TNPSC
ACF

Previous Year Paper
(Electrical Engineering)
2018

ACFELE

Register No.

2018

ELECTRICAL ENGINEERING

Duration : 3 Hours

Max. Marks : 300

General Instructions to the Applicants :

i) This Question Paper is descriptive type in Degree Standard.

ii) There is no reservation of marks for neatness of execution and correctness of spelling in respect of this paper.

ELECTRICAL ENGINEERING

PART — A

Note : i) Answer **not exceeding 50 words** each.

ii) Each question carries **three marks.**

iii) Answer any **thirty** questions only out of **thirty five** Questions.

(30 × 3 = 90)

1. What are the various addressing modes in PIC microcontrollers? What is the role of INDF in indirect addressing mode?

2. In a two port symmetrical and reciprocal network $h_{11} = 4\Omega$ and $h_{12} = 2$. What is the value of h_{22}?

3. Implement $AB + \overline{C}\,\overline{D} = F$ with three NAND gates. Draw the logic circuit.

4. Give the expression for energy stored per unit volume in dielectric.

5. Define magnetisation.

6. Express $\vec{B}$ for a magnetic field of a Toroid.

7. Derive the relation between self inductance and mutual inductance.

8. What is a Galvanometer and what is its application?

9. A (0 – 150) V voltmeter has a guaranteed accuracy of 1 percent of full scale reading. The voltage measured by this instrument is 75 V. Calculate the limiting error in percent.

10. Why platinum is most commonly used in resistance thermometer?

11. Compare moving coil and moving iron instruments.

12. List basic modes of control of a closed loop system and write the mathematical expression for the controller.

13. Define gain margin and phase margin.

14. For a type O system with open loop transfer function $G(S)\ H(S) = \frac{1}{1+TS}$ where T is constant. Obtain its polar plot.

15. Inductors are not used for implementations of compensators. Why?

16. A 230 V dc shunt motor takes a current of 40 A and runs at 1100 rpm. If armature and shunt field resistances are 0.25 Ω and 230 Ω respectively. Find the torque developed by the armature.

17. A 220/110 V, 60 Hz ideal transformer has 166 turns on its primary. What is the instantaneous flux?

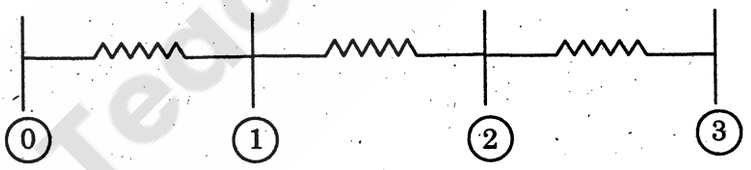
18. Draw the Scott connection of a transformer.

19. Compare slip ring induction motor with squirrel cage induction motor.

20. What is the line current of a circuit, when the current transformer of 2000 : 5 rating measures 4 amperes?

21. Justify the reason why it is desirable to have a high power factor of the system in case of HVDC transmission.

22. Formulate the Z_{bus} for the system shown in figure.



23. A 50 Hz, 4 pole turbo generator rated at 20 MVA, 13.2 kV has an inertia constant of H = 9 kW-sec/kVA. Determine the kinetic energy stored in the rotor at synchronous speed. If mechanical power input is 20,000 HP and electrical power output is 15,000 kW. Determine the accelerating power.

24. Design a fixed bias circuit using silicon transistor having β value of 100 V. V_{CC} is 10 V and dc bias conditions are to be $V_{CE} = 5$ V and $I_C = 5$ mA.

25. Draw the small signal high frequency equivalent circuit of a Common-Drain Amplifier.

26. What is Class B Amplifier? Why is it employed?

27. Calculate the power factor for a three phase bidirectional delta-connected voltage controller if the rms value of phase current is 10 A, $R = 6\ \Omega$ $V_S = 220\ V_{rms}$ and frequency is 50 Hz.

28. Define the switch utilization ratio of an inverter. Give its expression.

29. What are the functions of Snubber circuits in power electronic circuits?

30. Define harmonic factor.

31. List the addressing modes of 8086.

32. What is the advantage in using INTEL 8279 for keyboard and display interfacing?

33. What is the necessity of multiplexing? And list any two methods of multiplexing.

34. Define fill factor and what is its significance?

35. Determine the Air mass if the Zenith angle is
    (a) 90°
    (b) 60°.

PART — B

Note : i) Answer **not exceeding 100 words** each.

ii) Each question carries **eight marks.**

iii) Answer any **fifteen** questions only out of **eighteen** Questions.

$(15 \times 8 = 120)$

36. A three phase, 3 wire unbalanced load in star connected. The phase voltages of two of the arms are $V_R = 100 \angle -10^\circ$ volt and $V_Y = 150 \angle 100^\circ$ volt. Calculate voltage between star point of the load and supply neutral.

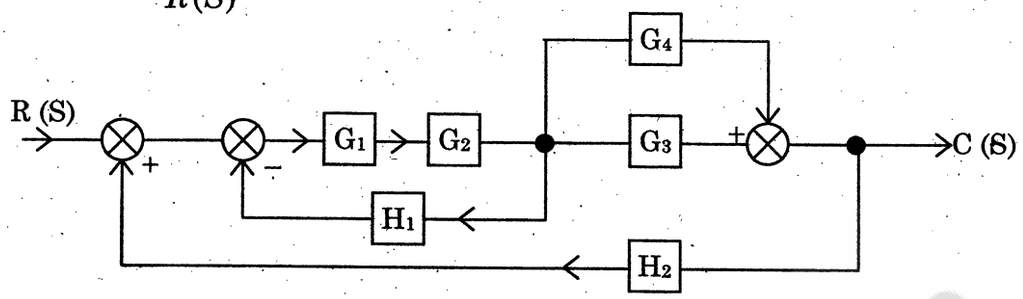
37. Two semi-infinite filaments on the Z-axis lie in the region $-\infty < Z < -4$ and $4 < Z < \infty$. Each carries a current of 3π Amp in the $\vec{a}_z$ direction. Determine the magnetic field intensity $\vec{H}$ at $\rho = 3$ and $\theta = 60^\circ$ in the XY plane.

38. Derive the magnetic field intensity caused by a circular loop of radius "a" in XY plane with its axis at origin.

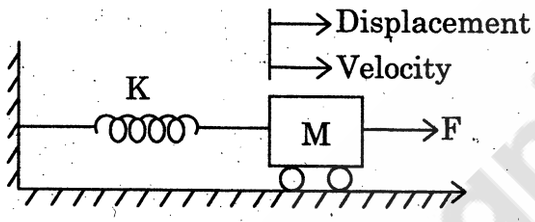
39. Describe the working of Haye's bridge for measurement of inductance. Derive the balance equation and draw the phasor diagram under condition of balance.

40. Describe the basic components of a magnetic tape recorder used for instrumentation applications using direct recording techniques.

41. Reduce the given block diagram to its canonical form and hence obtain the equivalent transfer function $\frac{C(S)}{R(S)}$



42. Consider the mass-spring-damper system shown in figure



Find the transfer function model of the system.

43. Determine the efficiency of a transformer of 50 kVA 2300/230 V has the primary and secondary winding resistance of 2Ω and 0.02Ω respectively. The iron losses equal 412 W.

44. A 3ϕ 16 pole star connected alternator has 144 slots on the armature periphery. Each slot containing 10 conductors. It is driven at 375 rpm. The line value of emf available across the terminal is observed to be 2.657 kV. Find the frequency of the induced emf and flux per pole.

45. Prove the statement mathematically that power per conductor is more for dc than ac. Also compare power transfer capability of bipolar line and 3ϕ ac single circuit line.

46. Prove that double line to ground fault involves negative and zero sequence components. Derive the expression for finding the fault current.

47. Draw a feedback amplifier in block diagram form and explain each block giving its function.

48. Implement the following Boolean function using 4 : 1 multiplexer.

$F(A, B, C) = \sum m\ (1, 3, 5, 6)$

49. Discuss how output power in single phase full-bridge inverter becomes four times the power handled by a single phase half bridge inverter.

50. Discuss the control strategies involved in operating DC-DC converters.

51. Show that the complex exponential signal $X(t) = e^{j\omega_0}$ is periodic and its fundamental period is $\frac{2\pi}{\omega_0}$.

52. Discuss the reasons for low efficiency of solar cells.

53. Distinguish between battery and fuel cell.

PART — C

Note : i) Answer **not exceeding 200 words** each.

ii) Each question carries **fifteen marks.**

iii) Answer any **six** questions only out of **nine** questions.

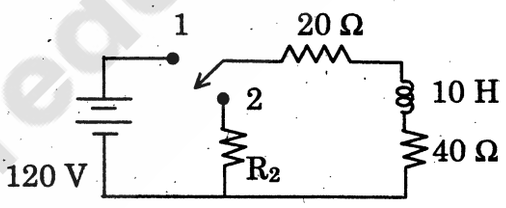
(6 × 15 = 90)

54. Switch is initially in position :

(a) Find the voltage across the coil at which switch is changed to position 2, if $R_2 = 500\ \Omega$.

(b) Find the value of R_2, if the voltage across the coil is limited to 120 V.

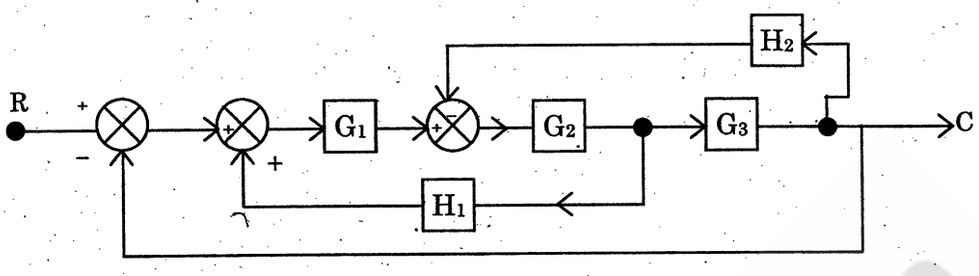
(c) Find the time taken to dissipate 95% of stored energy with R_2 found in (b).



55. Find the magnetic flux density at the centre of a square of sides equal to 6 m and carrying 15 A of current.

56. Explain the construction and working of PMMC instruments and derive its torque equation. Also compare the attraction and repulsion types of moving iron instruments.

57. Obtain the closed loop transfer function $\frac{C(S)}{R(S)}$ by use of Mason's gain formula.



58. Explain with neat sketches, the function of
    (a) Auto transformer starters and
    (b) Star-delta starters.

59. Design a synchronous counter that count as 000, 010, 101, 110, 000, 010,... Ensure that unused states of 001, 011, 100 and 111 go to 000 on next clock pulse. Use J-K flip flops. How will the counter hardware look like if the unused states are to be considered as "don't care's"?

60. Derive the expression of
    (a) rms value of output voltage V_{or}, output current I_{or}
    (b) power delivered to load resistance
    (c) power factor
    for a single phase voltage controller with R load.

61. Discuss in detail the functions of 7 layer OSI model.

62. Derive the empirical equation for estimating the availability of solar radiation.
