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(DO NOT OPEN THIS QUESTION BOOKLET BEFORE TIME OR UNTIL YOU ARE ASKED TO DO SO) PHD-EE-2023-24 Electrical Engineering 10009

		Sr. No.		
Time : 11/4 Hours	Max. Marks : 100	Total Questions : 100		
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- In PWM bipolar voltage switching scheme for single phase inverter. DC side have 1. following components :
 - (1) DC and sinusoidal components at twice the fundamental frequency
 - (2) DC and sinusoidal components at twice the fundamental frequency
 - (3) Pure DC only

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- (4) None of the above
- Kirchhoff's current law can be applied on : 2.
 - (1) Planer network
 - (2) Non-planer network
 - (3) All types of network
 - (4) Neither planer nor non-planer
- 3. Eigen value of Hermitian matrix is :
 - (1) Zero only
 - (3) Real

- (2) Imaginary
- (4) Purely Imaginary or Zero

3. Relvin double bridge is best su

- Divergence theorem of gauss discuss about transformation between : 4.
 - (1) Line integrals and Surface integrals
 - (2) Volume integrals and Line integrals
 - (3) Line integrals and Line integrals
 - (4) Surface integrals and Volume integrals
- 5. For a single line to ground fault the zero-sequence current is given by j 3.0 pu. The current carried by the neutral during the fault is :

(1) <i>j</i> 1.0 <i>pu</i>	(2) j 3.0 pu
(3) <i>j</i> 9.0 <i>pu</i>	(4) j 6.0 pu

6. The emitter of the transistor is generally doped the heaviest because it :

- (1) has to dissipate maximum power
- (2) has to supply the charge carriers
- (3) is the first region of transistor
- (4) must possess low resistance
- 7. A JFET has disadvantage of :
 - (1) being noisy
 - (2) having small gain bandwidth product
 - (3) possessing positive temperature coefficient
 - (4) having low input impedance

8. Routh's stability criterion can be used for determining :

- (1) System response for the disturbance
- (2) Absolute and relative stability of the system
- (3) Noise present in the system
- (4) Transient and steady state response a same in second to mercoal some response
- 9. Kelvin double bridge is best suited for the measurement of :
 - (1) Resistance of very low value (2) Low value capacitance
 - (3) Resistance of very high value (4) High value capacitance
- 10. In transformer, eddy current loss is 1000 watts which is half of the total core loss. If thickness of lamination and frequency by 10%, the new core losses are :

Knohhoff's carrent law can be applied on

Figen value of Hermitian matrix i

(1)	3200 W	(2)	1000 W	
(3)	2200 W	(4)	2000 W	

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11.	A Schottky diode is a :
	(1) Majority carrier device
	(2) Minority carrier device
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- (3) Fast a recovery diode
- (4) Both a majority and minority carrier diode
- 12. Which logic family provide maximum power dissipation ?
 - (1) TTL (2) CMOS (3) ECL (4) JEET

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- 13. DC machines have windings and synchronous use windings.
 - (1) Closed, open (2) Open, closed
 - (3) Open, open (4) Closed, closed
- 14. The per unit impedance of a circuit element is 0.15, if the base KV and base MVA are halved, then new value of the per unit impedance of the circuit element will be :
 - (1) 0.30 (2) 0.0075 (3) 0.600 (4) 0.15
- 15. Which of these sets of logic gates are designated as universal gates ?
 - (1) OR, AND (2) XOR, NOR, NAND
 - (3) NOR, NAND, XNOR (4) NOR, NAND
- 16. In the toggle mode a JK flip flop has :
 - (1) J = 1, K = 1(2) J = 0, K = 1(3) J = 1, K = 0(4) J = 0, K = 0

- 17. A 100 μ A ammeter has an internal resistance of 100 ohm. For extending its range to measure 500 μ A, the shunt resistance required is of :
 - (2) 22.22 Ω
 - (4) 50.0 Ω (1) 20.0Ω
 - (3) 25.0 Ω

The high torque to weight ratio in an analogue indicating instruments indicates : 18.

- (2) Low friction loss (1) High friction loss
- (3) Nothing as regards friction loss (4) None of the above
- 19. A 3-phase 400V, synchronous motor is providing load at 0.8 p.f. lagging. If the field current of the motor is continuously increased, then :
 - (1) Power factor increases and the decreases
 - (2) Power factor is not affected
 - (3) Power factor decreases up to certain value of field current and then increases
 - (4) Power factor increases simply 14. The per unit intredance of a current element is 0
- 20. A transmission line has a surge impedance of 400 Ω is connected with the cable having surge impedance of 40 Ω , a surge magnitude of 100 kV is travelling from the transmission line toward the cable. Find the incident current ?
 - (1) 100 A (2) 200 A (3) 250 A (4) 2500 A
- 21. A3-phase 440V, 50 Hz induction motor has 4% slip. The frequency of the rotor current will be :
 - (1) 5 Hz (2) 50 Hz (3) 25 Hz (4) 2 Hz
- If the fault current is 2000 A the relay setting 50% and the CT ratio is 400/5, then the 22. plug setting multiplier will be :
 - (1) 10 A (2) 25 A (3) 15 A (4) 50 A

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total voltage. The string efficiency is : (2) 50% (4) 75% (3) 80% (1) 25%Which is the following true for the bode plot? 24. (1) Time response of the system for the step input (2) It's a frequency (3) Power factor decreases up to certain value of field current and then increases (4) Power factor increases simply A 183-bus power system has 150 PQ buses and 32 PV buses. In the general case, to 25. obtain the load flow solution using Newton Raphson method in polar coordinates, the minimum number of simultaneous equations to be solved is : (4) 182 (3) 183 (2) 332 (1) 214 If the penalty factor of a plant is unity, its incremental transmission loss is : 26.

A string insulator has 5 units. The voltage across the bottom most unit is 25% of the

- (2) -1(1) 1
- (4) None of the above (3) 0

The dielectric losses of an electrical system are 50 Watts. What will be the dielectric 27. losses if the voltage of the system is doubled ?

- (2) 100 Watts (1) 50 Watts
- (4) 200 Watts (3) 300 Watts
- The difference between sending end voltage and receiving end voltage of transmission 28. line controls :

(1) Active power	(2) Reactive power
	(A) Name Co

(3) Frequency

A

23.

(4) None of these

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- **29.** To protect the power transformer (Y-Y, with neutral earthed) against fault, the current transformer will have :
 - (1) Delta-delta connection
- (2) Delta-star connection
- (3) Star-delta connection (4) Star-star connection
- **30.** The steady state stability of the power system can be increased by :
 - (1) Using machines of high impedance
 - (2) Connecting line in series impedance
 - (3) Connecting lines in parallel
 - (4) Reducing the excitation of the machine
- 31. If the base kVA is 25,000 then a 5000 kVA alternator with 8% reactance will have :
 - (1) A 4% reactance (2) A 40% reactance
 - (3) A 16% reactance (4) A 20% reactance

32. Ferranti effect states that under certain conditions the sending end voltage is :

- (1) Less than receiving end voltage
- (2) Greater than receiving end voltage
- (3) Equal to receiving end voltage
- (4) Abnormally high
- **33.** If the shunt admittance of the transmission line is neglected, the maximum power will occur when torque angle :
 - (1) 45° (2) -90° (3) 90° (4) 180°

34. Four identical alternators each are rated for 20 MVA, 11 KV having a sub-transient of 16% are working in parallel. The short-circuit level at the bus bar is :

(1) 500 MVA(2) 400 MVA(3) 125 MVA(4) 100 MVA

- **35.** If the fault current is 2000A, the relay setting is 50% and CT ration is 400:5, then plug setting multiplier (PSM) will be :
 - (1) 15 (2) 20 (3) 12.5 (4) 10

36. Maximum power transfer capability of transmission line can be increased by :

- (1) Parallel transmission lines
- (2) Using series capacitance
- (3) Using bundled conductors
- (4) All of the above

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37. A transmission line has a reactance of 1 pu is operating at $V_s = V_r = 1 pu$. The generator is connected at source end which delivering 0.5pu of active power ? Find the load angle :

0.5 when the value of K issue as an error

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- (1) 35° (2) 30° (3) 32° (4) 45°
- 38. A network containing 100 buses in which 10 are the voltage control buses, 20 are the reactive power support bussed, 6 are the generator bi=uses and rest all are load buses. Find the size of the Jacobian matrix ?
 - (1) 162X162 (2) 163X163(3) 160X160 (4) 164X164
 - (3) 160X160
- 39. Transmission lines are transposed to reduce :
 - (1) Skin effect
 - (2) Proximity effect
 - (3) Ferranti effect
 - (4) Interference with neighbouring communication

40. The generating station suitable to operate as peak load plant is :

- (1) Nuclear power plant
- (2) Thermal power plant
- (3) Pumped storage power plant
- (4) None of the above

41. Consider system with transfer function $G(s) = \frac{s+6}{(Ks^2+s+6)}$. Its damping ratio will be 0.5 when the value of K is :

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

42. If pole-zero cancellation occurs, the system will be :

- (1) Un-controllable
- (2) Un-observable
- (3) Either controllable or observable
- (4) Either un-controllable or un-observable

43. Consider the function $f(x) = x_1^2 + 2x_2^2 + 4x_3^2 + 2x_1x_2 - 4x_2x_3 - 4x_3x_1$. The function is :

- (1) Positive definite (2) Positive semi-definite
- (3) Negative definite (4) Negative semi-definite

44. A synchronous motor is operating on no load at unity power factor. If the field current is increased, the power factor will become :

- (1) Leading and the current will decrease
- (2) Lagging and the current will increase
- (3) Lagging and the current will decrease
- (4) Leading and the current will increase

45. The Double edge modulation eliminates certain harmonics when the reference is :

(1) Sine wave

(2) Square wave

- (3) Triangular wave
- (4) Trapezoidal wave

46. In dual converter :

- (1) Both rectifiers provide positive current to the load
- (2) Both rectifiers provide negative current to the load
- (3) One rectifier provides positive current to the load and the other negative current
- (4) One rectifier provides positive current to the source and the other negative current to the load and a source and the other negative current and source and the other negative current
- **47.** In communication PAC stands for :
 - (1) Permanent angle converter
 - (2) Phase angle converter
 - (3) Phase angle communication
 - (4) Phase and commutation
- **48.** A control system described by $\dot{x} = \begin{vmatrix} -4 & 1 \\ 2 & -3 \end{vmatrix} x + \begin{vmatrix} 2 \\ 3 \end{vmatrix} u, y = \begin{bmatrix} 3 & -2 \end{bmatrix} x$. The system is to be controlled by control law u = -Kx(t). The feedback matrix K for placing the poles at $-4 \pm j4$ is :
 - (1) $K = [-10 \ 7]$ (2) $K = [-2 \ 7]$ (3) $K = [2 \ 7]$ (4) $K = [10 \ 7]$

 $\begin{array}{ccc} 0 & 6 & -5 \\ \hline & & 49. \end{array}$ Consider the matrix $A = \begin{vmatrix} 1 & 0 & 2 \end{vmatrix}$. The eigen vectors of A are : 3 2 4

(1)
$$p_1 = [2 -1 2]', p_2 = \left| 1 - \frac{3}{7} - \frac{5}{7} \right|'$$
 and $p_3 = \left[1 - \frac{22}{28} - \frac{46}{28} \right]'$
(2) $p_1 = [2 -1 2]', p_2 = \left| 1 - \frac{3}{7} - \frac{5}{7} \right|'$ and $p_3 = \left[1 - \frac{22}{35} - \frac{46}{35} \right]'$
(3) $p_1 = [2 -1 2]', p_2 = \left| 1 - \frac{3}{7} - \frac{5}{7} \right|'$ and $p_3 = \left[1 - \frac{22}{42} - \frac{46}{42} \right]'$
(4) $p_1 = [2 -1 2]', p_2 = \left| 1 - \frac{3}{7} - \frac{5}{7} \right|'$ and $p_3 = \left[1 - \frac{22}{49} - \frac{46}{49} \right]'$

50. For what value of *d*, does the following system of linear equations has a non-trivial solution ?

$$(4d-1)x + y + z = 0$$

$$-y + z = 0$$

$$(4d-1)z = 0$$

$$(4d-1)z = 0$$

$$(2) \left(\frac{3}{4}\right)$$

$$(3) \left(\frac{1}{4}\right)$$

$$(4) 1$$

51. What is the correct representation of the probability distribution of a fair die that may provide an output of any number from 1 to 6 ?

(1)
$$p(x) = \frac{x}{6}; x = 0, 1, ..., 6$$

(2) $p(x) = \frac{1}{6}; x = 0, 1, ..., 6$
(3) $p(x) = \int_{a}^{b} \frac{1}{6} dx; a = 1, ..., 6$
(4) $p(x) = \frac{1}{8}; x = 0, 1, ..., 8$

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- 52. We wish to solve $x^2 2 = 0$ by Newton Rahson technique. If initial guess is $x_0 = 1.0$ subsequent estimate of x (i.e. x_1) will be :
 - (1) 1.414 (2) 2.0 (3) 1.5 (4) None of these

53. Determine the maxima and minima of the following function :

$$f(x) = x^3 - 6x^2 + 9x + 25$$

(1) Maxima at x = 1 and minima at x = -3

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- (2) Maxima at x = 3 and minima at x = -1
- (3) Maxima at x = 1 and minima at x = 4
- (4) Maxima at x = 1 and minima at x = 3

54. Find the particular solution of the following differential equation :

 $\ddot{y} + y = \sec(x)$

A smiles R-L-C circuit when excited by a IGV

sunformer and me? (b)

- (1) $\cos(x)\ln|\cos(x)| + x\sin(x)$
- (2) $\sin(x)\ln|\cos(x)| + x\cos(x)$
- (3) $\cos(x)\ln|\cot(x)| + x\tan(x)$
- (4) $\sin(x)\ln|\cos(x)| + x\cot(x)$

55. Laplace transform of piece wise continuous function f(t) with a period p is:

(1)
$$F(s) = \frac{1}{1+e^{-ps}} \int_{0}^{p} e^{-st} f(t) dt$$

(2)
$$F(s) = \frac{1}{1 - e^{-ps}} \int_{0}^{p} e^{-st} f(t) dt$$

(3)
$$F(s) = \frac{1}{1 - e^{ps}} \int_{0}^{p} e^{-st} f(t) dt$$

(4)
$$F(s) = \frac{1}{1+e^{-ps}} \int_{0}^{p} e^{-st} f(t) dt$$

- 56. A fixed capacitor of reactance $-j0.02 \Omega$ is connected in parallel across a series combination of a fixed inductor of reactance j0.01 Ω and a variable resistance R. As R is varied from zero to infinity, the locus diagram of the admittance of this R-L-C circuit will be :
 - (1) A semi-circle of diameter j 100 and center at zero.
 - (2) A straight line inclined at an angle.
 - (3) A semi-circle of diameter j50 and center at zero.
 - (4) A straight line parallel to the x-axis.
 - 57. The percentage resistance and percentage reactance of a 10 kVA, 400V/200V, 3-Phase transformer is 2% and 10 % respectively. If the constant losses in the machine are 1%. the maximum possible percentage efficiency of the transformer is :
 - (1) 98.32 (2) 97.25 (3) 96.85 (4) 96.12
- 58. A series R-L-C circuit when excited by a 10V sinusoidal voltage source of a variable frequency, exhibits resonance at 100 Hz and has a 3 dB bandwidth of 5 Hz. The voltage across the inductor L at resonance is :
 - (1) 10 V(2) 14.14 V (3) 7.07 V (4) 200 V
- 59. In the protection of transformers harmonic restraint is used to guard against :
 - (1) Magnetizing inrush current
 - (2) Unbalance operation
 - (3) Lightning
 - (4) Switching overvoltage
- The RMS value of the current in a wire which carries a d.c. current of 10 A and a 60. sinusoidal alternating current of peak value 20 A is : (1) 10 A

(2) 14.14 A PHD-EE-2023-24/(Electrical Engg.)(SET-Y)/(A)

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61. Which of the following is true?

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- (1) A finite signal is always bounded
- (2) A bounded signal always possesses finite energy
- (3) A bounded signal is always zero outside the interval $[-t_0, t_0]$ for some t_0
- (4) A bounded signal is always finite
- 62. A current of $-8 + 6\sqrt{2} \sin(\omega t + 30^\circ)$ A is passed through three meters. They are a centre zero PMMC meter, a true RMS meter and a moving iron instrument. The respective readings (in A) will be :

(1) 8, 6, 10	(3) 48 kB	(2)	8, 6, 8	
(3) -8, 10, 10		(4)	-8, 2, 2	
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63. A non-ideal voltage source Vs has an internal impedance of Z_s . If a purely resistive load is to be chosen that maximizes the power transferred to the load, its values must be :

- (1) 0 (2) Real part of Z_s
- (3) Magnitude of Z_s (4) Complex conjugate of Z_s
- 64. A unit step voltage is applied at t = 0 to a series RL circuit with zero initial conditions :
 - (1) It is possible for the current to be oscillatory.
 - (2) The voltage across the resistor at $t = 0^+$ is zero.
 - (3) The energy stored in inductor in the steady state is zero.
 - (4) The resistor current eventually falls to zero.

65. The core flux of a practical transformer with a resistive load :

- (1) Is strictly constant with load variation
- (2) Increases with linear load
- (3) Increases as the square root of the load
- (4) Decreases with increased load

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- (1) Heaviside Campbell Bridge
- (2) Schering Bridge
- (3) De Sauty Bridge
- (4) Wien Bridge
- A memory system has a total of 8 memory chips, each with 12 address lines and 4 data 67. lines. The total size of the memory system is :
 - (1) $16 \, \text{kB}$ (2) 32 kB (3) 48 kB(4) 64 kB
- 68. A differentiable non constant even function x(t) has a derivative y(t), and their respective Fourier Transforms are $X(\omega)$ and $Y(\omega)$. Which of the following statements is to be chosen that meximizes the power transformed to the load. Its val? surt ai
 - (1) $X(\omega)$ and $Y(\omega)$ are both real
 - (2) $X(\omega)$ is real and $Y(\omega)$ is imaginary
 - (3) $X(\omega)$ and $Y(\omega)$ are both imaginary $x \to 0$ and $y \to 0$ and $y \to 0$ and $y \to 0$.
 - (4) $X(\omega)$ is imaginary and $Y(\omega)$ is real
- A 3-phase, 50 Hz, 6 pole induction motor has a rotor resistance of 0.1 Ω and reactance 69. of $0.92.\Omega$. Neglect the voltage drop in stator and assume that the rotor resistance is constant. Given that the full load slip is 3%, the ratio of maximum torque to full load
 - Factore first of a practical manaformer (1) 1.567 (2) 1.712 (3) 1.948
 - (4) 2.134
- In a microprocessor, the address of the next instruction to be executed, is stored in : 70.
 - (1) Stack pointer (2) Address latch
 - (3) Program counter (4) General purpose register

- 71. An Op-Amp has an open-loop gain of 10⁵ and an open-loop upper cut-off frequency of 10 Hz. If this op-amp is connected as an amplifier with a closed loop gain of 100, then the new upper cut-off frequency is :
 - (1) 10 Hz (2) 100 Hz (3) 10 kHz (4) 100 kHz

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- 72. Let x(t) be a periodic signal with time period T, Let $y(t) = x(t t_0) + x(t + t_0)$ for some t_0 . The Fourier series coefficients of y(t) are denoted by bk. If $b_k = 0$ for all odd k. Then t_0 can be equal to :
 - (1) T/8 (2) T/4 (3) T/2 (4) 2T

73. 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
- 74. The resistance and reactance of a 100 kVA 11000/400 V, ΔY distribution transformer is 0.02 and 0.07 *pu* respectively. The phase impedance (in Ω) of the transformer referred to the primary is :

(1) $0.02 + j0.07$	(2) $0.55 + j1.925$
(3) 15.125 + j52.94	(4) 72.6 + j254.1

- 75. An op-amp having a slew rate of 62.8 V/ μ sec is connected in a voltage follower configuration. If the maximum amplitude of the input sinusoidal is 10 V, then the minimum frequency at which the slew rate limited distortion would set in the output is :
 - (1) 1 MHz (2) 6.28 MHz (3) 10 MHz (4) 62.8 MHz

76. The pu parameters for a 500 MVA machine on its own base are :

Inertia, M = 20 pu; reactance, X = 2 pu. The pu values of inertia and reactance on 100 MVA common base, respectively are :

(1) 4, 0.4 (2) 100, 10 (3) 4, 10 (4) 100, 0.4

- (i) Cache Memory
- (ii) CD-ROM
- (iii) Dynamic RAM
- (iv) Processor Registers
- (v) Magnetic Tape
- (1) (v), (ii), (iii), (iv), (i)
- (2) (v), (ii), (iii), (i), (iv)
- (3) (v), (iii), (ii), (iv), (i)
- (4) (iv), (ii), (iii), (v), (i)
- 78. A source $v_s(t) = V \cos(100\pi t)$ has an internal impedance of $(4 + j3)\Omega$. If a purely resistive load connected to the source has to extract the maximum power out of this source, its value in Ω should be :
 - (1) 3 (2) 4 (3) 5 (4) 7
- 79. The Laplace transform of a function f(t) is $F(s) = \frac{5s^2 + 23s + 6}{s(s^2 + 2s + 2)}$. As $t \to \infty$, f(t) approaches:
 - (1) 3 (2) 5 (3) 17/2 (4) ∞
- 80. Two wattmeters', which are connected to measure the total power on a three-phase system supplying a balanced load, read 10.5 kW and -2.5 kW, respectively. The total power and the power factor respectively, are :
 - (1) 13 kW, 0.334
 (2) 13 kW, 0.684

 (3) 13 kW, 0.52
 (4) 8 kW, 0.52

- 81. Feedback control systems are :
 - (1) Insensitive to both forward and feedback path parameter changes
 - (2) Less sensitive to feedback path parameter changes than to forward path parameter changes
 - (3) Less sensitive to forward path parameter changes than to feedback path parameter changes
 - (4) Equally sensitive to forward and feedback path parameter changes
- 82. The unit impulse response of a unit feedback control system is given by $c(t) = -te^{-t} + 2e^{-t}$ ($t \ge 0$) the open loop transfer function is equal to :
 - (1) $\frac{s+1}{(s+2)^2}$ (2) $\frac{2s+1}{s^2}$ (3) $\frac{2s+1}{(s+1)^2}$ (4) $\frac{(s+1)}{s^2}$
- 83. The depletion region (or) space charge region (or) transition region in a semiconductor p-n junction diode has :
 - (1) Electrons and holes (2) Positive ions and electrons
 - (3) Positive and negative ions (4) Negative ions and holes
- 84. The output Y of a 2-bit comparator is logic 1 whenever the 2-bit input A is greater than the 2-bit input B. The number of combinations for which the output is logic 1 is :
 - (1) 4 (2) 6 (3) 8 (4) 10

85. If an A. C. voltage wave is corrupted with an arbitrary number of harmonics, then the overall voltage waveform differs from its fundamental frequency component in terms of Inertia, $M = 20 \ pu$; reactance, $X = 2 \ pu$ The pu values of inertia and reactance on 100 MVA common base, respectively are :

- (1) Only the peak values (2) Only the rms values
- (3) Only the average values
- (4) All of the above

86. The system represented by the input-output relationship $y(t) = \int_{0}^{5t} x(\tau) d\tau$, t > 0 is :

- (1) Linear and causal (2) Linear but not causal
- (3) Causal but not linear (4) Neither linear nor causal

87. A voltage waveform $v(t) = 12 t^2$ is applied across a 1 H inductor for $t \ge 0$, with initial current through it being zero. The current through the inductor for $t \ge 0$ is given by :

(1) 12 t (2) 24 t (3) 12 t^3 (4) 4 t^3

88. A 10-bit A/D converter is used to digitize an analog signal in the 0 to 5V range. The maximum peak to peak ripple voltage that can be allowed in the DC supply voltage is :

(1) Nearly 100 mV	(2) Nearly 50 mV
	(2) incarity sum V

(3) Nearly 25 mV

(4) Nearly 5 mV

89. A current impulse of 5 $\delta(t)$, is forced through a capacitor C. The voltage $v_c(t)$, across the capacitor is given by :

(1) 5t(2) 5u(t) - C(3) $\frac{5t}{C}$ (4) $\frac{5u(t)}{C}$

90. The graph of an electrical network has N nodes and B branches. The number of links L, with respect to the choice of a tree is given by :

- (1) B N + 1(2) B + N(3) N - B + 1(4) N = 5
 - (4) N 2B 1
- **91.** Power consumed by a balanced 3-phase 3 wire load is measured by two wattmeter method. The first wattmeter reads twice that of the second. Then the load impedance angle in radians is :
 - (1) $\frac{\pi}{12}$ (2) $\frac{\pi}{8}$ (3) $\frac{\pi}{6}$ (4) $\frac{\pi}{3}$

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92. A switched mode power supply operating at 20 kHz to 100 kHz range uses as the main switching element :

(1) Thyristor	(2) MOSFET
(3) Triac	(4) UJT

93. The conductors of a 10 km long, single phase, two wire line are separated by a distance of 1.5 m. The diameter of each conductor is 1 cm. If the conductors are of copper, the inductance of the circuit is -

(1) 50 mH	(2) 45.3 mH
(3) 23.8 mH	(4) 19.6 mH

94. If \overline{E} is the electric field intensity, $\nabla(\nabla \times \overline{E})$ is equal to :

(1) \overline{E} lot silf .V. Lite fermiolog is losi	(2) $I\overline{E}I^{+}$ to stand a subman wolling A
(3) Null vector	(4) Zero

95. Consider a long, two wire line composed of solid round conductors. The radius of both conductors is 0.25 cm and the distance between their centres as l meters. If this distance is doubled, then the inductance per unit length :

The requester components of the fault current are as follows :

(1) Doubles

A

- (2) Halves
- (3) Increases but does not double
- (4) Decreases but does not halve
- The conduction loss v/s device current characteristics of a power MOSFET is best 96. approximated by :
 - (1) Parabola
 - (2) Straight Line
 - (3) Rectangular Hyperbola
 - (4) Exponentially decaying function

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

(1) 5 (2) 2 (3) 1 (4) 0.5

98. In a uniform electric field, field lines at equipotential surfaces :

- (1) Are parallel to one another
- (2) Intersect at 45°

(3) Intersect at 30°

- (4) Are orthogonal
- **99.** A hollow metallic sphere of radius r is kept at potential of 1 V. The total electric flux coming out of the concentric spherical surface of radius R (> r) is :

inductions net

- (1) $4\pi \in_0 r$ (2) $4\pi \in_0 r^2$
- (3) $4\pi \in_0 R$

 $(4) \quad 4\pi \in_0 \mathbb{R}^2$

100. The sequence components of the fault current are as follows :

 $I_{+ve} = j1.5 \ pu, I_{-ve} = -j0.5 \ pu, I_0 = -j1 \ pu.$

The type of the fault in the system is :

(1) LG (2) LL (3) LLG

(4) LLLG

Total No. o	f Printed	Pages	:	21
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(DO NOT OPEN THIS QUESTION BOOKLET BEFORE TIME OR UNTIL YOU ARE ASKED TO DO SO) SET-PHD-EE-2023-24 **Electrical Engineering** 10002

		Sr. No
Time : 1¼ Hours Roll No. (in figures)	Max. Marks : 100 (in words)	Total Questions : 100
Name	Date of Birth	
Father's Name	Mother's Name	
Date of Examination	and the company of the	
(Signature of the Candidate)	and the fact the state of the	(Signature of the Invigilator)

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

1. All questions are compulsory.

(Signature of the Candidate)

- 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 unfairmeans / 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 shall be got uploaded on the University Website immediately after the conduct of Entrance Examination. Candidates may raise valid objection/complaint if any, with regard to discrepancy in the question booklet/answer key within 24 hours of uploading the same on the University Website. The complaint be sent by the students to the Controller of Examinations by hand or through email. 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. Consider system with transfer function $G(s) = \frac{s+6}{(Ks^2 + s + 6)}$. Its damping ratio will be 0.5 when the value of K is :

 - (2) 3 (3) 1/6 (4) 6 (1) 2/6
- 2. If pole-zero cancellation occurs, the system will be :
 - (1) Un-controllable
 - (2) Un-observable
 - (3) Either controllable or observable
 - (4) Either un-controllable or un-observable
- 3. Consider the function $f(x) = x_1^2 + 2x_2^2 + 4x_3^2 + 2x_1x_2 4x_2x_3 4x_3x_1$. The function is :
- (1) Positive definite
 - (2) Positive semi-definite and being the transformed with log non-years and log non-
 - (3) Negative definite
 - (4) Negative semi-definite
- A synchronous motor is operating on no load at unity power factor. If the field current is increased, the power factor will become :
 - (1) Leading and the current will decrease
 - (2) Lagging and the current will increase
 - (3) Lagging and the current will decrease
 - (4) Leading and the current will increase
- The Double edge modulation eliminates certain harmonics when the reference is : 5.
 - (1) Sine wave

(2) Square wave

(4) Trapezoidal wave

(3) Triangular wave

- (1) Both rectifiers provide positive current to the load
- (2) Both rectifiers provide negative current to the load
- (3) One rectifier provides positive current to the load and the other negative current
- (4) One rectifier provides positive current to the source and the other negative current to the load
- 7. In communication PAC stands for :
 - (1) Permanent angle converter

(2) Phase angle converter

- (3) Phase angle communication
- (4) Phase and commutation

8. A control system described by $\dot{x} = \begin{vmatrix} -4 & 1 \\ 2 & -3 \end{vmatrix} x + \begin{vmatrix} 2 \\ 3 \end{vmatrix} u, y = \begin{bmatrix} 3 & -2 \end{bmatrix} x$. The system is to be controlled by control law u = -Kx(t). The feedback matrix K for placing the poles at $-4 \pm j4$ is :

- (1) $K = [-10 \ 7]$ (2) $K = [-2 \ 7]$ (3) $K = [2 \ 7]$ (4) $K = [10 \ 7]$ 0 6 -5
- 9. Consider the matrix $A = \begin{vmatrix} 1 & 0 & 2 \end{vmatrix}$. The eigen vectors of A are : 3 2 4
 - (1) $p_1 = \begin{bmatrix} 2 & -1 & 2 \end{bmatrix}', p_2 = \begin{vmatrix} 1 \frac{3}{7} & \frac{-5}{7} \end{vmatrix}'$ and $p_3 = \begin{bmatrix} 1 \frac{22}{28} & -46\\ -28 & 28 \end{bmatrix}'$ (2) $p_1 = \begin{bmatrix} 2 & -1 & 2 \end{bmatrix}', p_2 = \begin{vmatrix} 1 - \frac{3}{7} & \frac{-5}{7} \end{vmatrix}'$ and $p_3 = \begin{bmatrix} 1 - \frac{22}{35} & -46\\ -35 & 35 \end{bmatrix}'$ (3) $p_1 = \begin{bmatrix} 2 & -1 & 2 \end{bmatrix}', p_2 = \begin{vmatrix} 1 - \frac{3}{7} & \frac{-5}{7} \end{vmatrix}'$ and $p_3 = \begin{bmatrix} 1 - \frac{22}{42} & -46\\ -42 & 42 \end{bmatrix}'$ (4) $p_1 = \begin{bmatrix} 2 & -1 & 2 \end{bmatrix}', p_2 = \begin{vmatrix} 1 - \frac{3}{7} & \frac{-5}{7} \end{vmatrix}'$ and $p_3 = \begin{bmatrix} 1 - \frac{22}{42} & -46\\ -42 & 42 \end{bmatrix}'$

- 10. For what value of d, does the following system of linear equations has a non-trivial solution ?
 - (4d-1)x + y + z = 0 -y + z = 0 (4d-1)z = 0 $(2) \left(\frac{3}{4}\right)$ $(3) \left(\frac{1}{4}\right)$ (4) 1
 - 11. An Op-Amp has an open-loop gain of 10⁵ and an open-loop upper cut-off frequency of 10 Hz. If this op-amp is connected as an amplifier with a closed loop gain of 100, then the new upper cut-off frequency is :
 - (1) 10 Hz (2) 100 Hz (3) 10 kHz (4) 100 kHz
 - 12. Let x(t) be a periodic signal with time period T, Let $y(t) = x(t t_0) + x(t + t_0)$ for some t_0 . The Fourier series coefficients of y(t) are denoted by bk. If $b_k = 0$ for all odd k. Then t_0 can be equal to :
 - (1) T/8 (2) T/4 (3) T/2 (4) 2T
 - **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. The resistance and reactance of a 100 kVA 11000/400 V, ΔY distribution transformer is 0.02 and 0.07 pu respectively. The phase impedance (in Ω) of the transformer referred to the primary is :
 - (1) 0.02 + j0.07(2) 0.55 + j1.925(3) 15.125 + j52.94(4) 72.6 + j254.1

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15. An op-amp having a slew rate of 62.8 V/ μ sec is connected in a voltage follower configuration. If the maximum amplitude of the input sinusoidal is 10 V, then the minimum frequency at which the slew rate limited distortion would set in the output is :

(2) 6.28 MHz

- (1) 1 MHz
- (4) 62.8 MHz (3) 10 MHz
- The pu parameters for a 500 MVA machine on its own base are : 16. Inertia, M = 20 pu; reactance, X = 2 pu. The pu values of inertia and reactance on 100 MVA common base, respectively are : (4) 100, 0.4
 - (3) 4, 10 (2) 100, 10 (1) 4, 0.4
- 17. The increasing order of speed of data access for the following devices is : of 16 Fb. If this op-amp is connected as an amplificer
 - (i) Cache Memory
 - (ii) CD-ROM
 - (iii) Dynamic RAM
 - (iv) Processor Registers
 - (v) Magnetic Tape
 - (1) (v), (ii), (iii), (iv), (i)
 - (2) (v), (ii), (iii), (i), (iv)
 - (3) (v), (iii), (ii), (iv), (i)
 - (4) (iv), (ii), (iii), (v), (i)
 - A source $v_s(t) = V \cos(100\pi t)$ has an internal impedance of $(4 + j3)\Omega$. If a purely 18. resistive load connected to the source has to extract the maximum power out of this source, its value in Ω should be :

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

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 - **19.** The Laplace transform of a function f(t) is $F(s) = \frac{5s^2 + 23s + 6}{s(s^2 + 2s + 2)}$. As $t \to \infty$, f(t) approaches :
 - (1) 3 (2) 5 (3) 17/2 (4) ∞
 - 20. Two wattmeters', which are connected to measure the total power on a three-phase system supplying a balanced load, read 10.5 kW and -2.5 kW, respectively. The total power and the power factor respectively, are :
 - (1) 13 kW, 0.334 (2) 13 kW, 0.684
 - $(3) 13 \text{ kW}, 0.52 \qquad (4) 8 \text{ kW}, 0.52$
 - 21. Power consumed by a balanced 3-phase 3 wire load is measured by two wattmeter method. The first wattmeter reads twice that of the second. Then the load impedance angle in radians is :
 - (1) $\frac{\pi}{12}$ (2) $\frac{\pi}{8}$ (3) $\frac{\pi}{6}$ (4) $\frac{\pi}{3}$
 - 22. A switched mode power supply operating at 20 kHz to 100 kHz range uses as the main switching element :
 - (1) Thyristor(2) MOSFET(3) Triac(4) UJT
 - 23. The conductors of a 10 km long, single phase, two wire line are separated by a distance of 1.5 m. The diameter of each conductor is 1 cm. If the conductors are of copper, the inductance of the circuit is :
 - (1) 50 mH (2) 45.3 mH
 - (3) 23.8 mH (4) 19.6 mH
 - 24. If \overline{E} is the electric field intensity, $\nabla(\nabla \times \overline{E})$ is equal to :
 - (1) \overline{E} (2) $|\overline{E}|$ (3) Null vector (4) Zero

25. Consider a long, two wire line composed of solid round conductors. The radius of both conductors is 0.25 cm and the distance between their centres as *l* meters. If this distance is doubled, then the inductance per unit length :

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- (1) Doubles
- (2) Halves
- (3) Increases but does not double
- (4) Decreases but does not halve
- 26. The conduction loss v/s device current characteristics of a power MOSFET is best approximated by :
 - (1) Parabola
 - (2) Straight Line
 - (3) Rectangular Hyperbola
 - (4) Exponentially decaying function
- 27. The typical ratio of latching current to holding current in a 20 thyristor is : (1) 5 (2) 2 (3) 1 (4) 0.5

28. In a uniform electric field, field lines at equipotential surfaces :

- (1) Are parallel to one another (2) Intersect at 45°
- (3) Intersect at 30° (4) Are orthogonal

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

- (1) $4\pi\epsilon_0 r$ (2) $4\pi\epsilon_0 r^2$
- (3) $4\pi\epsilon_0 R$ (4) $4\pi\epsilon_0 R^2$

30. The sequence components of the fault current are as follows :

$$I_{+ve} = j1.5 \ pu, I_{-ve} = -j0.5 \ pu, I_0 = -j1 \ pu.$$

The type of the fault in the system is :

- (1) LG (2) LL (3) LLG (4) LLLG
- **31.** In PWM bipolar voltage switching scheme for single phase inverter. DC side have following components :
 - (1) DC and sinusoidal components at twice the fundamental frequency
 - (2) DC and sinusoidal components at twice the fundamental frequency
 - (3) Pure DC only
 - (4) None of the above
- 32. Kirchhoff's current law can be applied on :
 - (1) Planer network (2) Non-planer network
 - (3) All types of network (4) Neither planer nor non-planer
- 33. Eigen value of Hermitian matrix is :
 - (1) Zero only (2) Imaginary
 - (3) Real (4) Purely Imaginary or Zero
- 34. Divergence theorem of gauss discuss about transformation between :
 - (1) Line integrals and Surface integrals
 - (2) Volume integrals and Line integrals and bolive read as as bird aldors are a N
 - (3) Line integrals and Line integrals
 - (4) Surface integrals and Volume integrals

- **35.** For a single line to ground fault the zero-sequence current is given by j 3.0 pu. The current carried by the neutral during the fault is :
 - (1) j 1.0 pu (2) j 3.0 pu
 - (3) j 9.0 pu (4) $j 6.0 pu^{-1}$ (4) $j 6.0 pu^{-1}$ (4) $j 6.0 pu^{-1}$

36. The emitter of the transistor is generally doped the heaviest because it :

- (1) has to dissipate maximum power
- (2) has to supply the charge carriers
- (3) is the first region of transistor
- (4) must possess low resistance and some inclusion provide labiosume lans DCL (C)
- 37. A JFET has disadvantage of :
 - (1) being noisy

8

- (2) having small gain bandwidth product being set and was treasure a traditional
- (3) possessing positive temperature coefficient
- (4) having low input impedance
- 38. Routh's stability criterion can be used for determining :

13) All types of network:

- (1) System response for the disturbance
- (2) Absolute and relative stability of the system
- (3) Noise present in the system
- (4) Transient and steady state response
- **39.** Kelvin double bridge is best suited for the measurement of : measurement of :
 - (1) Resistance of very low value (2) Low value capacitance
 - (3) Resistance of very high value (4) High value capacitance

40. In transformer, eddy current loss is 1000 watts which is half of the total core loss. If thickness of lamination and frequency by 10%, the new core losses are :

9

(1)
$$3200 \text{ W}$$
 (2) 1000 W (3) 3200 W

41. What is the correct representation of the probability distribution of a fair die that may provide an output of any number from 1 to 6 ?

(1)
$$p(x) = \frac{x}{6}; x = 0, 1, ..., 6$$
 (2) $p(x) = \frac{1}{6}; x = 0, 1, ..., 6$

(3)
$$p(x) = \int_{a}^{b} \frac{1}{6} dx; a = 1,...,6$$
 (4) $p(x) = \frac{1}{8}; x = 0, 1,...,8$

42. We wish to solve $x^2 - 2 = 0$ by Newton Rahson technique. If initial guess is $x_0 = 1.0$ subsequent estimate of x (i.e. x_1) will be :

- (1) 1.414 (2) 2.0
- (3) 1.5 (4) None of these

43. Determine the maxima and minima of the following function :

$$f(x) = x^3 - 6x^2 + 9x + 25$$

- (1) Maxima at x = 1 and minima at x = -3
- (2) Maxima at x = 3 and minima at x = -1
- (3) Maxima at x = 1 and minima at x = 4 from the process in the decay of the second seco
- (4) Maxima at x = 1 and minima at x = 3

44. Find the particular solution of the following differential equation :

$$\ddot{y} + y = \sec(x)$$

- (1) $\cos(x)\ln|\cos(x)| + x\sin(x)$
- (2) $\sin(x)\ln|\cos(x)| + x\cos(x)$
- (3) $\cos(x)\ln|\cot(x)| + x\tan(x)$
- (4) $\sin(x)\ln|\cos(x)| + x\cot(x)$
- 45. Laplace transform of piece wise continuous function f(t) with a period p is:

(1)
$$F(s) = \frac{1}{1+e^{-ps}} \int_{0}^{p} e^{-st} f(t) dt$$

(2)
$$F(s) = \frac{1}{1 - e^{-ps}} \int_{0}^{p} e^{-st} f(t) dt$$

(3)
$$F(s) = \frac{1}{1 - e^{ps}} \int_{0}^{p} e^{-st} f(t) dt$$

(4)
$$F(s) = \frac{1}{1 + e^{-ps}} \int_{0}^{p} e^{-st} f(t) dt$$

- 46. A fixed capacitor of reactance $-j0.02 \ \Omega$ is connected in parallel across a series combination of a fixed inductor of reactance $j0.01 \ \Omega$ and a variable resistance R. As R is varied from zero to infinity, the locus diagram of the admittance of this R-L-C circuit will be :
 - (1) A semi-circle of diameter j 100 and center at zero.
 - (2) A straight line inclined at an angle.
 - (3) A semi-circle of diameter j50 and center at zero.
 - (4) A straight line parallel to the x-axis.

- 47. The percentage resistance and percentage reactance of a 10 kVA, 400V/200V, 3-Phase transformer is 2% and 10 % respectively. If the constant losses in the machine are 1%, the maximum possible percentage efficiency of the transformer is :
 - (1) 98.32 (2) 97.25 (3) 96.85 (4) 96.12

48. A series R-L-C circuit when excited by a 10V sinusoidal voltage source of a variable frequency, exhibits resonance at 100 Hz and has a 3 dB bandwidth of 5 Hz. The voltage across the inductor L at resonance is :

If is saushe for the current to be excillator

- (1) 10 V (2) 14.14 V (3) 7.07 V (4) 200 V
- 49. In the protection of transformers harmonic restraint is used to guard against :
 - (1) Magnetizing inrush current
 - (2) Unbalance operation
 - (3) Lightning

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- (4) Switching overvoltage
- 50. The RMS value of the current in a wire which carries a d.c. current of 10 A and a sinusoidal alternating current of peak value 20 A is :
 - (1) 10 A (2) 14.14 A (3) 15 A (4) 17.32 A
- 51. Which of the following is true ?
 - (1) A finite signal is always bounded
 - (2) A bounded signal always possesses finite energy
 - (3) A bounded signal is always zero outside the interval $[-t_0, t_0]$ for some t_0
 - (4) A bounded signal is always finite

52. A current of $-8 + 6\sqrt{2} \sin(\omega t + 30^\circ)$ A is passed through three meters. They are a centre zero PMMC meter, a true RMS meter and a moving iron instrument. The respective readings (in A) will be :

(2) 8, 6, 8 (1) 8, 6, 10 (4) -8, 2, 2

(3) -8, 10, 10

A non-ideal voltage source Vs has an internal impedance of Z_s . If a purely resistive load 53. is to be chosen that maximizes the power transferred to the load, its values must be :

(2) Real part of Z_s (1) 0

(4) Complex conjugate of Z_s (3) Magnitude of Z_s

A unit step voltage is applied at t = 0 to a series RL circuit with zero initial conditions : 54.

The RMS value of the current

allemating current of peak / sinc

- (1) It is possible for the current to be oscillatory.
- (2) The voltage across the resistor at $t = 0^+$ is zero.

(3) The energy stored in inductor in the steady state is zero.

(4) The resistor current eventually falls to zero.

The core flux of a practical transformer with a resistive load : 55.

- (1) Is strictly constant with load variation
- (2) Increases with linear load
- (3) Increases as the square root of the load
- (4) Decreases with increased load

The bridge method commonly used for finding mutual inductance is : 56.

- (1) Heaviside Campbell Bridge
 - (2) Schering Bridge
 - (3) De Sauty Bridge
 - (4) Wien Bridge

57. A memory system has a total of 8 memory chips, each with 12 address lines and 4 data lines. The total size of the memory system is :

(1) 16 kB (2) 32 kB (3) 48 kB (4) 64 kB

58. A differentiable non constant even function x(t) has a derivative y(t), and their respective Fourier Transforms are $X(\omega)$ and $Y(\omega)$. Which of the following statements is *true*?

Power factor increases samply

(1) $X(\omega)$ and $Y(\omega)$ are both real

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- (2) $X(\omega)$ is real and $Y(\omega)$ is imaginary
- (3) $X(\omega)$ and $Y(\omega)$ are both imaginary
- (4) $X(\omega)$ is imaginary and $Y(\omega)$ is real of 0.01 and matrix making and all A and A

59. A 3-phase, 50 Hz, 6 pole induction motor has a rotor resistance of 0.1 Ω and reactance of 0.92. Ω . Neglect the voltage drop in stator and assume that the rotor resistance is constant. Given that the full load slip is 3%, the ratio of maximum torque to full load torque is :

(1) 1.307 $(2) 1.712$ $(3) 1.740$ $(4) 2.134$	(1) 1.567	(2) 1.712	(3) 1.948	(4) 2.134
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60. In a microprocessor, the address of the next instruction to be executed, is stored in :

(1) Stack pointer	(2) Address latch
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(3) Program counter (4) General purpose register

- 61. A3-phase 440V, 50 Hz induction motor has 4% slip. The frequency of the rotor current will be :
 - (1) 5 Hz (2) 50 Hz (3) 25 Hz (4) 2 Hz
- 62. If the fault current is 2000 A the relay setting 50% and the CT ratio is 400/5, then the plug setting multiplier will be :
 - (1) 10 A (2) 25 A (3) 15 A (4) 50 A

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- **63.** A string insulator has 5 units. The voltage across the bottom most unit is 25% of the total voltage. The string efficiency is :
 - (1) 25% (2) 50% (3) 80% (4) 75%
- 64. Which is the following *true* for the bode plot ?
 - (1) Time response of the system for the step input
 - (2) It's a frequency
 - (3) Power factor decreases up to certain value of field current and then increases
 - (4) Power factor increases simply
- 65. 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) 214 (2) 332 (3) 183 (4) 182

66. If the penalty factor of a plant is unity, its incremental transmission loss is :

- (1) 1 (2) -1
- (3) 0 (4) None of the above
- 67. The dielectric losses of an electrical system are 50 Watts. What will be the dielectric losses if the voltage of the system is doubled ?
 - (1) 50 Watts (2) 100 Watts
 - (3) 300 Watts (4) 200 Watts
- **68.** The difference between sending end voltage and receiving end voltage of transmission line controls :
 - Active power
 Reactive power
 Frequency
 None of these

- 69. To protect the power transformer (Y-Y, with neutral earthed) against fault, the current transformer will have :
 - (1) Delta-delta connection (2) Delta-star connection
 - (3) Star-delta connection (4) Star-star connection
- 70. The steady state stability of the power system can be increased by :
 - (1) Using machines of high impedance
 - (2) Connecting line in series impedance
 - (3) Connecting lines in parallel
 - (4) Reducing the excitation of the machine and the ball of the procession
- 71. A Schottky diode is a :

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- (1) Majority carrier device
- (2) Minority carrier device
- (3) Fast a recovery diode
- (4) Both a majority and minority carrier diode
- 72. Which logic family provide maximum power dissipation?
 - (1) TTL (2) CMOS (3) ECL (4) JEET
- 73. DC machines have windings and synchronous use windings.
 - (1) Closed, open (2) Open, closed
 - (3) Open, open (4) Closed, closed
- 74. The per unit impedance of a circuit element is 0.15, if the base KV and base MVA are halved, then new value of the per unit impedance of the circuit element will be :
 - (1) 0.30 (2) 0.0075 (3) 0.600 (4) 0.15

75. Which of these sets of logic gates are designated as universal gates ?

- (2) XOR, NOR, NAND (1) OR, AND
- (4) NOR, NAND (3) NOR, NAND, XNOR
- 76. In the toggle mode a JK flip flop has :

(1) $J = 1, K = 1$	(2) $J = 0, K = 1$
(3) $J = 1, K = 0$	(4) $J = 0, K = 0$

77. A 100 µA ammeter has an internal resistance of 100 ohm. For extending its range to measure 500 μ A, the shunt resistance required is of :

(1) 20.0 Ω	(2) 22.22 Ω
(3) 25.0 Ω	(4) 50.0 Ω

The high torque to weight ratio in an analogue indicating instruments indicates : 78.

- (1) High friction loss
- (2) Low friction loss
- (3) Nothing as regards friction loss
- (4) None of the above

79. A 3-phase 400V, synchronous motor is providing load at 0.8 p.f. lagging. If the field current of the motor is continuously increased, then :

- (1) Power factor increases and the decreases
- (2) Power factor is not affected
- (3) Power factor decreases up to certain value of field current and then increases
- (4) Power factor increases simply

- A transmission line has a surge impedance of 400 Ω is connected with the cable having 80. surge impedance of 40 Ω , a surge magnitude of 100 kV is travelling from the transmission line toward the cable. Find the incident current ?
 - (4) 2500 A (1) 100 A (2) 200 A (3) 250 A

Feedback control systems are : 81.

E

B

- (1) Insensitive to both forward and feedback path parameter changes
- (2) Less sensitive to feedback path parameter changes than to forward path parameter changes
- (3) Less sensitive to forward path parameter changes than to feedback path parameter duive changes instantial N = 1 a cross ballous i = 1 i = 1 in motorum significant N
 - (4) Equally sensitive to forward and feedback path parameter changes
- The unit impulse response of a unit feedback control system is given by 82. $c(t) = -te^{-t} + 2e^{-t}$ ($t \ge 0$) the open loop transfer function is equal to :
 - (1) $\frac{s+1}{(s+2)^2}$ (3) $\frac{2s+1}{(s+1)^2}$ (4) $\frac{(s+1)}{s^2}$

The depletion region (or) space charge region (or) transition region in a semiconductor 83. p-n junction diode has : (2) 5u(n) - C

89. A current impulse of 5 8(d), is forced through a cupacitor C. The veitage 1, (d)

(1) Electrons and holes (2) Positive ions and electrons

- (3) Positive and negative ions (4) Negative ions and holes
- The seash of an electrical network has N nodes and B invinches The number of fash The output Y of a 2-bit comparator is logic 1 whenever the 2-bit input A is greater than 84. the 2-bit input B. The number of combinations for which the output is logic 1 is :

(2) 6 (3) 8 (1) 4(4) 10

- 85. If an A. C. voltage wave is corrupted with an arbitrary number of harmonics, then the overall voltage waveform differs from its fundamental frequency component in terms
 - of Inertia, $M = 20 \ pu$; reactance, $X = 2 \ pu$ The pu values of inertia and reactance on 100 MVA common base, respectively are :

E

- (1) Only the peak values (2) Only the rms values
- (3) Only the average values (4) All of the above

86. The system represented by the input-output relationship $y(t) = \int_{0}^{5t} x(\tau) d\tau$, t > 0 is :

- (1) Linear and causal (2) Linear but not causal
- (3) Causal but not linear (4) Neither linear nor causal
- 87. A voltage waveform $v(t) = 12 t^2$ is applied across a 1 H inductor for $t \ge 0$, with initial current through it being zero. The current through the inductor for $t \ge 0$ is given by :
 - (1) 12 t (2) 24 t (3) 12 t^3 (4) 4 t^3

88. A 10-bit A/D converter is used to digitize an analog signal in the 0 to 5V range. The maximum peak to peak ripple voltage that can be allowed in the DC supply voltage is :

- (1) Nearly 100 mV (2) Nearly 50 mV
- (3) Nearly 25 mV (4) Nearly 5 mV

89. A current impulse of 5 $\delta(t)$, is forced through a capacitor C. The voltage $v_c(t)$, across the capacitor is given by :

(1) 5t(2) 5u(t) - C(3) $\frac{5t}{C}$ (4) $\frac{5u(t)}{C}$

90. The graph of an electrical network has N nodes and B branches. The number of links L, with respect to the choice of a tree is given by :

- (1) B N + 1 (2) B + N
- (3) N B + 1 (4) N 2B 1

91. If the base kVA is 25,000 then a 5000 kVA alternator with 8% reactance will have :
(1) A 4% reactance
(2) A 40% reactance

- (3) A 16% reactance (4) A 20% reactance
- 92. Ferranti effect states that under certain conditions the sending end voltage is :
 - (1) Less than receiving end voltage
 - (2) Greater than receiving end voltage
 - (3) Equal to receiving end voltage
 - (4) Abnormally high
- **93.** If the shunt admittance of the transmission line is neglected, the maximum power will occur when torque angle :
 - (1) 45° (2) -90° (3) 90° (4) 180° (7)
- **94.** Four identical alternators each are rated for 20 MVA, 11 KV having a sub-transient of 16% are working in parallel. The short-circuit level at the bus bar is :
 - (1) 500 MVA (2) 400 MVA
 - (3) 125 MVA (4) 100 MVA
- **95.** If the fault current is 2000A, the relay setting is 50% and CT ration is 400:5, then plug setting multiplier (PSM) will be :
 - (1) 15 (2) 20 (3) 12.5 (4) 10
- 96. Maximum power transfer capability of transmission line can be increased by :
 - (1) Parallel transmission lines
 - (2) Using series capacitance
 - (3) Using bundled conductors
 - (4) All of the above

- 97. A transmission line has a reactance of 1 pu is operating at $V_r = V_r = 1$ pu. The generator
 - is connected at source end which delivering 0.5pu of active power ? Find the load angle :

E

(1) 35° (2) 30° (3) 32° (4) 45°

98. A network containing 100 buses in which 10 are the voltage control buses, 20 are the reactive power support bussed, 6 are the generator bi=uses and rest all are load buses. Find the size of the Jacobian matrix ?

(1) 162X162 (2) 163X163

- (3) 160X160 (4) 164X164
- 99. Transmission lines are transposed to reduce :
 - (1) Skin effect
 - (2) Proximity effect
 - (3) Ferranti effect
 - (4) Interference with neighbouring communication

100. The generating station suitable to operate as peak load plant is :

- (1) Nuclear power plant
- (2) Thermal power plant
- (3) Pumped storage power plant
- (4) None of the above

Total No. of Printed Pages : 21

Sr. No.

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PHD-EE-2023-24

Electrical Engineering

Time : 1¼ Hours	Max. Marks : 100	Total Questions : 100
Roll No. (in figures)	(in words)	
Name	Date of Birth	
Father's Name	Mother's Name	in contractor della della .
Date of Examination		

(Signature of the Candidate)

(Signature of the Invigilator)

10003

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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 unfairmeans / 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 shall be got uploaded on the University Website immediately after the conduct of Entrance Examination. Candidates may raise valid objection/complaint if any, with regard to discrepancy in the question booklet/answer key within 24 hours of uploading the same on the University Website. The complaint be sent by the students to the Controller of Examinations by hand or through email. Thereafter, no complaint in any case, will be considered.
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- 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. A3-phase 440V, 50 Hz induction motor has 4% slip. The frequency of the rotor current will be :
 - (4) 2 Hz (2) 50 Hz (3) 25 Hz (1) 5 Hz
- If the fault current is 2000 A the relay setting 50% and the CT ratio is 400/5, then the 2. plug setting multiplier will be the anatov bits godered
 - (3) 15 A (4) 50 A (2) 25 A (1) 10 A
- A string insulator has 5 units. The voltage across the bottom most unit is 25% of the 3. total voltage. The string efficiency is :
 - (1) 25% (2) 50% (3) 80% (4) 75%
- Which is the following true for the bode plot ? 4.
 - (1) Time response of the system for the step input
 - (2) It's a frequency
 - (3) Power factor decreases up to certain value of field current and then increases
 - (4) Power factor increases simply
- A 183-bus power system has 150 PQ buses and 32 PV buses. In the general case, to 5. obtain the load flow solution using Newton Raphson method in polar coordinates, the minimum number of simultaneous equations to be solved is ;
 - (4) 182 (2) 332 (1) 214
- If the penalty factor of a plant is unity, its incremental transmission loss is : 6.
 - (1) 1
 - (2) -1(4) None of the above (3) 0

- 7. The dielectric losses of an electrical system are 50 Watts. What will be the dielectric losses if the voltage of the system is doubled ?
 - (1) 50 Watts (2) 100 Watts
 - (3) 300 Watts (4) 200 Watts
- 8. The difference between sending end voltage and receiving end voltage of transmission line controls :
 - (1) Active power (2) Reactive power
 - (3) Frequency (4) None of these
- 9. To protect the power transformer (Y-Y, with neutral earthed) against fault, the current transformer will have :
 - (1) Delta-delta connection (2) Delta-star connection
 - (3) Star-delta connection (4) Star-star connection
- 10. The steady state stability of the power system can be increased by :
 - (1) Using machines of high impedance
 - (2) Connecting line in series impedance
 - (3) Connecting lines in parallel
 - (4) Reducing the excitation of the machine
- 11. What is the correct representation of the probability distribution of a fair die that may provide an output of any number from 1 to 6 ?
 - (1) $p(x) = \frac{x}{6}; x = 0, 1, ..., 6$ (2) $p(x) = \frac{1}{6}; x = 0, 1, ..., 6$ (3) $p(x) = \int_{a}^{b} \frac{1}{6} dx; a = 1, ..., 6$ (4) $p(x) = \frac{1}{8}; x = 0, 1, ..., 8$

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- 12. We wish to solve $x^2 2 = 0$ by Newton Rahson technique. If initial guess is $x_0 = 1.0$ subsequent estimate of x (i.e. x_1) will be :
 - (1) 1.414 (2) 2.0 (3) 1.5 (4) None of these

13. Determine the maxima and minima of the following function :

$$f(x) = x^3 - 6x^2 + 9x + 25$$

(1) Maxima at x = 1 and minima at x = -3

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- (2) Maxima at x = 3 and minima at x = -1
- (3) Maxima at x = 1 and minima at x = 4
- (4) Maxima at x = 1 and minima at x = 3
- 14. Find the particular solution of the following differential equation :

$$\ddot{y} + y = \sec(x)$$

- (1) $\cos(x)\ln|\cos(x)| + x\sin(x)$
- (2) $\sin(x)\ln|\cos(x)| + x\cos(x)$
- (3) $\cos(x)\ln|\cot(x)| + x\tan(x)$
- (4) $\sin(x)\ln|\cos(x)| + x\cot(x)$
- 15. Laplace transform of piece wise continuous function f(t) with a period p is:

(1)
$$F(s) = \frac{1}{1+e^{-ps}} \int_{0}^{p} e^{-st} f(t) dt$$

(2)
$$F(s) = \frac{1}{1 - e^{-ps}} \int_{0}^{p} e^{-st} f(t) dt$$

(3)
$$F(s) = \frac{1}{1 - e^{ps}} \int_{0}^{p} e^{-st} f(t) dt$$

(4)
$$F(s) = \frac{1}{1+e^{-ps}} \int_{0}^{p} e^{-st} f(t) dt$$

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- 16. A fixed capacitor of reactance $-j0.02 \Omega$ is connected in parallel across a series combination of a fixed inductor of reactance j0.01 Ω and a variable resistance R. As R is varied from zero to infinity, the locus diagram of the admittance of this R-L-C circuit will be :
 - (1) A semi-circle of diameter j 100 and center at zero.
 - (2) A straight line inclined at an angle.

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- (3) A semi-circle of diameter j50 and center at zero.
- (4) A straight line parallel to the x-axis.
- 17. The percentage resistance and percentage reactance of a 10 kVA, 400V/200V, 3-Phase transformer is 2% and 10 % respectively. If the constant losses in the machine are 1%. the maximum possible percentage efficiency of the transformer is :
 - (2) 97.25 (3) 96.85 (1) 98.32 (4) 96.12
- 18. A series R-L-C circuit when excited by a 10V sinusoidal voltage source of a variable frequency, exhibits resonance at 100 Hz and has a 3 dB bandwidth of 5 Hz. The voltage across the inductor L at resonance is :
 - (1) 10 V(2) 14.14 V (3) 7.07 V (4) 200 V
- 19. In the protection of transformers harmonic restraint is used to guard against :
 - (1) Magnetizing inrush current
 - (2) Unbalance operation

(3) Lightning

- (4) Switching overvoltage
- The RMS value of the current in a wire which carries a d.c. current of 10 A and a 20. sinusoidal alternating current of peak value 20 A is :

(1) 10 A(2) 14.14 A (3) 15 A

- 21. Feedback control systems are :
 - (1) Insensitive to both forward and feedback path parameter changes
 - (2) Less sensitive to feedback path parameter changes than to forward path parameter changes
 - (3) Less sensitive to forward path parameter changes than to feedback path parameter changes
 - (4) Equally sensitive to forward and feedback path parameter changes
- 22. The unit impulse response of a unit feedback control system is given by $c(t) = -te^{-t} + 2e^{-t}$ ($t \ge 0$) the open loop transfer function is equal to :
 - (1) $\frac{s+1}{(s+2)^2}$ (2) $\frac{2s+1}{s^2}$ (3) $\frac{2s+1}{(s+1)^2}$ (4) $\frac{(s+1)}{s^2}$
- 23. The depletion region (or) space charge region (or) transition region in a semiconductor p-n junction diode has :
 - (1) Electrons and holes (2) Positive ions and electrons
 - (3) Positive and negative ions (4) Negative ions and holes
- 24. The output Y of a 2-bit comparator is logic 1 whenever the 2-bit input A is greater than the 2-bit input B. The number of combinations for which the output is logic 1 is :
 - (1) 4 (2) 6 (3) 8 (4) 10
- 25. If an A. C. voltage wave is corrupted with an arbitrary number of harmonics, then the overall voltage waveform differs from its fundamental frequency component in terms of Inertia, $M = 20 \ pu$; reactance, $X = 2 \ pu$ The pu values of inertia and reactance on 100 MVA common base, respectively are :
 - (1) Only the peak values (2) Only the rms values
 - (3) Only the average values (4) All of the above

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- **26.** The system represented by the input-output relationship $y(t) = \int x(\tau) d\tau$, t > 0 is :
 - (1) Linear and causal (2) Linear but not causal

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- (4) Neither linear nor causal (3) Causal but not linear
- 27. A voltage waveform $v(t) = 12 t^2$ is applied across a 1 H inductor for $t \ge 0$, with initial current through it being zero. The current through the inductor for $t \ge 0$ is given by :
 - (1) 12 t (2) 24 t (3) 12 t^3 (4) 4 t^3
- 28. A 10-bit A/D converter is used to digitize an analog signal in the 0 to 5V range. The maximum peak to peak ripple voltage that can be allowed in the DC supply voltage is :

(1) Nearly 100 mV	(2) Nearly 50 mV

- (3) Nearly 25 mV (4) Nearly 5 mV
- **29.** A current impulse of 5 $\delta(t)$, is forced through a capacitor C. The voltage $v_c(t)$, across the capacitor is given by :
 - Fire Jepletron record (or) andro char (1) 5t(2) 5u(t) - C(4) $\frac{5u(t)}{C}$ (4) $\frac{5u(t)}{C}$ (3) $\frac{5t}{C}$

The graph of an electrical network has N nodes and B branches. The number of links L, 30. with respect to the choice of a tree is given by :

the 2-but mout B. The u

(1) B - N + 1(2) B + N(3) N - B + 1(4) N - 2B - 1

31. An Op-Amp has an open-loop gain of 10^5 and an open-loop upper cut-off frequency of 10 Hz. If this op-amp is connected as an amplifier with a closed loop gain of 100,

- (1) 10 Hz(2) 100 Hz
- (3) 10 kHz (4) 100 kHz

32. Let x(t) be a periodic signal with time period T, Let $y(t) = x(t - t_0) + x(t + t_0)$ for some t_0 . The Fourier series coefficients of y(t) are denoted by bk. If $b_k = 0$ for all odd k. Then t_0 can be equal to :

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- (1) T/8 (2) T/4 (3) T/2 (4) 2T
- 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:
 - (1) 5 (2) 12 (3) 15 (4) 20
- 34. The resistance and reactance of a 100 kVA 11000/400 V, ΔY distribution transformer is 0.02 and 0.07 pu respectively. The phase impedance (in Ω) of the transformer referred to the primary is :
 - (1) 0.02 + j0.07(2) 0.55 + j1.925(3) 15.125 + j52.94(4) 72.6 + j254.1
- **35.** An op-amp having a slew rate of 62.8 V/ μ sec is connected in a voltage follower configuration. If the maximum amplitude of the input sinusoidal is 10 V, then the minimum frequency at which the slew rate limited distortion would set in the output is :
 - (1) 1 MHz (2) 6.28 MHz (4) 62.8 MHz

(3) 10 MHz

36. The pu parameters for a 500 MVA machine on its own base are :
Inertia, M = 20 pu; reactance, X = 2 pu. The pu values of inertia and reactance on 100 MVA common base, respectively are :

(1) 4, 0.4 (2) 100, 10 (3) 4, 10 (4) 100, 0.4 PHD-EE-2023-24/(Electrical Engg.)(SET-Y)/(C) P. T. O.

- (i) Cache Memory
- (ii) CD-ROM
- (iii) Dynamic RAM
- (iv) Processor Registers
- (v) Magnetic Tape
 - (1) (v), (ii), (iii), (iv), (i)
 - (2) (v), (ii), (iii), (i), (iv)
 - (3) (v), (iii), (ii), (iv), (i) 011 AVst 001 a to sometans but constructs self
- (4) (iv), (ii), (iii), (v), (i) and a view longer and V0.0 bas 20.0 m sometimes
 - **38.** A source $v_s(t) = V \cos(100\pi t)$ has an internal impedance of $(4 + j3)\Omega$. If a purely resistive load connected to the source has to extract the maximum power out of this source, its value in Ω should be :

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

39. The Laplace transform of a function f(t) is $F(s) = \frac{5s^2 + 23s + 6}{s(s^2 + 2s + 2)}$. As $t \to \infty$, f(t) approaches:

(1) 3 (2) 5 (3) 17/2 (4) ∞

40. Two wattmeters', which are connected to measure the total power on a three-phase system supplying a balanced load, read 10.5 kW and -2.5 kW, respectively. The total power and the power factor respectively, are :

(1)	13 kW, 0.334		(2) 13 kW, 0.684	
(3)	13 kW, 0.52	01 t (E)	(4) 8 kW, 0.52	

41.	A Schottky diode is a :			
	(1) Majority carrier device			
	(1) Majority carrier device		(2) 22.22 Ω	
	(2) Minority carrier device			
	(3) Fast a recovery diode			
	Total and the second se			
	(4) Both a majority and minority carrier	r dioc	le i poirait das	gen au grinftoll (7)
42.	Which logic family provide maximum p		r dissipation ?	48. A 3-planet 400V.
	(1) TTL (2) CMOS		ECL	(4) JEET
43.	DC machines have windings			
	(1) Closed, open		Open, closed	 Power factor d Power factor in
	(3) Open, open		Closed, closed	50. A generation line
44.	The per unit impedance of a circuit eler			
	halved, then new value of the per unit in			
	(1) 0.30 (2) 0.0075		0.600	(4) 0.15
	VA alternator with 8 birendades will be	. (8)	Ur - 1981 (100 C.	
45.	Which of these sets of logic gates are de	esign	ated as universal	gates (
	(1) OR, AND	(2)	XOR, NOR, N	AND
	(3) NOR, NAND, XNOR	(4)	NOR, NAND	S2. Ferrian cifea state
			sollar big gas	(i) Les that receipt
46.	In the toggle mode a JK flip flop has :			
	(1) $J = 1, K = 1$	(2)	J = 0, K = 1	(ii) Equal to receiv
	(3) $J = 1, K = 0$			(4) Abaamaliy bi
DTT	(SET-Y)	(C)	生活的 机混合的现在分子	P. T. O.

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47.	A 100 μ A ammeter has an internal measure 500 μ A, the shunt resistance	resistance of 100 ohm. For extending its range required is of :
	(1) 20.0 O (2) 22.22 Ω	(5) 25:0 -
48.	The high torque to weight ratio in an	analogue indicating instruments indicates :
-0.		
	(3) Nothing as regards friction loss	(4) None of the above (4) None of the fu
49.	current of the motor is continuously i	r is providing load at 0.8 p.f. lagging. If the figure nereased, then :
	(1) Power factor increases and the de	creases
	(2) Power factor is not affected	ain value of field current and then increases
	(4) Power factor increases simply	
50.	i i l'as has a surge imper	lance of 400 Ω is connected with the cable have e magnitude of 100 kV is travelling from the
	(1) 100 A (2) 200 A	(3) 250 A (4) 2500 A
51.	If the base kVA is 25,000 then a 5000	kVA alternator with 8% reactance will have :
	(1) A 4% reactance	(2) A 40% reactance
	(3) A 16% reactance	
52.	Ferranti effect states that under certain	conditions the sending end voltage is :
	(1) Less than receiving end voltage	44. In the rocate mode a FK the flop ha
	(2) Greater than receiving end voltage	
	(3) Equal to receiving end voltage	
	(4) Abnormally high	

If the shunt admittance of the transmission line is neglected, the maximum power will 53. occur when torque angle : (1) 45° $(2) -90^{\circ}$ (3) 90° (4) 180° 54. Four identical alternators each are rated for 20 MVA, 11 KV having a sub-transient of 16% are working in parallel. The short-circuit level at the bus bar is : (1) 500 MVA (2) 400 MVA (3) 125 MVA (4) 100 MVA If the fault current is 2000A, the relay setting is 50% and CT ration is 400:5, then plug 55. setting multiplier (PSM) will be : (1) 15 (2) 20(3) 12.5 (4) 10 Maximum power transfer capability of transmission line can be increased by : 56. (2) Using series capacitance (3) Using bundled conductors (2) DC and simisoidal components at twice the fun-(4) All of the above A transmission line has a reactance of 1 pu is operating at $V_s = V_r = 1$ pu. The generator 57. is connected at source end which delivering 0.5pu of active power ? Find the load angle : (2) 30° (3) 32° (4) 45° (1) 35° A network containing 100 buses in which 10 are the voltage control buses, 20 are the 58. reactive power support bussed, 6 are the generator bi=uses and rest all are load buses. Find the size of the Jacobian matrix ? (2) 163X163 (1) 162X162 (4) 164X164 (3) 160X160 PHD-EE-2023-24/(Electrical Engg.)(SET-Y)/(C) P. T. O. 59. Transmission lines are transposed to reduce :

- (1) Skin effect
- (2) Proximity effect
- (3) Ferranti effect
- (4) Interference with neighbouring communication

60. The generating station suitable to operate as peak load plant is :

- (1) Nuclear power plant
- (2) Thermal power plant
- (3) Pumped storage power plant
- (4) None of the above
- 61. In PWM bipolar voltage switching scheme for single phase inverter. DC side have following components :
 - (1) DC and sinusoidal components at twice the fundamental frequency
 - (2) DC and sinusoidal components at twice the fundamental frequency
 - (3) Pure DC only
 - (4) None of the above

62. Kirchhoff's current law can be applied on :

- (1) Planer network (2) Non-planer network
- (3) All types of network (4) Neither planer nor non-planer
- 63. Eigen value of Hermitian matrix is :
 - (1) Zero only

(3) Real

- (2) Imaginary
- (4) Purely Imaginary or Zero

64.	Divergence theorem of gauss discuss about the	ransformation between :
	(1) Line integrals and Surface integrals	
	(2) Volume integrals and Line integrals	
	(3) Line integrals and Line integrals	
	(4) Surface integrals and Volume integrals	
65.	For a single line to ground fault the zero-se current carried by the neutral during the fault	t is :
	(1) <i>j</i> 1.0 <i>pu</i> (2)	j 3.0 pu
		j 6.0 pu
66.	(1) sine state (1) The emitter of the transistor is generally dee	(3) 3200 W System (3)
00.	(a) (4) 2000 W swew hubbach (6)	ed the neaviest because it :
	(1) has to dissipate maximum power	
	(2) has to supply the charge carriers	77. Consider system with transfer fanc
	(3) is the first region of transistor	0.5 when the value of K is a second
	(4) must possess low resistance	 2.6 (2) 3
67.		
	(1) being noisy	72. E ogie-zero cameeliquica pacets, the
	(2) having small gain bandwidth product	U. Un songeofficiers and the
	(3) possessing positive temperature coeffici	ent oktovis-odo-sU (2)
	(4) having low input impedance	
68.	Routh's stability criterion can be used for de	termining :
	(1) System response for the disturbance	
	(2) Absolute and relative stability of the sys	stem
	(3) Noise present in the system	

(4) Transient and steady state response

69.	Kelvin double bridge is best suited for th	ne measurement of :
		 Volume integrals and Line integrals
	(2) Low value capacitance	(3) Line mirgrals and Line integrals
	(3) Resistance of very high value	(4) Surface integrals and Volume integ
	(4) High value capacitance	85. For a single line to ground fault the z
70.	In transformer, eddy current loss is 10	00 watts which is half of the total core loss. If
	thickness of lamination and frequency b	y 10%, the new core losses are :
	(1) 3200 W	(2) 1000 W
	(3) 2200 W	(4) 2000 ₩
71.	Consider system with transfer function	$G(s) = \frac{s+6}{(Ks^2+s+6)}$. Its damping ratio will be
	0.5 when the value of K is :	RUSIAN B IN HINGS FROM THE SECOND
	(1) 2/6 (2) 3	(3) 1/6 (4) 6
72.	If pole-zero cancellation occurs, the sys	stem will be :
	(1) Un-controllable	C1 having small gain handwidth produc
		(3) free caing positive temperature coef
	(3) Either controllable or observable	(4) having low hoper respectively
	(4) Either un-controllable or un-observ	vable
73.	Consider the function $f(x) = x_1^2 + 2x_2^2$	+ $4x_3^2$ + $2x_1x_2 - 4x_2x_3 - 4x_3x_1$. The function is:
	(1) Positive definite	(2) Positive semi-definite
	(3) Negative definite	(4) Negative semi-definite
PHD-	EE-2023-24/(Electrical Engg.)(SET-Y	Property F-2023-24/(Electrical Engg. (SEET (3))(

- **74.** A synchronous motor is operating on no load at unity power factor. If the field current is increased, the power factor will become :
 - (1) Leading and the current will decrease
 - (2) Lagging and the current will increase
 - (3) Lagging and the current will decrease
 - (4) Leading and the current will increase
- 75. The Double edge modulation eliminates certain harmonics when the reference is :
 - (1) Sine wave (2) Square wave
 - (3) Triangular wave

(4) Trapezoidal wave

76. In dual converter :

- (1) Both rectifiers provide positive current to the load
- (2) Both rectifiers provide negative current to the load
- (3) One rectifier provides positive current to the load and the other negative current
- (4) One rectifier provides positive current to the source and the other negative current to the load
- 77. In communication PAC stands for :
 - (1) Permanent angle converter
 - (2) Phase angle converter
 - (3) Phase angle communication
 - (4) Phase and commutation

16

- **78.** A control system described by $\dot{x} = \begin{vmatrix} -4 & 1 \\ 2 & -3 \end{vmatrix} x + \begin{vmatrix} 2 \\ 3 \end{vmatrix} u, y = \begin{bmatrix} 3 & -2 \end{bmatrix} x$. The system is to be controlled by control law u = -Kx(t). The feedback matrix K for placing the poles at $-4 \pm j4$ is: (2) $K = \begin{bmatrix} -2 & 7 \end{bmatrix}$
 - (1) $K = [-10 \ 7]$ (2) $K = [-2 \ 7]$ (4) $K = [10 \ 7]$
 - (3) $K = [2 \ 7]$

0 6 - 5.

- 79. Consider the matrix $A = \begin{vmatrix} 1 & 0 & 2 \end{vmatrix}$. The eigen vectors of A are : 3 2 4
 - (1) $p_1 = \begin{bmatrix} 2 & -1 & 2 \end{bmatrix}', p_2 = \begin{vmatrix} 1 \frac{3}{7} & \frac{-5}{7} \end{vmatrix}'$ and $p_3 = \begin{bmatrix} 1 \frac{22}{28} & -\frac{46}{28} \end{bmatrix}'$ (2) $p_1 = \begin{bmatrix} 2 & -1 & 2 \end{bmatrix}', p_2 = \begin{vmatrix} 1 - \frac{3}{7} & \frac{-5}{7} \end{vmatrix}'$ and $p_3 = \begin{bmatrix} 1 - \frac{22}{35} & \frac{-46}{35} \end{bmatrix}'$ (3) $p_1 = \begin{bmatrix} 2 & -1 & 2 \end{bmatrix}', p_2 = \begin{vmatrix} 1 - \frac{3}{7} & \frac{-5}{7} \end{vmatrix}'$ and $p_3 = \begin{bmatrix} 1 - \frac{22}{42} & -\frac{46}{42} \end{bmatrix}'$ (4) $p_1 = \begin{bmatrix} 2 & -1 & 2 \end{bmatrix}', p_2 = \begin{vmatrix} 1 - \frac{3}{7} & \frac{-5}{7} \end{vmatrix}'$ and $p_3 = \begin{bmatrix} 1 - \frac{22}{42} & -\frac{46}{42} \end{bmatrix}'$
- **80.** For what value of *d*, does the following system of linear equations has a non-trivial solution ?

$$(4d-1)x + y + z = 0$$
$$-y + z = 0$$
$$(4d-1)z = 0$$
$$(2) \quad \left(\frac{3}{4}\right)$$
$$(4) \quad 1$$

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(1) $\left(\frac{1}{2}\right)$

(3) $\left(\frac{1}{4}\right)$

- 81. Power consumed by a balanced 3-phase 3 wire load is measured by two wattmeter method. The first wattmeter reads twice that of the second. Then the load impedance angle in radians is :
 - (1) $\frac{\pi}{12}$ (2) $\frac{\pi}{8}$ (3) $\frac{\pi}{6}$ (4) $\frac{\pi}{3}$
- 82. A switched mode power supply operating at 20 kHz to 100 kHz range uses as the main switching element :
 - (1) Thyristor (2) MOSFET 87. The typical ratio of latelung , arren (3) Triac (4) UJT
- The conductors of a 10 km long, single phase, two wire line are separated by a distance 83. of 1.5 m. The diameter of each conductor is 1 cm. If the conductors are of copper, the inductance of the circuit is :

(1) 50 mH	(2) 45.3 mH
(3) 23.8 mH	(4) 19.6 mH

- 84. If \overline{E} is the electric field intensity, $\nabla(\nabla \times \overline{E})$ is equal to :
 - (2) $|\overline{B}|$ (2) $|\overline{B}|$ (2) $|\overline{B}|$ (3) $|\overline{B}| = 1$ (4) $|\overline{B}| = 1$ (5) $|\overline{B}| = 1$ (7) $|\overline{B}| = 1$ (1) \overline{E} (4) Zero (3) Null vector

Consider a long, two wire line composed of solid round conductors. The radius of both 85. conductors is 0.25 cm and the distance between their centres as l meters. If this distance is doubled, then the inductance per unit length :

(1) Doubles

(2) Halves

- (3) Increases but does not double
- (4) Decreases but does not halve

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

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- **86.** The conduction loss v/s device current characteristics of a power MOSFET is best approximated by :
 - (1) Parabola
 - (2) Straight Line
 - (3) Rectangular Hyperbola
 - (4) Exponentially decaying function
- 87. The typical ratio of latching current to holding current in a 20 thyristor is :
 - (1) 5 (2) 2 (3) 1 (4) 0.5
- 88. In a uniform electric field, field lines at equipotential surfaces :
 - (1) Are parallel to one another
 - (2) Intersect at 45°
 - (3) Intersect at 30°
 - (4) Are orthogonal
- 89. A hollow metallic sphere of radius r is kept at potential of 1 V. The total electric flux coming out of the concentric spherical surface of radius R (> r) is :
 - (1) $4\pi\epsilon_0 r$ (2) $4\pi\epsilon_0 r^2$
 - (3) $4\pi\epsilon_0 R$ (4) $4\pi\epsilon_0 R^2$
- 90. The sequence components of the fault current are as follows :

 $I_{+ve} = j1.5 \ pu, \ I_{-ve} = -j0.5 \ pu, \ I_0 = -j1 \ pu.$

The type of the fault in the system is :

(1) LG (2) LL (3) LLG (4) LLLG

С

- 91. Which of the following is *true*?
 - (1) A finite signal is always bounded
 - (2) A bounded signal always possesses finite energy
 - (3) A bounded signal is always zero outside the interval $[-t_0, t_0]$ for some t_0
 - (4) A bounded signal is always finite
- 92. A current of $-8 + 6\sqrt{2} \sin(\omega t + 30^\circ)$ A is passed through three meters. They are a centre zero PMMC meter, a true RMS meter and a moving iron instrument. The respective readings (in A) will be :
 - (1) $8, 6, 10^{(1)}$ (2) $8, 6, 8^{(1)}$ (2)
 - (3) -8, 10, 10 (4) -8, 2, 2
- **93.** A non-ideal voltage source V_s has an internal impedance of Z_s . If a purely resistive load is to be chosen that maximizes the power transferred to the load, its values must be :
 - (1) 0 (2) Real part of Z_{r}
 - (3) Magnitude of Z_s (4) Complex conjugate of Z_s
- 94. A unit step voltage is applied at t = 0 to a series RL circuit with zero initial conditions :
 - (1) It is possible for the current to be oscillatory.
 - (2) The voltage across the resistor at $t = 0^+$ is zero.
 - (3) The energy stored in inductor in the steady state is zero.
 - (4) The resistor current eventually falls to zero.
- 95. The core flux of a practical transformer with a resistive load :
 - (1) Is strictly constant with load variation
 - (2) Increases with linear load
 - (3) Increases as the square root of the load
 - (4) Decreases with increased load

96. The bridge method commonly used for finding mutual inductance is :

- (1) Heaviside Campbell Bridge
- (2) Schering Bridge
- (3) De Sauty Bridge
- (4) Wien Bridge
- **97.** A memory system has a total of 8 memory chips, each with 12 address lines and 4 data lines. The total size of the memory system is :
 - (1) 16 kB (2) 32 kB (3) 48 kB (4) 64 kB
- **98.** A differentiable non constant even function x(t) has a derivative y(t), and their respective Fourier Transforms are $X(\omega)$ and $Y(\omega)$. Which of the following statements is *true*?
 - (1) $X(\omega)$ and $Y(\omega)$ are both real
 - (2) $X(\omega)$ is real and $Y(\omega)$ is imaginary
 - (3) $X(\omega)$ and $Y(\omega)$ are both imaginary
 - (4) $X(\omega)$ is imaginary and $Y(\omega)$ is real
- **99.** A 3-phase, 50 Hz, 6 pole induction motor has a rotor resistance of 0.1 Ω and reactance of 0.92. Ω . Neglect the voltage drop in stator and assume that the rotor resistance is constant. Given that the full load slip is 3%, the ratio of maximum torque to full load torque is :
 - (1) 1.567 (2) 1.712 (3) 1.948 (4) 2.134
- 100. In a microprocessor, the address of the next instruction to be executed, is stored in :
 - (1) Stack pointer (2) Address latch
 - (3) Program counter (4) General purpose register
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	HIS QUESTION BOOKLET BEFORM ARE ASKED TO DO SO) PHD-EE-2023-24	No. of Printed Pages : 21 E TIME OR UNTIL YOU SET-Y
	Electrical Engineering	Sr. No
Name	Max. Marks : 100 (in words) Date of Birth Mother's Name	Total Questions : 100
Date of Examination	lidate)	(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 unfairmeans / 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.
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- 4. Question Booklet along with answer key of all the A, B, C & D code shall be got uploaded on the University Website immediately after the conduct of Entrance Examination. Candidates may raise valid objection/complaint if any, with regard to discrepancy in the question booklet/answer key within 24 hours of uploading the same on the University Website. The complaint be sent by the students to the Controller of Examinations by hand or through email. Thereafter, no complaint in any case, will be
- 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.
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- and complete booklet. Complaints, if any, regarding misprinting etc. will not be entertained 30 minutes after starting of the examination.

- 1. Power consumed by a balanced 3-phase 3 wire load is measured by two wattmeter method. The first wattmeter reads twice that of the second. Then the load impedance angle in radians is :
 - (1) $\frac{\pi}{12}$ (2) $\frac{\pi}{8}$ (3) $\frac{\pi}{6}$ (4) $\frac{\pi}{3}$

2. A switched mode power supply operating at 20 kHz to 100 kHz range uses as the main switching element :

- (1) Thyristor (2) MOSFET
- (3) Triac (4) UJT
- 3. The conductors of a 10 km long, single phase, two wire line are separated by a distance of 1.5 m. The diameter of each conductor is 1 cm. If the conductors are of copper, the inductance of the circuit is :
 - (1) 50 mH
 (2) 45.3 mH

 (3) 23.8 mH
 (4) 19.6 mH
- 4. If \overline{E} is the electric field intensity, $\nabla(\nabla \times \overline{E})$ is equal to :
 - (1) \overline{E} and \overline{E} is a lower property (2) $|\overline{E}|$ is a set with we low \overline{E}
 - (3) Null vector (4) Zero
- 5. Consider a long, two wire line composed of solid round conductors. The radius of both conductors is 0.25 cm and the distance between their centres as *l* meters. If this distance is doubled, then the inductance per unit length :
 - (1) Doubles
 - (2) Halves
 - (3) Increases but does not double
 - (4) Decreases but does not halve

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6. The conduction loss v/s device current characteristics of a power MOSFET is best approximated by : ______ (1) Parabola (2) Straight Line (3) Rectangular Hyperbola (4) Exponentially decaying function The typical ratio of latching current to holding current in a 20 thyristor is : 7. (4) 0.5 (1) 5(2) 2 (3) 1 8. In a uniform electric field, field lines at equipotential surfaces : states and the dimension of each conductor is 1 and 40 the condu-(1) Are parallel to one another (2) Intersect at 45° (3) Intersect at 30° RESERVE (MY (4) Are orthogonal A hollow metallic sphere of radius r is kept at potential of 1 V. The total electric flux 9. coming out of the concentric spherical surface of radius R (> r) is : (1) $4\pi \in_0 r$ (2) $4\pi \in_0 r^2$ (3) $4\pi \epsilon_0 R$ (4) $4\pi \epsilon_0 R^2$ at and any the consistent of a fit half out of a state of the The sequence components of the fault current are as follows : 10. $I_{+ve} = j1.5 \ pu, I_{-ve} = -j0.5 \ pu, I_0 = -j1 \ pu.$ The type of the fault in the system is : and the second second second second second

(1) LG (2) LL (3) LLG (4) LLLG

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11.	If the base kVA is 25,000 then a 5000 k	VA alternator	with 8% reactance will have :
	(1) A 4% reactance	(2) A 40% re	eactance
	(3) A 16% reactance	(4) A 20% re	eactance
12.	Ferranti effect states that under certain of	conditions the s	ending end voltage is :
	(1) Less than receiving end voltage	idaan tassad D	H gamiettan Amarian (184
	(2) Greater than receiving end voltage	ditamin' dipensit	i numpia remon antitata
	(3) Equal to receiving end voltage	" zitiela ker	land on he skis of her lace
	(4) Abnormally high		11 191 7627 (1)
13.	If the shunt admittance of the transmiss occur when torque angle :		lected, the maximum power will
	(1) 45° (2) -90°	(3) 90°	(4) 180°
14.	Four identical alternators each are rated 16% are working in parallel. The short-o		he bus bar is :
	(1) 500 MVA	(2) 400 MVA	
	(3) 125 MVA	(4) 100 MVA	an dink transfirstel (* 1977) 1990 - Marine Marine, 1997)
15.	If the fault current is 2000A, the relay s setting multiplier (PSM) will be :		nd CT ration is 400:5, then plug
	(1) 15 (2) 20		asia (4) 10 and 11
16.	Maximum power transfer capability of t	ransmission lin	e can be increased by :
Palling 1901 m	(2) Using series capacitance		21. Att Og: And had ad open milite Hat frither opening
	(4) All of the above		$(5) \in \mathbb{N}^{n}$
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- 17. A transmission line has a reactance of 1 pu is operating at $V_s = V_r = 1 pu$. The generator is connected at source end which delivering 0.5pu of active power ? Find the load angle :
 - (1) 35° (2) 30° (3) 32° (4) 45°

18. A network containing 100 buses in which 10 are the voltage control buses, 20 are the reactive power support bussed, 6 are the generator bi=uses and rest all are load buses. Find the size of the Jacobian matrix ?

(4) 164X164

visiting in one allot. The share-circuit level

hour significal allernators each are rated for 20 MV

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duid vhenrund A. (H)

(1) 162X162 (2) 163X163

(3) 160X160

4

- 19. Transmission lines are transposed to reduce :
 - (1) Skin effect

(2) Proximity effect

(3) Ferranti effect

(4) Interference with neighbouring communication

20. The generating station suitable to operate as peak load plant is :

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(1) Nuclear power plant

(2) Thermal power plant

- (3) Pumped storage power plant
- (4) None of the above

21. An Op-Amp has an open-loop gain of 10⁵ and an open-loop upper cut-off frequency of 10 Hz. If this op-amp is connected as an amplifier with a closed loop gain of 100, then the new upper cut-off frequency is :

(1) 10 Hz (2) 100 Hz (3) 10 kHz (4) 100 kHz

- 22. Let x(t) be a periodic signal with time period T, Let $y(t) = x(t t_0) + x(t + t_0)$ for some t_0 . The Fourier series coefficients of y(t) are denoted by bk. If $b_k = 0$ for all odd k. Then t_0 can be equal to :
 - (1) T/8 (2) T/4 (3) T/2 (4) 2T

23. 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
- 24. The resistance and reactance of a 100 kVA 11000/400 V, ΔY distribution transformer is 0.02 and 0.07 pu respectively. The phase impedance (in Ω) of the transformer referred to the primary is :

(1) 0.02 + j0.07	(2) 0.55 + j1.925
(3) 15.125 + j52.94	(4) 72.6 + j254.1

- 25. An op-amp having a slew rate of 62.8 V/μ sec is connected in a voltage follower configuration. If the maximum amplitude of the input sinusoidal is 10 V, then the minimum frequency at which the slew rate limited distortion would set in the output is :
 - (1) 1 MHz (2) 6.28 MHz
 - (3) 10 MHz (4) 62.8 MHz
- 26. The pu parameters for a 500 MVA machine on its own base are :

Inertia, M = 20 pu; reactance, X = 2 pu. The *pu* values of inertia and reactance on 100 MVA common base, respectively are :

 (1) 4, 0.4
 (2) 100, 10

 (3) 4, 10
 (4) 100, 0.4

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27. The increasing order of speed of data access for the following devices is :

- (i) Cache Memory
- (ii) CD-ROM
- (iii) Dynamic RAM
- (iv) Processor Registers bines were a during state of the property independent of the principal system is a new valid
 - (v) Magnetic Tape
 - (1) (v), (ii), (iii), (iv), (i)
 - (2) (v), (ii), (iii), (i), (iv)
 - The exectance and machine of a 100 kVA 11009 (3) (v), (iii), (ii), (iv), (i)
 - (4) (iv), (ii), (iii), (v), (i)
 - A source $v_s(t) = V \cos(100\pi t)$ has an internal impedance of $(4 + j3)\Omega$. If a purely 28. resistive load connected to the source has to extract the maximum power out of this source, its value in Ω should be : 25. An original having a downline of \$2.6 Witshed Avenuation.
 - (1) 3 (2) 4 (3) 5 (4) 7

The Laplace transform of a function f(t) is $F(s) = \frac{5s^2 + 23s + 6}{s(s^2 + 2s + 2)}$. As $t = \frac{5s^2 + 23s + 6}{s(s^2 + 2s + 2)}$. 29. approaches :

(1) 3 (2) 5(3) 17/2(4) ∞ In a participation for a State M. A matching on

Two wattmeters', which are connected to measure the total power on a three-phase 30. system supplying a balanced load, read 10.5 kW and -2.5 kW, respectively. The total power and the power factor respectively, are :

(1) 13 kW, 0.334	1	(2)	13 kW, 0.684
(3) 13 kW, 0.52		(4)	8 kW, 0.52

- 31. A3-phase 440V, 50 Hz induction motor has 4% slip. The frequency of the rotor current will be :
 - (2) 50 Hz (3) 25 Hz (1) 5 Hz (4) 2 Hz

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- If the fault current is 2000 A the relay setting 50% and the CT ratio is 400/5, then the 32. plug setting multiplier will be that such as been and the setting multiplier will be
 - (2) 25 A (3) 15 A (4) 50 A (1) 10 A
- A string insulator has 5 units. The voltage across the bottom most unit is 25% of the 33. total voltage. The string efficiency is :
 - (1) 25% (2) 50% (3) 80% (4) 75%
- Which is the following *true* for the bode plot? 34.
 - (1) Time response of the system for the step input
 - (2) It's a frequency
 - (3) Power factor decreases up to certain value of field current and then increases
 - (4) Power factor increases simply
- A 183-bus power system has 150 PQ buses and 32 PV buses. In the general case, to 35. obtain the load flow solution using Newton Raphson method in polar coordinates, the minimum number of simultaneous equations to be solved is :
 - (4) 182 (3) 183 (1) 214(2) 332
- If the penalty factor of a plant is unity, its incremental transmission loss is : 36.
 - (1) A bounded signal is always zero antique the macroal (-0) (1) 1
 - (4) None of the above (3) 0

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Using machines of hird impedance

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- **37.** The dielectric losses of an electrical system are 50 Watts. What will be the dielectric losses if the voltage of the system is doubled ?
 - (1) 50 Watts (2) 100 Watts
 - (3) 300 Watts (4) 200 Watts
- **38.** The difference between sending end voltage and receiving end voltage of transmission line controls :

We have due to the Difference of the state of the set of the

- (1) Active power (2) Reactive power
- (3) Frequency (4) None of these
- **39.** To protect the power transformer (Y-Y, with neutral earthed) against fault, the current transformer will have :
 - (1) Delta-delta connection (2) Delta-star connection
 - (3) Star-delta connection (4) Star-star connection
- 40. The steady state stability of the power system can be increased by :
 - (1) Using machines of high impedance
 - (2) Connecting line in series impedance
 - (3) Connecting lines in parallel
 - (4) Reducing the excitation of the machine
- 41. Which of the following is true ?
 - (1) A finite signal is always bounded
 - (2) A bounded signal always possesses finite energy
 - (3) A bounded signal is always zero outside the interval $[-t_0, t_0]$ for some t_0
 - (4) A bounded signal is always finite

- D
 - 42. A current of $-8 + 6\sqrt{2} \sin(\omega t + 30^\circ)$ A is passed through three meters. They are a centre zero PMMC meter, a true RMS meter and a moving iron instrument. The respective readings (in A) will be :

(2) 8, 6, 8

(1) 8, 6, 10

(3) -8, 10, 10 (4) -8, 2, 2

- **43.** A non-ideal voltage source Vs has an internal impedance of Z_s . If a purely resistive load is to be chosen that maximizes the power transferred to the load, its values must be :
 - (1) 0 (2) Real part of Z_s
 - (3) Magnitude of Z_s (4) Complex conjugate of Z_s
- 44. A unit step voltage is applied at t = 0 to a series RL circuit with zero initial conditions :
 - (1) It is possible for the current to be oscillatory.
 - (2) The voltage across the resistor at $t = 0^+$ is zero.
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45. The core flux of a practical transformer with a resistive load :

- (1) Is strictly constant with load variation
- (2) Increases with linear load
- (3) Increases as the square root of the load
- (4) Decreases with increased load
- 46. The bridge method commonly used for finding mutual inductance is :
 - (1) Heaviside Campbell Bridge
 - (2) Schering Bridge
 - (3) De Sauty Bridge
 - (4) Wien Bridge

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(a) Tomativiscositivo to forecord and feedback pain plant

47. A memory system has a total of 8 memory chips, each with 12 address lines and 4 data lines. The total size of the memory system is : 2149 and 1999 and 1999

The second s			
(1) 16 kB	(2) 32 kB	(3) 48 kB	(4) 64 kB

- 48. A differentiable non constant even function x(t) has a derivative y(t), and their respective Fourier Transforms are X (ω) and Y (ω). Which of the following statements is true ? In a M . Not react again herrord an application of the same segment (1) $X(\omega)$ and $Y(\omega)$ are both real

 - (2) $X(\omega)$ is real and $Y(\omega)$ is imaginary
 - (3) $X(\omega)$ and $Y(\omega)$ are both imaginary
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- ussible for the duracht to by exciliation A 3-phase, 50 Hz, 6 pole induction motor has a rotor resistance of 0.1 Ω and reactance 49. of $0.92.\Omega$. Neglect the voltage drop in stator and assume that the rotor resistance is constant. Given that the full load slip is 3%, the ratio of maximum torque to full load torque is :
 - (4) 2.134 (3) 1.948(2) 1.712 (1) 1.567

In a microprocessor, the address of the next instruction to be executed, is stored in : 50.

- (2) Address latch (1) Stack pointer
- (4) General purpose register (3) Program counter
- 51. Feedback control systems are :
 - (1) Insensitive to both forward and feedback path parameter changes
 - (2) Less sensitive to feedback path parameter changes than to forward path parameter changes
 - (3) Less sensitive to forward path parameter changes than to feedback path parameter changes
 - (4) Equally sensitive to forward and feedback path parameter changes

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- The unit impulse response of a unit feedback control system is given by 52. $c(t) = -te^{-t} + 2e^{-t}$ ($t \ge 0$) the open loop transfer function is equal to :
 - (1) $\frac{s+1}{(s+2)^2}$ (2) $\frac{2s+1}{s^2}$ (3) $\frac{2s+1}{(s+1)^2}$ (4) $\frac{(s+1)}{s^2}$
- The depletion region (or) space charge region (or) transition region in a semiconductor 53. p-n junction diode has :
 - (1) Electrons and holes (2) Positive ions and electrons
 - (3) Positive and negative ions (4) Negative ions and holes
- The output Y of a 2-bit comparator is logic 1 whenever the 2-bit input A is greater than 54. the 2-bit input B. The number of combinations for which the output is logic 1 is :
 - (1) 4 (2) 6(3) 8 (4) 10

55. If an A. C. voltage wave is corrupted with an arbitrary number of harmonics, then the overall voltage waveform differs from its fundamental frequency component in terms of Inertia, M = 20 pu; reactance, X = 2 pu The pu values of inertia and reactance on 100 MVA common base, respectively are :

- (2) Only the rms values (1) Only the peak values
- (4) All of the above (3) Only the average values

The system represented by the input-output relationship $y(t) = \int_{0}^{5t} x(\tau) d\tau$, t > 0 is : 56.

- (2) Linear but not causal (1) Linear and causal
- (4) Neither linear nor causal (3) Causal but not linear
- 57. A voltage waveform $v(t) = 12 t^2$ is applied across a 1 H inductor for $t \ge 0$, with initial current through it being zero. The current through the inductor for $t \ge 0$ is given by :

(3) $12t^3$ $(4) 4 t^3$ (2) 24t(1) 12t

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58. A 10-bit A/D converter is used to digitize an analog signal in the 0 to 5V range. The maximum peak to peak ripple voltage that can be allowed in the DC supply voltage is :

(1)	Nearly 100 mV	(2) Nearly 50 mV
(1)	incarry roomin	(-)

- (3) Nearly 25 mV (4) Nearly 5 mV
- **59.** A current impulse of 5 $\delta(t)$, is forced through a capacitor C. The voltage $v_c(t)$, across the capacitor is given by :

(1) 5 <i>t</i>		(2) $5u(t) - C$	
(3) $\frac{5t}{C}$	 (2) Populy: passed alcuncture (4) Necture entry and helicy 	$(4) \ \frac{5u(t)}{C}$	

60. The graph of an electrical network has N nodes and B branches. The number of links L, with respect to the choice of a tree is given by :

man bins white A Ra

Only the peak values.

The setting to provide the set of

(1) B - N + 1 (2) B + N

(3) N-B+1 (4) N-2B-1

61. Consider system with transfer function $G(s) = \frac{s+6}{(Ks^2+s+6)}$. Its damping ratio will be

0.5 when the value of K is :

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

62. If pole-zero cancellation occurs, the system will be :

- (1) Un-controllable
- (2) Un-observable
- (3) Either controllable or observable
- (4) Either un-controllable or un-observable

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Consider the function $f(x) = x_1^2 + 2x_2^2 + 4x_3^2 + 2x_1x_2 - 4x_2x_3 - 4x_3x_1$. The function is : 63.

(1) Positive definite

(2) Positive semi-definite

(3) Negative definite

- (4) Negative semi-definite
- A synchronous motor is operating on no load at unity power factor. If the field current 64. is increased, the power factor will become :
 - (1) Leading and the current will decrease
 - (2) Lagging and the current will increase
 - (3) Lagging and the current will decrease
 - (4) Leading and the current will increase

65. The Double edge modulation eliminates certain harmonics when the reference is :

- (1) Sine wave (2) Square wave
- (4) Trapezoidal wave (3) Triangular wave
- 66. In dual converter :
 - (1) Both rectifiers provide positive current to the load
 - (2) Both rectifiers provide negative current to the load
 - (3) One rectifier provides positive current to the load and the other negative current
 - (4) One rectifier provides positive current to the source and the other negative current to the load 1. 小田市市市市市市市市市
- In communication PAC stands for : 67.
 - (2) Phase angle converter (1) Permanent angle converter
 - (3) Phase angle communication
- (4) Phase and commutation

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- **68.** A control system described by $\dot{x} = \begin{vmatrix} -4 & 1 \\ 2 & -3 \end{vmatrix} x + \begin{vmatrix} 2 \\ 3 \end{vmatrix} u, y = \begin{bmatrix} 3 & -2 \end{bmatrix} x$. The system is to be controlled by control law u = -Kx(t). The feedback matrix K for placing the poles at $-4 \pm j4$ is :
 - (1) $K = [-10 \ 7]$ (2) $K = [-2 \ 7]$ (3) $K = [2 \ 7]$ (4) $K = [10 \ 7]$
- 69. Consider the matrix $A = \begin{vmatrix} 1 & 0 & 2 \end{vmatrix}$. The eigen vectors of A are : 3 2 4

(1)
$$p_1 = \begin{bmatrix} 2 & -1 & 2 \end{bmatrix}', p_2 = \begin{vmatrix} 1 - \frac{3}{7} & \frac{-5}{7} \end{vmatrix}'$$
 and $p_3 = \begin{bmatrix} 1 - \frac{22}{28} & -46\\ -28 & 28 \end{bmatrix}'$
(2) $p_1 = \begin{bmatrix} 2 & -1 & 2 \end{bmatrix}', p_2 = \begin{vmatrix} 1 - \frac{3}{7} & -5 \end{vmatrix}'$ and $p_3 = \begin{bmatrix} 1 - 22 & -46\\ -28 & 28 \end{bmatrix}'$

(2)
$$p_1 = \begin{bmatrix} 2 & -1 & 2 \end{bmatrix}, p_2 = \begin{vmatrix} 1 - \frac{2}{7} & \frac{7}{7} \end{vmatrix}$$
 and $p_3 = \begin{bmatrix} 1 - \frac{22}{35} & \frac{-46}{42} \end{bmatrix}$
(3) $p_1 = \begin{bmatrix} 2 & -1 & 2 \end{bmatrix}', p_2 = \begin{vmatrix} 1 - \frac{3}{7} & \frac{-5}{7} \end{vmatrix}'$ and $p_3 = \begin{bmatrix} 1 - \frac{22}{42} & \frac{-46}{42} \end{bmatrix}$

- (4) $p_1 = \begin{bmatrix} 2 & -1 & 2 \end{bmatrix}', p_2 = \left| 1 \frac{3}{7} \frac{-5}{7} \right|'$ and $p_3 = \left[1 \frac{-22}{49} \frac{-46}{49} \right]'$
- **70.** For what value of *d*, does the following system of linear equations has a non-trivial solution ?

$$(4d-1)x + y + z = 0$$
$$-y + z = 0$$
$$(4d-1)z = 0$$
$$\begin{pmatrix} \frac{1}{2} \end{pmatrix}$$
$$(2) \quad \begin{pmatrix} \frac{3}{4} \end{pmatrix}$$
$$\begin{pmatrix} \frac{1}{4} \end{pmatrix}$$
$$(4) \quad 1$$

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(1)

(3)

- 71. What is the correct representation of the probability distribution of a fair die that may provide an output of any number from 1 to 6?
 - (1) $p(x) = \frac{x}{6}; x = 0, 1, ..., 6$ (2) $p(x) = \frac{1}{6}; x = 0, 1, ..., 6$ (3) $p(x) = \int_{a}^{b} \frac{1}{6} dx; a = 1, ..., 6$ (4) $p(x) = \frac{1}{8}; x = 0, 1, ..., 8$
- 72. We wish to solve $x^2 2 = 0$ by Newton Rahson technique. If initial guess is $x_0 = 1.0$ subsequent estimate of x (i.e. x_1) will be :
 - (1) 1.414 (2) 2.0
 - (3) 1.5 (4) None of these
- 73. Determine the maxima and minima of the following function :

$$f(x) = x^3 - 6x^2 + 9x + 25$$

- (1) Maxima at x = 1 and minima at x = -3
- (2) Maxima at x = 3 and minima at x = -1
- (3) Maxima at x = 1 and minima at x = 4
- (4) Maxima at x = 1 and minima at x = 3

74. Find the particular solution of the following differential equation :

 $\ddot{y} + y = \sec(x)$

- (1) $\cos(x)\ln|\cos(x)| + x\sin(x)$
- (2) $\sin(x)\ln|\cos(x)| + x\cos(x)$
- (3) $\cos(x)\ln|\cot(x)| + x\tan(x)$
- (4) $\sin(x)\ln|\cos(x)| + x\cot(x)$

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D

(1)
$$F(s) = \frac{1}{1+e^{-ps}} \int_{0}^{p} e^{-st} f(t) dt$$

(2)
$$F(s) = \frac{1}{1 - e^{-ps}} \int_{0}^{p} e^{-st} f(t) dt$$

(3)
$$F(s) = \frac{1}{1 - e^{ps}} \int_{0}^{p} e^{-st} f(t) dt$$

(4)
$$F(s) = \frac{1}{1 + e^{-ps}} \int_{0}^{p} e^{-st} f(t) dt$$

- **76.** A fixed capacitor of reactance $-j0.02 \ \Omega$ is connected in parallel across a series combination of a fixed inductor of reactance $j0.01 \ \Omega$ and a variable resistance R. As R is varied from zero to infinity, the locus diagram of the admittance of this R-L-C circuit will be :
 - (1) A semi-circle of diameter j 100 and center at zero.
 - (2) A straight line inclined at an angle.
 - (3) A semi-circle of diameter j50 and center at zero.
 - (4) A straight line parallel to the x-axis.
- 77. The percentage resistance and percentage reactance of a 10 kVA, 400V/200V, 3-Phase transformer is 2% and 10 % respectively. If the constant losses in the machine are 1%, the maximum possible percentage efficiency of the transformer is :
 - (1) 98.32 (2) 97.25 (3) 96.85 (4) 96.12
- 78. A series R-L-C circuit when excited by a 10V sinusoidal voltage source of a variable frequency, exhibits resonance at 100 Hz and has a 3 dB bandwidth of 5 Hz. The voltage across the inductor L at resonance is :

(1) 10 V (2) 14.14 V (3) 7.07 V (4) 200 V

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In the protection of transformers harmonic restraint is used to guard against : 79.

- (1) Magnetizing inrush current (2) Unbalance operation
- (3) Lightning (4) Switching overvoltage

The RMS value of the current in a wire which carries a d.c. current of 10 A and a 80. sinusoidal alternating current of peak value 20 A is :

(1) 10 A (2) 14.14 A (3) 15 A (4) 17.32 A

In PWM bipolar voltage switching scheme for single phase inverter. DC side have 81. following components :

- (1) DC and sinusoidal components at twice the fundamental frequency
- (2) DC and sinusoidal components at twice the fundamental frequency
- (3) Pure DC only
- (4) None of the above
- Kirchhoff's current law can be applied on : 82.
 - (1) Planer network

(2) Non-planer network

(3) All types of network

- (4) Neither planer nor non-planer
- Eigen value of Hermitian matrix is : 83.
 - (1) Zero only

- (2) Imaginary
- (4) Purely Imaginary or Zero

- (3) Real
- Divergence theorem of gauss discuss about transformation between : 84.
 - (1) Line integrals and Surface integrals
 - (2) Volume integrals and Line integrals
 - (3) Line integrals and Line integrals
 - (4) Surface integrals and Volume integrals

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- **85.** For a single line to ground fault the zero-sequence current is given by *j* 3.0 *pu*. The current carried by the neutral during the fault is :
 - (1) j 1.0 pu (2) j 3.0 pu
 - (3) *j* 9.0 *pu* (4) *j* 6.0 *pu*
- 86. The emitter of the transistor is generally doped the heaviest because it :
 - (1) has to dissipate maximum power
- (2) has to supply the charge carriers
 - (3) is the first region of transistor
 - (4) must possess low resistance
 - 87. A JFET has disadvantage of :
 - (1) being noisy
 - (2) having small gain bandwidth product
 - (3) possessing positive temperature coefficient
 - (4) having low input impedance
 - 88. Routh's stability criterion can be used for determining :
 - (1) System response for the disturbance
 - (2) Absolute and relative stability of the system
 - (3) Noise present in the system
 - (4) Transient and steady state response
 - 89. Kelvin double bridge is best suited for the measurement of :
 - (1) Resistance of very low value (2) Low value capacitance
 - (3) Resistance of very high value (4) High value capacitance

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an work would (1)

In transformer, eddy current loss is 1000 watts which is half of the total core loss. If 90. thickness of lamination and frequency by 10%, the new core losses are :

D

	(1) 3200 W	(2) 1000 W		
	(3) 2200 W	(4) 2000 W	ent miterings / 0, 103; A	
91.	A Schottky diode is a :			
	(1) Majority carrier device			
	(2) Minority carrier device		0.021 15	
	(3) Fast a recovery diode			
	(4) Both a majority and minority carrie			
92.	Which logic family provide maximum	power dissipatio	n?	
	(1) TTL (2) CMOS	(3) ECL	(4) JEET	
93.	DC machines have winding	s and synchrono	us use windings.	
	(1) Closed, open	(2) Open, clo		
	(3) Open, open	(4) Closed, cl	losed	
94.	The per unit impedance of a circuit ele	ement is 0.15, if	the base KV and base MV	A are
	belied then now value of the per unit i	impedance of the	e circuit element will be :	
	(1) 0.30 (2) 0.0075	(3) 0.600	(4) 0.15	.00†
95.		lesignated as uni	iversal gates ?	
	(1) OR, AND	(2) XOR, NO	OR, NAND	
	(3) NOR, NAND, XNOR	(4) NOR, NA	AND	

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96. In the toggle mode a JK flip flop has :
(1) J = 1, K = 1
(2) J = 0, K = 1
(3) J = 1, K = 0
(4) J = 0, K = 0

97. A 100 μ A ammeter has an internal resistance of 100 ohm. For extending its range to measure 500 μ A, the shunt resistance required is of :

D

- (1) 20.0Ω (2) 22.22Ω
- (3) 25.0 Ω (4) 50.0 Ω

98. The high torque to weight ratio in an analogue indicating instruments indicates :

- (1) High friction loss (2) Low friction loss
- (3) Nothing as regards friction loss (4) None of the above

99. A 3-phase 400V, synchronous motor is providing load at 0.8 p.f. lagging. If the field current of the motor is continuously increased, then :

- (1) Power factor increases and the decreases
- (2) Power factor is not affected
- (3) Power factor decreases up to certain value of field current and then increases
- (4) Power factor increases simply

100. A transmission line has a surge impedance of 400 Ω is connected with the cable having surge impedance of 40 Ω , a surge magnitude of 100 kV is travelling from the transmission line toward the cable. Find the incident current ?

(1) 100 A (2) 200 A (3) 250 A (4) 2500 A

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Q. NO.	A	В	dated 22.03.2024 for ses	D
1	1	3	4	3
2	1	4	1	2
3	3	2	3	3
4	4	4	2	4
5	3	1	2	3
6	2	1	3	1
7	2	2	4	2
8	2	1	2	4
9	1	4	1	1
10	1	3	3	3
11	1	3	2	2
12	2	2	3	1
13	1	1	4	3
14	1	4	1	1
15	4	1	2	4
16	4	4	1	4
17	3	2	2	2
18	2	3	4	2
19	1	1	1	4
20	3	4	4	3
21	4	3	3	3
22	1	2	2	2
23	3	3	3	1
24	2	4	2	4
25	2	3		4
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		1	2	4
27	4	2	4	2
28	2	4	4	3
29	1	1	4	1
30	3	3	1	4
31	2	1	3	4
32	1	1	2	1
33	3	3	1	3
34	1	4	4	2
35	4	3	1	2
36	4	2	4	3
37	2	2	2	4
38	2	2	3	2
39	4	1	1	1
40	3	1	4	3
41	3	2	1	4
42	4	3	2	3
43	. 2	4	1	3
44	4	1	1	2
45	1	2	4	1
46	1	1	4	1
40	2	2	3	1
47 48	1	4	2	2
49	4	1	1	3

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55	2	1	4	4
56	1	1	4	2
57	2	1	2	4
58	4	2	2	4
59	1	3	4	4
60	4	3	3	1
61	4	4	1	3
62	3	1	1	4
63	3	3	3	2
64	2	2	4	4
65	1	2	3	1
66	1	3	2	1
67	1	4	2	2
68	2	2	2	1
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71	3	1	3	2
72	2	2	4	3
73	1	1	2	4
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75	1	4	1	2
76	4	4	1	1
77	2	3	2	2
78	3	2	1	4
79	1	1	4	1
80	4	3	3	4
81	3	3	3	1
82	2	2	2	1
83	3	3	3	3
84	2	2	4	4
85	4	4	3	3
86	2	2	1	2
87	4	4	2	2
88	4	4	4	2
89	4	4	1	1
90	1	1	3	1
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