

Seat No. _____

SUB: ELECTRICAL ENGINEERING (EE)

Time: 1 Hour 30 minutes

Instructions:

- 1. Ensure that all pages are printed.**
- 2. Use Black ball pen only**
- 3. Change in option is not allowed**
- 4. There is no negative marking**
- 5. Use of non -programmable scientific calculator is allowed**

1. Schmitt trigger can be used as
 - (A) Flip flop
 - (B) Comparator
 - (C) Square wave generator
 - (D) All of these
2. A 1 mA ammeter has a resistance of 100 ohm. It is to be converted to a 1 A ammeter. The value of shunt resistance is
 - (A) 0.001 ohm
 - (B) 100 ohm
 - (C) 0.100 ohm
 - (D) 100000 ohm
3. For Op-Amps, the ratio of change in input offset voltage when variation in supply voltage is made is called
 - (A) PSRR
 - (B) CMRR
 - (C) Transient Response
 - (D) Input Offset voltage stability
4. In control system integrator is represented by
 - (A) s
 - (B) s²
 - (C) 1/s²
 - (D) 1/s
5. Four identical alternators each are rated for 20 MVA, 11 KV having a subtransient reactance of 16% are working in parallel. The short circuit level at the busbar is
 - (A) 500 MVA
 - (B) 400 MVA
 - (C) 125 MVA
 - (D) 100 MVA
6. In a dc machine 4 pole lap winding is used. The number of parallel paths is?
 - (A) 4
 - (B) 2
 - (C) 1
 - (D) 8
7. A starting torque of 40 Nm is developed in an induction motor by an auto transformer starter with a tapping of 30%. If the tapping of auto transformer is 60%, then what is the starting torque?
 - (A) 160 N-m
 - (B) 100 N-m
 - (C) 240 N-m
 - (D) 80 N-m
8. Specified quantities of slack bus are
 - (A) P and Q
 - (B) V and δ
 - (C) P and δ
 - (D) P and V
9. The BCD code of 38 is
 - (A) 00111000
 - (B) 10000010
 - (C) 10000100
 - (D) 10000011
10. In DC Machine, Which of the following are variable losses?
 - (A) eddy current loss
 - (B) hysteresis loss

- (C) shunt field copper loss (D) armature copper loss
11. A solid iron cylinder is placed in a region containing a uniform magnetic field such that the cylinder axis is parallel to the magnetic field direction. The magnetic field lines inside the cylinder will
 - (A) Bend farther away from the axis
 - (B) Bend closer to the cylinder axis
 - (C) Remain uniform as before
 - (D) Cease to exist inside the cylinder
 12. A Pelton wheel turbine having a rated speed of 300 rpm is connected to an alternator to produce power at 50 Hz. The number of poles required in the alternator is
 - (A) 4
 - (B) 20
 - (C) 8
 - (D) 10
 13. A 10 bit A/D converter is used to digitize an analog signal in the 0 to 5 V range. The maximum peak to peak ripple voltage that can be allowed in the dc supply voltage is
 - (A) Nearly 100 mV
 - (B) Nearly 50 mV
 - (C) Nearly 25 mV
 - (D) Nearly 5 mV
 14. Two identical first order systems have been cascaded non interactively. The unit step response of the system will be
 - (A) Overdamped
 - (B) Underdamped
 - (C) Critically damped
 - (D) Undamped
 15. Proximity effect is more in case of
 - (A) Power cables
 - (B) Overhead lines
 - (C) Same for both A & B
 - (D) None of the above
 16. Maxwell's divergence equation for the magnetic field is given by
 - (A) $\nabla \times B = 0$
 - (B) $\nabla \times B = \rho$
 - (C) $\nabla \cdot B = 0$
 - (D) $\nabla \cdot B = \rho$
 17. A second order control system has a transfer function $16/(s^2 + 4s + 16)$. Find the settling time for 2% tolerance?
 - (A) 10 sec
 - (B) 4 sec
 - (C) 5 sec
 - (D) 2 sec
 18. A transmission line has impedance of $(0.005 + j0.05)$ pu. Find the line at which maximum value of negative DC off set current is produced, if it is applied with $V_m \cos \omega t$?
 - (A) 4.68 msec
 - (B) 9.68
 - (C) 1.47 msec
 - (D) 2.63 msec
 19. Slip test is performed to determine
 - (A) slip
 - (B) direct axis reactance and quadrature axis reactance
 - (C) positive sequence reactance and negative sequence reactance
 - (D) all of the above
 20. Universal motor have which of the following application?
 - (A) Domestic pump.
 - (B) Food mixer.
 - (C) Traction.
 - (D) Lift.
 21. A 230 volt dc motor has an armature winding resistance of 0.5 ohm. Calculate the emf induced by the motor if the full load armature current is 23 ampere.
 - (A) 120 volt.
 - (B) 218.5 volt.
 - (C) 220.4 volt.
 - (D) None of these.
 22. In a commutation circuit employed to turn-off an SCR, satisfactory turn-off is obtained when
 - (A) Circuit turn-off time < device turn-off time
 - (B) Circuit turn-off time > device turn-off time

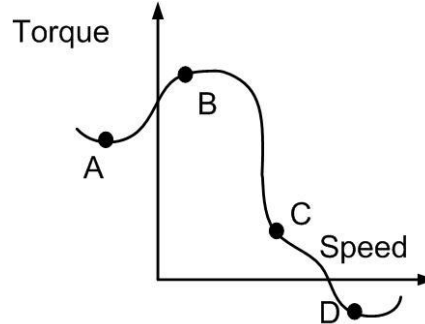
- (C) Circuit time constant > device turn-off time (D) Circuit time constant < device turn-off time
23. When a program is being executed in an 8085 microprocessor, its program counter contains
- (A) The number of instructions in the current program that have already been executed (B) The total number of instruction in the program being executed
- (C) The memory address of the instruction that is being currently executed (D) The memory address of the instructions that is to be executed next
24. Which type of connection is employed for current transformers for the protection of delta- star connected 3-phase transformer?
- (A) delta-delta (B) star-star
(C) delta-star (D) star-delta
25. For emitter bias, the voltage at the emitter is 0.7 V less than the
- (A) Base voltage. (B) Emitter voltage.
(C) Collector voltage (D) Ground voltage
26. Angle condition for complimentary root locus or inverse root locus is
- (A) $\pm (2q + 1) 180^\circ$ (B) $\pm (2q) 180^\circ$
(C) $\pm (2q + 1) 360^\circ$ (D) $\pm (2q) 360^\circ$
27. For a stranded conductors, how to find the total number of strands (N) when number of layers (x) are given
- (A) Total number of strands $N = 3x^2 + 3x + 1$ (B) Total number of strands $N = 3x^2 - 3x - 1$
(C) Total number of strands $N = 3x^2 + 3x - 1$ (D) Total number of strands $N = 3x^2 - 3x + 1$
28. The inductance of a long solenoid of length 1000 mm wound uniformly with 3000 turns on a cylindrical paper tube of 60 mm diameter is
- (A) 3.2 μ H (B) 3.2mH
(C) 32.0mH (D) 3.2 H
29. The empty space between the plates of a capacitor is filled with a liquid of dielectric constant K. The capacitance of capacitor
- (A) Increases by a factor K^2 (B) Decreases by a factor K
(C) Increases by a factor K (D) Decreases by a factor K^2
30. The frequency response of a linear system $G(j\omega)$ is provided in the tabular form below.

$ G(j\omega) $	1.3	1.2	1.0	0.8	0.5	0.3
Angle $(G(j\omega))$	-130°	-140°	-150°	-160°	-180°	-200°

The gain margin and the phase margin of the system are

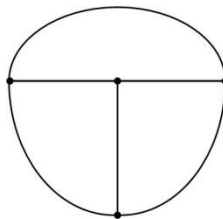
- (A) 6 dB and 30° (B) 6 dB and -30°
(C) -6 dB and 30° (D) -6 dB and -30°
31. It is desirable to eliminate 5th harmonic voltage from the phase voltage of an alternator. The coils should be short pitched by an electrical angle of
- (A) 36° (B) 30°
(C) 18° (D) 72°
32. DIAC and TRIAC both are semiconductor devices and conduct in

- (A) Both conducts in forward direction (B) DIAC conducts in forward direction and TRIAC conducts in reverse direction
- (C) Both conducts in reverse direction (D) Both conduct in either direction.
33. The number of comparisons carried out in a 4 bit flash-type A/D convertor is
 (A) 16 (B) 15
 (C) 4 (D) 3
34. On the torque speed curve of an Induction motor as shown in figure, four points of operation are marked as A, B, C and D

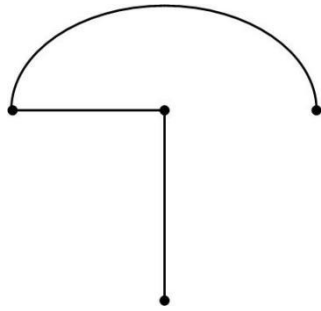


- Which one of them represents operation at a Slip greater than 1?
 (A) D (B) C
 (C) B (D) A
35. Which of the following rules determines the mapping of s-plane to z-plane?
 (A) Right half of the s-plane maps into outside of the unit circle in z-plane (B) Left half of the s-plane maps into inside of the unit circle
 (C) Imaginary axis in s-plane maps into the circumference of the unit circle (D) All of the above
36. AC to DC circulating current dual convertors are operated with the following relationship between their triggering angles (α_1 and α_2)
 (A) $\alpha_1 + \alpha_2 = 180^\circ$ (B) $\alpha_1 + \alpha_2 = 360^\circ$
 (C) $\alpha_1 - \alpha_2 = 180^\circ$ (D) $\alpha_1 + \alpha_2 = 90^\circ$
37. A stationary closed Lissajous pattern on an oscilloscope has 3 horizontal tangencies and 2 vertical tangencies for a horizontal input with frequency 3 kHz. The frequency of the vertical input is
 (A) 1.5 kHz (B) 2 kHz
 (C) 3 kHz (D) 4.5 kHz
38. 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, then the new upper cut-off frequency is
 (A) 10 kHz (B) 100 Hz
 (C) 10 kHz (D) 100 kHz
39. With regard to filtering property, the lead compensator is
 (A) Low pass filter (B) band pass filter
 (C) high pass filter (D) band reject filter

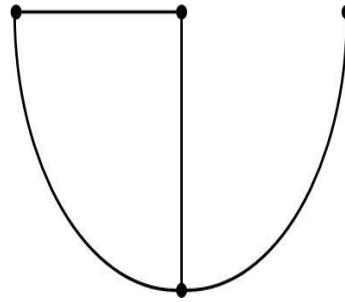
40. A single phase transformer has no-load loss of 64 W, as obtained from an open-circuit test. When a short-circuit test is performed on it with 90% of the rated currents flowing in its both LV and HV windings, the measured loss is 81W. The transformer has maximum efficiency when operated at
- (A) 50.0% of the rated current (B) 64.0% of the rated current
(C) 80.0% of the rated current (D) 88.8% of the rated current
41. Circuit turn-off time of an SCR is defined as the time
- (A) Taken by the SCR to turn off (B) Required for the SCR current to become zero
(C) For which the SCR is reverse biased by the commutation circuit (D) For which the SCR is reverse biased to reduce its current below the holding current.
42. The equivalent circuit of a transformer has leakage reactances X_1 , X'_2 and magnetizing reactance X_M , their magnitudes satisfy
- (A) $X_1 \gg X'_2 \gg X_M$ (B) $X_1 \ll X'_2 \ll X_M$
(C) $X_1 \approx X'_2 \gg X_M$ (D) $X_1 \approx X'_2 \ll X_M$
43. Two capacitors of capacitances 3 μF and 6 μF in series will have a total capacitance of
- (A) 9 μF (B) 2 μF
(C) 18 μF (D) 24 μF
44. When a unit ramp input is applied to the unity feedback system having closed loop transfer function, $C(s) / R(s) = (Ks+b) / (s^2 + as + b)$; ($a>0$, $b>0$, $K>0$), the steady state error will be
- (A) 0 (B) a/b
(C) $(a + K)/b$ (D) $(a-K) / b$
45. A 500 kVA, 3 phase transformer has iron losses of 300 W and full load copper losses of 600 W. The percentage load at which the transformer is expected to have maximum efficiency is
- (A) 50.0% (B) 70.7%
(C) 141.4% (D) 100%
46. Consider the network graph shown in the figure. Which one of the following is NOT a 'tree' of this graph?



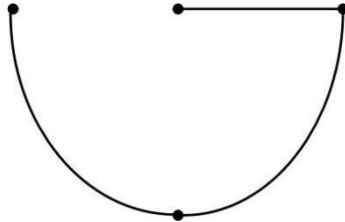
(A)



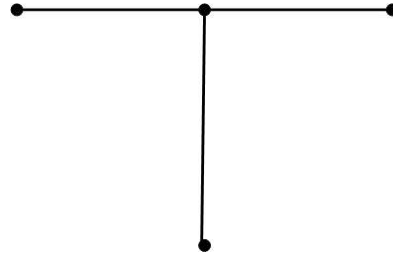
(B)



(C)

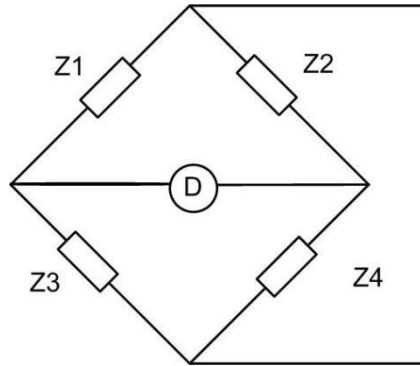


(D)



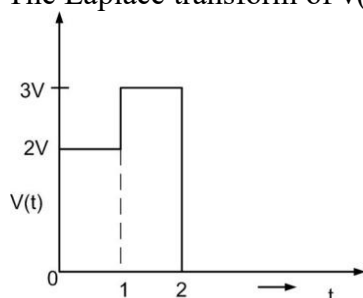
47. When a junction diode is Reverse Biased then diode acts like
- (A) Short switch (B) Close switch
(C) An open switch (D) None of the above
48. The feedback factor of a Wien bridge oscillator using Op-Amp is
- (A) $\frac{1}{3}$ (B) $\frac{1}{4}$
(C) $\frac{1}{2}$ (D) 1
49. The total harmonic distortion (THD) of ac supply input current of rectifiers is maximum for
- (A) Single phase diode rectifier with DC inductive filter (B) 3 Phase diode rectifier with dc inductive filter
(C) 3 phase thyristor rectifier with inductive filter (D) Single phase diode rectifier with capacitive filter
50. The bridge method commonly used for finding mutual inductance is
- (A) Heaviside Campbell Bridge (B) Schering Bridge
(C) De Sauty Bridge (D) Wein Bridge
51. Which of the following will take least time in starting from cold condition to full load operation
- (A) Gas turbine plant. (B) Nuclear power plant.
(C) Hydroelectric power plant. (D) Thermal power plant.
52. The function of snubber circuit connected across the [SCR](#) is to
- (A) Suppress dV / dt . (B) Increase dV / dt .
(C) Decrease di / dt . (D) All of the above
53. A galvanometer with a full scale current of 10 mA has a resistance of 1000 Ω . The multiplying power (the ratio of measured current to galvanometer current) of 100 Ω shunt with this galvanometer is
- (A) 110 (B) 11

- (C) 100 (D) 10
54. A six pulse thyristor rectifier bridge is connected to a balanced 50 Hz three phase ac source. Assuming that the DC output current of the rectifier is constant. The lowest frequency harmonics component of the ac source line current is
- (A) 100 Hz (B) 150 Hz
(C) 250 Hz (D) 300 Hz
55. In figure, $Z_1 = 200\angle 60^\circ$ ohm. $Z_2 = 400\angle -90^\circ$ ohm, $Z_3 = 300\angle 0^\circ$ ohm. Then Z_4 for bridge to be balanced is



- (A) $400\angle -90^\circ$ ohm. (B) $150\angle 30^\circ$ ohm.
(C) $600\angle -150^\circ$ ohm. (D) $300\angle 90^\circ$ ohm.
56. Which of the following factor does not contribute to decide right of way (R-O-W) for transmission line
- (A) Electric field (B) Audible noise
(C) Insulating material of isolator string (D) Radio interference
57. A sinusoidal signal waveform, when observed on an oscilloscope, has a peak to peak amplitude of 6 cm. If the vertical sensitivity setting is 5 v/cm, then rms value of the voltage will be
- (A) 15V (B) 12.6V
(C) 11.1V (D) 10.6V
58. The thermal, nuclear and hydro power plant alternators should have following speeds respectively
- (A) 3000, 2000, 1000 (B) 3000, 3000, 300
(C) 1000, 2000, 3000 (D) 3000, 300, 300
59. To increase Q factor of a coil, the wire should be
- (A) Thick (B) Thin
(C) Long (D) Long and thin
60. A 3 phase balanced load which has a power factor of 0.707 is connected to a balanced supply. The power consumed by the load is 5 kW. The power is measured by the two- wattmeter method. The readings of the two wattmeters are
- (A) 3.94 kW and 1.06 kW (B) 2.50 kW and 2.50 kW
(C) 5.00 kW and 0.00 kW (D) 2.96 kW and 2.04 kW
61. The instrument transformers are known to introduce magnitude and phase errors in measurements. These are primarily due to
- (A) Improper connections on the primary side (B) Measurement errors inherent in the meter connected to the transformer secondary

- (C) Open and short-circuit parameters of the instrument transformers (D) None of these.
62. The maximum percentage error in the sum of two voltage measurements when $V_1 = 100V \pm 1\%$ and $V_2 = 80V \pm 5\%$ is
 (A) $\pm 4\%$ (B) $\pm 2.8\%$
 (C) $\pm 6\%$ (D) $\pm 3\%$
63. An overhead line having a surge impedance of 400 ohm is connected in series with an underground cable having a surge impedance of 100 ohm. If a surge of 50 kV travels from the line towards the cable junctions, the value of the transmitted voltage wave at the junction is
 (A) 30 kV (B) 20 kV
 (C) 80 kV (D) -30 kV
64. 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
 (A) 16 Kbytes (B) 32 Kbytes
 (C) 48 Kbytes (D) 64 Kbytes
65. In an inverse definite minimum time electromagnetic type over-current relay, the minimum time feature is achieved because of
 (A) Saturation of the magnetic circuit (B) Proper mechanical design
 (C) Appropriate time delay element (D) Electromagnetic Damping
66. In a residential electrical connection having load less than 5 kW, the following rating of leakage current for ELCB is suggested
 (A) 300 mA (B) 30 mA
 (C) 3 mA (D) 3000 mA
67. In a thyristor dc chopper, which type of commutation results in best performance?
 (A) Voltage Commutation (B) Current commutation
 (C) Load Commutation (D) Supply Commutation
68. The Laplace transform of $v(t)$ in the figure is



- (A) $\frac{v}{s}e^{-s} - \frac{3v}{s}e^{-2s}$ (B) $\frac{2v}{s} - \frac{3v}{s}e^{-2s}$
 (C) $\frac{2v}{s} + \frac{v}{s}e^{-s}$ (D) $\frac{2v}{s} + \frac{v}{s}e^{-s} - \frac{3v}{s}e^{-2s}$
69. A Power system consists of 300 buses out of which 20 buses are generator bus, 25 buses are ones with reactive power support and 15 buses are the ones with fixed shunt capacitors. All the other buses are load buses. It is proposed to perform a load flow analysis in the system using NEWTON RAPHSON Method. The size of Newton Raphson Jacobian Matrix is
 (A) 553×553 (B) 540×540

- (C) 555×555 (D) 554×554

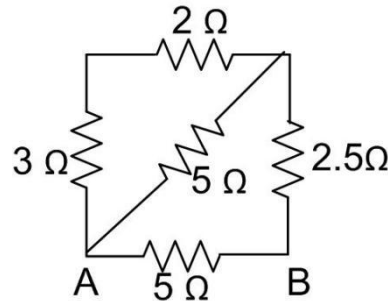
70. A unity feedback system has the open loop transfer function

$$G(s) = \frac{1}{(s-1)(s+2)(s+3)}$$

The Nyquist Plot of $G(s)$ encircles the origin

- (A) Never (B) Once
(C) Twice (D) Thrice
71. What should be the power factor for an Ideal Inductor?
- (A) Unity (B) Zero
(C) 0.707 (D) 0.5
72. The dissipation factor of a good dielectric is of the order of
- (A) 0.0002 (B) 0.02
(C) 0.1 (D) 1
73. The desirable properties of transformer core material are
- (A) Low permeability and low hysteresis loss (B) High permeability and low hysteresis loss
(C) High permeability and high hysteresis loss (D) Low permeability and high hysteresis loss
74. A shunt-connected DC Motor operates at its rated terminal voltage. Its no-load speed is 200 radian/second. At its rated torque of 500 Nm, its speed is 180 radian/second. The motor is used to directly drive a load whose load torque T_L depends on its rotational speed ω_r (in radian/second), such that $T_L = 2.78 \times \omega_r$. Neglecting rotational losses, the steady-state speed (in radian/second) of the motor, when it drives this load is approximately equal to
- (A) 180 (B) 90
(C) 135 (D) 225
75. The BCD code for a decimal number $(874)_{10}$ is
- (A) $(100001110100)_{BCD}$ (B) $(010001111000)_{BCD}$
(C) $(100001000111)_{BCD}$ (D) $(011110000100)_{BCD}$
76. Bundled conductors are mainly used in high voltage overhead transmission lines to
- (A) Reduce transmission line losses (B) Increase mechanical strength of the line
(C) Reduce corona (D) Reduce sag
77. A bulb in a staircase has two switches, one switch being at the ground floor and the other one at the first floor. The bulb can be turned ON and also can be turned OFF by any one of the switches irrespective of the state of the other switch. The logic of switching of the bulb resembles
- (A) An AND gate (B) An OR gate
(C) An XOR gate (D) An NAND gate
78. A 4 pole induction machine is working as an induction generator. The generator supply frequency is 60 Hz. The rotor current frequency is 5 Hz. The mechanical speed of the rotor in rpm is

- (A) 1350 (B) 1650
(C) 1950 (D) 2250
79. Supply to one terminal of Delta-Star connected three-phase core type transformer which is on no-load fails. Assuming magnetic-circuit symmetry, voltages on the secondary sides will be
(A) 230, 230, 115 (B) 345, 0, 345
(C) 345, 115, 115 (D) 230, 115, 115
80. Five resistances are connected as shown in figure below. The equivalent resistance between the points A and B will be



- (A) 2.5 ohms (B) 10 ohms
(C) 5 ohms (D) 15 ohms
81. Improper integral $\int_0^1 \frac{dx}{\sqrt{1-x^2}}$ is
- A $\frac{\pi}{3}$ B $\frac{\pi}{2}$
C $\frac{\pi}{4}$ D 2π
82. Determine the saddle point of $x^2 + xy + 3x + 2y + 5$.
- A $(-2, 1)$ B $(-2, -1)$
C $(-2, 2)$ D None of these.
83. Find the derivative of the function $f(x, y) = 3e^x \cos(yz)$ at $P(0, 0, 0)$ in the direction of $\vec{u} = 2\hat{i} + \hat{j} - 2\hat{k}$.
- A 3 B 4
C 2 D None of these.
84. Evaluate $\int_C (x+y) ds$ where C is the straight line segment $x=t, y=(1-t), z=0$ from $(0, 1, 0)$ to $(1, 0, 0)$.
- A 2 B 1

- C 3 D None of these.
85. Evaluate $\oint_C ((6y+x) dx + (y+2x) dy)$ where C is the circle $(x-2)^2 + (y-3)^2 = 4$.
- A 0 B 16π
C -16π D None of these
86. General solution of $4y'' + y' = 0$ is
- A $y = c_1 + c_2 e^{-x/4}$ B $y = c_1 + c_2 e^{-x/2}$
C $y = c_1 + c_2 e^{-x}$ D None of these
87. Determine the particular integral of $y'' - y' + \frac{1}{4}y = 3 + e^{x/2}$
- A $y_p = 12 + \frac{1}{2}x^2 e^{x/2}$ B $y_p = 6 + \frac{1}{2}x^2 e^{x/2}$
C $y_p = 12 + \frac{1}{2}e^{x/2}$ D None of these
88. Find the solution of $\cos x \frac{dy}{dx} + (\sin x)y = 1$.
- A $y = \cos x + c \sin x$ B $y = \sin x + c \cos x$
C $y = 2 \sin x + c \cos x$ D None of these
89. The particular integral of $y'' - y = \cosh x$
- A $y_p = \frac{1}{2}x \cosh x$ B $y_p = \frac{1}{2}x \sin x$
C $y_p = \frac{1}{2}x \sinh x$ D None of these
90. The solution of $x^2 y'' - 2y = 0$ is
- A $y = c_1 x^{-2} + c_2 x^2$ B $y = c_1 x^{-2} + c_2 x^3$
C $y = c_1 x + c_2 x^2$ D None of these
91. Let $A = \begin{bmatrix} 5 & 2 \\ 0 & k \end{bmatrix}$. Find the number k such that A is the root of the polynomial $f(x) = x^2 - 25$.
- A 2 B 3
C 4 D None of these
92. Find the eigen values of $A = \begin{bmatrix} 2 & -3 \\ 2 & -5 \end{bmatrix}$.
- A 1, -4 B 1, -1
C 2, -1 D 2, -4
93. Solve $2x - 4y = 10$, $3x - 6y = 15$.
- A $(3 + 2a, a)$ where $a \in R$ B $(5 + 2a, a)$ where $a \in R$

- C $(5 + a, a)$ where $a \in R$ D None of these
94. Find the derivative of $f(z) = 3z^2 + 4i z - 5 + i$ at $z = 2$.
 A $3 + 4i$ B $9 + 4i$
 C $12 + 4i$ D $-3 + 4i$
95. Evaluate $\oint_C \frac{e^z}{(z^2 + \pi^2)^2} dz$ where C is the circle $|z| = 4$.
 A $\frac{4i}{\pi}$ B $\frac{i}{\pi}$
 C $\frac{2i}{\pi}$ D None of these
96. Choose correct option for the series of $\coth z$.
 A $\frac{1}{z} + \frac{z}{3} - \frac{z^3}{45} + \dots$ B $\frac{1}{z} + \frac{z}{2} - \frac{z^3}{45} + \dots$
 C $\frac{1}{z} + \frac{z}{3} - \frac{z^3}{15} + \dots$ D None of these
97. A card is drawn at random from an ordinary deck of 52 playing cards. Find the probability that it is any suit except hearts.
 A $\frac{1}{2}$ B $\frac{1}{13}$
 C $\frac{1}{4}$ D $\frac{3}{4}$
98. Find the probability that in tossing a fair coin three times, there will appear 3 heads.
 A $\frac{1}{2}$ B $\frac{1}{3}$
 C $\frac{1}{8}$ D $\frac{2}{3}$
99. Determine the interval where root lies for the function $f(x) = x^4 + 2x^2 - x - 3$.
 A $(0, 1)$ B $(1, 2)$
 C $(2, 3)$ D None of these
100. Which one is not the formula for numerical integration?
 A False position method B Trapezoidal Rule
 C Simpson's One-Third rule D Simpson's Three-Eighths rule