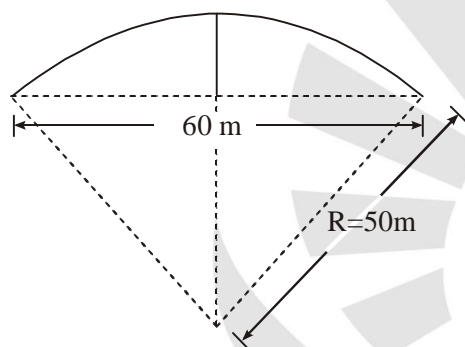
31. Ans. (a)

32. Ans. (d)

33. Ans. (b)

34. Ans. (b)

35. Ans. (a)



Mid ordinate,

$$\begin{aligned} M &= R - \sqrt{R^2 - (L/2)^2} \\ &= 50 - \sqrt{(50)^2 - (60/2)^2} \\ &= 10 \text{ m} \end{aligned}$$

36. Ans. (d)

37. Ans. (b)

Sag correction for the chain is  $\frac{W^2 L}{24T^2}$ 

Where, W is total weight of chain.

38. Ans. (b)

From question

$$m = 100 \text{ kg}$$

So entropy

$$(S_1)_{\text{system}} = 100 \times 0.3 = 30 \text{ kJ/K}$$

$$(S_2)_{\text{system}} = 100 \times 0.4 = 40 \text{ kJ/K}$$

$$(S_1)_{\text{surrounding}} = 80 \text{ kJ/K}$$

$$(S_2)_{\text{surrounding}} = 75 \text{ kJ/K}$$

$$\begin{aligned} (dS)_{\text{universe}} &= (dS)_{\text{system}} + (dS)_{\text{surrounding}} \\ &= (S_2 - S_1)_{\text{system}} + (S_2 - S_1)_{\text{surrounding}} \\ &= (40 - 30) + (75 - 80) \\ &= 10 - 5 = 5 \text{ kJ/K} \end{aligned}$$

$$(dS)_{\text{universe}} > 0$$

 $\Rightarrow$  Process is irreversible

39. Ans. (b)

$$U_2 - U_1 = (m_2 - m_1)h_i$$

$$\Rightarrow m_2 U_2 = m_2 h_i$$

$$\Rightarrow U_2 = h_i$$

[Enthalpy = Specific internal energy]

 $\therefore m_1 = 0$  [ $\because$  initially tank is empty]

40. Ans. (c)

Clausius-Clapeyron equation is a relationship between the saturation pressure, temperature, enthalpy of evaporation and the specific volume of the two phases involved.

It can be derived from the use of following

Maxwell equation:

$$\left(\frac{\partial p}{\partial T}\right)_v = \left(\frac{\partial S}{\partial v}\right)_T$$

$$\frac{dp}{dT} = \frac{s_g - s_f}{v_g - v_f} = \frac{h_{fg}}{T \cdot v_{fg}}$$

Thus, it can be used to find latent heat during change of phase. Also, enthalpy can be found out from other properties.

41. Ans. (d)

42. Ans. (b)

43. Ans. (a)

A reversible process must be quasi-static and frictionless.

Heat engine cycle in which there is a temperature difference

- The source and the working fluid during heat supply.
- The working fluid and the sink during heat rejection, exhibits external thermal irreversibility.

Thus, P and T of the working substance must not differ, appreciably from those of the surroundings at any state in the process.

44. *Ans. (b)*

The isothermal process is very slow, while isentropic process is very fast this is what renders impracticality to Carnot cycle.

45. *Ans. (b)*

46. *Ans. (d)*

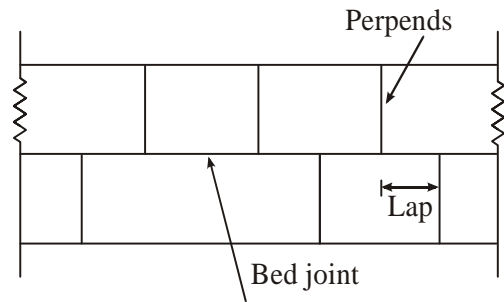
47. *Ans. (b)*

Terrazzo, is an artificial stone made from pieces of marble and cement and used for floors, facing of walls etc.

48. *Ans. (a)*

Bitumen consist of 87% of carbon, 11% of hydrogen and 2% of oxygen.

49. *Ans. (b)*



50. *Ans. (b)*

A solid foundation or structure laid below ground level to support or strength a building called “underpinning.”

Props used to support or hold up something called “shoring”.

