

This Question Booklet contains  
16 printed pages

PGAE

A  
Seal Sticker

Total Marks : 100  
Time : 100 Minutes

Question  
Booklet  
Code :

A

Candidate's  
Seat No. :

Candidate's Signature \_\_\_\_\_ Block Supervisor's Signature \_\_\_\_\_

**DO NOT OPEN QUESTION BOOKLET UNTIL INSTRUCTED.**

INSTRUCTIONS FOR CANDIDATE:

1. Check Number printed on your OMR SHEET and Question Paper with your SEAT No. before answering the questions. Consult block supervisors in case the above mentioned numbers do not match with your seat number.
2. There are total 100 questions. For answer of each question A, B, C, D, E options are given in OMR SHEET. In OMR SHEET, there is "E" option. "E" option is for "Not Attempted". If candidate do not wish to answer the question he/she should select "E" option (Not Attempted). All questions are compulsory.

For Example:

Which state of India has the longest sea shore ?

A ☐ B ☐ C ☒ D ☐ E ☐

(A) Maharashtra (B) Tamilnadu  
(C) Gujarat (D) Andhra Pradesh

In this example, the right answer is (C). Therefore, the Circle of (C) has been darkened (encoded). Candidate should not give the answer "Gujarat" in writing.

**The options once darkened/answered by candidate cannot be changed.**

3. Candidates are not permitted to leave examination hall during examination.
4. Candidates must strictly enter SEAT NO. in the designated space provided in OMR SHEET as well as Question Paper neatly as soon as they receive the OMR SHEET & Question Paper.
5. Candidates must not write name or put any identification sign/symbol on OMR SHEET. In such case strict disciplinary action will be taken against candidate & will be considered disqualified/ineligible. Only Seat No. must be

entered at designated space provided in OMR SHEET.

6. Both, Candidate's & Supervisor's signature must be done on Certificate of OMR SHEET. Unsigned OMR SHEET would not be considered for evaluation.
7. Candidates are not permitted to use or carry with them any kind of literature, guide, hand written notes, or printed books, mobile phone, pagers, smart watches, camera or any electronic gadgets to examination hall.
8. Use of only Non-scientific / Non-programmable calculator shall allow during examination.
9. Candidates are not permitted to talk/discuss in the Examination Hall. Any candidate found violating supervisor's instructions will be disqualified.
10. Candidates must fully darken circle A, B, C, D and E accordingly with Blue / Black ball pen. If answers are marked with any other coloured ball pen, pencil, white ink (whitner), any corrections are done by candidate by means of blade or rubber or whitner will not be considered for evaluation.
11. Candidates may carry QP with them after Examination.
12. **For correct answer 1 (One) marks will be given.**

**If candidate gives more than one option as answer for one question in answer sheet (OMR SHEET), or gives wrong answer then the candidate will be allotted Zero (0) marks.**

**If candidate does not want to answer a particular question and marks (E) or leave the option without encoding on OMR sheet, then no minus marks will be given.**

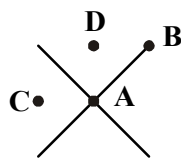
Submit the OMR SHEET to the block supervisor after completion of examination without fail before leaving examination hall, failure to do so will result in disqualification of the candidature for the examination and disciplinary action will be taken against such candidate.



1. What principle allows lighter-than air vehicles to float in the air?  
(A) Lift (B) Drag  
(C) Thrust (D) Buoyancy
2. In what way does the shape of the aircraft fuselage contribute to aerodynamics  
(A) By generating lift (B) By reducing drag  
(C) By controlling pitch (D) By increasing thrust
3. What advantage does a swept wing planform offer at high speeds?  
(A) Increased lift (B) Enhanced maneuverability  
(C) Reduced Drag (D) Great stability
4. Which of the following is the most common type of Powerplant used in commercial aircraft at high altitude and high speed?  
(A) Turboprop (B) Turboshaft  
(C) Piston Engine (D) Turbofan
5. What is the limitation of a ramjet engine?  
(A) Inefficient fuel consumption (B) Inability to operate at low speeds  
(C) Complex maintenance requirements (D) Limited thrust output
6. Which of the following factors affects the lift generated by an airfoil?  
(A) Speed of the air (B) Shape of the airfoil  
(C) Angle of attack (D) All of the above
7. Which statement best describes the advantages of NACA airfoils?  
(A) They are simple and easy to manufacture.  
(B) They are suitable for subsonic flight.  
(C) They offer high lift to drag ratios.  
(D) They are primarily used in supersonic aircraft designs.
8. Stall angle of attack of camber airfoil are \_\_\_\_\_ than the symmetrical airfoil.  
(A) Lower  
(B) Higher  
(C) Same  
(D) Can't Say, depends upon free stream velocity
9. What is the aerodynamic center of an airfoil?  
(A) A point where the lift force acts  
(B) A point where the pitching moment is constant  
(C) A point where the pitching moment is zero  
(D) A point where the resultant of aerodynamic forces act
10. The drag divergence Mach number of an airfoil.  
(A) Mach number at which lift is zero.  
(B) is equal to the critical Mach number.  
(C) is always higher than the critical Mach number.  
(D) is always lower than the critical Mach number.

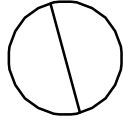
11. Total pressure at a point is defined as the pressure, when the flow is brought to rest
  - (A) adiabatically
  - (B) isentropically
  - (C) isothermally
  - (D) isobarically
12. Across the normal shock
  - (A) both total temperature and total pressure decreases
  - (B) both total temperature and total pressure remains constant
  - (C) total pressure remains constant but total temperature decreases
  - (D) total temperature remains constant but total pressure decreases
13. One of the criteria for high speed airplane is that the critical Mach number should be as high as possible. Therefore, High speed subsonic airplanes are usually designed with:
  - (A) thin airfoils
  - (B) thick airfoils
  - (C) laminar flow airfoils
  - (D) diamond airfoils
14. Two pipes of constant sections but different diameters carry water at the same volume flow rate. The Reynolds number, based on the pipe diameter is
  - (A) same in both pipes
  - (B) larger in the narrower pipe
  - (C) smaller in the narrower pipe
  - (D) depends on the material of the pipes
15. The magnitude of the pressure at an altitude of 10000 meter in the ISA. Assume pressure at Sea level is 101325 N/m<sup>2</sup>.
  - (A) 26400 N/m<sup>2</sup>
  - (B) 39400 N/m<sup>2</sup>
  - (C) 10500 N/m<sup>2</sup>
  - (D) 45200 N/m<sup>2</sup>
16. The airplane is flying at an altitude where the ambient pressure is 30000 N/m<sup>2</sup> and temperature -44.4°C. What is indicated airspeed if the true air speed of the airplane is 270 m/sec. Neglect the effect of compressibility.
  - (A) 150 m/sec.
  - (B) 164 m/sec.
  - (C) 180 m/sec.
  - (D) 193 m/sec.
17. When a clockwise circulation imposed on the circular cylinder placed in the free stream, the stagnation point moves (compared with no circulation case)?
  - (A) remain at the same location
  - (B) upwards
  - (C) downwards
  - (D) depends on the diameter of the cylinder
18. Which of the following phenomena is NOT associated with compressible flow.
  - (A) Choked flow
  - (B) Shock waves
  - (C) Sound waves
  - (D) Laminar flow
19. In converging-diverging nozzle, the flow is
  - (A) always subsonic.
  - (B) always supersonic.
  - (C) supersonic in the converging section and subsonic in the diverging section.
  - (D) subsonic in the converging section and supersonic in the diverging section.

20. Two airplanes are identical except for the location of wing. The longitudinal static stability of the airplane with low wing configuration will be:
- (A) more than the airplane with high wing configuration  
 (B) less than the airplane with high wing configuration  
 (C) same as the airplane with high wing configuration  
 (D) more if elevator is deflected
21. For a fixed center of gravity location of an airplane, when the propeller is mounted on the nose of the fuselage
- (A) Longitudinal static stability increases.      (B) Longitudinal static stability decreases.  
 (C) Longitudinal static stability is same.      (D) Longitudinal static stability is maximum.
22. Let an airplane in a steady level flight be trimmed at a certain speed. A level and steady flight at a higher speed could be achieved by changing
- (A) engine throttle only      (B) elevator only  
 (C) throttle and elevator together      (D) rudder only
23. The absolute ceiling is the altitude at which maximum rate of climb of an aircraft is:
- (A) 0      (B) 100 ft/min  
 (C) Minimum      (D) Maximum
24. The condition for maximum range for an Jet-propelled airplane is:
- (A) fly at minimum drag condition      (B) fly at maximum speed  
 (C) fly at high altitude      (D) fly at low altitude
25. An airplane has an wing loading of  $2400 \text{ N/m}^2$  and its drag equation is  $C_D = 0.016 + 0.055 C_L^2$ . The value of lift coefficient at the minimum drag condition is:
- (A) 0.54      (B) 0.68  
 (C) 0.87      (D) 0.95
26. The take-off distance for an aircraft can be decreases by:
- (A) increases in wing loading.      (B) decreases in maximum lift coefficient.  
 (C) increases in thrust to weight ratio.      (D) increases in Drag coefficient.
27. Shear center is the point in the cross-section about which
- (A) Shear force is zero      (B) Bending moment is zero  
 (C) Twist is zero      (D) Deformation is zero
28. The location of shear center for the section shown below, is at point:



- (A) A      (B) B  
 (C) C      (D) D

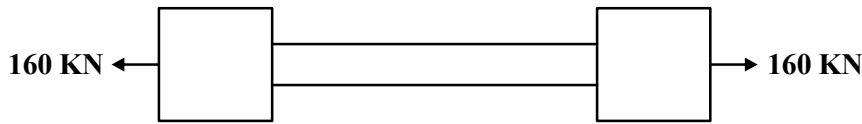
29. A thin walled tube of circular cross-section with radius ' $r$ ' has a central web which divides it into two symmetrical cells. A torque  $T$  is acting on the section. The shear flow ( $q$ ) in the central web is:



- (A)  $q = \frac{T}{2\pi r^2}$  (B)  $q = 0$   
 (C)  $q = \frac{T}{4\pi r^2}$  (D)  $q = \frac{T}{\pi r^2}$
30. A cylindrical pressure vessel has an internal diameter of 2 m and is fabricated from plates 20 mm thick. If the pressure inside the vessel is 1.5 N/mm<sup>2</sup>. The longitudinal and circumferential stress are:  
 (A) 37.5 N/mm<sup>2</sup> and 75 N/mm<sup>2</sup> (B) 75 N/mm<sup>2</sup> and 37.5 N/mm<sup>2</sup>  
 (C) 55.5 N/mm<sup>2</sup> and 82 N/mm<sup>2</sup> (D) 82 N/mm<sup>2</sup> and 55.5 N/mm<sup>2</sup>
31. The angle between the principal plane and the plane of maximum shear is:  
 (A) 90° (B) 180°  
 (C) 45° (D) 210°
32. There are \_\_\_\_\_ equations of strain compatibility which must be satisfied in the solution of three-dimensional problems in elasticity.  
 (A) 3 (B) 4  
 (C) 5 (D) 6
33. Consider the stress function  
 $\phi = Ax^2 + Bxy + cy^2$   
 Where  $A$ ,  $B$  and  $C$  are constants.  
 The stresses  $\sigma_x$ ,  $\sigma_y$  and  $\tau_{xy}$  are:  
 (A)  $2A$ ,  $2C$  and  $-B$  (B)  $2C$ ,  $2A$  and  $-B$   
 (C)  $2A$ ,  $2C$  and  $B$  (D)  $2C$ ,  $2A$  and  $B$
34. A cantilever beam of length ' $L$ ' is subjected to a uniformly distributed load of intensity ' $W$ ' over the entire length. ' $E$ ' is the Young's modulus of the material of the beam and ' $I$ ' is the moment of inertia of the cross-section. The deflection at the free end of the beam is:  
 (A)  $\frac{WL^4}{8EI}$  (B)  $\frac{WL^3}{3EI}$   
 (C)  $\frac{WL^4}{6EI}$  (D)  $\frac{WL^3}{6EI}$
35. SPAR beam of the wing cross-section is able to resist:  
 (A) Bending load only (B) Shear load only  
 (C) Torsional load only (D) Both bending and shear loads

36. The \_\_\_\_\_ relies on the fact that the failure of a member in a redundant structure does not necessarily lead to the collapse of the complete structure:
- (A) Safe life (B) Fail-safe  
(C) Load factor (D) Limit load
37. The cross-section of I-beam has the following dimensions:  
Flanges : 200 mm × 20 mm.  
Web : 260 mm × 25 mm.  
and overall height is 300 mm.
- If the beam is subjected to a bending moment of 100 kN.m applied in a vertical plane. The maximum bending stress on the section is:  
(Take  $I = 193.7 \times 10^6 \text{ mm}^4$ )
- (A) 78 N/mm<sup>2</sup> (B) 85 N/mm<sup>2</sup>  
(C) 95 N/mm<sup>2</sup> (D) 100 N/mm<sup>2</sup>
38. The shear flow distribution varies \_\_\_\_\_ in the thin wall Z-section due to a shear load  $S_y$  applied through the shear center of the section.
- (A) constant (B) linear  
(C) parabolic (D) cubic
39. The shear flow is \_\_\_\_\_ when a pure torque is applied on thin walled single closed-section.
- (A) constant (B) vary linearly  
(C) vary parabolic (D) zero
40. A load of 5 kN is to be raised with the help of steel wire. What is the diameter of the steel wire if the stresses is not to exceed 100 MPa.
- (A) 3 mm (B) 4.5 mm  
(C) 6.5 mm (D) 8 mm
41. The relationship between Young's modulus (E), Bulk modulus (K) and Poisson's ratio (M) is
- (A)  $E = 2K (1-2 M)$  (B)  $E = 3K (1-2 M)$   
(C)  $E = K (1-2 M)$  (D)  $E = 2K (1-3 M)$
42. The length of a wire is increased by 1 mm on the application of a certain load. In a wire of the same material but twice the length and half the radius, the same force will produce on elongation of
- (A) 0.5 mm (B) 2 mm  
(C) 4 mm (D) 8 mm
43. The major and minor principal stresses at a point are 3 MPa and -3 MPa. The maximum shear at the point is:
- (A) 3 MPa (B) 6 MPa  
(C) 9 MPa (D) 0
44. For plane stress conditions the number of independent stress components are:
- (A) 1 (B) 2  
(C) 3 (D) 4

45. A bar as shown, is subjected to load of 160 kN. If the stress in the middle portion is limited to  $150 \text{ N/mm}^2$ , what will be the diameter of the middle portion?



- (A) 3.456 cm (B) 3.685 cm  
(C) 4.124 cm (D) 4.524 cm
46. The center of pressure moves \_\_\_\_\_ when angle of attack of an airfoil decreases.  
(A) forward (B) backward  
(C) remain at the same location (D) independent of angle of attack
47. Interpret the flow given by the stream function (units:  $\text{m}^2/\text{sec}$ )  
 $\Psi = 6x + 12y$   
The velocity in the horizontal direction is:  
(A)  $-6 \text{ m/sec}$  (B)  $+6 \text{ m/sec}$   
(C)  $-12 \text{ m/sec}$  (D)  $+12 \text{ m/sec}$
48. A sink of strength  $120 \text{ m}^2/\text{sec}$  is situated 2 m downstream from a source of equal strength in an irrotational uniform stream of  $30 \text{ m/sec}$ . The fineness ratio of the oval formed by the streamline  $\Psi = 0$  is:  
(A) 1.35 (B) 1.51  
(C) 1.89 (D) 2.23
49. A high-speed wind-tunnel consists of a reservoir of compressed air that discharges through a convergent divergent nozzle. The temperature and pressure in the reservoir are  $200^\circ\text{C}$  and  $2 \text{ MN/m}^2$  gauge respectively. In the test section Mach number is to be 2.5. If the test section is to be  $125 \text{ mm}$  square, what should be the throat area?  
(A)  $3450 \text{ mm}^2$  (B)  $4525 \text{ mm}^2$   
(C)  $5355 \text{ mm}^2$  (D)  $5920 \text{ mm}^2$
50. The magnitude of free stream velocity after the normal shock wave is always:  
(A) Subsonic (B) Transonic  
(C) Supersonic (D) Depends on free stream Mach number
51. The free stream velocity across the boundary layer varies \_\_\_\_\_.  
(A) linearly (B) parabolic  
(C) cubic (D) constant
52. A flat plate of  $0.6 \text{ m}$  chord at zero incidence placed in a uniform free stream of  $45 \text{ m/sec}$ . the friction drag coefficient of the plate is:  
(A) 0.0010 (B) 0.0019  
(C) 0.0032 (D) 0.0048
53. A body is \_\_\_\_\_ if, out of its own accord, it eventually returns to and remains at its equilibrium position over a period of time.  
(A) statically stable (B) statically unstable  
(C) dynamically stable (D) dynamically unstable



54. An airplane is in equilibrium in pitch, when the moment about the center of gravity is:  
 (A) Zero (B) Negative  
 (C) Positive (D) Constant
55. For a given wing body combination, the aerodynamic center lies at 0.05 chord length ahead of the center of gravity. The moment coefficient about the aerodynamic center is  $-0.016$ . If the lift coefficient is 0.45, then the moment coefficient about the center of gravity is:  
 (A) 0.032 (B) 0.0065  
 (C) 0.0089 (D) 0.0156
56. For longitudinal static stability, the position of center of gravity must always \_\_\_\_\_ of the neutral point.  
 (A) coincide (B) backward  
 (C) forward (D) can't say
57. What is the Brayton cycle?  
 (A) A refrigeration cycle (B) A power cycle for gas turbine  
 (C) A combustion cycle for diesel engines (D) A cycle used in hydraulic systems
58. What happens to the air as it passes through the compressor of a gas turbine?  
 (A) It cools down (B) It speeds up  
 (C) It slows down and become zero velocity (D) It increases in pressure
59. What material is commonly used for the blades in high-temperature regions of gas turbines?  
 (A) Aluminum (B) Stainless steel  
 (C) Nickel-based superalloys (D) Copper
60. Which of the following is a major advantage of turbofan engine compared to turbojet engine?  
 (A) High thrust-to-weight ratio (B) High operational altitude  
 (C) Simple design (D) Lower fuel consumption
61. Choose the correct statement:  
 I. Turboprop engine have a higher thrust at take-off and better fuel economy.  
 II. At high speeds, due to shock waves and flow separation, the propeller efficiency decreases.  
 III. The fuel economy at low operational speed is extremely poor for turbojet engine  
 (A) I & II (B) II & III  
 (C) I & III (D) I, II & III
62. The afterburner is mainly used during:  
 (A) High thrust for short duration (B) High thrust for larger duration  
 (C) Low thrust for short duration (D) Low thrust for longer duration
63. A turbojet powerplant uses aviation Kerosene having a calorific value of 43 MJ/kg. The fuel consumption is 0.18 kg per hour per N of thrust, when the thrust is 9 kN. The aircraft velocity is 500 m/sec and the mass of air passing through the compressor is 27 kg/sec. What is the overall efficiency of the engine?  
 (A) 23.26% (B) 28.92%  
 (C) 32.43% (D) 39.58%

64. The effective jet exit velocity from the jet engine is 2700 m/sec. The forward flight velocity is 1350 m/sec and the air flow rate is 78.6 kg/sec. What is the thrust produced?
- (A) 136110 N (B) 126110 N  
(C) 116110 N (D) 106110 N
65. Reciprocating engines are not used in modern aircraft due to
- (A) high specific weight (B) high speed requirement  
(C) large drop in power with altitude (D) all of the above
66. Pressure rise in a ramjet engine is achieved by:
- (A) Diffuser (B) Centrifugal compressor  
(C) Axial flow compressor (D) None of the above
67. A centrifugal compressor of 40.6 cm diameter revolving at 18000 rpm delivers air at an isentropic efficiency of 0.78. What would be the approximate pressure ratio expected if the machine was at 6000 meter altitude, where  $P_0 = 35$  cm of Hg and  $T_0 = 248$  K?
- (A) 4 (B) 5  
(C) 6 (D) 7
68. In the axial flow compressor, the absolute velocity in the stator:
- (A) increases (B) decreases  
(C) initially increases then decreases (D) remains constant
69. The work absorbing capacity of an axial flow compressor:
- (A) increases with increases in the axial velocity  
(B) decreases with increases in the axial velocity  
(C) remains the same with increases in the axial velocity  
(D) has no relation between them
70. The performance of an exhaust nozzle is a function of
- (A) gross thrust coefficient (B) flow coefficient  
(C) velocity and angular coefficient (D) all of the above
71. What is one of the primary challenges associated with solid rocket propellants
- (A) They require complex plumbing systems.  
(B) They are difficult to store for long periods  
(C) They cannot be easily throttled or shut down once ignited.  
(D) They have lower specific fuel consumption or specific impulse compared to liquid propellants.
72. What is the term for the speed needed to break free from a planet's gravitational pull?
- (A) Orbital speed (B) Terminal velocity  
(C) Escape velocity (D) Launch speed
73. What is the term for the point in an orbit where a satellite is closest to the earth?
- (A) Apogee (B) Perigee  
(C) Zenith (D) Nadir

74. What phenomenon allows a spacecraft to gain speed by passing close to a planet  
 (A) Gravitational lensing (B) Hohmann transfer  
 (C) Gravitational assist (D) Keplerian motion
75. At  $29^\circ$  north latitude, what is the deviation ' $d$ ' from the vertical of a plumb bob at the end of a 30 meter string due to the earth's rotation?  
 (A) 34.8 (B) 40.8  
 (C) 44.1 (D) 54.1
76. At two points on a geocentric orbit the altitude and true anomaly are  $Z_1 = 1545$  km,  $\theta_1 = 126^\circ$  and  $Z_2 = 852$  km,  $\theta_2 = 58^\circ$  respectively. Find the eccentricity?  
 (A) 0.8 (B) 0.7  
 (C) 0.6 (D) 0.4
77. A geocentric elliptical orbit has a perigee radius of 9600 km and an apogee radius of 21000 km. Calculate the time to fly from perigee ' $P$ ' to a true anomaly of  $120^\circ$ .  
 (A) 18.8 sec (B) 20.9 sec  
 (C) 6.8 sec (D) 14.8 sec
78. What shape are the orbits of planets around the Sun, according to Kepler's First Law?  
 (A) Circular (B) Elliptical  
 (C) Parabolic (D) Hyperbolic
79. In the context of multi degree of freedom systems, what does the stiffness matrix represent  
 (A) The relationship between applied forces and accelerations  
 (B) The relationship between velocities and displacements  
 (C) The relationship between masses and forces  
 (D) The relationship between displacements and applied forces
80. Which of the following describes a system that oscillates with decreasing amplitude over time due to energy loss?  
 (A) Damped Vibration (B) Undamped Vibration  
 (C) Resonant Vibration (D) Forced Vibration
81. Eigen values of the matrix "A" are \_\_\_\_\_, where  $A = \begin{bmatrix} 5 & 4 \\ 1 & 2 \end{bmatrix}$   
 (A) 1, 6 (B) 5, 2  
 (C) -1, 6 (D) 5, -2
82. Which of the following Statements are true in general?  
 Statement 1 : Singular matrix is always a square matrix.  
 Statement 2 : Every square matrix has determinant.  
 Statement 3 : Every square matrix satisfies its own characteristics equation.  
 (A) Only Statement 1 (B) Statement 1 and 2  
 (C) Statement 1 and 3 (D) Statement 2 and 3

83. Which of the following is correct pair of Cauchy - Riemann Equations ?

Here  $f(z) = u(x,y) + i v(x,y)$  is given.

(A)  $\frac{\partial u}{\partial y} = \frac{\partial v}{\partial x}$  and  $\frac{\partial u}{\partial x} = \frac{\partial v}{\partial y}$

(B)  $\frac{\partial u}{\partial y} = -\frac{\partial v}{\partial x}$  and  $\frac{\partial u}{\partial x} = -\frac{\partial v}{\partial y}$

(C)  $\frac{\partial u}{\partial x} = \frac{\partial v}{\partial x}$  and  $\frac{\partial u}{\partial y} = -\frac{\partial v}{\partial y}$

(D)  $\frac{\partial u}{\partial x} = \frac{\partial v}{\partial y}$  and  $\frac{\partial u}{\partial y} = \frac{\partial v}{\partial x}$

84. Evaluate  $\lim_{x \rightarrow a} \frac{\log(x-a)}{\log(e^x - e^a)}$

(A) 0

(B) 1

(C) -1

(D) None of the above

85. Find  $\frac{dy}{dx}$  if  $x^3 + y^3 = 7xy$ .

(A)  $(7y - 3x^2) / (3y^2 - 7x)$

(B)  $(3x^2 - 7y) / (3y^2 - 7x)$

(C)  $(3y^2 - 7x) / (7y - 3x^2)$

(D) None of the above

86. Find the directional derivative of  $x^2 y^2 z^2$  at the Point  $(1, 1, -1)$  in the direction of the tangent to the curve  $x = e^t$ ,  $y = \sin 2t + 1$  and  $z = 1 - \cos t$  at  $t = 0$ .

(A) 0

(B) 1

(C)  $\frac{6}{\sqrt{5}}$

(D)  $\frac{5}{\sqrt{6}}$

87. Laplace Transform of  $t^3 \cdot e^{-2t}$  is \_\_\_\_\_

(A)  $3! / (S - 2)^4$

(B)  $3! / (S + 2)^4$

(C)  $4! / (S - 2)^4$

(D)  $4! / (S + 2)^4$

88. If  $x = r \cos \theta$ ,  $y = r \sin \theta$  then find out Jacobian  $\frac{\partial(x,y)}{\partial(r,\theta)}$

(A) r

(B) 1/r

(C) 0

(D) 1

89. Which of the following is an iterative method to solve ordinary differential equations?

(A) False Position Method

(B) LU Decomposition method

(C) Newton-Raphson Method

(D) Picard's method

90. Find the inverse Laplace Transform of the function  $\frac{5}{(S-2)(S+3)}$

(A)  $e^{-2t} + e^{-3t}$

(B)  $e^{-2t} + e^{3t}$

(C)  $e^{-2t} - e^{3t}$

(D)  $e^{2t} - e^{-3t}$

91. The solution of differential equation  $\frac{dy}{dx} = e^{x+y}$  is \_\_\_\_\_.  
 (A)  $e^x + e^y = c$  (B)  $e^x + e^{-y} = c$   
 (C)  $e^x - e^y = c$  (D)  $e^x - e^{-y} = c$
92. Solve the differential equation,  $\frac{d^2y}{dx^2} - 5\frac{dy}{dx} + 6y = e^{4x}$   
 (A)  $y = \frac{1}{2}e^{4x} + c_1 + c_2x$  (B)  $y = c_1e^{2x} + c_2e^{-3x} + x$   
 (C)  $y = c_1e^{2x} + c_2e^{3x} + \frac{1}{2}e^{4x}$  (D) None of above
93. The probability of an Impossible event is \_\_\_\_\_.  
 (A) 0 (B) 1  
 (C) Between 0 and 1 (D) None of the above
94. Evaluate  $\int_0^1 \frac{1}{1+x} dx$  taking  $h = 1$  using Simpson's  $\frac{1}{3}$  rule. (correct up to 3 decimal places)  
 (A) 1.0092 (B) 1.1959  
 (C) 1.1991 (D) 1.2172
95. Evaluate  $\oint \frac{e^z}{z^2+1} dz$  over the circle  $|z| = 2$   
 (A)  $2\pi i$  (B)  $\sin(1)$   
 (C)  $2\pi i \cdot \sin(1)$  (D)  $2\pi i / \sin(1)$
96. Find the residue of  $\frac{1}{(z+1)^4}$  at its pole.  
 (A) 0 (B) 1  
 (C) -1 (D) 5/9
97. For a Binomial Distribution with  $n = 20$ ,  $p = 0.35$  (probability of success) then find Variance  
 (A) 2.45 (B) 4.55  
 (C) 8.45 (D) 4.3225
98. Two unbiased dice are tossed simultaneously. Find the probability that the sum of numbers on the upper face of dice is 9 or 12.  
 (A) 4/36 (B) 1/36  
 (C) 5/36 (D) None of the above

99. Find the median of 10, 23, 18, 38, 65, 92, 40, 58
- (A) 38 (B) 65
- (C) 40 (D) 39

100. For  $F(x,y)$  we define,

$$r = \frac{\partial^2 F}{\partial x^2}, S = \frac{\partial^2 F}{\partial x \partial y}, t = \frac{\partial^2 F}{\partial y^2}$$

Which of the following condition is true for  $F(x,y)$  to have maxima?

- (A)  $rt - S^2 < 0, r > 0$  (B)  $rt - S^2 < 0, r < 0$
- (C)  $rt - S^2 > 0, r > 0$  (D)  $rt - S^2 > 0, r < 0$

**SPACE FOR ROUGH WORK / રફ કામ માટેની જગ્યા**

