SEAL

Booklet Serial No.

1900053

Booklet Series

A

05/EFC/M-2025-04(A)

Question Booklet

ELECTRICAL ENGINEERING

PAPER – II

Candidate's Roll Number

Time Allowed : 2 Hours

Maximum Marks : 300

Read the following instructions carefully before you begin to answer the questions.

IMPORTANT INSTRUCTIONS

1. This Question Booklet contains **100** questions in all.
2. **All** questions carry equal marks.
3. An Answer Sheet has been supplied inside the question booklet to mark the answers. **You must write your Roll Number and encode it and write other particulars in the space provided in the Answer Sheet, failing which your Answer Sheet will not be evaluated.**
4. **Immediately after commencement of the examination, you should check up your Question Booklet and attached answer sheet and ensure that the Question Booklet Series is printed on the top left-hand corner of the Booklet and the series encoded in answer sheet are same. Also please check that the Booklet contains 20 printed pages including two pages (Page Nos. 19 and 20) for Rough Work and no page or question is missing or unprinted or torn or repeated or question booklet and answer sheet have different series. If you find any defect in this Booklet and attached answer sheet, get it replaced immediately by a complete Booklet with OMR sheet of the same series.**
5. You must write your Roll Number in the space provided on the top of this page. Do not write anything else on the Question Booklet.
6. Questions and their responses are printed in English version in this Booklet. Each question comprises of **four** responses – (A), (B), (C) and (D). You are to select ONLY ONE correct response and mark it in your Answer Sheet. In case you feel that there are more than one correct response, mark the response which you consider the best. In any case choose ONLY ONE response for each question.
7. In the Answer Sheet, there are **four** circles – Ⓐ, Ⓑ, Ⓒ and Ⓓ against each question. To answer the questions, you are to mark with **Black/Blue ink ballpoint pen ONLY ONE circle** of your choice for each question. Select only one response for each question and mark it in your Answer Sheet. If you mark more than one circle for one question, the answer will be treated as wrong. **Use Black/Blue ink ballpoint pen only to mark the answer in the Answer Sheet. Any erasure or change is not allowed.**
8. For each question for which a wrong answer/more than one answer has been given by the candidates, **one third (1/3)** of the marks assigned to that question will be deducted as penalty.
9. You should not remove or tear off any sheet from the Question Booklet. You are not allowed to take this Question Booklet and the Answer Sheet out of the Examination Hall during the examination. **After the examination has concluded, you must hand over your Answer Sheet to the Invigilator.** Thereafter, you are permitted to take away the Question Booklet with you.
10. Failure to comply with any of the above instructions will render you liable to such action or penalty as the Commission may decide at their discretion.
11. Candidates must assure before leaving the Examination Hall that their Answer Sheets will be kept in Self Adhesive LDPE Bag and completely packed/sealed in their presence.

SEAL

1. An iron cored inductor has following data :

No. of turns : N, Mean path length of Iron core : l, cross section of core : A relative permeability of core : μr

Inductance, L, of the device is given by

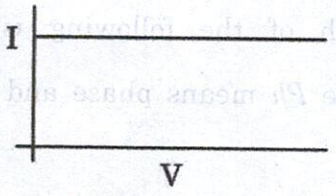
(A) $\frac{\mu_r A N^2}{l}$

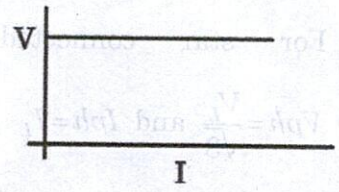
(B) $\frac{\mu_o \mu_r A N^2}{l}$

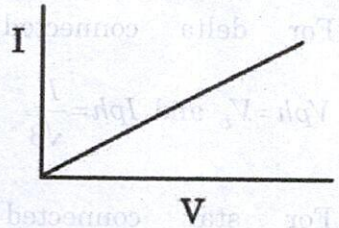
(C) $\frac{\mu_r l N^2}{A}$

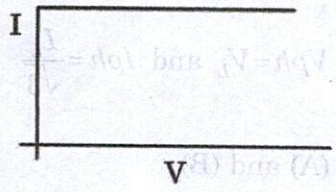
(D) $\frac{\mu_o \mu_r l N^2}{A}$

2. Which of the following is correct for an ideal current source?

(A) 

(B) 

(C) 

(D) 

3. Time Constants of series R-L and series R-C circuits are τ_L & τ_C respectively. Which is the correct match?

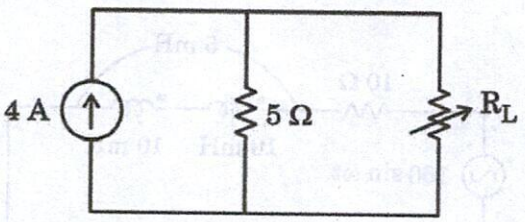
(A) $\tau_L = \frac{L}{R}$ and $\tau_C = \frac{C}{R}$

(B) $\tau_L = \frac{R}{L}$ and $\tau_C = \frac{R}{C}$

(C) $\tau_L = \frac{L}{R}$ and $\tau_C = RC$

(D) $\tau_L = LR$ and $\tau_C = \frac{C}{R}$

4. Consider the following circuit, maximum power transferred to the load will be



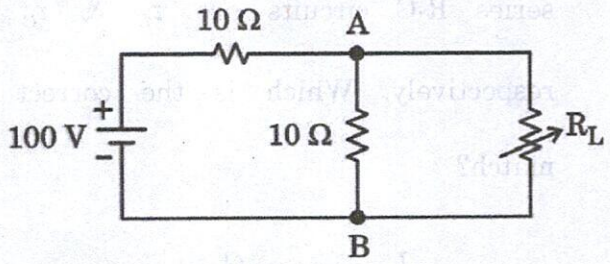
(A) 10 W

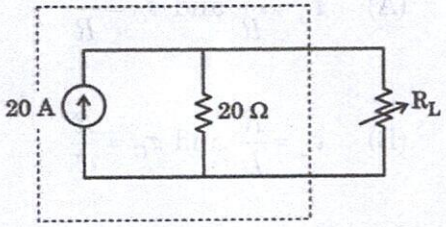
(B) 20 W

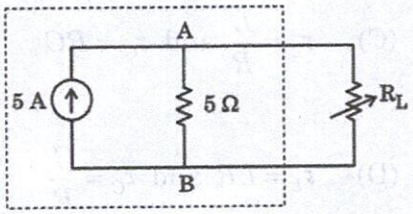
(C) 5 W

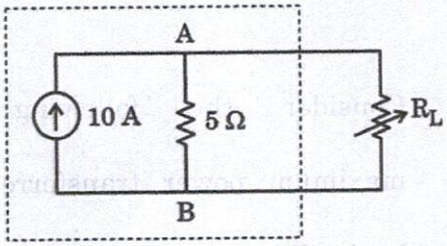
(D) None

5. Norton's equivalent of the following is given by

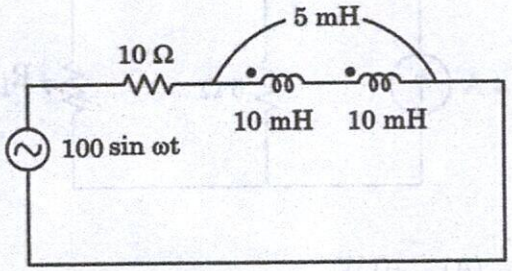


(A)


(B)


(C)


(D) None of the above

6.


What is the net inductance of the above circuit?

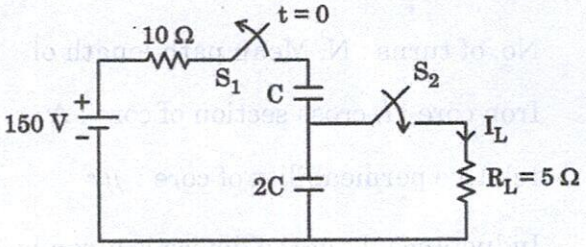
(A) 20 mH

(B) 25 mH

(C) 30 mH

(D) 10 mH

7. Consider following circuit :



At t= 0, S_1 is opened and S_2 is closed. What is the value of the current, I_L, at t = 0?

(A) 20 A

(B) 10 A

(C) 5 A

(D) None

8. Which of the following is correct? where *Ph* means phase and L means line

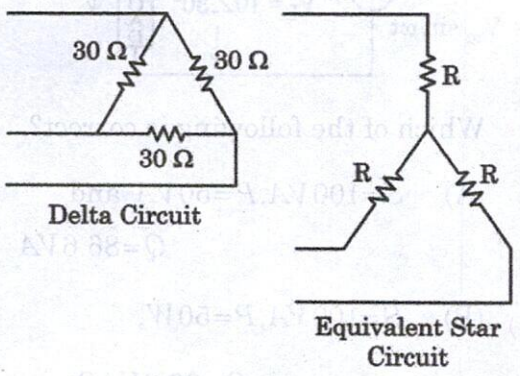
(A) For star connected circuit $Vph=\frac{V_L}{\sqrt{3}}$ and $Iph=I_L$

(B) For delta connected circuit $Vph=V_L$ and $Iph=\frac{I_L}{\sqrt{3}}$

(C) For star connected circuit $Vph=V_L$ and $Iph=\frac{I_L}{\sqrt{3}}$

(D) (A) and (B)

9. Consider following delta and star circuits :



Value of R is

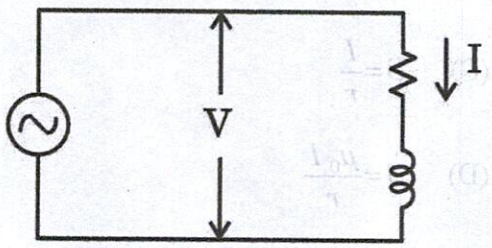
(A) $10\sqrt{3}\,\Omega$

(B) $10\,\Omega$

(C) $30\,\Omega$

(D) None

10. Formula for complex power in the following circuit is :



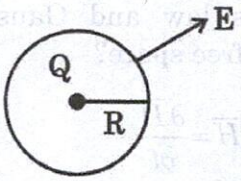
(A) $V^* I$

(B) $V I$

(C) $V I^*$

(D) $V^* I^*$

11. Consider following figure :



Corresponding to the point charge, Q, electric field intensity at a distance, R, is

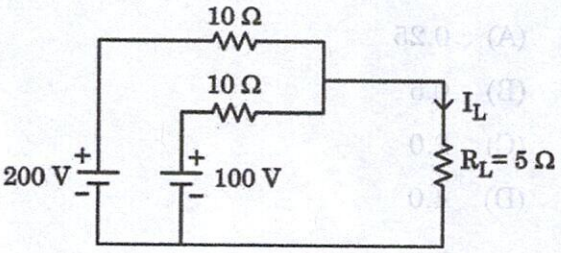
(A) $E = \dfrac{Q}{4\pi R^2}$

(B) $E = \dfrac{\epsilon_0 Q}{4\pi R^2}$

(C) $E = \dfrac{Q}{4\pi\epsilon_0 R^2}$

(D) $E = \dfrac{Q}{4\pi\epsilon_0 R}$

12. Consider following figure :



The value of the current, I_L, is

(A) 10 A

(B) 20 A

(C) 15 A

(D) 5 A

13. Which of the following equations as are derived from Ampere's law, Faraday's law and Gauss' Law are valid for free space?

1. $\overline{\nabla} \times \overline{H} = \frac{\partial \overline{D}}{\partial t}$

2. $\overline{\nabla} \times \overline{H} = J + \frac{\partial \overline{D}}{\partial t}$

3. $\overline{\nabla} \times \overline{E} = -\frac{\partial \overline{B}}{\partial t}$

4. $\overline{\nabla} \times D = 0$

5. $\overline{\nabla} \times \overline{D} = \rho$

6. $\overline{\nabla} \times \overline{D} = 0$

(A) 1, 4 and 5

(B) 2, 4 and 6

(C) 2, 3 and 5

(D) 1, 3 and 6

14. The ratio of the velocities of propagation of EM waves in an overhead line and in a cable with dielectric permittivity of 4 is

(A) 0.25

(B) 0.5

(C) 2.0

(D) 4.0

15. Tangential components of electric field on a perfect conductor will be

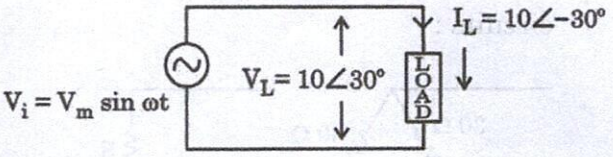
(A) Infinite

(B) Zero

(C) Same as the normal field component and 90° out of phase

(D) Same as the normal component and 180° out of phase

16. Consider following circuit :



Which of the following is correct?

(A) $S = 100\,VA, P = 50\,VA$ and $Q = 86.6\,VA$

(B) $S = 100\,VA, P = 50\,W$, $Q = 86.6\,VAR$

(C) $S = 100\,VA, P = 50\,W$, $Q = 86.6\,VA$

(D) None of the above

17. A long conductor carries a dc current I. The flux density, B, at a distance, r, is equal to

(A) $B = \frac{I}{2\pi r}$

(B) $B = \frac{\mu_0 I}{2\pi r}$

(C) $B = \frac{I}{r}$

(D) $B = \frac{\mu_0 I}{r}$

18. Which of the following is true for a good permanent magnet?

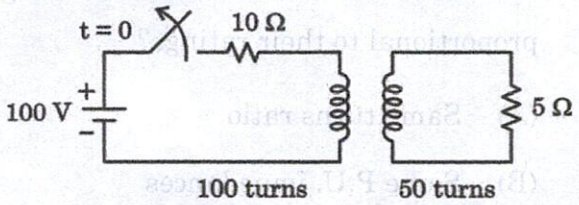
(A) Retentivity must be high

(B) Coercivity must be high

(C) Both (A) and (B)

(D) None

19. Consider the following circuit. The switch is on for a long time for $t \leq 0$. At $t=0$, it is opened. What is the value of secondary current at $t=0$?



(A) 10 A

(B) 20 A

(C) 0 A

(D) None

20. Full cycle average value of an ac current $i=10\sin wt$ is

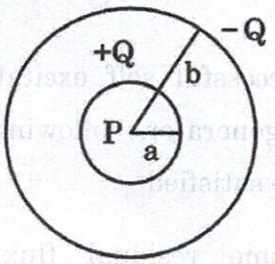
(A) 10 A

(B) 7.07 A

(C) 5 A

(D) 0 A

21. Two concentric hollow spheres of radii a and b have charge of Q and –Q respectively as shown in the figure. Potential at the centre will be :



(A) Zero

(B) $\dfrac{Q}{4\pi\epsilon_0 b}$

(C) $-\dfrac{Q}{4\pi\epsilon_0 b}$

(D) $\dfrac{Q}{4\pi\epsilon_0}\left(\dfrac{1}{a}-\dfrac{1}{b}\right)$

22. Which of the following waveforms has same peak value, rms value and half cycl average value?

(A) Sinusoidal wave

(B) Square wave

(C) Triangular wave

(D) Ramb wave

23. Laplace transform of $e^{-\alpha t}$ is

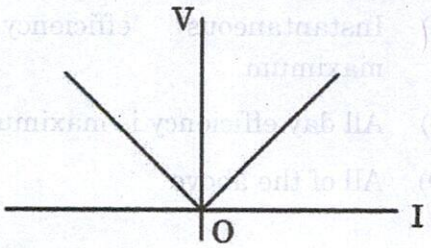
(A) $\dfrac{1}{s-\alpha}$

(B) $\dfrac{1}{s+\alpha}$

(C) $s-\alpha$

(D) $s+\alpha$

24. The V-I characteristic of an element is shown in the following figure:



The element is

(A) Non Linear, active and non-bilateral

(B) Linear, active, non-bilateral

(C) Non linear, Passive, non-bilateral

(D) Non-linear, active, bilateral

25. Laplace transform of $\sin wt$ is

(A) $\frac{s}{s^2+w^2}$

(B) $\frac{w^2}{s^2+w^2}$

(C) $\frac{s^2}{s^2+w^2}$

(D) $\frac{w}{s^2+w^2}$

26. Which of the following is determined by open circuit test of transformer?

(A) Iron loss

(B) Copper loss

(C) Shunt parameters

(D) (A) and (C)

27. When iron loss is equal to copper loss in a transformer then

(A) Regulation is maximum

(B) Instantaneous efficiency is maximum

(C) All day efficiency is maximum

(D) All of the above

28. When a transformer is loaded with leading power factor load, what is likely outcome?

(A) Load voltage is always less than supply voltage

(B) Load voltage may be more than supply voltage

(C) Efficiency may be maximum

(D) None

29. Two transformers of different KVA ratings are connected in parallel. Which of the following conditions must be satisfied for load sharing proportional to their ratings?

(A) Same turns ratio

(B) Same P.U. impedances

(C) Same iron losses

(D) (A) and (B)

30. In a high voltage star/star connected 3-phase transformer, a low voltage delta connected tertiary winding is used due to following reason :

(A) To improve regulation

(B) To improve efficiency

(C) To flow triplex harmonics to improve emf waveform

(D) All of the above

31. For successful self excitation of DC shunt generator, following condition must be satisfied

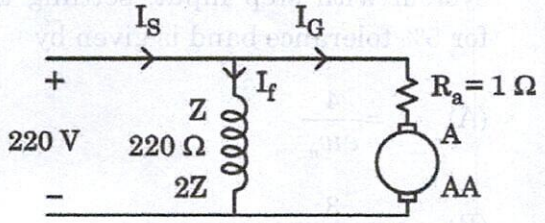
(A) Some residual flux must be available

(B) Field resistance is less than critical resistance

(C) Generator's speed must be more than critical speed

(D) All of the above

32. Consider following circuit :



At no load ($I_a = 0$), motor's speed is 1500 rpm. The speed of motor at a source current $I_s = 21A$, is equal to (neglect armature reaction)

(A) 1500 rpm

(B) 1450 rpm

(C) 1364 rpm

(D) 1200 rpm

33. Four point starter has the following advantages over three point starter :

(A) It is a cheaper

(B) Speed control by field control method can be implemented without affecting the operation of the starter

(C) Efficiency of the motor improves

(D) Speed regulation improves

34. Which of the following is correct for a DC motor?

(A) By armature control method, motor operates in constant torque mode

(B) By field control method, motor operates in constant power mode

(C) The operation is for constant load (armature) current

(D) All of the above

35. Which of the following is true for a 3 phase squirrel cage induction motor?

(A) Crawling is caused by 7th flux harmonic

(B) Logging is caused when rotor slots are integral multiple of stator slots

(C) Skewing eliminates logging

(D) All of the above

36. Which of the following is true for 3-phase squirrel cage induction machine?

(A) For N > NS, induction motor runs as a generator

(B) In an isolated area, reactive power to 3-phase induction machine is provided by capacitor bank for its operation as generator

(C) No load current of the motor is 30-70 percent of full load current

(D) All of the above

37. Which of the following is true?

(A) Stator voltage control of 3-phase induction motor applicable to far type load only

(B) Stator v/f control provides almost constant peak torque at all frequencies

(C) Rotor resistance control of slip ring induction motor reduces the starting current, at the same time increases the starting current

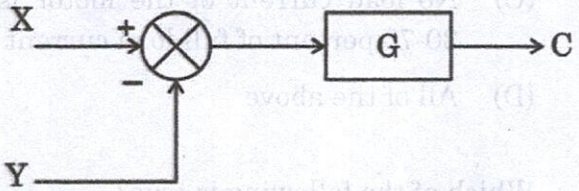
(D) All of the above

38. The stator winding of a 3 phase synchronous generator is short pitched by 36° (electrical). Which one of the harmonics in induced voltage is completely eliminated?
(A) Third
(B) Fifth
(C) Seventh
(D) Second

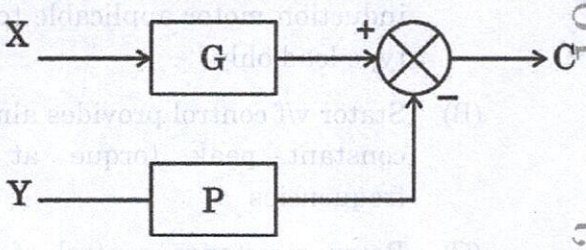
39. Advantage of star connection of stator winding of a 3-phase alternator is
(A) Third harmonic component in Line voltage is eliminated
(B) Less stress on insulation
(C) Neutral can be grounded
(D) All of the above

40. An over excited synchronous motor acts as
(A) Synchronous inductor
(B) Synchronous condenser
(C) It improves power factor
(D) (B) and (C)

41. Consider the following block diagram



If the summing point is shifted beyond the block, then what is the value of P?



(A) 1
(B) G
(C) $\frac{1}{G}$
(D) 0

42. For a second order underdamped system with step input, settling time for 5% tolerance band is given by

(A) $t_s = \frac{4}{\varepsilon w_n}$

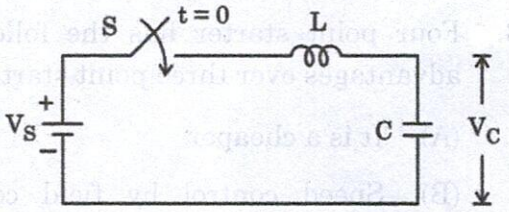
(B) $t_s = \frac{3}{\varepsilon w_n}$

(C) $t_s = \frac{2}{\varepsilon wn}$

(D) $t_s = \frac{5}{\varepsilon w_n}$

Where ε is damping ratio

43. Consider following second order undamped system with ideal elements



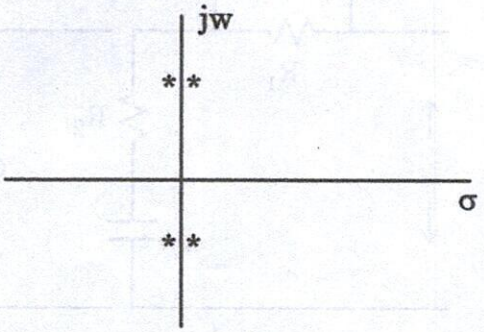
Peak over shoot of capacitor's voltage, V_c, is equal to

(A) 75%
(B) 100%
(C) 50%
(D) 25%

44. Which of the following is true for AC servo-motor?

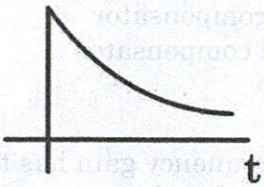
(A) $\frac{R}{X}$ ratio of rotor is high
(B) Length of rotor is large and diameter is small
(C) Stator has two phase supply
(D) All of the above

45. Double pair of roots are on jw axis as shown in the following figure :

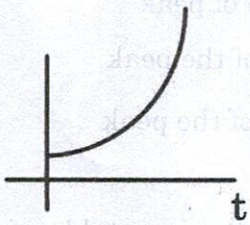


The response will be

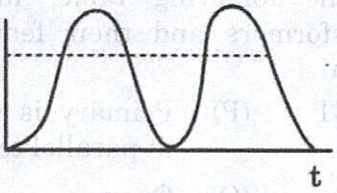
(A)



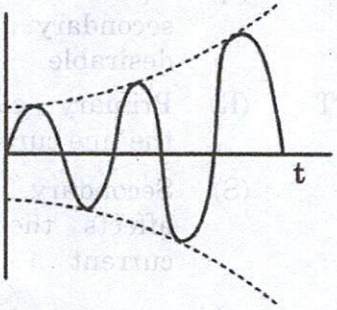
(B)



(C)



(D)



46. For $s^3+8s^2+14s+24=0$ the system is

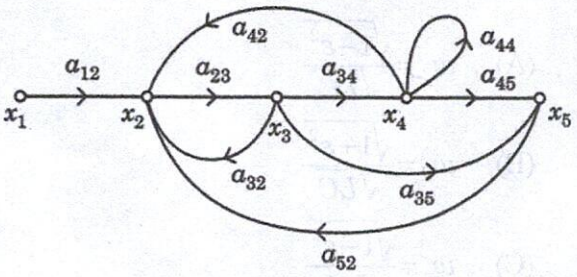
(A) Marginally stable

(B) Stable

(C) Unstable

(D) None

47. Consider following signal flow graph:



How many combinations of three non-touching loops are there?

(A) 2

(B) 1

(C) 0

(D) 4

48. Steady state error of type-1 system for unit ramp input is :

(A) $\frac{1}{1+K_p}$

(B) 0

(C) $\frac{1}{K_v}$

(D) $\frac{1}{K_a}$

49. Synchro is a

(A) Three phase device

(B) Single phase device

(C) Remote position control device

(D) (B) and (C)

50. Which of the following is true?

(A) Root locus is symmetrical to the real axis

(B) It originates from open loop pole with K = 0 and terminates on open loop zero

(C) Root Locus starts from zero and terminates on pole

(D) (A) and (B)

51. Which of the following is true?

(A) $w_d = \frac{\sqrt{1-\varepsilon^2}}{\sqrt{LC}}$

(B) $w_d = \frac{\sqrt{1+\varepsilon^2}}{\sqrt{LC}}$

(C) $w_c = \frac{\sqrt{1-\varepsilon^2}}{LC}$

(D) None

52. Given a state-space model : $\dot{x} = \begin{bmatrix} 0 & 1 \\ -2 & -3 \end{bmatrix} x + \begin{bmatrix} 0 \\ 1 \end{bmatrix} u$. What are the eigenvalues of the system (poles)?

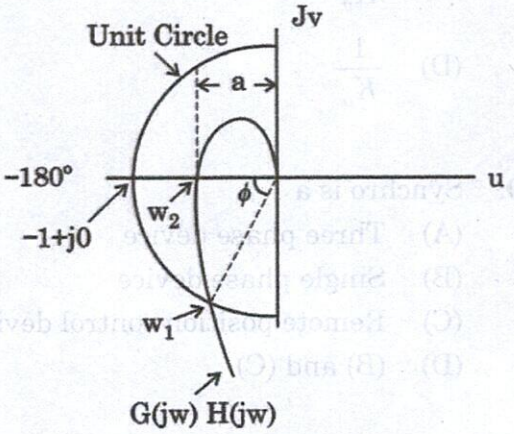
(A) $-1, -2$

(B) $0, -3$

(C) $1, 2$

(D) $-1, 3$

53. Consider following figure :



Which one of the following is true?

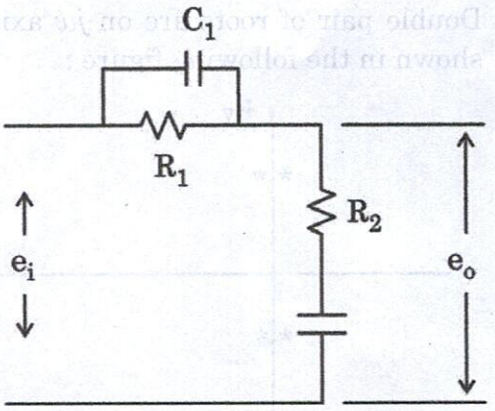
(A) Gain margin = a

(B) Phase margin $\phi = \angle G(jw)H(jw)\big|_{w=w_1} + 180^\circ$

(C) Phase margin $\phi = \angle G(jw)H(jw)\big|_{w=w_1} - 180^\circ$

(D) None

54.



Above circuit is

(A) Lag-lead compensator

(B) Lag compensator

(C) Lead compensator

(D) None

55. A cut off frequency gain has the value

(A) 100% of peak

(B) $\frac{1}{\sqrt{2}}$ of the peak

(C) 50% of the peak

(D) None

56. In the following table, instrument transformers and their features are given

[X] CT	(P)	Primary is connected in parallel to the grid
	(Q)	Open circuited secondary is not desirable
[Y] PT	(R)	Primary current is the line current
	(S)	Secondary burden affects the primary current

Correct matching is :

(A) X matches with P and Q and Y matches with R and S

(B) X matches with Q and S, Y matches with P and R

(C) X matches with Q and R, Y matches with P and S

(D) X matches with P and R, Y matches with Q and S

57. String efficiency of insulator string in dc system is :

(A) 75%

(B) 100%

(C) 50%

(D) 85%

58. Zero sequence current flows in

(A) Three phase fault

(B) L-L fault

(C) L-L-G fault

(D) None

59. SF_6 gas is used in high voltage circuit breaker due to

(A) High dielectric strength

(B) Chemically stable

(C) High affinity to electrons

(D) All of the above

60. Series compensation is used

(A) To increase steady state stability limit

(B) To improve load power factor

(C) To improve generator's power factor

(D) All of the above

61. Shunt compensation is used to

(A) Improve load end power factor

(B) Increase steady state stability limit

(C) To improve utilization factor of transmission line

(D) (A) and (C)

62. Ferranti effect is

(A) Receiving end voltage of long transmission line at no load is more than sending end voltage

(B) It reduces corona loss

(C) It reduces line inductance

(D) All of the above

63. Advantage of bundled conductors is

(A) Steady state limit is increased

(B) Corona discharge is reduced

(C) Line inductance is reduced

(D) All of the above

64. Which of the following is true?

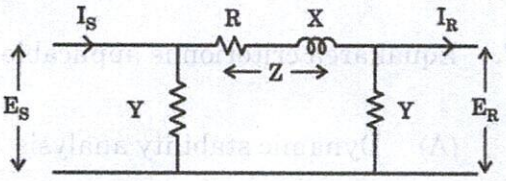
(A) Z_s of a cable is $35 - 60\,\Omega$

(B) Z_s of single circuit line is 400 Ω

(C) Z_s of a double circuit line is 200 Ω

(D) All of the above

65. Which is true for the following equivalent circuit?



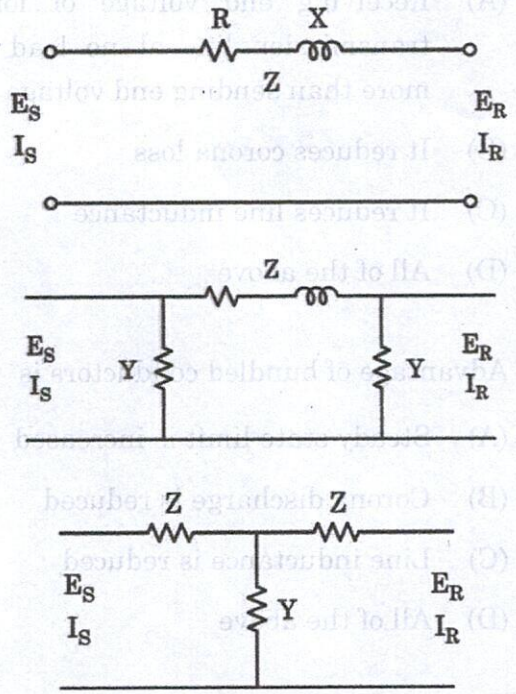
(A) $A = 1 + YZ$

(B) $B = Z$

(C) $D = 1 + YZ$

(D) All of the above

66. Consider following equivalent circuits:



What is common among them?

(A) $A=B$

(B) $A=D$

(C) $A=C$

(D) $B=C$

67. Equal area criterion is applicable for

(A) Dynamic stability analysis

(B) Transient stability analysis

(C) Steady state stability analysis

(D) All of the above

68. For economic operation of all the units of a power plant, the criterion is

(A) All the generators must have same p.u. impedances

(B) All the generators must have same rating

(C) All the units must have same incremental fuel cost

(D) None

69. Which one of the following is true?

(A) Z_{Bus} can be formed by inspection

(B) Y_{Bus} can be formed by inspection

(C) Z_{Bus} is a sparse matrix

(D) All of the above

70. Which of the following is true?

(A) Infinite bus is represented by $1\angle 0^\circ$

(B) Load bus is a P-Q bus

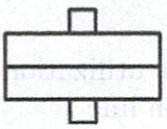
(C) Generator bus is a P-V bus

(D) All of the above

71. Symbol of the moving iron instrument is

(A) 

(B) 

(C) 

(D) None

72. Which of the following is true for PMMC instrument?

(A) $T_d = BNAI$

(B) $T_c = K_s \theta$

(C) Scale is linear

(D) All of the above

73. A D'Arsonval galvanometer can be converted to a voltmeter by

(A) Shunt of low value

(B) Shunt of high value

(C) Multiplier of small value

(D) Multiplier of high value

74. Which one of the following bridges measure frequency?

(A) D' Stuth

(B) Anderson

(C) Maxwell

(D) Wien's

75. Very high resistance can be measured by

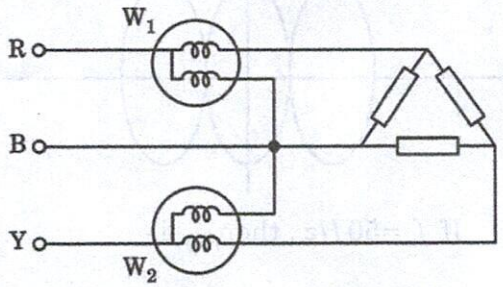
(A) Voltmeter and ammeter

(B) Megohm bridge

(C) Anderson bridge

(D) Ohm's bridge

76. Two Wattmeter method, as shown in the following figure, is used to measure 3-phase power



If the load power factor of balanced load is less than 0.5 (leading) then which of the following is true?

(A) w_1 and w_2 have positive readings

(B) w_1 is negative and w_2 is positive

(C) w_1 is positive and w_2 is negative

(D) Both w_1 and w_2 are negative

77. Which of the following is true?

(A) Voltmeter is in series with load

(B) Ammeter is in parallel with load

(C) CC of wattmeter is in series and PC is in parallel with load

(D) All of the above

78. Input impedance of the channels of CRO is

(A) Infinite

(B) About $10^6\ \Omega$

(C) Zero

(D) $100\ \Omega$

79. If two sinusoidal signals have same amplitudes and there is a phase difference of 90°, the pattern on CRO screen is :

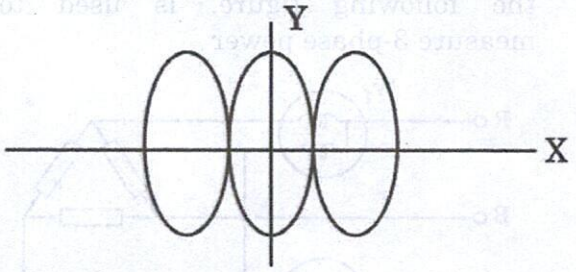
(A) Ellipse

(B) Circle

(C) Straight line at 45°

(D) Straight line on verticle axis

80. Lissajous figure is shown below :



If $f_x = 50\,Hz$, then f_y is

(A) 100 Hz
(B) 50 Hz
(C) 150 Hz
(D) 90 Hz

81. Which of the following has lowest turn off time?

(A) SCR
(B) IGBT
(C) GTO
(D) MOSFET

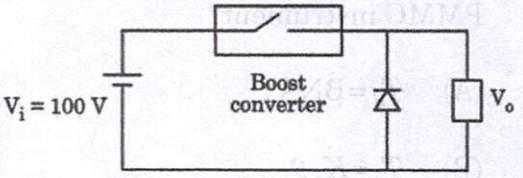
82. What is the drawback of R-firing circuit?

(A) Firing angle cannot be more than 45°
(B) Firing angle cannot be more than 135°
(C) Firing angle cannot be more than 90°
(D) None

83. What is used for protection of SCR against high $\frac{di}{dt}$?

(A) Snuffer circuit
(B) Series inductance
(C) MOV
(D) All of the above

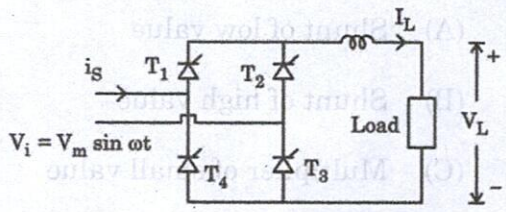
84. Consider following boost converter



If duty cycle, $\alpha = 0.5$, then out put voltage is :

(A) 50 V
(B) 200 V
(C) 150 V
(D) 100 V

85. Consider following circuit



load current I_L, is ripple free dc current of 10 A firing angle is 60°. The input power factor is equal to

(A) 0.5
(B) 0.866
(C) 0.45
(D) 1.0

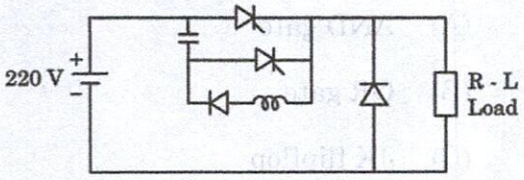
86. For four quadrant operation of a dc motor which one of the following is used?

(A) Non circulating current dual converter
(B) Circulating current dual converter
(C) Four quadrant dc chopper
(D) All of the above

87. Which of the following commutation method is used in modified Mc-Murray half bridge inverter?

(A) Current commutation
(B) Voltage commutation
(C) Line commutation
(D) External pulse commutation

88. Consider following circuit :



Which of the following commutation scheme is used in above circuit?

(A) Complementary current commutation

(B) Complementary voltage commutation

(C) Auxiliary voltage commutation

(D) Auxiliary current commutation

89. Advantage of CSI is

(A) Commutation circuit is not bulky

(B) Commutation is simple

(C) Four quadrant operation can be implemented

(D) All of the above

90. A load current of single phase fully controlled converter is ripple free dc current. Harmonics in line current are

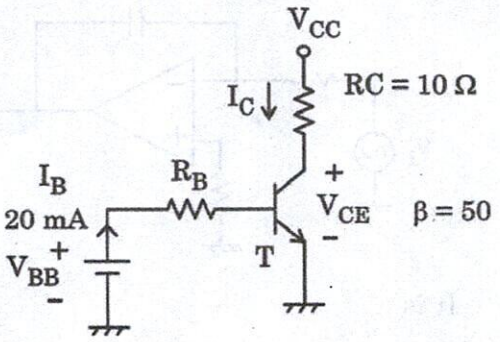
(A) Even harmonics only

(B) Odd harmonics only

(C) No harmonics

(D) Both (A) and (B)

91. Consider following circuit with $\beta = 50$



Calculate power loss in R_C, when transistor is in saturation state. $V_{CE} \simeq O$

(A) 20 W

(B) 15 W

(C) 10 W

(D) 5 W

92. Which of the following is true?

(A) Ripple factor of half wave rectifier is 1.10

(B) Ripple factor of full wave rectifier is 0.48.

(C) Ripple factor of full wave rectifier is 1.10

(D) Both (A) and (B)

93. Which of the following is a three stage oscillator?

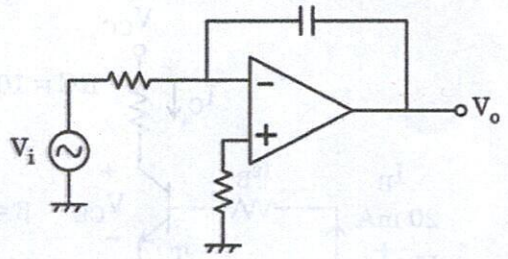
(A) R-C phase shift oscillator

(B) Colpitt oscillator

(C) Hartley oscillator

(D) All of the above

94. Consider following circuit



It is

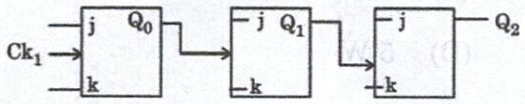
(A) A differentiator

(B) An integrator

(C) Summing circuit

(D) None

95. Consider following circuit :



All the values of J_s and K_s are 1 (one)

If frequency of CK, is 80 Hz, then frequency of Q_2 will be

(A) 80

(B) 40

(C) 10

(D) None

96. Which of the following is true?

(A) $XY+X\overline{Y}=X$

(B) $XY+X\overline{Y}=Y$

(C) $X(\overline{X}+XY)=X$

(D) $ZX+ZXY=Y$

97. Race around condition occurs in

(A) AND gate

(B) OR gate

(C) JK flipflop

(D) All of the above

98. For TTL gates, open input is equivalent to

(A) 1

(B) 0

(C) Not allowed

(D) None

99. Which of the following is true for ideal OP-AMP?

(A) $Z_i=\infty$

(B) $Z_0=0$

(C) Slew rate is infinite

(D) All of the above

100. Fan out of a TTL gate is

(A) 5

(B) 7

(C) 10

(D) 1