KD Campus
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2007, OUTRAM LINES, 1ST FLOOR, OPPOSITE MUKHERJEE NAGAR POLICE STATION, DELHI-110009

Answer-key & Solution

SSC JE (Machine)
Date 03.9.2017

1. A	14. A	26. C	38. B	50. A	62. C	74. B	86. D
2. D	15. A	27. C	39. C	51. C	63. B	75. A	87. B
3. A	16. A	28. B	40. A	52. B	64. B	76. A	88. B
4. A	17. D	29. B	41. D	53. C	65. B	77. C	89. B
5. C	18. D	30. B	42. C	54. B	66. C	78. C	90. D
6. A7.	19. A	31. A	43. C	55. D	67. C	79. D	
D	20. B	32. B	44. B	56. C	68. D	80. B	
8. C	21. D	33. C	45. A	57. D	69. A	81. C	
9. A	22. B	34. A	46. A	58. D	70. D	82. C	
10. D	23. D	35. C	47. A	59. B	71. D	83. D	
11. A	24. A	36. A	48. B	60. D	72. D	84. A	
12. A	25. A	37. A	49. C	61. A	73. B	85. B	
13. A							

Note : *If your opinion differ regarding any answer, please message the mock test and Question number to 9560620353*

Note : *If you face any problem regarding result or marks scored, please contact : 9313111777*

SOLUTION

1.(A)

Let W = stray losses (mechanical and magnetic losses)

Average voltage across resistance = (200+190)/2 =195 V,

Average current = 10A

∴ Power absorbed W' = 1950 W

Using the relation $\frac{W}{W'} = \frac{t_2}{t_1 - t_2}$; we get

$$W = 1950 \times \frac{20}{30-20} = 3,900 \text{ watt}$$

11. (A)

$$\% \, drop = \frac{(\%R) I \cos\phi}{I_f} + \frac{(\%X) I \sin\phi}{I_f}$$

Where I_f is the full-load current and I the actual current.

∴ $$\% drop = \frac{(\%R) kW}{kVA rating} + \frac{(\%X) kVAR}{kVA \ rating}$$

In the present case, kW = 400 ×0.8 = 320 and kVAR = 400 × 0.6 = 240

∴ $$\% drop = \frac{2.5 \times 320}{500} + \frac{5 \times 240}{500} = 4\%$$

12 (A)

Since the flux density is the same in both cases, we can use the relation

Total core loss $W_i = Af + Bf^2$

or $W_i/f = A + Bf$

∴ 52/40 = A + 40B and 90/60 = A + 60B;

∴ A = 0.9 and B = 0.01

At 50Hz, the two losses are

$W_h = A_f = 0.9 \times 50 = 45$ W;

We = $Bf^2 = 0.01 \times 50^2 = 25$W

13 (A)

I = 200/8 = 25 A, Z = 1280,

$\theta_m = 4 \times 360/160 = 9°$; P = 8

$$AT_c/\text{ pole} = ZI\left(\frac{1}{2p} - \frac{\theta_m}{360}\right) =$$

$$1280 \times 25\left(\frac{1}{2 \times 8} - \frac{9}{360}\right) = 1200$$

14 (A)

Formula : $E = L.\frac{2I}{T_c}$ Now, L = 0.05 ×10^{-3} H; W_b = 1.2 segments

$$v = \frac{1500}{60} \times 64 = 1600 \text{ segment/second}$$

∴ $$T_c = \frac{1.2}{1600} = 7.5 \times 10^{-4} \text{ second;}$$

$$I = \frac{150}{4} A = 37.5A$$

∴ $$\frac{2I}{T_c} = \frac{2 \times 37.5}{7.5 \times 10^{-4}} = 10^5 A/s$$

For linear commutation, E = 0.05 ×10^{-3} ×10^5 = 5V

15 (A)

$T_a \propto \Phi I_a$. Since Φ is constant, $T_a \propto I_a$

∴ $T_{a1} \propto I_{a1}$ and $T_{a2} \propto I_{a2}$

∴ $T_{a2}/T_{a1} = I_{a2}/I_{a1}$

∴ 2 = I_{a2}/50 or I_{a2} = 100 A

Now, $N_2/N_1 = E_{b2}/E_{b1}$

– since Φ remains constant

F_{b1} = 220 – (50 × 0.2) = 210 V

E_{b2} = 220 – (100 × 0.2) = 220 V

∴ N_2/500 = 200/210

∴ N_2 = 476 r.p.m

16 (A)

Ta ∝ Φ I_a ∝ I_a^2. Also, Ta ∝ N^2. Hence N^2 ∝ I_a^2 or N ∝ I_a

∴ $N^2 \propto I_{a1}$ and $N^2 \propto I_{a1}$ or $N_2/N_1 = I_{a2}/I_{a1} \propto I_{a1}$

Since, N_2/N_1 = 1/2

∴ I_{a2}/I_{a1} = 1/2 or $I_{a2} = I_{a1}/2$

Let V_1 and V_2 be the voltages across the motor in the two cases. Since motor resistance is neglible, $E_{b1} = V_1$ and $E_{b2} = V_2$. Also $\Phi_1 \propto I_{a1}$ and $\Phi_2 \propto I_{a2}$ or $\Phi_1/\Phi_2 = I_{a1}/I_{a2} = I_{a1} \times 2/I_{a1} = 2$

Now $$\frac{N_2}{N_1} = \frac{E_{b2}}{E_{b1}} \times \frac{\Phi_1}{\Phi_2} \text{ or } \frac{1}{2} = \frac{V_2}{V_1} \times 2$$

or $$\frac{V_2}{V_1} = \frac{1}{4}$$

∴ $$\frac{V_2 - V_1}{V_1} = \frac{4-1}{4} = 0.75$$

∴ Percentage reduction in voltage =

$$\frac{V_1 - V_2}{V_1} \times 100 = 0.75 \times 100 = 75\%$$

40.(A) The number of poles is

$$p = \frac{120f}{n_s} = \frac{120 \times 60}{180} = 40$$

The electrical torque angle is

$$\delta = \frac{p\alpha}{2} = \frac{40 \times 1}{2} = 20^o$$

41.(D)Let a resistance $R_{external}$ is to be added in series with rotor circuit, then at maximum load slip is

$$S_m = \frac{0.025 + R_{external}}{0.12}$$

Ratio of starting torque to maximum torque is given by

$$\frac{T_{st}}{T_{max}} = \frac{2s_m}{s_m^2 + 1} \quad \therefore T_{st}/T_{max} = 0.8$$

or $$0.8 = \frac{2s_m}{s_m^2 + 1}$$

or $$s_m^2 - 2.5s_m + 1 = 0$$

or s_m = 2 or 0.5

Taking lower value

$$0.5 = \frac{0.025 + R_{external}}{0.12}$$

$R_{external}$ = 0.5 ×0.12 – 0.025 = 0.035Ω

42.(C) $n = \frac{\beta \times f_p}{360} = \frac{2.0 \times 1800}{360} = 10 rev/s$

44(B).In a three-phase stepper motor, mechanical angle and electrical angle are related as

$$\theta_m = \frac{2}{P}\theta_e$$

so $$P = 2\left(\frac{\theta_e}{\theta_m}\right) = 2\left(\frac{60^o}{10^o}\right) = 12 \text{ poles}$$

45.(A) $Z = 5 + j8.66 = 10\angle 60^o$

$$I_m = I_a = \frac{V}{Z} = \frac{V\angle 0}{5 + j8.66} =$$

$$\frac{V\angle 0}{10\angle 60^o} = \frac{V\angle -60^o}{10}$$

auxiliary winding current I'_a will now make an angle of 30° with V. After the introduction of an additional resistance, R and a capacitor C, in the auxiliary winding circuit we get,

$$\cos 30^o = \frac{5 + R}{Z}$$

5 + R = Z cos 30°

R = Z cos 30° – 5 = 10 cos 30° – 5 = $5\sqrt{3}$ – 5 = 3.67Ω

85.(B)Since the voltage of the generator is directly proportional to the speed of the generator, the voltage rating and hence the apparent power rating of the generator will be reduced by a factor of 5/6.

$$V_{t(rated)} = \frac{5}{6} \times 13.8 \text{ kV} = 11.5 \text{ kV}$$

$$S_{rated} = \frac{5}{6} \times 126 \text{ MVA} = 105 \text{ MVA}$$