Question Bank in Electric Drives

1. Define electric drives.

2. What are the advantages of electric drives?

3. What are the factors affecting the choice of electric drives?

4. Mention some applications of electric drives.

5. What are the basic elements of electric drives?

6. What are the types of transmission of power in electric drives?

7. Draw the block diagram of electric drive.

8. What is meant by group drive? give an example.

9. What is meant by individual drive? give an example.

10. What is meant by multimotor drive? give an example.

11. What are the advantages and disadvantages of individual drive system?

12. What are the advantages and disadvantages of group drive system?

13. Mention the functions of power modulators.

14. What are the motors used in electric drives?

15. Mention the necessity of power rating?

16. Compare between AC and DC drives.

17. What is meant by continuous rating?

18. What is meant by continuous maximum rating?

19. What is meant by intermittent rating?

20. What is meant by Continuous running?

21. What is meant by short time duty?

22. What is meant by intermittent periodic duty?

23. What is meant by Intermittent periodic duty with starting?

24. What is meant by intermittent periodic duty with electric braking?

25. What is meant by continuous-operation periodic duty with related load/speed?

26. Draw the heating and cooling curve for a particular electric drive.

27. Define heating time constant.

28. Define cooling time constant.

29. What happens if the motor is selected at highest load handling?

30. Draw the circuit diagram of Ward Leonard method of speed control?

31. What are the advantages and disadvantages of Ward Leonard method of speed control?

32. Draw the circuit diagram for DC shunt motor drive?

33. Draw the speed torque curve of DC shunt motor and explain the constant torque region and constant power region?

34. Draw the circuit diagram of dual converter?

35. Draw the Four-quadrant operation of a DC motor.

36. Explain the four-quadrant operation of DC shunt motor.

37. What is meant by regenerative braking?

38. What is meant by plugging?

39. What is meant by dynamic braking?

40. Define the DC chopper?

41. What is meant by duty cycle?

42. What are the different types of chopper?

43. What is the function of freewheeling diode?

44. What is slip-power recovery system?

45. What are the advantages of slip-power recovery system?

46. What is meant by Voltage control in induction motor? and where it is applicable?

47. What is meant by Voltage / Frequency control?

48. Draw the circuit diagram of class A chopper and explain it.

49. Draw the circuit diagram of class B chopper and explain it.

50. Draw the circuit diagram of class C chopper and explain it.

51. Draw the circuit diagram of class D chopper and explain it.

52. Draw the circuit diagram of class E chopper and explain it.

53. What is meant by the equalizing component for series connected thyristors?

54. Define the AC drives?

55. What are the benefits of AC electric drives?

56. Explain with the help of circuit diagram the static rotor resistance for speed control of induction motor then derive the equation of equivalent added resistance.

57. Explain with the help of circuit diagram the slip power recovery of three phase induction motor then derive the equation of the slip in this method.

58. Define the traction system?

59. Mention the advantages of electric traction system.

60. What are the types of electric traction system.

61. Mention the parts of electric locomotive.

62. Draw the speed time curve for main line service.

63. Mention the time periods of speed time curve for main line service and explain each one.

64. Draw the simplified trapezoidal speed time curves of the main line service.

65. What is the difference between the average speed and schedule speed of the main line service?

66. A variable speed Dc drive has rated power of 10 KW; rated speed of 1500 rpm drives a load that comprises a constant load of (TL = 30 Nm). The inertia of the drive system is 0.1 kg. m^2. Calculate the time taken to accelerate the load from zero to 800 rpm. Assuming the drive develops rated torque during the acceleration phase.

67. A 10 KW motor has a heating time constant and cooling time constant of 45 and 70 min, respectively. The final temperature attained is 60 °C. find the temperature of the motor: i) after 45 min full-load run. ii) and then switched off for 30 min.

68. Example: An induction motor has a final steady-state temperature raise of 50°C when running at its rated output. Calculate its half-hour rating for the same temperature raise (50°C) if the copper losses at the rated output are 1.5 times its constant losses. The heating time constant is 60 min.

69. A motor operates continuously on the following load cycle: 20 KW for 10 sec, 10 KW for 15 sec, 30 KW for 5 sec, 50 KW for 20 sec, 40 KW for 10 sec, and idle for 5 sec. Draw the load diagram and find the size of the motor required.

70. A motor has to perform the following load cycle: Load raising uniformly from 0 to 100 KW in 10 sec, constant load 300 KW for 5 sec, constant load 200 KW for 15 sec, regenerative braking power returned falling from 50 to 0 KW in 5 sec and the motor is at rest for 4 sec. Draw the load cycle and suggest a suitable continuous rated motor.

71. A motor has the following load cycle: load raising uniformly from 100 KW to 200 KW in 5 sec, continuous load 50 KW for 10 sec, regenerative braking from 50 KW to 0 KW for 3 sec and idle for 2 sec. Draw the load diagram for one cycle. Find the size of continuously rated motor for the above duty.

72. A separately excited DC motor has a constant torque load of 60 Nm. The motor is driven by a single phase full wave converter (without freewheeling diode) connected to a 240 V AC supply. The motor constant is 2.5 (V-Sec / rad) and the armature resistance is 2 Ohm. Calculate the firing angle for the motor to operate at 200 rpm. Assume the current is constant.

73. A single phase full wave half-controlled bridge converter (semi converter) is used to control the speed of separately excited shunt motor rated at 220 V, 1500 rpm. The converter is connected to a single phase 220 V, 50 Hz supply. the armature resistance is 0.5 Ohm. The motor voltage constant is 0.1 V/rpm. The motor runs at 1200 rpm and carries an armature current of 16 A. Assume that the motor current is continuous and ripple free, determine: i) The firing angle. ii) The power delivered to the motor. iii) The supply current.

74. The speed of DC series motor is controlled by Single Phase Full Wave Half Controlled Bridge Converter (Single Phase Semi Converter) supplied from 240 V AC supply. The combined armature and field resistance is 0.3 Ω. Assuming continuous and ripple free motor current with speed of 1000 rpm and K= 0.03 N-m/amp^2. For a firing angle of 35 °. determine motor current & motor torque.

75. A single phase full wave full controlled rectifier without freewheeling diode is connected to DC shunt motor. The AC supply voltage is 230 V, 60 Hz. If the firing angle is 30°, the DC output (armature) current is 17.3 A, the source inductance is 1.4 mH, and armature resistance is 0.5 Ω calculate: i) Overlap angle. ii) DC output voltage. iii) Motor speed if the voltage constant (K_b) is 0.16 V/rpm. iv) Supply current.

76. A single phase full wave full controlled bridge converter is used to control the speed of separately-excited d.c. motor. The converter is connected to a single-phase 230 V, 50 Hz supply. The armature resistance is $Ra = 0.50\ \Omega$ and the armature circuit inductance is $La = 10$ mH. The motor voltage constant is 0.07 V/rpm, the d.c. motor runs at 1200 rpm and carries an armature current of 35 A. Assume that the motor current is continuous, determine: i) The firing angle α. ii) The power delivered to the motor. iii) The power factor of the supply.

77. A 30 kW, 415 V dc shunt motor is braked by plugging. The armature resistance of the motor is 0.1 Ω and the full load armature current is 100 A at full load speed of 600 rpm. Calculate: i) The value of the external resistance R_x to be placed in series with the armature circuit to limit braking current to 164 A. ii) the braking torque obtained from the motor.

78. A 600 V dc shunt motor having an efficiency of 80% operates a hoist having an efficiency of 75%. Determine the current taken from the supply when the hoist raise

the load of 450 kg at speed of 3 m/s. If rheostat braking is used to brake the motor, what is the value of the external resistance must be put in series with the armature circuit in order to lower the same load at the same speed?

79. A 250 V separately excited motor, Ra = 2.5 Ω. when driving a load at 600 rpm with constant torque, the armature takes 20 A. the motor is controlled by a step down chopper with a frequency of 400 Hz and an input voltage of 250 V. find the duty cycle to reduce the speed from 600 to 400 rpm with the load torque maintained constant. Then find the output power, developed torque.

80. A Step-down chopper is used to control of DC series motor from 220 V supply. armature and field resistances are 0.02 and 0.01 Ω respectively. Armature current is100 A and chopper frequency is 200 Hz. Calculate the pulse width if the average value of back emf is 50 V.

81. A DC series motor drives an elevator load controlled by DC step down chopper, it requires a constant torque of 200 N-m, the DC supply voltage is 400 V and the combined resistance of armature and series field winding is 0.75 Ω. If the armature current is 40 A and the duty cycle is 0.5. Calculate: i) The speed of the motor ii) The horse power output and efficiency of the system. iii)The additional losses and the efficiency of the system when the motor speed is controlled by inserting an external resistance.

82. The string consist of 5 thyristors in series is supplied with 3KV, the maximum blocking voltages of each thyristor is 1000 V. calculate the value of static equalizing resistance of each thyristor, if its maximum current is 5 mA.

83. the thyristor with a rating of 1000 V and 100 A are available to be used in a string to handle 5 KV and 2 KA. Find the number of series and parallel thyristors required, if the derating factor is 0.1.

84. A 400 V, 50 Hz, 4 pole, 1400 rpm delta-connected induction motor has the following parameters referred to stator: R1 = 2.5 Ω, R'_2 = 4.5 Ω, $X_1 = X'_2$= 6 Ω. Speed control is achieved by the stator voltage control method. When driving a fun load, the motor runs at rated speed and rated voltage. Calculate the voltage to be applied to the motor for 1300 rpm.

85. A three phase 1460 rpm. 415 V, 50 Hz, 4 pole star-connected induction motor has the following parameters: R1 = 0.65 Ω, R'2 = 0.35 Ω, X1 = 0.95 Ω, X'2 = 1.43 Ω, and Xm = 28 Ω, the speed of the motor is controlled by varying the stator voltage and frequency. The voltage-to-frequency ratio at the rated condition is kept constant. Determine the maximum torque and speed at which it occurs for stator frequencies of 50 Hz, 35 Hz and 10 Hz.

86. A 440 V, 50 Hz, 6 poles, Y connected wound rotor type I. M has the following parameters: Stator to rotor turns ratio is 3.5, motor is controlled by static rotor resistance control. External resistance is chosen such that the maximum torque is produced at starting and duty ratio is zero. Calculate the value of rotor resistance R_x.

87. A three phase 415 V, 50 Hz, 4 poles, Y connected I. M. is controlled by the chopper resistance. 4 Ω is connected across the chopper switch. t_{off} =4 msec, f = 200 Hz, s= 0.02. find the motor torque. Neglect all resistances and reactance's. Stator to rotor turns ratio = 1.

88. A three phase, 60 Hz, 8 poles, wound rotor induction motor. When the motor is connected to 4160 V line, the open circuit rotor line voltage is 1800 V. A three phase, 4160 V/480 V transformer is connected between the inverter and the line. If the motor has to develop 800 KW (mechanical power) at a speed of 700 rpm, calculate the following: i) The power supplied to AC line. ii) Rotor L – L voltage (E1) and link voltage (E_d). iii) Link current I_d and rotor current I_R. iv) Firing angle of the inverter.

89. The distance between two stops is 1.2 Km. A schedule speed of 40 Kmph is required to cover that distance. The stop is of 18 sec duration. The values of the acceleration and retardation are 2 Kmphps and 3 Kmphps, respectively. Determine the maximum speed over the run. Assume a simplified trapezoidal speed-time curve.

90. the speed-time curve of train has the following parameters: 1) Free running for 12 min. 2) Uniform acceleration of 6.5 Kmphps for 20 sec. 3) Uniform deceleration of 6.5 Kmphps to stop the train. 4) A stop of 7 min. Determine the distance between two stations, the average, and the schedule speeds