

**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. The arc voltage in a circuit breaker is
  - A In phase with the arc current.
  - B Leading the arc current by  $90^\circ$ .
  - C Lagging the arc current by  $90^\circ$ .
  - D Lagging the arc current by  $45^\circ$ .
2. It is difficult to interrupt a capacitive current as
  - A The current has a leading power factor.
  - B The restriking voltage can be high.
  - C Current magnitude is small.
  - D The stored energy in the capacitor is very high.
3. The bridge used for the measurement of capacitance is
  - A Schering bridge.
  - B Anderson's bridge
  - C Hay's bridge.
  - D Maxwell's bridge.
4. If the positive, negative and zero sequence reactances of an element of a power system are 0.2, 0.2 and 0.6 pu respectively, then the element would be a
  - A Synchronous generator.
  - B Static load.
  - C Synchronous motor.
  - D Transmission line.
5. Which method of braking is generally used in elevators?
  - A Regenerative braking.
  - B Rheostatic braking.
  - C Plugging.
  - D Retrogenerative braking
6. Ybus as used in power flow studies and Zbus as used in short circuit studies
  - A Are the same.
  - B Have no inter-relation.
  - C Are the inverse of each other.
  - D Are the transpose of each other.
7. The number of roots of the equation  $2s^4 + s^3 + 3s^2 + 5s + 7 = 0$  that lie on the right half of the s plane is
  - A Zero
  - B One
  - C Two
  - D Three
8. A d.c. series motor develops a torque of 30 N-m at 3 A load current. If the current is increased to 6 A, the torque developed will be
  - A 30 N-m
  - B 120 N-m
  - C 60 N-m
  - D 90 N-m
9. If the air gap in an induction motor is increased,
  - A The power factor will decrease.
  - B The magnetizing current of the rotor will decrease.
  - C The motor speed will increase.
  - D The windage losses will increase.
10. If the value of the shunt field resistance of a shunt generator is greater than the critical resistance, the generator will
  - A Excite to full voltage.
  - B Fail to excite.

- C Excite to half of the full voltage.      D Excite to one fourth of the full voltage.
11. Five cells are connected in series in a row and then four such rows are connected in parallel to feed current to a resistive load of  $1.25 \Omega$ . Each cell has an emf of  $1.5 \text{ V}$  with an internal resistance of  $0.2 \Omega$ . The current through the load will be  
 A  $5 \text{ A}$       B  $2.5 \text{ A}$   
 C  $10 \text{ A}$       D  $2 \text{ A}$
12. When bundled conductors are used in place of single conductors, the effective inductance and capacitance will respectively  
 A Decrease and increase.      B Increase and decrease.  
 C Increase and remain unaffected.      D Remain unaffected and decrease.
13. Resistance switching is used in air blast circuit breakers to  
 A Reduce the magnitude of fault current.      B Control the circuit breaker operating time.  
 C Damp out the fast transient.      D Change the fault current power factor.
14. A transformer at full load has a copper loss of  $400 \text{ W}$  and an iron loss of  $200 \text{ W}$ . The copper loss and iron loss at half full load will respectively be  
 A  $100 \text{ W}$  and  $200 \text{ W}$       B  $200 \text{ W}$  and  $200 \text{ W}$   
 C  $200 \text{ W}$  and  $100 \text{ W}$       D  $400 \text{ W}$  and  $400 \text{ W}$
15. The operating time of the back-up relay should be more than  
 A The primary relay time.      B The primary fault clearing time.  
 C The critical clearing time.      D The pick up time.
16. In a squirrel cage rotor, the bars are not placed parallel to the shaft but are skewed to have  
 A Greater mechanical strength.      B Less rotor losses  
 C Uniform torque      D High efficiency.
17. Three identical resistances connected in star consume  $5000 \text{ W}$ . If the resistances are now connected in delta across the same supply, the power consumed will be  
 A  $5000 \text{ W}$       B  $20000 \text{ W}$   
 C  $10000 \text{ W}$       D  $15000 \text{ W}$
18. For a 12 bus system, with 3 voltage controlled buses, the size of the Jacobian matrix is  
 A  $11 \times 11$       B  $12 \times 12$   
 C  $24 \times 24$       D  $19 \times 19$
19. When load on a transformer is increased, the eddy current  
 A Is increased.      B Remains unchanged.  
 C Is decreased.      D Becomes zero.
20. A power station supplies a peak load of  $50 \text{ MW}$ ,  $40 \text{ MW}$  and  $70 \text{ MW}$  to three localities. The annual load factor is  $0.5 \text{ pu}$  and the diversity factor of the load at the station is  $1.55$ . the maximum demand on the station and the average load respectively will be  
 A  $120$  and  $60.8 \text{ MW}$       B  $90$  and  $50.6 \text{ MW}$   
 C  $103.2$  and  $51.61 \text{ MW}$       D  $100$  and  $0.51 \text{ MW}$

21. The following sequence currents were recorded in a power system under a fault condition:  
 $I_{\text{positive}} = j1.653 \text{ p.u.}$  ,  $I_{\text{negative}} = -j0.5 \text{ p.u.}$  and  $I_{\text{zero}} = -j 1.153 \text{ p.u.}$  The fault is  
 A Single line to ground. B Three phase  
 C Double line to ground. D Line to line
22. An RLC series circuit is predominantly inductive  
 A At resonant frequency. B Above resonance frequency.  
 C Below resonance frequency. D At lower half power frequency.
23. A change of 5% in the supply voltage to an induction motor will produce a change of approximately  
 A 5 % in the rotor torque. B 10 % in the rotor torque.  
 C 20% in the rotor torque. D 25% in the rotor torque.
24. To limit current chopping in vacuum circuit breakers, the contact material employed should have the properties of  
 A Low conductivity and high vapour pressure. B High conductivity and low vapour pressure.  
 C Low conductivity and low vapour pressure. D High conductivity and high vapour pressure.
25. The surge impedance of a 400 km long overhead transmission line is 400 ohms. For a 200 km length of the same line, the surge impedance will be  
 A 100  $\Omega$  B 400  $\Omega$   
 C 800  $\Omega$  D 200  $\Omega$
26. The motor used where high starting torque is required and where the load is subject to heavy fluctuations is a  
 A d.c. series motor B Differential compound motor.  
 C d.c. shunt motor D Cumulative compound motor.
27. A transformer takes a current of 0.6 A and absorbs 64 W when the primary is connected to its normal supply of 200 V, 50 Hz, the secondary being on open circuit. The iron loss current is  
 A 0.2 A B 0.43 A  
 C 1 A D 0.32 A
28. Four identical alternators each rated for 20 MVA, 11 kV having a subtransient reactance of 16% are working in parallel. The short circuit level at the bus bars is  
 A 500 MVA B 200 MVA  
 C 1000 MVA D 750 MVA
29. In an interconnected grid system, the more efficient plants are used as  
 A Peak load plants. B Base load plants.  
 C Both base and peak load plants. D Standby plants.
30. The in-rush current in a transformer at no load is maximum if the supply voltage is switched on at  
 A Peak voltage value. B Half peak voltage value.  
 C Zero voltage value. D 0.866 times peak voltage value.
31. In a three phase system, line losses are  
 A Directly proportional to  $\cos \phi$  B Inversely proportional to  $\cos \phi$   
 C Directly proportional to  $\cos^2 \phi$  D Inversely proportional to  $\cos^2 \phi$

32. An inductor which has previously not attained any steady state, will act at  $t=0+$  and  $t=\infty$  act as  
 A Open circuit and short circuit respectively. B Short circuit and open circuit respectively.  
 C Open circuit and current source respectively. D Short circuit and voltage source respectively.
33. A 100 V source has a series internal resistance of  $1\Omega$ . The maximum power that can be delivered to the load is  
 A 1000 W B 2000 W  
 C 2500 W D 5000 W
34. The open loop transfer function of a unity feedback control system is  $G(s)=\frac{1}{(s+2)^2}$ . The closed loop transfer function will have poles at  
 A -2, -2 B -2, -1  
 C -2,  $\pm j$  D -2, 2
35. In a d.c. generator, the main function of the compensating winding is to  
 A Assist in commutation. B Eliminate reactance voltage.  
 C Reduce the demagnetizing effect of armature reaction. D Reduce the distorting effect of armature reaction.
36. The earth transformer is used to  
 A Avoid harmonics in the transformer. B Provide artificial neutral earthing where the neutral point is not accessible.  
 C Improve stability of the system. D Measure the voltage.
37. The mechanical power developed by a d.c. motor is maximum when the back e.m.f is  
 A Equal to half of the applied voltage. B Equal to the applied voltage.  
 C Equal to one third of the applied voltage. D Equal to one fourth of the applied voltage.
38. The bus-bar zone faults are generally  
 A Phase to phase faults. B Single line to ground faults.  
 C Double line to ground faults. D Three phase short circuits.
39. For a given number of poles and armature conductors, a lap winding will carry  
 A More current than a wave winding. B Less current than a wave winding.  
 C Same current as a wave winding. D No current.
40. Shunt compensation in EHV lines is used to  
 A Reduce the fault level. B Improve the voltage profile.  
 C Improve stability. D Improve the efficiency.
41. The no load turns ratio of a 50 Hz single phase transformer is 6000/250 V. The maximum flux in the core is 0.06 Wb. The number of secondary turns is  
 A 38 B 19  
 C 76 D 104
42. A 240 V d.c. series motor takes 40 A when giving its rated output at 1500 rpm. Its resistance is 0.3 ohm. What resistance must be added to obtain the rated torque at starting?  
 A  $2.4\Omega$  B  $1.5\Omega$

- C  $3.2 \Omega$  D  $5.7 \Omega$
43. On the two sides of a star-delta transformer,  
 A Voltages and currents are in phase. B Voltages and currents differ in phase by  $30^\circ$ .  
 C Voltages differ in phase by  $30^\circ$ , but currents are in phase. D Currents differ in phase by  $30^\circ$ , but voltages are in phase.
44. To send 10% of the main current through a resistor of value  $99 \Omega$ , the value of the shunt resistance required is  
 A  $33 \Omega$  B  $9.9 \Omega$   
 C  $22 \Omega$  D  $11 \Omega$
45. All the instruments stated below are suitable for use for both a.c. and d.c except  
 A Moving Iron type. B Hot wire type.  
 C Induction type. D Dynamometer type.
46. The steady state stability of the power system can be increased by  
 A Using machines having high impedance. B Connecting transmission lines in series.  
 C Connecting lines in parallel. D Reducing the excitation of the machines.
47. Which of the following plants is almost inevitably used as a base load plant?  
 A Diesel engine plant. B Gas turbine plant.  
 C Nuclear power plant. D Pumped storage plant.
48. The induced voltages on the transmission lines due to electrostatic and electromagnetic induction is reduced by  
 A Ferranti effect. B Corona effect  
 C Bundling of conductors. D Transposition of conductors.
49. By which of the following factors is the sag of the transmission line least affected?  
 A Current through the conductor. B Self weight of the conductor.  
 C Ice deposited on the conductor. D Temperature of the surrounding air.
50. The reserve generating capacity of a plant which is not in operation but can be made available for service is the  
 A Firm power. B Hot reserve.  
 C Cold reserve. D Spinning reserve.
51. Which instruments are free from hysteresis and eddy current errors?  
 A Electrostatic B Moving iron  
 C Moving coil permanent magnet D Moving coil dynamometer type.  
 type.
52. In over current protection, the setting of the earth fault relay is  
 A More than the phase fault relay. B Less than the phase fault relay.  
 C Equal to that of the phase fault relay. D Zero.
53. The insulation resistance of a cable of length 10 km is  $1 \text{ M}\Omega$ . For a cable of length 200 km, the insulation resistance will be  
 A  $0.05 \text{ M}\Omega$  B  $0.1 \text{ M}\Omega$   
 C  $0.5 \text{ M}\Omega$  D  $20 \text{ M}\Omega$

54. Compared to the breaking capacity of a circuit breaker, its making capacity should normally be
- |        |                          |
|--------|--------------------------|
| A Less | B Equal                  |
| C More | D The two are unrelated. |
55. In a thyristor, the rate of rise of the anode current at the time of turn-on can be kept below specified limits by
- |   |  |
|---|--|
| A Using a small inductor in series with the anode circuit.    | B Using a small inductor in parallel with the anode circuit. |
| C Using a small capacitor in parallel with the anode circuit. | D Using a small capacitor series with the anode circuit.     |
56. During a disturbance on a synchronous machine, the rotor swings from A to B and finally settles down at a steady point C on the power angle curve. The speed of the machine during oscillation is synchronous at the point(s)
- |           |                 |
|-----------|-----------------|
| A A and B | B A and C       |
| C B and C | D Only point C. |
57. 100 % string efficiency means
- |                                |                                 |
|--------------------------------|---------------------------------|
| A Self capacitance is zero     | B Shunt capacitance is maximum. |
| C Self capacitance is maximum. | D Shunt capacitance is zero.    |
58. An over current relay, having a plug setting of 75% is connected to the supply circuit through a current transformer of ratio 200/5. The pick-up value of the current is
- |          |         |
|----------|---------|
| A 5 A    | B 2.5 A |
| C 6.25 A | D 3.75A |
59. Biot Savart law states that
- |  |  |
|--|--|
| A The magnetic flux density at a point due to a current element is normal to the plane containing the element and the line joining the element and the point.        | B The magnetic flux density at a point due to a current element is in phase with the plane containing the element and the line joining the element and the point.          |
| C The magnetic flux density at a point due to a current element is at $45^\circ$ to the plane containing the element and the line joining the element and the point. | D The magnetic flux density at a point due to a current element is in phase opposition to the plane containing the element and the line joining the element and the point. |
60. Which of the following is not a characteristic of an ideal op-amp?
- |  |                                       |
|--|---------------------------------------|
| A The open loop voltage gain is negatively infinite. | B The open loop voltage gain is zero. |
| C The input impedance is infinitely large.           | D The output impedance is zero.       |
61. Directional over current relay is used for the protection of
- |                                |                            |
|--------------------------------|----------------------------|
| A Ring main distribution line. | B Long transmission line.  |
| C Radial distribution line.    | D Large power transformer. |
62. If the inductance and capacitance of a system are 1 H and 0.01  $\mu$ F respectively and the instantaneous value of the current interrupted is 10 A, the value of the shunt resistance across the breaker for critical damping is
- |                 |                 |
|-----------------|-----------------|
| A 5 k $\Omega$  | B 50 k $\Omega$ |
| C 10 k $\Omega$ | D 80 k $\Omega$ |

63. For a two port symmetrical bilateral network, if the transmission parameters  $A=3$  and  $B=1 \Omega$ , the value of parameter  $C$  is
- |              |              |
|--------------|--------------|
| A $3 \Omega$ | B $9 \Omega$ |
| C $8 \Omega$ | D $6 \Omega$ |
64. Which semiconductor power device out of the following is not a current triggered device?
- |             |          |
|-------------|----------|
| A Thyristor | B G.T.O. |
| C Triac     | D MOSFET |
65. The single phase induction motor that can be used on both d.c. and a.c. circuits is
- |                               |                              |
|-------------------------------|------------------------------|
| A Hysteresis motor.           | B Universal motor.           |
| C Reluctance induction motor. | D Repulsion induction motor. |
66. A power system has two generating plants and the power is being dispatched economically with  $P_1 = 125 \text{ MW}$  and  $P_2 = 250 \text{ MW}$ . The loss coefficients are  $B_{11} = 0.10 \times 10^{-2} \text{ MW}^{-1}$ ,  $B_{12} = -0.01 \times 10^{-2} \text{ MW}^{-1}$  and  $B_{22} = 0.13 \times 10^{-2} \text{ MW}^{-1}$ . To raise the total load on the system by  $1 \text{ MW}$ , there will be an additional cost of Rs. 200 per hour. The penalty factor for the plant 1 will be
- |        |       |
|--------|-------|
| A 1.5  | B 1.4 |
| C 1.25 | D 1.6 |
67. The relay that is best suited for phase fault relaying for medium transmission lines is
- |                      |                    |
|----------------------|--------------------|
| A Admittance relay.  | B Impedance relay  |
| C Directional relay. | D Reactance relay. |
68. 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. |
69. The distribution transformers are designed to keep the iron losses minimum because
- |  |   |
|--|---|
| A The primary of the distribution transformer is energized for all 24 hours. | B The primary of the distribution transformer is energized during peak hours. |
| C Iron losses may damage the insulation.                                     | D Iron losses will heat up the coil.  |
70. In the measurement of power by two wattmeter method, when the readings of the two wattmeters are equal and opposite, it can be concluded that the power factor is
- |            |            |
|------------|------------|
| A Zero.    | B Unity.   |
| C Lagging. | D Leading. |
71. The unit protection scheme provides
- |                       |                            |
|-----------------------|----------------------------|
| A Primary protection. | B Remote protection.       |
| C Back up protection. | D Simultaneous protection. |
72. The inertia constant  $H$  of a machine of  $200 \text{ MVA}$  is  $2 \text{ pu}$ . Its value corresponding to  $400 \text{ MVA}$  will be
- |     |      |
|-----|------|
| A 2 | B 1  |
| C 4 | D 10 |
73. If the excitation of a synchronous generator fails, it acts as a/an
- |                     |                         |
|---------------------|-------------------------|
| A Synchronous motor | B Synchronous generator |
| C Induction motor   | D Induction generator   |

74. The presence of earth wire in case of overhead lines  
 A Increases the line capacitance. B Decreases the line capacitance.  
 C Increases the line inductance. D Decreases the line inductance.
75. Which of the following is the most likely source of harmonics in a transformer?  
 A Poor insulation. B Loose connections.  
 C Overload D Core saturation.
76. The boundary of a protective system is decided by the location of  
 A Circuit breakers. B Transformers.  
 C Current transformers. D Generators.
77. Capacitor voltage transformer (CVT) is used  
 A Improve the power factor of transmission. B Reduce the incidence of overvoltage surges on the transmission lines.  
 C Reduce losses in a transmission line. D Connect instruments on the LT side.
78. If a 75 MVA, 10 kV synchronous generator has  $X_d = 0.4$  pu, then  $X_d$  value in pu to a base of 100 MVA, 11 kV is  
 A 0.4 pu B 0.2 pu  
 C 0.44 pu D 0.52 pu
79. In D.C. machines, fractional pitch windings are used  
 A To reduce copper losses. B To improve cooling.  
 C To increase the generated e.m.f. D To reduce the sparking.
80. In a thyristor, the holding current is  
 A More than the latching current. B Equal to the latching current.  
 C Less than the latching current. D Zero.
81. What is the value of  $\sin \theta \begin{bmatrix} \sin \theta & -\cos \theta \\ \cos \theta & \sin \theta \end{bmatrix} + \cos \theta \begin{bmatrix} \cos \theta & \sin \theta \\ -\sin \theta & \cos \theta \end{bmatrix}$  ?  
 A  $\begin{bmatrix} 1 & 1 \\ 1 & 1 \end{bmatrix}$  B  $\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$   
 C  $\begin{bmatrix} \sin \theta \cos \theta & \sin \theta + \cos \theta \\ \sin \theta - \cos \theta & \sin \theta \cos \theta \end{bmatrix}$  D  $\begin{bmatrix} \sin \theta \cos \theta & 0 \\ 0 & \sin \theta + \cos \theta \end{bmatrix}$
82. Find A and B if  $A + B = \begin{bmatrix} 8 & 5 \\ 8 & 13 \end{bmatrix}$  and  $A - B = \begin{bmatrix} 6 & 1 \\ 2 & 3 \end{bmatrix}$ .  
 A  $A = \begin{bmatrix} 7 & 3 \\ 5 & 8 \end{bmatrix}, B = \begin{bmatrix} 1 & 2 \\ 3 & 5 \end{bmatrix}$  B  $A = \begin{bmatrix} 1 & 2 \\ 3 & 5 \end{bmatrix}, B = \begin{bmatrix} 7 & 3 \\ 5 & 8 \end{bmatrix}$   
 C  $A = \begin{bmatrix} 5 & 2 \\ 5 & 6 \end{bmatrix}, B = \begin{bmatrix} 3 & 3 \\ 3 & 7 \end{bmatrix}$  D  $A = \begin{bmatrix} 10 & 5 \\ 5 & 8 \end{bmatrix}, B = \begin{bmatrix} 4 & 4 \\ 3 & 5 \end{bmatrix}$



83.

What is the nullity of the matrix  $A = \begin{bmatrix} 0 & 1 & 1 \\ 1 & -1 & 0 \\ -1 & 0 & -1 \end{bmatrix}$ ?

- |   |   |   |   |
|---|---|---|---|
| A | 0 | B | 3 |
| C | 2 | D | 1 |

84.

The eigenvalues of the matrix  $\begin{bmatrix} 4 & -2 \\ -2 & 1 \end{bmatrix}$

- A are 1 and 4.
- B are -1 and 2.
- C are 0 and 5.
- D cannot be determined.

85.

What are the eigenvalues of the matrix  $\begin{bmatrix} 2 & -1 \\ -4 & 5 \end{bmatrix}$ ?

- A -1 and 1                      B 1 and 6
- C 2 and 5                        D 4 and -1

86.

What is the value of  $\lim_{x \rightarrow 0} \frac{\sin\left[\frac{4}{3}x\right]}{x}$  ?

- A     $\frac{3}{4}$
- B     $\frac{1}{3}$
- C     $\frac{1}{4}$
- D    None of these.

87.

If  $f(x) = \begin{cases} 4x-5, & \text{if } x \leq 2 \\ x-\lambda, & \text{if } x > 2 \end{cases}$ , then find  $\lambda$  for which  $\lim_{x \rightarrow 2} f(x)$  exists.

- |   |    |   |   |
|---|----|---|---|
| A | 1  | B | 5 |
| C | -1 | D | 2 |

88.

For what interval is  $f(x) = \frac{x}{2} + \frac{2}{x}$ ,  $x \neq 0$  increasing?

- A  $(-\infty, -2) \cup (2, \infty)$       B  $(-\infty, -1) \cup (1, \infty)$   
C  $(-2, 2)$       D  $(0, \infty)$

89.

If  $\phi = x^2 y z^3$  and  $\bar{F} = xz\hat{i} - y^2\hat{j} + 2x^2\hat{k}$ , then what is the value of  $\text{curl}(\phi\bar{F})$ ?

$$\begin{aligned} \text{A} \quad & (2xy^4 + 3x^2y^3z) \hat{i} \\ & - (4x^3yz + 8x^2y^2z^3) \hat{j} \\ & - (2x^2yz^3 + x^3z^4) \hat{k} \end{aligned}$$

$$\begin{aligned} \text{B} \quad & (4x^4yz^3 + 3x^2y^3z^2) \hat{i} \\ & + (4x^3yz^3 - 8x^3y^2z^3) \hat{j} \\ & - (2x^2yz^3 + x^3z^4) \hat{k} \end{aligned}$$

$$\begin{aligned} \text{C} \quad & (2x^2yz + 3y^2z) \hat{i} \\ & + (4x^2yz + 3x^2y^2z^3) \hat{j} \\ & - (2x^2yz^3 + x^3z^4) \hat{k} \end{aligned}$$

D None of these.

90. If  $x = a(\theta + \sin \theta)$  and  $y = a(1 - \cos \theta)$  then  $dy/dx$  will be equal to

$$\text{A} \quad \sin\left(\frac{\theta}{2}\right)$$

$$\text{B} \quad \cos\left(\frac{\theta}{2}\right)$$

$$\text{C} \quad \tan\left(\frac{\theta}{2}\right)$$

$$\text{D} \quad \cot\left(\frac{\theta}{2}\right)$$

91. The order and degree of the differential equation  $2y + \frac{dy}{dx} = \frac{3}{4} \int y \, dx$  are

$$\text{A} \quad 2, 1$$

$$\text{B} \quad 1, 2$$

$$\text{C} \quad 1, 1$$

$$\text{D} \quad 2, 2$$

92. Find the solution to  $\frac{dy}{dx} = \cos\left(y - x \frac{dy}{dx}\right)$ .

$$\text{A} \quad y = c^2 x + \cos c$$

$$\text{B} \quad y = c(x - 1) - \cos(cx)$$

$$\text{C} \quad y = c \cos^{-1} x$$

$$\text{D} \quad y = c x + \cos^{-1} c$$

93. The solution of  $\frac{dy}{dx} = -\frac{x}{y}$  at  $x = 1$  and  $y = \sqrt{3}$  is

$$\text{A} \quad x^2 - y^2 = -2$$

$$\text{B} \quad x^2 + y^2 = 4$$

$$\text{C} \quad x^2 + y^2 = 4$$

$$\text{D} \quad x^2 - y^2 = -2$$

94. If the characteristic equation of the differential equation  $\frac{d^2y}{dx^2} + 2\alpha \frac{dy}{dx} + y = 0$  has

two equal roots then the values of  $\alpha$  are

$$\text{A} \quad \pm i$$

$$\text{B} \quad 0, 0$$

- C  $\pm 1$  D  $\pm 1/2$
95. What is the value of  $\int_0^{2+i} \left(\frac{-}{z}\right)^2 dz$  along the line  $y = x/2$ ?
- A  $\frac{5}{3}(2-i)$  B  $5i$
- C  $3i$  D  $\frac{5}{3}(i-2)$
96. The analytic function  $f(z) = \frac{z-1}{z^2+1}$  has singularities at
- A 1 and -1 B  $i$  and  $-i$
- C 1 and  $-i$  D 1 and  $i$
97. All the values of the multi valued complex function  $1^i$  where  $i = \sqrt{-1}$ , are
- A purely imaginary B real and non negative
- C on the unit circle D equal in real and imaginary parts
98. Out of all the words that can be formed from the letters of ROLE, what is the probability that a word chosen at random will start with R.
- A  $1/4$  B  $1/2$
- C  $3/4$  D  $2/5$
99. A random variable  $x$  has the following probability distribution:
- |       |     |     |     |      |     |     |
|-------|-----|-----|-----|------|-----|-----|
| $x_i$ | -2  | -1  | 0   | 1    | 2   | 3   |
| $p_i$ | 0.1 | $k$ | 0.2 | $2k$ | 0.3 | $k$ |
- What is the value of  $k$  ?
- A 0.4 B 0.3
- C 0.2 D 0.1
- 100 Given that one root of the equation  $x^3 - 10x^2 + 31x - 30 = 0$  is 5, the other two roots are
- A 3 and 4 B 2 and 4
- C 2 and 3 D -2 and -3