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A

SET-X

Ph.D./URS-EE-Jan-2022

SUBJECT : Electrical Engineering.

10025

Sr. No. .....

Time : **1¼ Hours** Max. Marks : **100** Total Questions : **100**

Roll No. (in figures)_____ (in words) _____

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SEAL

A

1. The Laplace transform of a function f(t) is :

$F(s) = 1/s(s + 1)$

As t tends to infinity, f(t) approaches

(1) 1/2 (2) Zero

(3) 1 (4) Infinity

2. Power transmission line are transposed to reduce :

(1) Skin effect

(2) Ferranti effect

(3) Transmission loss

(4) Interference with neighbouring communication

3. An open loop Transfer function of unity feedback system is given by :

$G(s) = 1/(s+2)^2$

The closed loop transfer function will have poles at

(1) –2, –2 (2) –2, –1

(3) $-2 + j, -2 - j$ (4) –2, 2

4. A 1mA galvanometer with internal resistance of 50 ohm is to be converted to measure 5A (full scale). What is the value of shunt resistance required for this conversion ?

(1) 1 ohm (2) 0.01 ohm

(3) 1 Kilo ohm (4) 10 ohm

5. The average power delivered to an impedance (4-j3) Ω by a current $5\cos(100\pi+100)$ A is :

(1) 44.2 W (2) 50 W

(3) 62.5 W (4) 125 W

6. The full load copper loss and iron loss of a transformer are 6400W and 500W, respectively. The above copper loss and iron loss at half load will be :

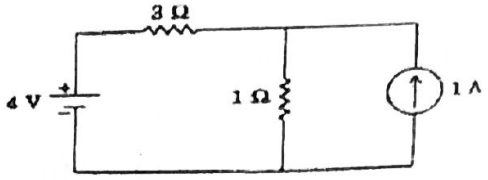
(1) 3200 Wand 250 W respectively

(2) 3200 Wand 500 W respectively

(3) 1600 Wand 125 W respectively

(4) 1600 Wand 500 W respectively

7. For the circuit shown below, the voltage across the 1 ohm resistor is given by :



(1) 7/4

(2) 5/4

(3) c

(4) 7/3

8. In a synchronous machine the rotor speed becomes more than the synchronous speed during hunting, the damping bars develop :

(1) Synchronous motor torque

(2) DC motor torque

(3) Induction motor torque

(4) Induction generator torque

9. The per unit value of a 4 ohm resistor at 100 MVA base and 10 KV base voltage is :

(1) 2 pu

(2) 4 pu

(3) 0.4 pu

(4) 40 pu

10. The voltage regulation of transformer having 2% and 5% reactance, at full load, 0.8 pf lagging is :

(1) 4.6%

(2) –4.6%

(3) –1.4%

(4) 6.4%

11. The torque speed characteristics of two phase induction motor is largely affected by :

(1) Voltage

(2) R/X and speed

(3) X/R

(4) Supply voltage frequency

12. A 3 phase, 50 Hz, 6 poles Induction motor has rotor resistance of 0.1 Ω and reactance of 0.92 Ω. Neglect the voltage drop in stator and assume that rotor resistance is constant. Given that full load slip is 3%. The ratio of maximum torque to full load torque i :

(1) 1.567 (2) 1.712

(3) 1.94 (4) 2.134

13. An analog voltmeter uses external multiplier settings. With a multiplier setting of 20 kΩ, it reads 440V and with a multiplier setting of 80 kΩ it reads 352 V. For a multiplier setting of 40 kΩ, the voltmeter reads ..... .

(1) 371 V (2) 383 V

(3) 394 V (4) 406 V

14. In s-domain representation, the transfer function of a system is ..... .

(1) Laplace transform of unit step response of a system

(2) Laplace transform of OC test/Laplace transform of SC test

(3) Zeros/poles

(4) Output/ Input

15. The transfer function of a compensator is given by :

$G(s) = (s + a)/(s + b)$

$G(s)$ is lead compensator if

(1) a=l, b=2 (2) a=3, b=2

(3) a=7, b=5 (4) a=3, b=1

16. Nichol's chart is used to determine :

(1) transient response

(2) closed loop frequency response

(3) open loop frequency response

(4) settling time due to step input

17. Following is ***not*** a performance specification for transient response of a system :

(1) Settling time
(2) Peak overshoot
(3) Steady state error
(4) Rise time

18. A 3-phase diode bridge rectifier is fed from a 400V (rms), 50 Hz, 3-phase ac source. If the load is purely resistive, then peak instantaneous output voltage is equal to :

(1) 400 V
(2) $400\sqrt{2}$
(3) $400\sqrt{(2/3)}$
(4) $400\sqrt{3}$

19. Power consumed by a balanced 3-phase, 3-wire load is measured by two wattmeter method. The first wattmeter reads twice that of second. Then the load impedance angle in radians is :

(1) $\pi/12$
(2) $\pi/8$
(3) $\pi/6$
(4) $\pi/3$

20. The two voltage surges are defined as 1/50 μs and 3/50μ s. Which surge is more harmful ?

(1) 1/50 μs
(2) 3/50 μs
(3) Both equally
(4) None of the above

21. If the fault current is 2000 A, the relay setting 50% and CT ratio is 400/5, the P.S.M is :

(1) 23
(2) 50
(3) 15
(4) None of the above

22. NAND and NOR gates are called 'universal gates' primarily because :

(1) they are available everywhere
(2) they are widely used in IC packages
(3) they can be easily combined to produce AND, OR and NOR gates
(4) they can be manufactured easily

23. The minimum number of 2-input NAND gates required to implement a 2-input XOR gate is :

(1) 4
(2) 5
(3) 6
(4) 7

24. The impulse response of a continuous time system is given by $h(t) = \delta(t-1) + \delta(t-3)$. The value of the step response at $t = 2$ is :

(1) 0 (2) 1

(3) 2 (4) 3

25. Which resistive component is designed to be temperature sensitive ?

(1) Thermistor (2) Rheostat

(3) Potentiometer (4) Photoconductive cell

26. If series current doubles, then :

(1) resistance is halved

(2) voltage is doubled

(3) voltage is reduced

(4) resistance is doubled

27. The initial slope of Bode Plot for transfer function having poles at the origin is :

(1) –10db/decade (2) +10db/decade

(3) –20db/decade (4) 0db/decade

28. A series R-L-C circuit has R=50 ohm, L=100 mH and C=1μF. The lower half power frequency of the circuit is :

(1) 30.55 KHz (2) 3.055 KHz

(3) 51.92 KHz (4) 1.92 KHz

29. The combined capacity of the parallel combination of two capacitors is four times their combined capacity when connected in series. This means that :

(1) Their capacitance are equal

(2) Their capacitance are 1μF and 2μ

(3) Their capacitances are 0.5μF and 1μF

(4) Their capacitances are infinite

30. The angular Velocity of 4 pole 2 KW Induction motor is 2π radians per second. Therefore, its speed in rpm should be :

(1) 15 (2) 30

(3) 60 (4) 90

31. The function $f(x) = 2x - x^2 + 3$ has ..... .

(1) a maximum at $x = 1$ and a minimum at $x = 5$

(2) a maximum at $x = 1$ and a minimum at $x = -5$

(3) only a maximum at $x = 1$

(4) only a minimum at $x = 1$

32. Two readings obtained on a 440V (2-wire) system with a voltmeter having resistance of 60 MΩ were i) 75V between positive mains and earth and ii) 25V between negative main and earth. The insulation resistance of each main is ..... and ..... respectively.

(1) 0.816 MΩ and 0.272 MΩ

(2) 0.45 MΩ and 0.15 MΩ

(3) 80 MΩ and 240 MΩ

(4) 75 MΩ and 25 MΩ

33. Induction motors are called asynchronous because ..... .

(1) They are rotating transformers

(2) They work on principles of induction

(3) Synchronously rotating field is absent

(4) Their rotor can never run at synchronous speed

34. The maximum torque of IM occurs when :

(1) rotor reactance equals its resistance

(2) pf is unity

(3) cu losses are minimum

(4) rotor slots are even in number

35. The instantaneous power in an ac circuit varies with the frequency ..... that of supply frequency.

(1) two times
(2) three times
(3) equal to
(4) four times

36. Calculate the values of two resistances which when connected in series gives 50Ω and 8Ω when connected in parallel ?

(1) 40Ω and 10Ω
(2) 36Ω and 14Ω
(3) 30Ω and 20Ω
(4) None of the above

37. The rms value of $i = 12\sin \omega t + 6 \sin(3 \omega t - \pi/6) + 4 \sin(5 \omega t + \pi/3)$:

(1) 4.69 A
(2) 14 A
(3) 15.5 A
(4) 9.74 A

38. The primary mmf is least affected by the secondary terminal conditions in a :

(1) power transformer
(2) potential transformer
(3) current transformer
(4) distribution transformer

39. Two players, A and B, alternately keep rolling a fair dice. The person to get a six first wins the game. Given that player A starts the game, the probability that A wins the game is :

(1) 5/11
(2) 1/2
(3) 7/13
(4) 6/11

40. Consider 3, 3 # matrix with every element being equal to 1. Its only non-zero eigen value is :

(1) 3,0,0
(2) 2,0,0
(3) 1,0,0
(4) 4,0,0

41. A single-phase thyristor-bridge rectifier is fed from a 230V, 50 Hz single-phase AC mains. If it is delivering a constant DC current of 10 A, at firing angle of 30°, then value of the power factor at AC mains is :

(1) 0.87
(2) 0.9
(3) 0.78
(4) 0.45

42. A closed loop system has the characteristic equation given by For this system to be stable, which one of the following conditions should be satisfied ?

(1) $0 < k < 0.5$
(2) $0.5 < k < 1$
(3) $0 < k < 1$
(4) $k > 1$

43. A 4 pole induction machine is working as an induction generator. The generator supply frequency is 60 Hz. The rotor current frequency is 5 Hz. The mechanical speed of the rotor in RPM is :

(1) 1350
(2) 1650
(3) 1950
(4) 2250

44. An urn contains 5 red balls and 5 black balls. In the first draw, one ball is picked at random and discarded without noticing its colour. The probability to get a red ball in the second draw is :

(1) 1/2
(2) 4/9
(3) 5/9
(4) 6/9

45. Consider a solid sphere of radius 5 cm made of a perfect electric conductor. If one million electrons are added to this sphere, these electrons will be distributed :

(1) uniformly over the entire volume of the sphere
(2) uniformly over the outer surface of the sphere
(3) concentrated around the centre of the sphere
(4) along a straight line passing through the centre of the sphere

46. Let x and y be integers satisfying the following equations

$2x^2 + y^2 = 34$

$x + 2y = 11$

The value of $(x + y)$ is :

(1) 7 (2) 8

(3) 4 (4) 5

47. A 3-phase, 4-pole, 400 V, 50 Hz squirrel-cage induction motor is operating at a slip of 0.02. The speed of the rotor flux in mechanical rad/sec, sensed by a stationary observer, is closest to :

(1) 1500 (2) 1470

(3) 157 (4) 154

48. A stationary closed Lissajous pattern on an oscilloscope has 3 horizontal tangencies and 2 vertical tangencies for a horizontal input with frequency 3 kHz. The frequency of the vertical input is :

(1) 1.5 KHz (2) 2 KHz

(3) 3 KHz (4) 4.5 KHz

49. The range of k for which all the roots of the equation are in the left half of the complex s-plane is :

(1) $0 < k < 6$

(2) $0 < k < 16$

(3) $6 < k < 36$

(4) $6 < k < 16$

50. The eigen values of the matrix given below are :

$$\begin{matrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ 0 & -3 & -4 \end{matrix}$$

(1) (0,-1,-3) (2) (0,-2,-3)

(3) (0,2,3) (4) (0,1,3)

51. Leakage flux in an induction motor is :

(1) flux that leaks through the machine

(2) flux that links both stator and rotor windings

(3) flux that links none of the windings

(4) flux that links the stator winding or the rotor winding but not both

52. The angle δ in the swing equation of a synchronous generator is the :

(1) angle between stator voltage and current

(2) angular displacement of the rotor with respect to the stator

(3) angular displacement of the stator mmf with respect to a synchronously rotating axis

(4) angular displacement of an axis fixed to the rotor with respect to a synchronously rotating axis

53. A band-limited signal with a maximum frequency of 5 kHz is to be sampled. According to the sampling theorem, the sampling frequency in kHz which is ***not*** valid is ?

(1) 5 (2) 12

(3) 15 (4) 20

54. A function $2y = 5x^2 + 10x$ is defined over an open interval $x = (1,2)$. At least at one point in this interval, dy/dx is exactly :

(1) 20 (2) 25

(3) 30 (4) 35

55. The typical ratio of latching current to holding current in a 20 A thyristor is :

(1) 5.0 (2) 2.0

(3) 1.0 (4) 0.5

56. Let $f(x) = xe^{-x}$ The maximum value of the function in the interval $(0, \infty)$ is :

(1) e^{-1} (2) e

(3) $1 - e^{-1}$ (4) $1 + e^{-1}$

57. Let $X(s) = (3s+5)/(s^2+10s+21)$ be the Laplace Transform of a signal x(t). Then, $x(0^+)$ is :

(1) 0 (2) 3

(3) 5 (4) 21

58. An 8-pole, 3-phase, 50 Hz induction motor is operating at a speed of 700 rpm. The frequency of the rotor current of the motor in Hz is :

(1) 3.33 Hz (2) 4.44 Hz

(3) 5.55 Hz (4) 6.66 Hz

59. For a specified input voltage and frequency, if the equivalent radius of the core of a transformer is reduced by half, the factor by which the number of turns in the primary should change to maintain the same no load current is :

(1) 1/4 (2) 1/2

(3) 2 (4) 4

60. The undesirable property of an electrical insulating material is :

(1) High dielectric strength

(2) High relative permittivity

(3) High thermal conductivity

(4) High insulation resistivity

61. In the formation of Routh-Hurwitz array for a polynomial, all the elements of a row have zero values. This premature termination of the array indicates the presence of :

(1) Only one root at the origin

(2) Imaginary roots

(3) Only positive real roots

(4) Only negative real roots

62. In an oscilloscope screen, linear sweep is applied at the :

(1) Vertical axis

(2) Horizontal axis

(3) Origin

(4) Both horizontal and vertical axis

63. A cascade of three identical modulo-5 counters has an overall modulus of :

(1) 5 (2) 25

(3) 125 (4) 625

64. A system matrix is given as follows :

$$\begin{matrix} 0 & 1 & -1 \\ -6 & -11 & 6 \\ -6 & -11 & 5 \end{matrix}$$

The absolute value of the ratio of the maximum eigen value to the minimum eigen value is :

(1) 1/3 (2) 1/2

(3) 1/4 (4) 1/5

65. The phase cross-over frequency of the transfer function $G(s) = 100/(s+1)^3$ in rad/s is :

(1) $\sqrt{3}$ (2) $1/\sqrt{3}$

(3) 3 (4) $3\sqrt{3}$

66. Consider a continuous-time system with input x(t) and output y(t) given by $y(t) = x(t) \cos t$. This system is :

(1) linear and time-invariant

(2) non-linear and time-invariant

(3) linear and time-varying

(4) non-linear and time-varying

67. A temperature in the range of -40 °C to 55 °C is to be measured with a resolution of 0.1 °C. The minimum number of ADC bits required to get a matching dynamic range of the temperature sensor is :

(1) 8 (2) 10

(3) 12 (4) 14

68. A DC shunt generator delivers 45 A at a terminal voltage of 220 V. The armature and the shunt field resistances are 0.01 Ω and 44 Ω respectively. The stray losses are 375 W. The percentage efficiency of the DC generator is :

(1) 86.84% (2) 90.4%

(3) 94.6% (4) 82.3%

69. A hollow metallic sphere of radius r is kept at potential of 1 Volt. The total electric flux coming out of the concentric spherical surface of radius R (> r) is :

(1) $4\pi\varepsilon_0 r$ (2) $4\pi\varepsilon_0 r^2$

(3) $4\pi\varepsilon_0 R$ (4) $4\pi\varepsilon_0 R^2$

70. In a synchronous machine, hunting is predominantly damped by :

(1) mechanical losses in the rotor

(2) iron losses in the rotor

(3) copper losses in the stator

(4) copper losses in the rotor

71. In a long transmission line with r,l,g and c are the resistance, inductance, shunt conductance and capacitance per unit length, respectively, the condition for distortion less transmission is :

(1) rc = lg

(2) rc = $\sqrt{l/c}$

(3) rg = lc

(4) g = .$\sqrt{c/l}$

72. For a fully transposed transmission line :

(1) positive, negative and zero sequence impedances are equal

(2) positive and negative sequence impedances are equal

(3) zero and positive sequence impedances are equal

(4) negative and zero sequence impedances are equal

73. A 183-bus power system has 150 PQ buses and 32 PV buses. In the general case, to obtain the load flow solution using Newton-Raphson method in polar coordinates, the minimum number of simultaneous equations to be solved is :

(1) 443 (2) 332

(3) 554 (4) 667

74. Which one of the following statements is true for all real symmetric matrices ?

(1) All the eigen values are real

(2) All the eigen values are positive

(3) All the eigen values are distinct

(4) Sum of all the eigen values is zero

75. All the values of the multi-valued complex function 1^i, where $i = \sqrt{-1}$, are :

(1) purely imaginary

(2) real and non-negative

(3) on the unit circle

(4) equal in real and imaginary parts

76. Two identical coupled inductors are connected in series. The measured inductances for the two possible series connections are 380 μH and 240 μH. Their mutual inductance in μH is :

(1) 35 (2) 25

(3) 54 (4) 43

77. A three-phase, 4 pole, self excited induction generator is feeding power to a load at a frequency F_1. If the load is partially removed, the frequency becomes F_2. If the speed of the generator is maintained at 1500 rpm in both the cases, then :

(1) $F_1 F_2 > 50$Hz and $F_1 > F_2$

(2) $F_1 < 50$ Hz and $F_2 > 50$ Hz

(3) $F_1 F_2 < 50$Hz and $F_1 > F_2$

(4) $F_1 > 50$ Hz and $F_2 < 50$ Hz

78. Shunt reactors are sometimes used in high voltage transmission system to :

(1) limit the short circuit current through the line.

(2) compensate for the series reactance of the line under heavily loaded condition.

(3) limit over-voltages at the load side under lightly loaded condition.

(4) compensate for the voltage drop in the line under heavily loaded condition.

79. While measuring power of a three-phase balanced load by the two-wattmeter method, the readings are 100 W and 250 W. The power factor of the load is :

(1) 0.802 (2) 0.943

(3) 0.754 (4) 0.654

80. Which of the following is an invalid state in an 8-4-2-1. Binary Coded Decimal counter ?

(1) 1 0 0 0 (2) 1 0 0 1

(3) 0 0 1 1 (4) 1 1 0 0

81. In a constant V/f control of induction motor, the ratio V/f is maintained constant from 0 to base frequency, where V is the voltage applied to the motor at fundamental frequency f. Which of the following statements relating to low frequency operation of the motor is TRUE ?

(1) At low frequency, the stator flux increases from its rated value.

(2) At low frequency, the stator flux decreases from its rated value.

(3) At low frequency, the motor saturates.

(4) At low frequency, the stator flux remains unchanged at its rated value.

82. The minimum value of the function $f(x) = x^3 - 3x^2 - 24x + 100$ in the interval [–3. 3] is :

(1) 20 (2) 28

(3) 16 (4) 32

83. A 10 kHz even-symmetric square wave is passed through a bandpass filter with centre frequency at 30 kHz and 3 dB passband of 6 kHz. The filter output is :

(1) a highly attenuated square wave at 10kHz

(2) nearly zero

(3) a nearly perfect cosine wave at 30kHz

(4) a nearly perfect sine wave at 30kHz

84. For a single phase, two winding transformer, the supply frequency and voltage are both increased by 10%. The percentage changes in the hysteresis loss and eddy current loss, respectively, are :

(1) 10 and 21 (2) –10 and 21

(3) 21 and 10 (4) –21 and 10

85. Suppose that resistors Rl and R2 are connected in parallel to give an equivalent resistor R. If resistors R1 and R2 have tolerance of 1% each, the equivalent resistor R for resistors Rl = 300Ω and R2 = 200Ω will have tolerance of :

(1) 0.5% (2) 1%

(3) 1.2% (4) 2%

86. A fully controlled converter bridge feeds a highly inductive load with ripple free load current. The input supply Vs to the bridge is a sinusoidal source. Triggering angle of the bridge converter is $\alpha = 30°$. The input power factor of the bridge is :

(1) 0.78 (2) 0.866

(3) 0.45 (4) 0.5

87. The transfer function of a second order real system with a perfectly flat magnitude response of unity has a pole at (2 - j3). List all the poles and zeroes :

(1) Poles at (2 ± j3), no zeroes

(2) Poles at (±2 – j3), one zero at origin

(3) Poles at (2 – j3), (–2 + j3), zeroes at (–2 – j3), (2 + j3)

(4) Poles at (2 ± j3), zeroes at (–2 ±j3)

88. A 4-point starter is used to start and control the speed of a :

(1) dc shunt motor with armature resistance control

(2) dc shunt motor with field weakening control

(3) dc series motor

(4) dc compound motor

89. A three-phase, salient pole synchronous motor is connected to an infinite bus. Ig is operated at no load a normal excitation. The field excitation of the motor is first reduced to zero and then increased in reverse direction gradually. Then the armature current :

(1) Increases continuously

(2) First increases and then decreases steeply

(3) First decreases and then increases steeply

(4) Remains constant

90. Consider the following statement :

(i) The compensating coil of a low power factor wattmeter compensates the effect of the impedance of the current coil.

(ii) The compensating coil of a low power factor wattmeter compensates the effect 0 of the impedance of the voltage coil circuit.

(1) (i) is true but (ii) is false

(2) (i) is false but (ii) is true

(3) both (i) and (ii) are true

(4) both (i) and (ii) are false

91. A low - pass filter with a cut-off frequency of 30Hz is cascaded with a high-pass filter with a cut-off frequency of 20Hz. The resultant system of filters will function as :

(1) an all-pass filter

(2) an all-stop filter

(3) an band stop (band-reject) filter

(4) a band - pass filter

92. A negative sequence relay is commonly used to protect :

(1) an alternator

(2) an transformer

(3) a transmission line

(4) a bus bar

93. For enhancing the power transmission in along EHV transmission line, the most preferred method is to connect a :

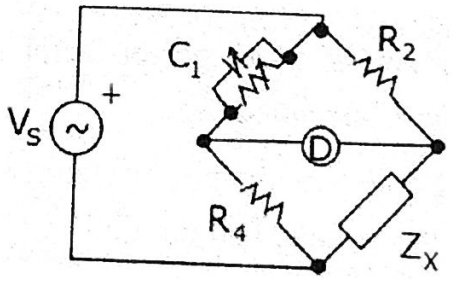
(1) Series inductive compensator in the line

(2) Shunt inductive compensator at the receiving end

(3) Series capacitive compensator in the line

(4) Shunt capacitive compensator at the sending end

94. The bridge circuit shown in the figure below is used for the measurement of an unknown element Zx. The bridge circuit is best suited when Zx is a :



(1) low resistance

(2) high resistance

(3) low Q inductor

(4) lossy capacitor

95. A dual trace oscilloscope is set to operate in the alternate mode. The control input of the multiplexer used in the y-circuit is fed with a signal having a frequency equal to :

(1) the highest frequency that the multiplexer can operate properly

(2) twice the frequency of the time base (sweep) oscillator

(3) the frequency of the time base (sweep) oscillator

(4) half the frequency of the time base (sweep) oscillator

96. A zero mean random signal is uniformly distributed between limits –a and +a and its mean square value is equal to its variance. Then the r.m.s value of the signal is :

(1) $a/\sqrt{3}$

(2) $a/\sqrt{2}$

(3) $a\sqrt{2}$

(4) $a\sqrt{3}$

97. A 220 V, DC shunt motor is operating at a speed of 1440 rpm. The armature resistance is 1.0 Ω and armature current is 10A. Of the excitation of the machine is reduced by 10%, the extra resistance to be put in the armature circuit to maintain the same speed and torque will be :

(1) 1.79 Ω

(2) 2.1 Ω

(3) 18.9 Ω

(4) 3.1 Ω

98. The direct axis and quadrature axis reactance's of a salient pole alternator are 1.2p.u and 1.0p.u respectively. The armature resistance is negligible. If this alternator is delivering rated kVA at upf and at rated voltage, then its power angle is :

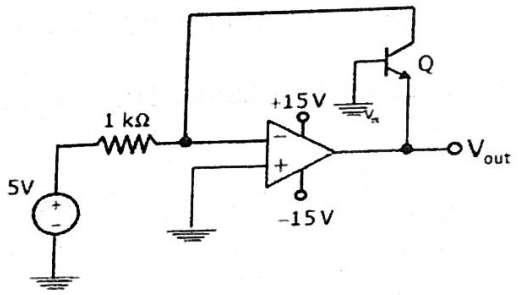
(1) 30°

(2) 45°

(3) 60°

(4) 90°

99. In the circuit shown below what is the output voltage out (V) in Volts if a silicon transistor Q and an ideal op-amp are used ?



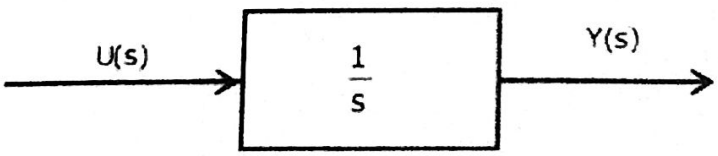
(1) –15

(2) –0.7

(3) +0.7

(4) +15

100. Assuming zero initial condition, the response y(t) of the system given below to a unit step input u(t) is :



(1) u(t)

(2) tu(t)

(3) $t^2 u(t)/2$

(4) $e^{-tu}(t)$

Total No. of Printed Pages : 21

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B

SET-X

Ph.D./URS-EE-Jan-2022

SUBJECT : Electrical Engineering.

Sr. No. 10014

Time : **1¼ Hours** Max. Marks : **100** Total Questions : **100**

Roll No. (in figures)_____ (in words) _____

Name _____ Father's Name_____

Mother's Name_____ Date of Examination_____

(Signature of the Candidate) (Signature of the Invigilator)

CANDIDATES MUST READ THE FOLLOWING INFORMATION/INSTRUCTIONS BEFORE STARTING THE QUESTION PAPER.

1. ***All questions are compulsory.***
2. The candidates ***must return*** the question booklet as well as OMR Answer-Sheet to the Invigilator concerned before leaving the Examination Hall, failing which a case of use of unfair-means / mis-behaviour will be registered against him / her, in addition to lodging of an FIR with the police. Further the answer-sheet of such a candidate will not be evaluated.
3. Keeping in view the transparency of the examination system, carbonless OMR Sheet is provided to the candidate so that a copy of OMR Sheet may be kept by the candidate.
4. Question Booklet along with answer key of all the A, B, C & D code will be got uploaded on the University website after the conduct of Entrance Examination. In case there is any discrepancy in the Question Booklet/Answer Key, the same may be brought to the notice of the Controller of Examination in writing/through E.Mail within 24 hours of uploading the same on the University Website. Thereafter, no complaint in any case, will be considered.
5. The candidate ***must not*** do any rough work or writing in the OMR Answer-Sheet. Rough work, if any, may be done in the question booklet itself. Answers ***must not*** be ticked in the question booklet.
6. ***There will be no negative marking. Each correct answer will be awarded one full mark. Cutting, erasing, overwriting and more than one answer in OMR Answer-Sheet will be treated as incorrect answer.***
7. Use only **Black** or **Blue Ball Point Pen** of good quality in the OMR Answer-Sheet.
8. *Before answering the questions, the candidates should ensure that they have been supplied correct and complete booklet. Complaints, if any, regarding misprinting etc. will not be entertained* **30** *minutes after starting of the examination.*

1. A single-phase thyristor-bridge rectifier is fed from a 230V, 50 Hz single-phase AC mains. If it is delivering a constant DC current of 10 A, at firing angle of 30°, then value of the power factor at AC mains is :

(1) 0.87 (2) 0.9

(3) 0.78 (4) 0.45

2. A closed loop system has the characteristic equation given by For this system to be stable, which one of the following conditions should be satisfied ?

(1) $0 < k < 0.5$ (2) $0.5 < k < 1$

(3) $0 < k < 1$ (4) $k > 1$

3. A 4 pole induction machine is working as an induction generator. The generator supply frequency is 60 Hz. The rotor current frequency is 5 Hz. The mechanical speed of the rotor in RPM is :

(1) 1350 (2) 1650

(3) 1950 (4) 2250

4. An urn contains 5 red balls and 5 black balls. In the first draw, one ball is picked at random and discarded without noticing its colour. The probability to get a red ball in the second draw is :

(1) 1/2 (2) 4/9

(3) 5/9 (4) 6/9

5. Consider a solid sphere of radius 5 cm made of a perfect electric conductor. If one million electrons are added to this sphere, these electrons will be distributed :

(1) uniformly over the entire volume of the sphere

(2) uniformly over the outer surface of the sphere

(3) concentrated around the centre of the sphere

(4) along a straight line passing through the centre of the sphere

6. Let x and y be integers satisfying the following equations

$2x^2 + y^2 = 34$

$x + 2y = 11$

The value of $(x + y)$ is :

(1) 7 (2) 8

(3) 4 (4) 5

7. A 3-phase, 4-pole, 400 V, 50 Hz squirrel-cage induction motor is operating at a slip of 0.02. The speed of the rotor flux in mechanical rad/sec, sensed by a stationary observer, is closest to :

(1) 1500 (2) 1470

(3) 157 (4) 154

8. A stationary closed Lissajous pattern on an oscilloscope has 3 horizontal tangencies and 2 vertical tangencies for a horizontal input with frequency 3 kHz. The frequency of the vertical input is :

(1) 1.5 KHz (2) 2 KHz

(3) 3 KHz (4) 4.5 KHz

9. The range of k for which all the roots of the equation are in the left half of the complex s-plane is :

(1) $0 < k < 6$

(2) $0 < k < 16$

(3) $6 < k < 36$

(4) $6 < k < 16$

10. The eigen values of the matrix given below are :

$$\begin{matrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ 0 & -3 & -4 \end{matrix}$$

(1) (0,-1,-3) (2) (0,-2,-3)

(3) (0,2,3) (4) (0,1,3)

11. If the fault current is 2000 A, the relay setting 50% and CT ratio is 400/5, the P.S.M is :

(1) 23 (2) 50

(3) 15 (4) None of the above

12. NAND and NOR gates are called 'universal gates' primarily because :

(1) they are available everywhere

(2) they are widely used in IC packages

(3) they can be easily combined to produce AND, OR and NOR gates

(4) they can be manufactured easily

13. The minimum number of 2-input NAND gates required to implement a 2-input XOR gate is :

(1) 4 (2) 5

(3) 6 (4) 7

14. The impulse response of a continuous time system is given by $h(t) = \delta(t - 1) + \delta(t - 3)$. The value of the step response at $t = 2$ is :

(1) 0 (2) 1

(3) 2 (4) 3

15. Which resistive component is designed to be temperature sensitive ?

(1) Thermistor

(2) Rheostat

(3) Potentiometer

(4) Photoconductive cell

16. If series current doubles, then :

(1) resistance is halved

(2) voltage is doubled

(3) voltage is reduced

(4) resistance is doubled

17. The initial slope of Bode Plot for transfer function having poles at the origin is :

(1) –10db/decade
(2) +10db/decade
(3) –20db/decade
(4) 0db/decade

18. A series R-L-C circuit has R=50 ohm, L=100 mH and C=1μF. The lower half power frequency of the circuit is :

(1) 30.55 KHz
(2) 3.055 KHz
(3) 51.92 KHz
(4) 1.92 KHz

19. The combined capacity of the parallel combination of two capacitors is four times their combined capacity when connected in series. This means that :

(1) Their capacitance are equal
(2) Their capacitance are 1μF and 2μ
(3) Their capacitances are 0.5μF and 1μF
(4) Their capacitances are infinite

20. The angular Velocity of 4 pole 2 KW Induction motor is 2π radians per second. Therefore, its speed in rpm should be :

(1) 15
(2) 30
(3) 60
(4) 90

21. The Laplace transform of a function f(t) is :

$F(s) = 1/s(s + 1)$

As t tends to infinity, f(t) approaches

(1) 1/2
(2) Zero
(3) 1
(4) Infinity

22. Power transmission line are transposed to reduce :

(1) Skin effect
(2) Ferranti effect
(3) Transmission loss
(4) Interference with neighbouring communication

23. An open loop Transfer function of unity feedback system is given by :

$G(s) = 1/(s+2)^2$

The closed loop transfer function will have poles at

(1) $-2, -2$ (2) $-2, -1$

(3) $-2+j, -2-j$ (4) $-2, 2$

24. A 1mA galvanometer with internal resistance of 50 ohm is to be converted to measure 5A (full scale). What is the value of shunt resistance required for this conversion ?

(1) 1 ohm (2) 0.01 ohm

(3) 1 Kilo ohm (4) 10 ohm

25. The average power delivered to an impedance (4-j3) Ω by a current $5\cos(100\pi+100)$ A is :

(1) 44.2 W (2) 50 W

(3) 62.5 W (4) 125 W

26. The full load copper loss and iron loss of a transformer are 6400W and 500W, respectively. The above copper loss and iron loss at half load will be :

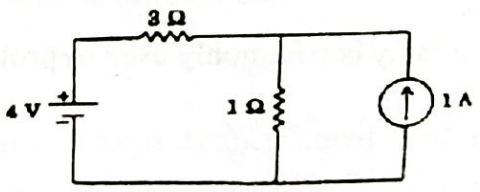
(1) 3200 Wand 250 W respectively

(2) 3200 Wand 500 W respectively

(3) 1600 Wand 125 W respectively

(4) 1600 Wand 500 W respectively

27. For the circuit shown below, the voltage across the 1 ohm resistor is given by :



(1) 7/4 (2) 5/4

(3) c (4) 7/3

28. In a synchronous machine the rotor speed becomes more than the synchronous speed during hunting, the damping bars develop :

(1) Synchronous motor torque

(2) DC motor torque

(3) Induction motor torque

(4) Induction generator torque

29. The per unit value of a 4 ohm resistor at 100 MVA base and 10 KV base voltage is :

(1) 2 pu (2) 4 pu

(3) 0.4 pu (4) 40 pu

30. The voltage regulation of transformer having 2% and 5% reactance, at full load, 0.8 pf lagging is :

(1) 4.6% (2) –4.6%

(3) –1.4% (4) 6.4%

31. A low - pass filter with a cut-off frequency of 30Hz is cascaded with a high-pass filter with a cut-off frequency of 20Hz. The resultant system of filters will function as :

(1) an all-pass filter

(2) an all-stop filter

(3) an band stop (band-reject) filter

(4) a band - pass filter

32. A negative sequence relay is commonly used to protect :

(1) an alternator

(2) an transformer

(3) a transmission line

(4) a bus bar

33. For enhancing the power transmission in along EHV transmission line, the most preferred method is to connect a :

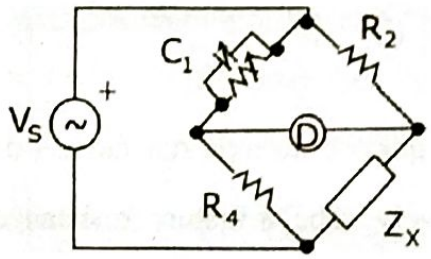
(1) Series inductive compensator in the line

(2) Shunt inductive compensator at the receiving end

(3) Series capacitive compensator in the line

(4) Shunt capacitive compensator at the sending end

34. The bridge circuit shown in the figure below is used for the measurement of an unknown element Zx. The bridge circuit is best suited when Zx is a :



(1) low resistance

(2) high resistance

(3) low Q inductor

(4) lossy capacitor

35. A dual trace oscilloscope is set to operate in the alternate mode. The control input of the multiplexer used in the y-circuit is fed with a signal having a frequency equal to :

(1) the highest frequency that the multiplexer can operate properly

(2) twice the frequency of the time base (sweep) oscillator

(3) the frequency of the time base (sweep) oscillator

(4) half the frequency of the time base (sweep) oscillator

36. A zero mean random signal is uniformly distributed between limits –a and +a and its mean square value is equal to its variance. Then the r.m.s value of the signal is :

(1) $a/\sqrt{3}$ (2) $a/\sqrt{2}$

(3) $a\sqrt{2}$ (4) $a\sqrt{3}$

37. A 220 V, DC shunt motor is operating at a speed of 1440 rpm. The armature resistance is 1.0 Ω and armature current is 10A. Of the excitation of the machine is reduced by 10%, the extra resistance to be put in the armature circuit to maintain the same speed and torque will be :

(1) 1.79 Ω

(2) 2.1 Ω

(3) 18.9 Ω

(4) 3.1 Ω

38. The direct axis and quadrature axis reactance's of a salient pole alternator are 1.2p.u and 1.0p.u respectively. The armature resistance is negligible. If this alternator is delivering rated kVA at upf and at rated voltage, then its power angle is :

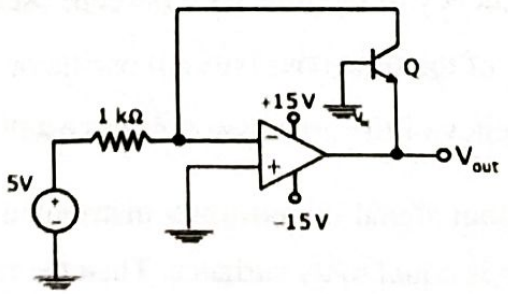
(1) 30°

(2) 45°

(3) 60°

(4) 90°

39. In the circuit shown below what is the output voltage out (V) in Volts if a silicon transistor Q and an ideal op-amp are used ?



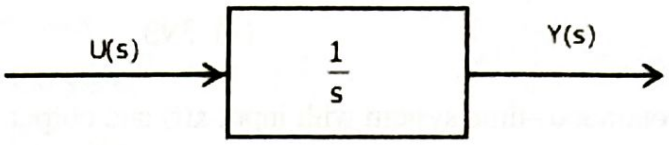
(1) –15

(2) –0.7

(3) +0.7

(4) +15

40. Assuming zero initial condition, the response y(t) of the system given below to a unit step input u(t) is :



(1) u(t) (2) tu(t)

(3) $t^2 u(t)/2$ (4) $e^{-tu}(t)$

41. In the formation of Routh-Hurwitz array for a polynomial, all the elements of a row have zero values. This premature termination of the array indicates the presence of :

(1) Only one root at the origin (2) Imaginary roots

(3) Only positive real roots (4) Only negative real roots

42. In an oscilloscope screen, linear sweep is applied at the :

(1) Vertical axis

(2) Horizontal axis

(3) Origin

(4) Both horizontal and vertical axis

43. A cascade of three identical modulo-5 counters has an overall modulus of :

(1) 5 (2) 25

(3) 125 (4) 625

44. A system matrix is given as follows :

$$\begin{matrix} 0 & 1 & -1 \\ -6 & -11 & 6 \\ -6 & -11 & 5 \end{matrix}$$

The absolute value of the ratio of the maximum eigen value to the minimum eigen value is :

(1) 1/3 (2) 1/2

(3) 1/4 (4) 1/5

45. The phase cross-over frequency of the transfer function $G(s) = 100/(s+1)^3$ in rad/s is :

(1) $\sqrt{3}$

(2) $1/\sqrt{3}$

(3) 3

(4) $3\sqrt{3}$

46. Consider a continuous-time system with input x(t) and output y(t) given by $y(t) = x(t) \cos t$. This system is :

(1) linear and time-invariant

(2) non-linear and time-invariant

(3) linear and time-varying

(4) non-linear and time-varying

47. A temperature in the range of -40 °C to 55 °C is to be measured with a resolution of 0.1 °C. The minimum number of ADC bits required to get a matching dynamic range of the temperature sensor is :

(1) 8

(2) 10

(3) 12

(4) 14

48. A DC shunt generator delivers 45 A at a terminal voltage of 220 V. The armature and the shunt field resistances are 0.01 Ω and 44 Ω respectively. The stray losses are 375 W. The percentage efficiency of the DC generator is :

(1) 86.84%

(2) 90.4%

(3) 94.6%

(4) 82.3%

49. A hollow metallic sphere of radius r is kept at potential of 1 Volt. The total electric flux coming out of the concentric spherical surface of radius R (> r) is :

(1) $4\pi\varepsilon_0 r$

(2) $4\pi\varepsilon_0 r^2$

(3) $4\pi\varepsilon_0 R$

(4) $4\pi\varepsilon_0 R^2$

50. In a synchronous machine, hunting is predominantly damped by :

(1) mechanical losses in the rotor

(2) iron losses in the rotor

(3) copper losses in the stator

(4) copper losses in the rotor

51. The function $f(x) = 2x - x^2 + 3$ has ..... .

(1) a maximum at $x = 1$ and a minimum at $x = 5$

(2) a maximum at $x = 1$ and a minimum at $x = -5$

(3) only a maximum at $x = 1$

(4) only a minimum at $x = 1$

52. Two readings obtained on a 440V (2-wire) system with a voltmeter having resistance of 60 MΩ were i) 75V between positive mains and earth and ii) 25V between negative main and earth. The insulation resistance of each main is ..... and ..... respectively.

(1) 0.816 MΩ and 0.272 MΩ

(2) 0.45 MΩ and 0.15 MΩ

(3) 80 MΩ and 240 MΩ

(4) 75 MΩ and 25 MΩ

53. Induction motors are called asynchronous because ..... .

(1) They are rotating transformers

(2) They work on principles of induction

(3) Synchronously rotating field is absent

(4) Their rotor can never run at synchronous speed

54. The maximum torque of IM occurs when :

(1) rotor reactance equals its resistance

(2) pf is unity

(3) cu losses are minimum

(4) rotor slots are even in number

55. The instantaneous power in an ac circuit varies with the frequency ..... that of supply frequency.

(1) two times
(2) three times
(3) equal to
(4) four times

56. Calculate the values of two resistances which when connected in series gives 50Ω and 8Ω when connected in parallel ?

(1) 40Ω and 10Ω
(2) 36Ω and 14Ω
(3) 30Ω and 20Ω
(4) None of the above

57. The rms value of $i = 12\sin \omega t + 6 \sin(3 \omega t - \pi/6) + 4 \sin(5 \omega t + \pi/3)$:

(1) 4.69 A
(2) 14 A
(3) 15.5 A
(4) 9.74 A

58. The primary mmf is least affected by the secondary terminal conditions in a :

(1) power transformer
(2) potential transformer
(3) current transformer
(4) distribution transformer

59. Two players, A and B, alternately keep rolling a fair dice. The person to get a six first wins the game. Given that player A starts the game, the probability that A wins the game is :

(1) 5/11
(2) 1/2
(3) 7/13
(4) 6/11

60. Consider 3, 3 # matrix with every element being equal to 1. Its only non-zero eigen value is :

(1) 3,0,0
(2) 2,0,0
(3) 1,0,0
(4) 4,0,0

61. In a long transmission line with r,l,g and c are the resistance, inductance, shunt conductance and capacitance per unit length, respectively, the condition for distortion less transmission is :

(1) $rc = lg$

(2) $rc = \sqrt{l/c}$

(3) $rg = lc$

(4) $g = .\sqrt{c/l}$

62. For a fully transposed transmission line :

(1) positive, negative and zero sequence impedances are equal

(2) positive and negative sequence impedances are equal

(3) zero and positive sequence impedances are equal

(4) negative and zero sequence impedances are equal

63. A 183-bus power system has 150 PQ buses and 32 PV buses. In the general case, to obtain the load flow solution using Newton-Raphson method in polar coordinates, the minimum number of simultaneous equations to be solved is :

(1) 443

(2) 332

(3) 554

(4) 667

64. Which one of the following statements is true for all real symmetric matrices ?

(1) All the eigen values are real

(2) All the eigen values are positive

(3) All the eigen values are distinct

(4) Sum of all the eigen values is zero

65. All the values of the multi-valued complex function 1^i, where $i = \sqrt{-1}$, are :

(1) purely imaginary

(2) real and non-negative

(3) on the unit circle

(4) equal in real and imaginary parts

66. Two identical coupled inductors are connected in series. The measured inductances for the two possible series connections are 380 μH and 240 μH. Their mutual inductance in μH is :

(1) 35 (2) 25

(3) 54 (4) 43

67. A three-phase, 4 pole, self excited induction generator is feeding power to a load at a frequency F_1. If the load is partially removed, the frequency becomes F_2. If the speed of the generator is maintained at 1500 rpm in both the cases, then :

(1) $F_1 F_2 > 50$Hz and $F_1 > F_2$

(2) $F_1 < 50$ Hz and $F_2 > 50$ Hz

(3) $F_1 F_2 < 50$Hz and $F_1 > F_2$

(4) $F_1 > 50$ Hz and $F_2 < 50$ Hz

68. Shunt reactors are sometimes used in high voltage transmission system to :

(1) limit the short circuit current through the line.

(2) compensate for the series reactance of the line under heavily loaded condition.

(3) limit over-voltages at the load side under lightly loaded condition.

(4) compensate for the voltage drop in the line under heavily loaded condition.

69. While measuring power of a three-phase balanced load by the two-wattmeter method, the readings are 100 W and 250 W. The power factor of the load is :

(1) 0.802 (2) 0.943

(3) 0.754 (4) 0.654

70. Which of the following is an invalid state in an 8-4-2-1. Binary Coded Decimal counter ?

(1) 1 0 0 0 (2) 1 0 0 1

(3) 0 0 1 1 (4) 1 1 0 0

71. In a constant V/f control of induction motor, the ratio V/f is maintained constant from 0 to base frequency, where V is the voltage applied to the motor at fundamental frequency f. Which of the following statements relating to low frequency operation of the motor is TRUE ?

(1) At low frequency, the stator flux increases from its rated value.

(2) At low frequency, the stator flux decreases from its rated value.

(3) At low frequency, the motor saturates.

(4) At low frequency, the stator flux remains unchanged at its rated value.

72. The minimum value of the function $f(x) = x^3 - 3x^2 - 24x + 100$ in the interval [–3. 3] is :

(1) 20 (2) 28

(3) 16 (4) 32

73. A 10 kHz even-symmetric square wave is passed through a bandpass filter with centre frequency at 30 kHz and 3 dB passband of 6 kHz. The filter output is :

(1) a highly attenuated square wave at 10kHz

(2) nearly zero

(3) a nearly perfect cosine wave at 30kHz

(4) a nearly perfect sine wave at 30kHz

74. For a single phase, two winding transformer, the supply frequency and voltage are both increased by 10%. The percentage changes in the hysteresis loss and eddy current loss, respectively, are :

(1) 10 and 21 (2) –10 and 21

(3) 21 and 10 (4) –21 and 10

75. Suppose that resistors Rl and R2 are connected in parallel to give an equivalent resistor R. If resistors R1 and R2 have tolerance of 1% each, the equivalent resistor R for resistors Rl = 300Ω and R2 = 200Ω will have tolerance of :

(1) 0.5% (2) 1%

(3) 1.2% (4) 2%

76. A fully controlled converter bridge feeds a highly inductive load with ripple free load current. The input supply Vs to the bridge is a sinusoidal source. Triggering angle of the bridge converter is $\alpha = 30°$. The input power factor of the bridge is :

(1) 0.78

(2) 0.866

(3) 0.45

(4) 0.5

77. The transfer function of a second order real system with a perfectly flat magnitude response of unity has a pole at (2 - j3). List all the poles and zeroes :

(1) Poles at $(2 \pm j3)$, no zeroes

(2) Poles at $(\pm 2 - j3)$, one zero at origin

(3) Poles at $(2 - j3)$, $(-2 + j3)$, zeroes at $(-2 - j3)$, $(2 + j3)$

(4) Poles at $(2 \pm j3)$, zeroes at $(-2 \pm j3)$

78. A 4-point starter is used to start and control the speed of a :

(1) dc shunt motor with armature resistance control

(2) dc shunt motor with field weakening control

(3) dc series motor

(4) dc compound motor

79. A three-phase, salient pole synchronous motor is connected to an infinite bus. Ig is operated at no load a normal excitation. The field excitation of the motor is first reduced to zero and then increased in reverse direction gradually. Then the armature current :

(1) Increases continuously

(2) First increases and then decreases steeply

(3) First decreases and then increases steeply

(4) Remains constant

80. Consider the following statement :

(i) The compensating coil of a low power factor wattmeter compensates the effect of the impedance of the current coil.

(ii) The compensating coil of a low power factor wattmeter compensates the effect 0 of the impedance of the voltage coil circuit.

(1) (i) is true but (ii) is false

(2) (i) is false but (ii) is true

(3) both (i) and (ii) are true

(4) both (i) and (ii) are false

81. The torque speed characteristics of two phase induction motor is largely affected by :

(1) Voltage

(2) R/X and speed

(3) X/R

(4) Supply voltage frequency

82. A 3 phase, 50 Hz, 6 poles Induction motor has rotor resistance of 0.1 Ω and reactance of 0.92 Ω. Neglect the voltage drop in stator and assume that rotor resistance is constant. Given that full load slip is 3%. The ratio of maximum torque to full load torque i :

(1) 1.567 (2) 1.712

(3) 1.94 (4) 2.134

83. An analog voltmeter uses external multiplier settings. With a multiplier setting of 20 kΩ, it reads 440V and with a multiplier setting of 80 kΩ it reads 352 V. For a multiplier setting of 40 kΩ, the voltmeter reads ..... .

(1) 371 V (2) 383 V

(3) 394 V (4) 406 V

84. In s-domain representation, the transfer function of a system is ..... .

(1) Laplace transform of unit step response of a system

(2) Laplace transform of OC test/Laplace transform of SC test

(3) Zeros/poles

(4) Output/ Input

85. The transfer function of a compensator is given by :

$G(s) = (s + a)/(s + b)$

$G(s)$ is lead compensator if

(1) a=l, b=2 (2) a=3, b=2

(3) a=7, b=5 (4) a=3, b=1

86. Nichol's chart is used to determine :

(1) transient response

(2) closed loop frequency response

(3) open loop frequency response

(4) settling time due to step input

87. Following is ***not*** a performance specification for transient response of a system :

(1) Settling time (2) Peak overshoot

(3) Steady state error (4) Rise time

88. A 3-phase diode bridge rectifier is fed from a 400V (rms), 50 Hz, 3-phase ac source. If the load is purely resistive, then peak instantaneous output voltage is equal to :

(1) 400 V (2) $400\sqrt{2}$

(3) $400\sqrt{(2/3)}$ (4) $400\sqrt{3}$

89. Power consumed by a balanced 3-phase, 3-wire load is measured by two wattmeter method. The first wattmeter reads twice that of second. Then the load impedance angle in radians is :

(1) $\pi/12$ (2) $\pi/8$

(3) $\pi/6$ (4) $\pi/3$

90. The two voltage surges are defined as 1/50 μs and 3/50μ s. Which surge is more harmful ?

(1) 1/50 μs

(2) 3/50 μs

(3) Both equally

(4) None of the above

91. Leakage flux in an induction motor is :

(1) flux that leaks through the machine

(2) flux that links both stator and rotor windings

(3) flux that links none of the windings

(4) flux that links the stator winding or the rotor winding but not both

92. The angle δ in the swing equation of a synchronous generator is the :

(1) angle between stator voltage and current

(2) angular displacement of the rotor with respect to the stator

(3) angular displacement of the stator mmf with respect to a synchronously rotating axis

(4) angular displacement of an axis fixed to the rotor with respect to a synchronously rotating axis

93. A band-limited signal with a maximum frequency of 5 kHz is to be sampled. According to the sampling theorem, the sampling frequency in kHz which is ***not*** valid is ?

(1) 5 (2) 12

(3) 15 (4) 20

94. A function $2y = 5x^2 + 10x$ is defined over an open interval $x = (1,2)$. At least at one point in this interval, dy/dx is exactly :

(1) 20 (2) 25

(3) 30 (4) 35

95. The typical ratio of latching current to holding current in a 20 A thyristor is :

(1) 5.0 (2) 2.0

(3) 1.0 (4) 0.5

96. Let $f(x) = xe^{-x}$ The maximum value of the function in the interval $(0, \infty)$ is :

(1) e^{-1} (2) e

(3) $1 - e^{-1}$ (4) $1 + e^{-1}$

97. Let $X(s) = (3s+5)/(s^2+10s+21)$ be the Laplace Transform of a signal x(t). Then, $x(0^+)$ is :

(1) 0 (2) 3

(3) 5 (4) 21

98. An 8-pole, 3-phase, 50 Hz induction motor is operating at a speed of 700 rpm. The frequency of the rotor current of the motor in Hz is :

(1) 3.33 Hz

(2) 4.44 Hz

(3) 5.55 Hz

(4) 6.66 Hz

99. For a specified input voltage and frequency, if the equivalent radius of the core of a transformer is reduced by half, the factor by which the number of turns in the primary should change to maintain the same no load current is :

(1) 1/4 (2) 1/2

(3) 2 (4) 4

100. The undesirable property of an electrical insulating material is :

(1) High dielectric strength

(2) High relative permittivity

(3) High thermal conductivity

(4) High insulation resistivity

Total No. of Printed Pages : 21

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C

Ph.D./URS-EE-Jan-2022

SET-X

SUBJECT : Electrical Engineering.

10015

Sr. No. .....

Time : **1¼ Hours** Max. Marks : **100** Total Questions : **100**

Roll No. (in figures)_____ (in words) _____

Name _____ Father's Name_____

Mother's Name_____ Date of Examination_____

_____ _____

(Signature of the Candidate) (Signature of the Invigilator)

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2. The candidates ***must return*** the question booklet as well as OMR Answer-Sheet to the Invigilator concerned before leaving the Examination Hall, failing which a case of use of unfair-means / mis-behaviour will be registered against him / her, in addition to lodging of an FIR with the police. Further the answer-sheet of such a candidate will not be evaluated.
3. Keeping in view the transparency of the examination system, carbonless OMR Sheet is provided to the candidate so that a copy of OMR Sheet may be kept by the candidate.
4. Question Booklet along with answer key of all the A, B, C & D code will be got uploaded on the University website after the conduct of Entrance Examination. In case there is any discrepancy in the Question Booklet/Answer Key, the same may be brought to the notice of the Controller of Examination in writing/through E.Mail within 24 hours of uploading the same on the University Website. Thereafter, no complaint in any case, will be considered.
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7. Use only **Black** or **Blue Ball Point Pen** of good quality in the OMR Answer-Sheet.
8. *Before answering the questions, the candidates should ensure that they have been supplied correct and complete booklet. Complaints, if any, regarding misprinting etc. will not be entertained* **30** *minutes after starting of the examination.*

1. The torque speed characteristics of two phase induction motor is largely affected by :
   (1) Voltage
   (2) R/X and speed
   (3) X/R
   (4) Supply voltage frequency

2. A 3 phase, 50 Hz, 6 poles Induction motor has rotor resistance of 0.1 Ω and reactance of 0.92 Ω. Neglect the voltage drop in stator and assume that rotor resistance is constant. Given that full load slip is 3%. The ratio of maximum torque to full load torque i :
   (1) 1.567 (2) 1.712
   (3) 1.94 (4) 2.134

3. An analog voltmeter uses external multiplier settings. With a multiplier setting of 20 kΩ, it reads 440V and with a multiplier setting of 80 kΩ it reads 352 V. For a multiplier setting of 40 kΩ, the voltmeter reads ..... .
   (1) 371 V (2) 383 V
   (3) 394 V (4) 406 V

4. In s-domain representation, the transfer function of a system is ..... .
   (1) Laplace transform of unit step response of a system
   (2) Laplace transform of OC test/Laplace transform of SC test
   (3) Zeros/poles
   (4) Output/ Input

5. The transfer function of a compensator is given by :
   $G(s) = (s + a)/(s + b)$
   $G(s)$ is lead compensator if
   (1) a=l, b=2 (2) a=3, b=2
   (3) a=7, b=5 (4) a=3, b=1

6. Nichol's chart is used to determine :

(1) transient response

(2) closed loop frequency response

(3) open loop frequency response

(4) settling time due to step input

7. Following is ***not*** a performance specification for transient response of a system :

(1) Settling time

(2) Peak overshoot

(3) Steady state error

(4) Rise time

8. A 3-phase diode bridge rectifier is fed from a 400V (rms), 50 Hz, 3-phase ac source. If the load is purely resistive, then peak instantaneous output voltage is equal to :

(1) 400 V

(2) $400\sqrt{2}$

(3) $400\sqrt{(2/3)}$

(4) $400\sqrt{3}$

9. Power consumed by a balanced 3-phase, 3-wire load is measured by two wattmeter method. The first wattmeter reads twice that of second. Then the load impedance angle in radians is :

(1) $\pi/12$

(2) $\pi/8$

(3) $\pi/6$

(4) $\pi/3$

10. The two voltage surges are defined as 1/50 μs and 3/50μ s. Which surge is more harmful ?

(1) 1/50 μs

(2) 3/50 μs

(3) Both equally

(4) None of the above

11. A low - pass filter with a cut-off frequency of 30Hz is cascaded with a high-pass filter with a cut-off frequency of 20Hz. The resultant system of filters will function as :

(1) an all-pass filter

(2) an all-stop filter

(3) an band stop (band-reject) filter

(4) a band - pass filter

12. A negative sequence relay is commonly used to protect :

(1) an alternator

(2) an transformer

(3) a transmission line

(4) a bus bar

13. For enhancing the power transmission in along EHV transmission line, the most preferred method is to connect a :

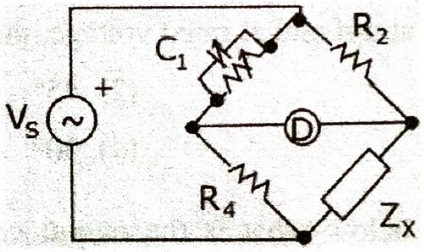
(1) Series inductive compensator in the line

(2) Shunt inductive compensator at the receiving end

(3) Series capacitive compensator in the line

(4) Shunt capacitive compensator at the sending end

14. The bridge circuit shown in the figure below is used for the measurement of an unknown element Zx. The bridge circuit is best suited when Zx is a :



(1) low resistance

(2) high resistance

(3) low Q inductor

(4) lossy capacitor

15. A dual trace oscilloscope is set to operate in the alternate mode. The control input of the multiplexer used in the y-circuit is fed with a signal having a frequency equal to :

(1) the highest frequency that the multiplexer can operate properly

(2) twice the frequency of the time base (sweep) oscillator

(3) the frequency of the time base (sweep) oscillator

(4) half the frequency of the time base (sweep) oscillator

16. A zero mean random signal is uniformly distributed between limits –a and +a and its mean square value is equal to its variance. Then the r.m.s value of the signal is :

(1) $a/\sqrt{3}$
(2) $a/\sqrt{2}$
(3) $a\sqrt{2}$
(4) $a\sqrt{3}$

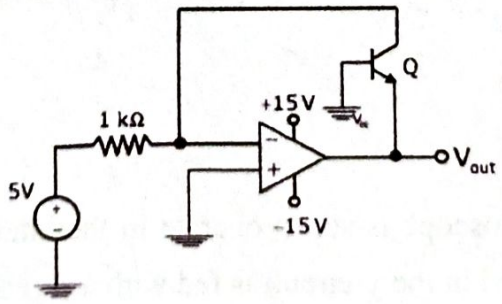
17. A 220 V, DC shunt motor is operating at a speed of 1440 rpm. The armature resistance is 1.0 Ω and armature current is 10A. Of the excitation of the machine is reduced by 10%, the extra resistance to be put in the armature circuit to maintain the same speed and torque will be :

(1) 1.79 Ω
(2) 2.1 Ω
(3) 18.9 Ω
(4) 3.1 Ω

18. The direct axis and quadrature axis reactance's of a salient pole alternator are 1.2p.u and 1.0p.u respectively. The armature resistance is negligible. If this alternator is delivering rated kVA at upf and at rated voltage, then its power angle is :

(1) 30°
(2) 45°
(3) 60°
(4) 90°

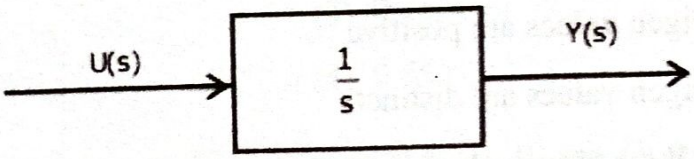
19. In the circuit shown below what is the output voltage out (V) in Volts if a silicon transistor Q and an ideal op-amp are used ?



(1) –15
(2) –0.7
(3) +0.7
(4) +15

C

20. Assuming zero initial condition, the response y(t) of the system given below to a unit step input u(t) is :



(1) u(t)

(2) tu(t)

(3) $t^2 u(t)/2$

(4) $e^{-tu}(t)$

21. In a long transmission line with r,l,g and c are the resistance, inductance, shunt conductance and capacitance per unit length, respectively, the condition for distortion less transmission is :

(1) rc = 1g

(2) rc = $\sqrt{1/c}$

(3) rg = 1c

(4) g =.$\sqrt{c/1}$

22. For a fully transposed transmission line :

(1) positive, negative and zero sequence impedances are equal

(2) positive and negative sequence impedances are equal

(3) zero and positive sequence impedances are equal

(4) negative and zero sequence impedances are equal

23. A 183-bus power system has 150 PQ buses and 32 PV buses. In the general case, to obtain the load flow solution using Newton-Raphson method in polar coordinates, the minimum number of simultaneous equations to be solved is :

(1) 443 (2) 332

(3) 554 (4) 667

24. Which one of the following statements is true for all real symmetric matrices ?

(1) All the eigen values are real

(2) All the eigen values are positive

(3) All the eigen values are distinct

(4) Sum of all the eigen values is zero

25. All the values of the multi-valued complex function 1^i, where $i = \sqrt{-1}$, are :

(1) purely imaginary

(2) real and non-negative

(3) on the unit circle

(4) equal in real and imaginary parts

26. Two identical coupled inductors are connected in series. The measured inductances for the two possible series connections are 380 μH and 240 μH. Their mutual inductance in μH is :

(1) 35

(2) 25

(3) 54

(4) 43

27. A three-phase, 4 pole, self excited induction generator is feeding power to a load at a frequency F_1. If the load is partially removed, the frequency becomes F_2. If the speed of the generator is maintained at 1500 rpm in both the cases, then :

(1) $F_1 F_2 > 50Hz$ and $F_1 > F_2$

(2) $F_1 < 50$ Hz and $F_2 > 50$ Hz

(3) $F_1 F_2 < 50Hz$ and $F_1 > F_2$

(4) $F_1 > 50$ Hz and $F_2 < 50$ Hz

28. Shunt reactors are sometimes used in high voltage transmission system to :

(1) limit the short circuit current through the line.

(2) compensate for the series reactance of the line under heavily loaded condition.

(3) limit over-voltages at the load side under lightly loaded condition.

(4) compensate for the voltage drop in the line under heavily loaded condition.

29. While measuring power of a three-phase balanced load by the two-wattmeter method, the readings are 100 W and 250 W. The power factor of the load is :

(1) 0.802 (2) 0.943

(3) 0.754 (4) 0.654

30. Which of the following is an invalid state in an 8-4-2-1. Binary Coded Decimal counter ?

(1) 1 0 0 0 (2) 1 0 0 1

(3) 0 0 1 1 (4) 1 1 0 0

31. Leakage flux in an induction motor is :

(1) flux that leaks through the machine

(2) flux that links both stator and rotor windings

(3) flux that links none of the windings

(4) flux that links the stator winding or the rotor winding but not both

32. The angle δ in the swing equation of a synchronous generator is the :

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33. A band-limited signal with a maximum frequency of 5 kHz is to be sampled. According to the sampling theorem, the sampling frequency in kHz which is ***not*** valid is ?

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(1) 20 (2) 25

(3) 30 (4) 35

35. The typical ratio of latching current to holding current in a 20 A thyristor is :

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36. Let $f(x) = xe^{-x}$ The maximum value of the function in the interval $(0, \infty)$ is :

(1) e^{-1} (2) e

(3) $1 - e^{-1}$ (4) $1 + e^{-1}$

37. Let $X(s) = (3s+5)/(s^2+10s+21)$ be the Laplace Transform of a signal x(t). Then, $x(0^+)$ is :

(1) 0 (2) 3

(3) 5 (4) 21

38. An 8-pole, 3-phase, 50 Hz induction motor is operating at a speed of 700 rpm. The frequency of the rotor current of the motor in Hz is :

(1) 3.33 Hz (2) 4.44 Hz

(3) 5.55 Hz (4) 6.66 Hz

39. For a specified input voltage and frequency, if the equivalent radius of the core of a transformer is reduced by half, the factor by which the number of turns in the primary should change to maintain the same no load current is :

(1) 1/4 (2) 1/2

(3) 2 (4) 4

40. The undesirable property of an electrical insulating material is :

(1) High dielectric strength

(2) High relative permittivity

(3) High thermal conductivity

(4) High insulation resistivity

41. The function $f(x) = 2x - x^2 + 3$ has ..... .

(1) a maximum at $x = 1$ and a minimum at $x = 5$

(2) a maximum at $x = 1$ and a minimum at $x = -5$

(3) only a maximum at $x = 1$

(4) only a minimum at $x = 1$

42. Two readings obtained on a 440V (2-wire) system with a voltmeter having resistance of 60 MΩ were i) 75V between positive mains and earth and ii) 25V between negative main and earth. The insulation resistance of each main is ..... and ..... respectively.

(1) 0.816 MΩ and 0.272 MΩ

(2) 0.45 MΩ and 0.15 MΩ

(3) 80 MΩ and 240 MΩ

(4) 75 MΩ and 25 MΩ

43. Induction motors are called asynchronous because ..... .

(1) They are rotating transformers

(2) They work on principles of induction

(3) Synchronously rotating field is absent

(4) Their rotor can never run at synchronous speed

44. The maximum torque of IM occurs when :

(1) rotor reactance equals its resistance

(2) pf is unity

(3) cu losses are minimum

(4) rotor slots are even in number

45. The instantaneous power in an ac circuit varies with the frequency ..... that of supply frequency.

(1) two times (2) three times

(3) equal to (4) four times

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45. The instantaneous power in an ac circuit varies with the frequency ..... that of supply frequency.

(1) two times (2) three times

(3) equal to (4) four times

46. Calculate the values of two resistances which when connected in series gives 50Ω and 8Ω when connected in parallel ?

(1) 40Ω and 10Ω

(2) 36Ω and 14Ω

(3) 30Ω and 20Ω

(4) None of the above

47. The rms value of $i = 12\sin \omega t + 6 \sin(3 \omega t - \pi/6) + 4 \sin(5 \omega t + \pi/3)$:

(1) 4.69 A

(2) 14 A

(3) 15.5 A

(4) 9.74 A

48. The primary mmf is least affected by the secondary terminal conditions in a :

(1) power transformer

(2) potential transformer

(3) current transformer

(4) distribution transformer

49. Two players, A and B, alternately keep rolling a fair dice. The person to get a six first wins the game. Given that player A starts the game, the probability that A wins the game is :

(1) 5/11

(2) 1/2

(3) 7/13

(4) 6/11

50. Consider 3, 3 # matrix with every element being equal to 1. Its only non-zero eigen value is :

(1) 3,0,0

(2) 2,0,0

(3) 1,0,0

(4) 4,0,0

51. If the fault current is 2000 A, the relay setting 50% and CT ratio is 400/5, the P.S.M is :

(1) 23

(2) 50

(3) 15

(4) None of the above

52. NAND and NOR gates are called 'universal gates' primarily because :

(1) they are available everywhere

(2) they are widely used in IC packages

(3) they can be easily combined to produce AND, OR and NOR gates

(4) they can be manufactured easily

53. The minimum number of 2-input NAND gates required to implement a 2-input XOR gate is :

(1) 4 (2) 5

(3) 6 (4) 7

54. The impulse response of a continuous time system is given by $h(t) = \delta(t - 1) + \delta(t - 3)$. The value of the step response at $t = 2$ is :

(1) 0 (2) 1

(3) 2 (4) 3

55. Which resistive component is designed to be temperature sensitive ?

(1) Thermistor (2) Rheostat

(3) Potentiometer (4) Photoconductive cell

56. If series current doubles, then :

(1) resistance is halved

(2) voltage is doubled

(3) voltage is reduced

(4) resistance is doubled

57. The initial slope of Bode Plot for transfer function having poles at the origin is :

(1) –10db/decade

(2) +10db/decade

(3) –20db/decade

(4) 0db/decade

58. A series R-L-C circuit has R=50 ohm, L=100 mH and C=1μF. The lower half power frequency of the circuit is :

(1) 30.55 KHz
(2) 3.055 KHz
(3) 51.92 KHz
(4) 1.92 KHz

59. The combined capacity of the parallel combination of two capacitors is four times their combined capacity when connected in series. This means that :

(1) Their capacitance are equal
(2) Their capacitance are 1μF and 2μ
(3) Their capacitances are 0.5μF and 1μF
(4) Their capacitances are infinite

60. The angular Velocity of 4 pole 2 KW Induction motor is 2π radians per second. Therefore, its speed in rpm should be :

(1) 15
(2) 30
(3) 60
(4) 90

61. A single-phase thyristor-bridge rectifier is fed from a 230V, 50 Hz single-phase AC mains. If it is delivering a constant DC current of 10 A, at firing angle of 30°, then value of the power factor at AC mains is :

(1) 0.87
(2) 0.9
(3) 0.78
(4) 0.45

62. A closed loop system has the characteristic equation given by For this system to be stable, which one of the following conditions should be satisfied ?

(1) $0 < k < 0.5$
(2) $0.5 < k < 1$
(3) $0 < k < 1$
(4) $k > 1$

63. A 4 pole induction machine is working as an induction generator. The generator supply frequency is 60 Hz. The rotor current frequency is 5 Hz. The mechanical speed of the rotor in RPM is :

(1) 1350 (2) 1650

(3) 1950 (4) 2250

64. An urn contains 5 red balls and 5 black balls. In the first draw, one ball is picked at random and discarded without noticing its colour. The probability to get a red ball in the second draw is :

(1) 1/2 (2) 4/9

(3) 5/9 (4) 6/9

65. Consider a solid sphere of radius 5 cm made of a perfect electric conductor. If one million electrons are added to this sphere, these electrons will be distributed :

(1) uniformly over the entire volume of the sphere

(2) uniformly over the outer surface of the sphere

(3) concentrated around the centre of the sphere

(4) along a straight line passing through the centre of the sphere

66. Let x and y be integers satisfying the following equations

$2x^2 + y^2 = 34$

$x + 2y = 11$

The value of $(x + y)$ is :

(1) 7 (2) 8

(3) 4 (4) 5

67. A 3-phase, 4-pole, 400 V, 50 Hz squirrel-cage induction motor is operating at a slip of 0.02. The speed of the rotor flux in mechanical rad/sec, sensed by a stationary observer, is closest to :

(1) 1500 (2) 1470

(3) 157 (4) 154

68. A stationary closed Lissajous pattern on an oscilloscope has 3 horizontal tangencies and 2 vertical tangencies for a horizontal input with frequency 3 kHz. The frequency of the vertical input is :

(1) 1.5 KHz
(2) 2 KHz
(3) 3 KHz
(4) 4.5 KHz

69. The range of k for which all the roots of the equation are in the left half of the complex s-plane is :

(1) $0 < k < 6$
(2) $0 < k < 16$
(3) $6 < k < 36$
(4) $6 < k < 16$

70. The eigen values of the matrix given below are :

$$\begin{matrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ 0 & -3 & -4 \end{matrix}$$

(1) (0,-1,-3)
(2) (0,-2,-3)
(3) (0,2,3)
(4) (0,1,3)

71. In the formation of Routh-Hurwitz array for a polynomial, all the elements of a row have zero values. This premature termination of the array indicates the presence of :

(1) Only one root at the origin
(2) Imaginary roots
(3) Only positive real roots
(4) Only negative real roots

72. In an oscilloscope screen, linear sweep is applied at the :

(1) Vertical axis
(2) Horizontal axis
(3) Origin
(4) Both horizontal and vertical axis

73. A cascade of three identical modulo-5 counters has an overall modulus of :

(1) 5 (2) 25

(3) 125 (4) 625

74. A system matrix is given as follows :

$$\begin{matrix} 0 & 1 & -1 \\ -6 & -11 & 6 \\ -6 & -11 & 5 \end{matrix}$$

The absolute value of the ratio of the maximum eigen value to the minimum eigen value is :

(1) 1/3 (2) 1/2

(3) 1/4 (4) 1/5

75. The phase cross-over frequency of the transfer function $G(s) = 100/(s+1)^3$ in rad/s is :

(1) $\sqrt{3}$ (2) $1/\sqrt{3}$

(3) 3 (4) $3\sqrt{3}$

76. Consider a continuous-time system with input x(t) and output y(t) given by $y(t) = x(t) \cos t$. This system is :

(1) linear and time-invariant

(2) non-linear and time-invariant

(3) linear and time-varying

(4) non-linear and time-varying

77. A temperature in the range of -40 °C to 55 °C is to be measured with a resolution of 0.1 °C. The minimum number of ADC bits required to get a matching dynamic range of the temperature sensor is :

(1) 8 (2) 10

(3) 12 (4) 14

78. A DC shunt generator delivers 45 A at a terminal voltage of 220 V. The armature and the shunt field resistances are 0.01 Ω and 44 Ω respectively. The stray losses are 375 W. The percentage efficiency of the DC generator is :

(1) 86.84%
(2) 90.4%
(3) 94.6%
(4) 82.3%

79. A hollow metallic sphere of radius r is kept at potential of 1 Volt. The total electric flux coming out of the concentric spherical surface of radius R (> r) is :

(1) $4\pi\varepsilon_0 r$
(2) $4\pi\varepsilon_0 r^2$
(3) $4\pi\varepsilon_0 R$
(4) $4\pi\varepsilon_0 R^2$

80. In a synchronous machine, hunting is predominantly damped by :

(1) mechanical losses in the rotor
(2) iron losses in the rotor
(3) copper losses in the stator
(4) copper losses in the rotor

81. The Laplace transform of a function f(t) is :

$F(s) = 1/s(s + 1)$

As t tends to infinity, f(t) approaches

(1) 1/2
(2) Zero
(3) 1
(4) Infinity

82. Power transmission line are transposed to reduce :

(1) Skin effect
(2) Ferranti effect
(3) Transmission loss
(4) Interference with neighbouring communication

83. An open loop Transfer function of unity feedback system is given by :

$G(s) = 1/(s+2)^2$

The closed loop transfer function will have poles at

(1) $-2, -2$ (2) $-2, -1$

(3) $-2+j, -2-j$ (4) $-2, 2$

84. A 1mA galvanometer with internal resistance of 50 ohm is to be converted to measure 5A (full scale). What is the value of shunt resistance required for this conversion ?

(1) 1 ohm (2) 0.01 ohm

(3) 1 Kilo ohm (4) 10 ohm

85. The average power delivered to an impedance (4-j3) Ω by a current $5\cos(100\pi+100)$ A is :

(1) 44.2 W (2) 50 W

(3) 62.5 W (4) 125 W

86. The full load copper loss and iron loss of a transformer are 6400W and 500W, respectively. The above copper loss and iron loss at half load will be :

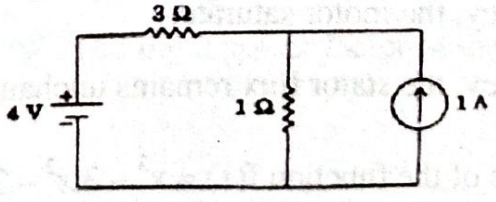
(1) 3200 Wand 250 W respectively

(2) 3200 Wand 500 W respectively

(3) 1600 Wand 125 W respectively

(4) 1600 Wand 500 W respectively

87. For the circuit shown below, the voltage across the 1 ohm resistor is given by :



(1) 7/4 (2) 5/4

(3) c (4) 7/3

88. In a synchronous machine the rotor speed becomes more than the synchronous speed during hunting, the damping bars develop :

(1) Synchronous motor torque

(2) DC motor torque

(3) Induction motor torque

(4) Induction generator torque

89. The per unit value of a 4 ohm resistor at 100 MVA base and 10 KV base voltage is :

(1) 2 pu

(2) 4 pu

(3) 0.4 pu

(4) 40 pu

90. The voltage regulation of transformer having 2% and 5% reactance, at full load, 0.8 pf lagging is :

(1) 4.6%

(2) –4.6%

(3) –1.4%

(4) 6.4%

91. In a constant V/f control of induction motor, the ratio V/f is maintained constant from 0 to base frequency, where V is the voltage applied to the motor at fundamental frequency f. Which of the following statements relating to low frequency operation of the motor is TRUE ?

(1) At low frequency, the stator flux increases from its rated value.

(2) At low frequency, the stator flux decreases from its rated value.

(3) At low frequency, the motor saturates.

(4) At low frequency, the stator flux remains unchanged at its rated value.

92. The minimum value of the function $f(x) = x^3 - 3x^2 - 24x + 100$ in the interval $[-3, 3]$ is :

(1) 20

(2) 28

(3) 16

(4) 32

93. A 10 kHz even-symmetric square wave is passed through a bandpass filter with centre frequency at 30 kHz and 3 dB passband of 6 kHz. The filter output is :

(1) a highly attenuated square wave at 10kHz

(2) nearly zero

(3) a nearly perfect cosine wave at 30kHz

(4) a nearly perfect sine wave at 30kHz

94. For a single phase, two winding transformer, the supply frequency and voltage are both increased by 10%. The percentage changes in the hysteresis loss and eddy current loss, respectively, are :

(1) 10 and 21

(2) –10 and 21

(3) 21 and 10

(4) –21 and 10

95. Suppose that resistors Rl and R2 are connected in parallel to give an equivalent resistor R. If resistors R1 and R2 have tolerance of 1% each, the equivalent resistor R for resistors Rl = 300Ω and R2 = 200Ω will have tolerance of :

(1) 0.5%

(2) 1%

(3) 1.2%

(4) 2%

96. A fully controlled converter bridge feeds a highly inductive load with ripple free load current. The input supply Vs to the bridge is a sinusoidal source. Triggering angle of the bridge converter is $\alpha = 30°$. The input power factor of the bridge is :

(1) 0.78

(2) 0.866

(3) 0.45

(4) 0.5

97. The transfer function of a second order real system with a perfectly flat magnitude response of unity has a pole at (2 - j3). List all the poles and zeroes :

(1) Poles at (2 ± j3), no zeroes

(2) Poles at (±2 – j3), one zero at origin

(3) Poles at (2 – j3), (–2 + j3), zeroes at (–2 – j3), (2 + j3)

(4) Poles at (2 ± j3), zeroes at (–2 ±j3)

98. A 4-point starter is used to start and control the speed of a :

(1) dc shunt motor with armature resistance control

(2) dc shunt motor with field weakening control

(3) dc series motor

(4) dc compound motor

99. A three-phase, salient pole synchronous motor is connected to an infinite bus. Ig is operated at no load a normal excitation. The field excitation of the motor is first reduced to zero and then increased in reverse direction gradually. Then the armature current :

(1) Increases continuously

(2) First increases and then decreases steeply

(3) First decreases and then increases steeply

(4) Remains constant

100. Consider the following statement :

(i) The compensating coil of a low power factor wattmeter compensates the effect of the impedance of the current coil.

(ii) The compensating coil of a low power factor wattmeter compensates the effect 0 of the impedance of the voltage coil circuit.

(1) (i) is true but (ii) is false

(2) (i) is false but (ii) is true

(3) both (i) and (ii) are true

(4) both (i) and (ii) are false

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D

SET-X

Ph.D./URS-EE-Jan-2022

SUBJECT : Electrical Engineering.

10016

Sr. No. .....

Time : **1¼ Hours** Max. Marks : **100** Total Questions : **100**

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Name _____ Father's Name_____

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SEAL

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1. In a long transmission line with r,l,g and c are the resistance, inductance, shunt conductance and capacitance per unit length, respectively, the condition for distortion less transmission is :

   (1) rc = lg

   (2) rc = √l/c

   (3) rg = lc

   (4) g =.√c/l

2. For a fully transposed transmission line :

   (1) positive, negative and zero sequence impedances are equal

   (2) positive and negative sequence impedances are equal

   (3) zero and positive sequence impedances are equal

   (4) negative and zero sequence impedances are equal

3. A 183-bus power system has 150 PQ buses and 32 PV buses. In the general case, to obtain the load flow solution using Newton-Raphson method in polar coordinates, the minimum number of simultaneous equations to be solved is :

   (1) 443 (2) 332

   (3) 554 (4) 667

4. Which one of the following statements is true for all real symmetric matrices ?

   (1) All the eigen values are real

   (2) All the eigen values are positive

   (3) All the eigen values are distinct

   (4) Sum of all the eigen values is zero

5. All the values of the multi-valued complex function 1^i, where $i = \sqrt{-1}$, are :

   (1) purely imaginary (2) real and non-negative

   (3) on the unit circle (4) equal in real and imaginary parts

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6. Two identical coupled inductors are connected in series. The measured inductances for the two possible series connections are 380 μH and 240 μH. Their mutual inductance in μH is :

(1) 35 (2) 25

(3) 54 (4) 43

7. A three-phase, 4 pole, self excited induction generator is feeding power to a load at a frequency F_1. If the load is partially removed, the frequency becomes F_2. If the speed of the generator is maintained at 1500 rpm in both the cases, then :

(1) $F_1 F_2 > 50$Hz and $F_1 > F_2$

(2) $F_1 < 50$ Hz and $F_2 > 50$ Hz

(3) $F_1 F_2 < 50$Hz and $F_1 > F_2$

(4) $F_1 > 50$ Hz and $F_2 < 50$ Hz

8. Shunt reactors are sometimes used in high voltage transmission system to :

(1) limit the short circuit current through the line.

(2) compensate for the series reactance of the line under heavily loaded condition.

(3) limit over-voltages at the load side under lightly loaded condition.

(4) compensate for the voltage drop in the line under heavily loaded condition.

9. While measuring power of a three-phase balanced load by the two-wattmeter method, the readings are 100 W and 250 W. The power factor of the load is :

(1) 0.802 (2) 0.943

(3) 0.754 (4) 0.654

10. Which of the following is an invalid state in an 8-4-2-1. Binary Coded Decimal counter ?

(1) 1 0 0 0

(2) 1 0 0 1

(3) 0 0 1 1

(4) 1 1 0 0

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11. Leakage flux in an induction motor is :

(1) flux that leaks through the machine

(2) flux that links both stator and rotor windings

(3) flux that links none of the windings

(4) flux that links the stator winding or the rotor winding but not both

12. The angle δ in the swing equation of a synchronous generator is the :

(1) angle between stator voltage and current

(2) angular displacement of the rotor with respect to the stator

(3) angular displacement of the stator mmf with respect to a synchronously rotating axis

(4) angular displacement of an axis fixed to the rotor with respect to a synchronously rotating axis

13. A band-limited signal with a maximum frequency of 5 kHz is to be sampled. According to the sampling theorem, the sampling frequency in kHz which is ***not*** valid is ?

(1) 5 (2) 12

(3) 15 (4) 20

14. A function $2y = 5x^2 + 10x$ is defined over an open interval $x = (1,2)$. At least at one point in this interval, dy/dx is exactly :

(1) 20 (2) 25

(3) 30 (4) 35

15. The typical ratio of latching current to holding current in a 20 A thyristor is :

(1) 5.0 (2) 2.0

(3) 1.0 (4) 0.5

16. Let $f(x) = xe^{-x}$ The maximum value of the function in the interval $(0, \infty)$ is :

(1) e^{-1} (2) e

(3) $1 - e^{-1}$ (4) $1 + e^{-1}$

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17. Let $X(s) = (3s+5)/(s^2+10s+21)$ be the Laplace Transform of a signal $x(t)$. Then, $x(0^+)$ is :

(1) 0
(2) 3
(3) 5
(4) 21

18. An 8-pole, 3-phase, 50 Hz induction motor is operating at a speed of 700 rpm. The frequency of the rotor current of the motor in Hz is :

(1) 3.33 Hz
(2) 4.44 Hz
(3) 5.55 Hz
(4) 6.66 Hz

19. For a specified input voltage and frequency, if the equivalent radius of the core of a transformer is reduced by half, the factor by which the number of turns in the primary should change to maintain the same no load current is :

(1) 1/4
(2) 1/2
(3) 2
(4) 4

20. The undesirable property of an electrical insulating material is :

(1) High dielectric strength
(2) High relative permittivity
(3) High thermal conductivity
(4) High insulation resistivity

21. The function $f(x) = 2x - x^2 + 3$ has ..... .

(1) a maximum at $x = 1$ and a minimum at $x = 5$
(2) a maximum at $x = 1$ and a minimum at $x = -5$
(3) only a maximum at $x = 1$
(4) only a minimum at $x = 1$

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22. Two readings obtained on a 440V (2-wire) system with a voltmeter having resistance of 60 MΩ were i) 75V between positive mains and earth and ii) 25V between negative main and earth. The insulation resistance of each main is ..... and ..... respectively.

(1) 0.816 MΩ and 0.272 MΩ

(2) 0.45 MΩ and 0.15 MΩ

(3) 80 MΩ and 240 MΩ

(4) 75 MΩ and 25 MΩ

23. Induction motors are called asynchronous because ..... .

(1) They are rotating transformers

(2) They work on principles of induction

(3) Synchronously rotating field is absent

(4) Their rotor can never run at synchronous speed

24. The maximum torque of IM occurs when :

(1) rotor reactance equals its resistance

(2) pf is unity

(3) cu losses are minimum

(4) rotor slots are even in number

25. The instantaneous power in an ac circuit varies with the frequency ..... that of supply frequency.

(1) two times

(2) three times

(3) equal to

(4) four times

26. Calculate the values of two resistances which when connected in series gives 50Ω and 8Ω when connected in parallel ?

(1) 40Ω and 10Ω

(2) 36Ω and 14Ω

(3) 30Ω and 20Ω

(4) None of the above

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27. The rms value of $i = 12\sin \omega t + 6 \sin(3 \omega t - \pi/6) + 4 \sin(5 \omega t + \pi/3)$:

(1) 4.69 A
(2) 14 A
(3) 15.5 A
(4) 9.74 A

28. The primary mmf is least affected by the secondary terminal conditions in a :

(1) power transformer
(2) potential transformer
(3) current transformer
(4) distribution transformer

29. Two players, A and B, alternately keep rolling a fair dice. The person to get a six first wins the game. Given that player A starts the game, the probability that A wins the game is :

(1) 5/11
(2) 1/2
(3) 7/13
(4) 6/11

30. Consider 3, 3 # matrix with every element being equal to 1. Its only non-zero eigen value is :

(1) 3,0,0
(2) 2,0,0
(3) 1,0,0
(4) 4,0,0

31. The torque speed characteristics of two phase induction motor is largely affected by :

(1) Voltage
(2) R/X and speed
(3) X/R
(4) Supply voltage frequency

32. A 3 phase, 50 Hz, 6 poles Induction motor has rotor resistance of 0.1 Ω and reactance of 0.92 Ω. Neglect the voltage drop in stator and assume that rotor resistance is constant. Given that full load slip is 3%. The ratio of maximum torque to full load torque i :

(1) 1.567
(2) 1.712
(3) 1.94
(4) 2.134

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33. An analog voltmeter uses external multiplier settings. With a multiplier setting of 20 kΩ, it reads 440V and with a multiplier setting of 80 kΩ it reads 352 V. For a multiplier setting of 40 kΩ, the voltmeter reads ..... .

(1) 371 V (2) 383 V

(3) 394 V (4) 406 V

34. In s-domain representation, the transfer function of a system is ..... .

(1) Laplace transform of unit step response of a system

(2) Laplace transform of OC test/Laplace transform of SC test

(3) Zeros/poles

(4) Output/ Input

35. The transfer function of a compensator is given by :

$G(s) = (s + a)/(s + b)$

$G(s)$ is lead compensator if

(1) a=l, b=2 (2) a=3, b=2

(3) a=7, b=5 (4) a=3, b=1

36. Nichol's chart is used to determine :

(1) transient response

(2) closed loop frequency response

(3) open loop frequency response

(4) settling time due to step input

37. Following is ***not*** a performance specification for transient response of a system :

(1) Settling time (2) Peak overshoot

(3) Steady state error (4) Rise time

38. A 3-phase diode bridge rectifier is fed from a 400V (rms), 50 Hz, 3-phase ac source. If the load is purely resistive, then peak instantaneous output voltage is equal to :

(1) 400 V (2) $400\sqrt{2}$

(3) $400\sqrt{(2/3)}$ (4) $400\sqrt{3}$

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39. Power consumed by a balanced 3-phase, 3-wire load is measured by two wattmeter method. The first wattmeter reads twice that of second. Then the load impedance angle in radians is :

(1) $\pi/12$ (2) $\pi/8$

(3) $\pi/6$ (4) $\pi/3$

40. The two voltage surges are defined as 1/50 μs and 3/50μ s. Which surge is more harmful ?

(1) 1/50 μs (2) 3/50 μs

(3) Both equally (4) None of the above

41. A low - pass filter with a cut-off frequency of 30Hz is cascaded with a high-pass filter with a cut-off frequency of 20Hz. The resultant system of filters will function as :

(1) an all-pass filter

(2) an all-stop filter

(3) an band stop (band-reject) filter

(4) a band - pass filter

42. A negative sequence relay is commonly used to protect :

(1) an alternator

(2) an transformer

(3) a transmission line

(4) a bus bar

43. For enhancing the power transmission in along EHV transmission line, the most preferred method is to connect a :

(1) Series inductive compensator in the line

(2) Shunt inductive compensator at the receiving end

(3) Series capacitive compensator in the line

(4) Shunt capacitive compensator at the sending end

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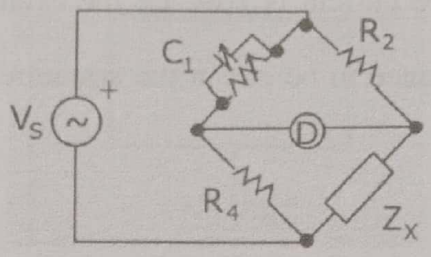
44. The bridge circuit shown in the figure below is used for the measurement of an unknown element Zx. The bridge circuit is best suited when Zx is a :



(1) low resistance

(2) high resistance

(3) low Q inductor

(4) lossy capacitor

45. A dual trace oscilloscope is set to operate in the alternate mode. The control input of the multiplexer used in the y-circuit is fed with a signal having a frequency equal to :

(1) the highest frequency that the multiplexer can operate properly

(2) twice the frequency of the time base (sweep) oscillator

(3) the frequency of the time base (sweep) oscillator

(4) half the frequency of the time base (sweep) oscillator

46. A zero mean random signal is uniformly distributed between limits –a and +a and its mean square value is equal to its variance. Then the r.m.s value of the signal is :

(1) $a/\sqrt{3}$

(2) $a/\sqrt{2}$

(3) $a\sqrt{2}$

(4) $a\sqrt{3}$

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47. A 220 V, DC shunt motor is operating at a speed of 1440 rpm. The armature resistance is 1.0 Ω and armature current is 10A. Of the excitation of the machine is reduced by 10%, the extra resistance to be put in the armature circuit to maintain the same speed and torque will be :

(1) 1.79 Ω

(2) 2.1 Ω

(3) 18.9 Ω

(4) 3.1 Ω

48. The direct axis and quadrature axis reactance's of a salient pole alternator are 1.2p.u and 1.0p.u respectively. The armature resistance is negligible. If this alternator is delivering rated kVA at upf and at rated voltage, then its power angle is :

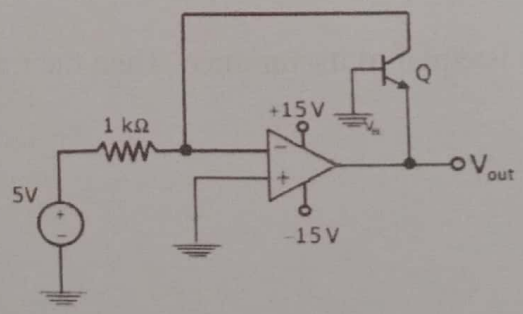
(1) 30°

(2) 45°

(3) 60°

(4) 90°

49. In the circuit shown below what is the output voltage out (V) in Volts if a silicon transistor Q and an ideal op-amp are used ?



(1) –15

(2) –0.7

(3) +0.7

(4) +15

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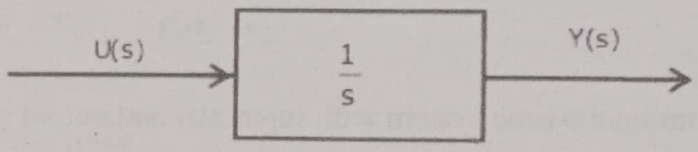
50. Assuming zero initial condition, the response y(t) of the system given below to a unit step input u(t) is :



(1) u(t)
(2) tu(t)
(3) $t^2 u(t)/2$
(4) $e^{-tu}(t)$

51. In the formation of Routh-Hurwitz array for a polynomial, all the elements of a row have zero values. This premature termination of the array indicates the presence of :

(1) Only one root at the origin
(2) Imaginary roots
(3) Only positive real roots
(4) Only negative real roots

52. In an oscilloscope screen, linear sweep is applied at the :

(1) Vertical axis
(2) Horizontal axis
(3) Origin
(4) Both horizontal and vertical axis

53. A cascade of three identical modulo-5 counters has an overall modulus of :

(1) 5
(2) 25
(3) 125
(4) 625

54. A system matrix is given as follows :

$$\begin{matrix} 0 & 1 & -1 \\ -6 & -11 & 6 \\ -6 & -11 & 5 \end{matrix}$$

The absolute value of the ratio of the maximum eigen value to the minimum eigen value is :

(1) 1/3
(2) 1/2
(3) 1/4
(4) 1/5

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55. The phase cross-over frequency of the transfer function $G(s) = 100/(s+1)^3$ in rad/s is :

(1) $\sqrt{3}$ (2) $1/\sqrt{3}$

(3) 3 (4) $3\sqrt{3}$

56. Consider a continuous-time system with input x(t) and output y(t) given by $y(t) = x(t) \cos t$. This system is :

(1) linear and time-invariant

(2) non-linear and time-invariant

(3) linear and time-varying

(4) non-linear and time-varying

57. A temperature in the range of -40 °C to 55 °C is to be measured with a resolution of 0.1 °C. The minimum number of ADC bits required to get a matching dynamic range of the temperature sensor is :

(1) 8 (2) 10

(3) 12 (4) 14

58. A DC shunt generator delivers 45 A at a terminal voltage of 220 V. The armature and the shunt field resistances are 0.01 Ω and 44 Ω respectively. The stray losses are 375 W. The percentage efficiency of the DC generator is :

(1) 86.84% (2) 90.4%

(3) 94.6% (4) 82.3%

59. A hollow metallic sphere of radius r is kept at potential of 1 Volt. The total electric flux coming out of the concentric spherical surface of radius R (> r) is :

(1) $4\pi\varepsilon_0 r$

(2) $4\pi\varepsilon_0 r^2$

(3) $4\pi\varepsilon_0 R$

(4) $4\pi\varepsilon_0 R^2$

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60. In a synchronous machine, hunting is predominantly damped by :

(1) mechanical losses in the rotor

(2) iron losses in the rotor

(3) copper losses in the stator

(4) copper losses in the rotor

61. In a constant V/f control of induction motor, the ratio V/f is maintained constant from 0 to base frequency, where V is the voltage applied to the motor at fundamental frequency f. Which of the following statements relating to low frequency operation of the motor is TRUE ?

(1) At low frequency, the stator flux increases from its rated value.

(2) At low frequency, the stator flux decreases from its rated value.

(3) At low frequency, the motor saturates.

(4) At low frequency, the stator flux remains unchanged at its rated value.

62. The minimum value of the function $f(x) = x^3 - 3x^2 - 24x + 100$ in the interval [–3. 3] is :

(1) 20 (2) 28

(3) 16 (4) 32

63. A 10 kHz even-symmetric square wave is passed through a bandpass filter with centre frequency at 30 kHz and 3 dB passband of 6 kHz. The filter output is :

(1) a highly attenuated square wave at 10kHz

(2) nearly zero

(3) a nearly perfect cosine wave at 30kHz

(4) a nearly perfect sine wave at 30kHz

64. For a single phase, two winding transformer, the supply frequency and voltage are both increased by 10%. The percentage changes in the hysteresis loss and eddy current loss, respectively, are :

(1) 10 and 21 (2) –10 and 21

(3) 21 and 10 (4) –21 and 10

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65. Suppose that resistors Rl and R2 are connected in parallel to give an equivalent resistor R. If resistors R1 and R2 have tolerance of 1% each, the equivalent resistor R for resistors Rl = 300Ω and R2 = 200Ω will have tolerance of :

(1) 0.5% (2) 1%

(3) 1.2% (4) 2%

66. A fully controlled converter bridge feeds a highly inductive load with ripple free load current. The input supply Vs to the bridge is a sinusoidal source. Triggering angle of the bridge converter is $\alpha = 30°$. The input power factor of the bridge is :

(1) 0.78

(2) 0.866

(3) 0.45

(4) 0.5

67. The transfer function of a second order real system with a perfectly flat magnitude response of unity has a pole at (2 - j3). List all the poles and zeroes :

(1) Poles at $(2 \pm j3)$, no zeroes

(2) Poles at $(\pm 2 - j3)$, one zero at origin

(3) Poles at $(2 - j3)$, $(-2 + j3)$, zeroes at $(-2 - j3)$, $(2 + j3)$

(4) Poles at $(2 \pm j3)$, zeroes at $(-2 \pm j3)$

68. A 4-point starter is used to start and control the speed of a :

(1) dc shunt motor with armature resistance control

(2) dc shunt motor with field weakening control

(3) dc series motor

(4) dc compound motor

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69. A three-phase, salient pole synchronous motor is connected to an infinite bus. Ig is operated at no load a normal excitation. The field excitation of the motor is first reduced to zero and then increased in reverse direction gradually. Then the armature current :

(1) Increases continuously

(2) First increases and then decreases steeply

(3) First decreases and then increases steeply

(4) Remains constant

70. Consider the following statement :

(i) The compensating coil of a low power factor wattmeter compensates the effect of the impedance of the current coil.

(ii) The compensating coil of a low power factor wattmeter compensates the effect 0 of the impedance of the voltage coil circuit.

(1) (i) is true but (ii) is false

(2) (i) is false but (ii) is true

(3) both (i) and (ii) are true

(4) both (i) and (ii) are false

71. The Laplace transform of a function f(t) is :

$F(s) = 1/s(s + 1)$

As t tends to infinity, f(t) approaches

(1) 1/2

(2) Zero

(3) 1

(4) Infinity

72. Power transmission line are transposed to reduce :

(1) Skin effect

(2) Ferranti effect

(3) Transmission loss

(4) Interference with neighbouring communication

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73. An open loop Transfer function of unity feedback system is given by :

$G(s) = 1/(s+2)^2$

The closed loop transfer function will have poles at

(1) $-2, -2$

(2) $-2, -1$

(3) $-2+j, -2-j$

(4) $-2, 2$

74. A 1mA galvanometer with internal resistance of 50 ohm is to be converted to measure 5A (full scale). What is the value of shunt resistance required for this conversion ?

(1) 1 ohm

(2) 0.01 ohm

(3) 1 Kilo ohm

(4) 10 ohm

75. The average power delivered to an impedance (4-j3) Ω by a current $5\cos(100\pi+100)$ A is :

(1) 44.2 W

(2) 50 W

(3) 62.5 W

(4) 125 W

76. The full load copper loss and iron loss of a transformer are 6400W and 500W, respectively. The above copper loss and iron loss at half load will be :

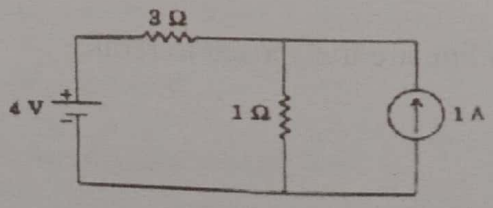
(1) 3200 Wand 250 W respectively

(2) 3200 Wand 500 W respectively

(3) 1600 Wand 125 W respectively

(4) 1600 Wand 500 W respectively

77. For the circuit shown below, the voltage across the 1 ohm resistor is given by :



(1) 7/4

(2) 5/4

(3) c

(4) 7/3

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78. In a synchronous machine the rotor speed becomes more than the synchronous speed during hunting, the damping bars develop :

(1) Synchronous motor torque

(2) DC motor torque

(3) Induction motor torque

(4) Induction generator torque

79. The per unit value of a 4 ohm resistor at 100 MVA base and 10 KV base voltage is :

(1) 2 pu (2) 4 pu

(3) 0.4 pu (4) 40 pu

80. The voltage regulation of transformer having 2% and 5% reactance, at full load, 0.8 pf lagging is :

(1) 4.6% (2) –4.6%

(3) –1.4% (4) 6.4%

81. If the fault current is 2000 A, the relay setting 50% and CT ratio is 400/5, the P.S.M is :

(1) 23 (2) 50

(3) 15 (4) None of the above

82. NAND and NOR gates are called 'universal gates' primarily because :

(1) they are available everywhere

(2) they are widely used in IC packages

(3) they can be easily combined to produce AND, OR and NOR gates

(4) they can be manufactured easily

83. The minimum number of 2-input NAND gates required to implement a 2-input XOR gate is :

(1) 4 (2) 5

(3) 6 (4) 7

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84. The impulse response of a continuous time system is given by $h(t) = \delta(t-1) + \delta(t-3)$. The value of the step response at $t = 2$ is :

(1) 0 (2) 1

(3) 2 (4) 3

85. Which resistive component is designed to be temperature sensitive ?

(1) Thermistor (2) Rheostat

(3) Potentiometer (4) Photoconductive cell

86. If series current doubles, then :

(1) resistance is halved (2) voltage is doubled

(3) voltage is reduced (4) resistance is doubled

87. The initial slope of Bode Plot for transfer function having poles at the origin is :

(1) –10db/decade (2) +10db/decade

(3) –20db/decade (4) 0db/decade

88. A series R-L-C circuit has R=50 ohm, L=100 mH and C=1μF. The lower half power frequency of the circuit is :

(1) 30.55 KHz (2) 3.055 KHz

(3) 51.92 KHz (4) 1.92 KHz

89. The combined capacity of the parallel combination of two capacitors is four times their combined capacity when connected in series. This means that :

(1) Their capacitance are equal

(2) Their capacitance are 1μF and 2μ

(3) Their capacitances are 0.5μF and 1μF

(4) Their capacitances are infinite

90. The angular Velocity of 4 pole 2 KW Induction motor is 2π radians per second. Therefore, its speed in rpm should be :

(1) 15 (2) 30

(3) 60 (4) 90

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91. A single-phase thyristor-bridge rectifier is fed from a 230V, 50 Hz single-phase AC mains. If it is delivering a constant DC current of 10 A, at firing angle of 30°, then value of the power factor at AC mains is :

(1) 0.87
(2) 0.9
(3) 0.78
(4) 0.45

92. A closed loop system has the characteristic equation given by For this system to be stable, which one of the following conditions should be satisfied ?

(1) $0 < k < 0.5$
(2) $0.5 < k < 1$
(3) $0 < k < 1$
(4) $k > 1$

93. A 4 pole induction machine is working as an induction generator. The generator supply frequency is 60 Hz. The rotor current frequency is 5 Hz. The mechanical speed of the rotor in RPM is :

(1) 1350
(2) 1650
(3) 1950
(4) 2250

94. An urn contains 5 red balls and 5 black balls. In the first draw, one ball is picked at random and discarded without noticing its colour. The probability to get a red ball in the second draw is :

(1) 1/2
(2) 4/9
(3) 5/9
(4) 6/9

95. Consider a solid sphere of radius 5 cm made of a perfect electric conductor. If one million electrons are added to this sphere, these electrons will be distributed :

(1) uniformly over the entire volume of the sphere
(2) uniformly over the outer surface of the sphere
(3) concentrated around the centre of the sphere
(4) along a straight line passing through the centre of the sphere

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96. Let x and y be integers satisfying the following equations

$2x^2 + y^2 = 34$

$x + 2y = 11$

The value of $(x + y)$ is :

(1) 7 (2) 8

(3) 4 (4) 5

97. A 3-phase, 4-pole, 400 V, 50 Hz squirrel-cage induction motor is operating at a slip of 0.02. The speed of the rotor flux in mechanical rad/sec, sensed by a stationary observer, is closest to :

(1) 1500 (2) 1470

(3) 157 (4) 154

98. A stationary closed Lissajous pattern on an oscilloscope has 3 horizontal tangencies and 2 vertical tangencies for a horizontal input with frequency 3 kHz. The frequency of the vertical input is :

(1) 1.5 KHz (2) 2 KHz

(3) 3 KHz (4) 4.5 KHz

99. The range of k for which all the roots of the equation are in the left half of the complex s-plane is :

(1) $0 < k < 6$

(2) $0 < k < 16$

(3) $6 < k < 36$

(4) $6 < k < 16$

100. The eigen values of the matrix given below are :

$$\begin{matrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ 0 & -3 & -4 \end{matrix}$$

(1) (0,-1,-3) (2) (0,-2,-3)

(3) (0,2,3) (4) (0,1,3)

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Ph.D/URS (Electrical Engineering) Entrance exam answer key 2021-22

	A	B	C	D
1	3	3	2	1
2	4	4	3	2
3	3	3	4	2
4	2	1	1	1
5	2	2	3	2
6	4	1	2	1
7	1	3	3	3
8	4	4	2	3
9	2	1	3	1
10	1	1	1	4
11	2	4	4	4
12	3	3	1	4
13	4	1	3	1
14	1	2	3	2
15	3	1	3	2
16	2	1	1	1
17	3	4	1	2
18	2	2	2	1
19	3	1	2	3
20	1	2	2	2
21	4	3	1	3
22	3	4	2	1
23	1	3	2	4
24	2	2	1	1
25	1	2	2	1
26	1	4	1	1
27	4	1	3	4
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37	4	1	2	3
38	3	2	1	2
39	4	2	3	3
40	1	2	2	1
41	3	2	3	4
42	4	2	1	1
43	3	3	4	3
44	1	1	1	3
45	2	1	1	3

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46	1	3	1	1
47	3	2	4	1
48	4	1	3	2
49	1	1	4	2
50	1	4	1	2
51	4	3	4	2
52	4	1	3	2
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81	2	2	3	4
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83	3	4	3	1
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86	1	2	4	1
87	4	3	1	4
88	1	2	4	2
89	2	3	2	1
90	2	1	1	2
91	4	4	2	3
92	1	4	2	4

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93	3	1	3	3
94	3	2	1	1
95	3	2	2	2
96	1	1	1	1
97	1	2	4	3
98	2	1	1	4
99	2	3	2	1
100	2	2	2	1