ENGLISH

I: Complete the sentences

1. The pilot was _____ injured, he died within half an hour.
    A. seriously
    B. fatally
    C. fatefully
    D. vitally

2. The punch made the boxer _____ in pain.
    A. wince
    B. gape
    C. grumble
    D. fumble

3. Since one cannot read every book, one should be content with making a _____ selection.
    A. normal
    B. standard
    C. moderate
    D. judicious

II. In each of the following questions, out of the four alternatives, choose the one, which can be substituted for the given word/sentence

4. Music sung or played at night below a person's window
    A. serenade
    B. sonnet
    C. lyric
    D. primo

5. A government by the nobles
    A. Democracy
    B. Bureaucracy
    C. Autocracy
    D. Aristocracy

6. A man of lax moral
   A. Ruffian
   B. Licentious
   C. Pirate
   D. Vagabond

7. The boy gave a vivid description of all that happened.
   A. brilliant
   B. fresh
   C. explanatory
   D. picturesque

8. It is compulsory for all the students to join this tour.
   A. regular
   B. necessary
   C. dutiful
   D. obligatory

9. The teacher felt that the student lacked discrimination in the study of his data.
   A. imagination
   B. good taste
   C. good judgement
   D. objectivity

10. Self-reliance has been <u>adopted</u> as an important objective of economic planning in modern India.
    A. refused
    B. forsaken
    C. denied
    D. discarded

11. He was in a <u>dejected</u> mood.
    A. jubilant
    B. rejected
    C. irritable
    D. romantic

12. There was a marked <u>deterioration</u> in his condition.
    A. improvement
    B. revision
    C. reformation
    D. amendment

13. His pocket has been picked.
    A. They have his pocket picked.
    B. Picking has been done to his pocket.
    C. Picked has been his pocket.
    D. Someone has picked his pocket.

14. My uncle promised me a present.
    A. A present was promised by my uncle to me.
    B. I was promised a present by my uncle.
    C. I had been promised a present by my uncle.
    D. I was promised by my uncle a present.

15. Who is creating this mess?
    A.   Who has created this mess?
    B.   By whom has this mess been created?
    C.   By whom this mess is being created?
    D.   By whom is this mess being created?

16. A lion may be helped even by a little mouse.
    A.   A little mouse may even help a lion.
    B.   Even a little mouse may help a lion.
    C.   A little mouse can even help a lion.
    D.   Even a little mouse ought to help a lion.

VI. Please complete the sentences with suitable alternatives.

17. She expects that her son _____
    A.   can return
    B.   may return
    C.   should return
    D.   None of he above

18. All felt that he _____ a cheat.
    A.   may be
    B.   can be
    C.   might be
    D.   None of the above

19. She _____ alone as it was raining heavily.
    A.   must not leave
    B.   must not have left
    C.   should not leave
    D.   None of the above

20. You _____ obey your parents.
    A.   should
    B.   ought to
    C.   must
    D.   None of the above

MATHEMATICS

1. 2 marbles are drawn in succession from a box containing 10 red, 30 white, 20 blue and 15 orange marbles, with replacement being made after each drawing. The probability that the first drawn marble is red and second is white is:
   a. 0.06333
   b. 0.05333
   c. 0.02433
   d. 0.05666

2. If $L\{f(t)\} = \frac{e^{\frac{-1}{s}}}{s}$, then $L\{e^{-t}f(3t)\}$ is
   a. s
   b. s+1
   c. s-1
   d. s^2

3. The directional derivative of $f(x, y, z) = 4e^{2x-y+z}$ at the point (1, 1, -1) in the direction towards the point (-3, 5, 6) is
   a. $\frac{-20}{9}$
   b. $\frac{20}{9}$
   c. $\frac{9}{20}$
   d. $\frac{-9}{20}$

4. The integral equation $\int_0^\infty f(x)\sin xt\, dx = \begin{cases} 1, & 0 \le t < 1 \\ 2, & 1 \le t < 2 \\ 0, & t \ge 2 \end{cases}$ is

   a. $\frac{2}{\pi x}$ (1+cos x-2 cos2x)
   b. $\frac{2}{\pi x}$ (1-cos x+2 cos2x)
   c. $\frac{2}{\pi x}$ (cos x-2 cos2x)
   d. $\frac{2}{\pi x}$ (cos x-2 cos2x-1)

5. By dividing [0, 1] into 4 equal sub intervals, the value of $\int_0^1 \frac{dx}{1+x}$ (using trapezoidal rule) correct to 3 decimal places is:
   a. 0.693
   b. 0.694
   c. 0.697
   d. 0.699

6. If u = x²-y², x=2r-3s+4, y=-r+8s-5, then $\frac{\partial u}{\partial r}$ =
   a. 4x+2y
   b. 2x+4y
   c. 4x-2y
   d. 2x-4y

7. The total mass of the region in the cube $0 \le x \le 1, 0 \le y \le 1, 0 \le z \le 1$ with density at any point given by xyz is
   a. 1/8
   b. 2/3
   c. 5/7
   d. 3/2

8. Two circles x²+y²-4x+10y+20 = 0 and x²+y²+8x-6y-24 = 0
   a. Touch externally
   b. Touch internally
   c. Are orthogonal
   d. Are disjoint

9. If the vectors xi+j-2k, i+j+3k, 8i+5j are coplanar, then the value of x is
   a. -2
   b. 5
   c. 2
   d. -5

10. The Laplace transformation of the following function using second translation theorem: 4sin(t-3)u(t-3) is
   a. $e^{3s}\frac{4}{(s^2+1)}$
   b. $e^{3s}\frac{4}{(s^2-1)}$
   c. $e^{-3s}\frac{4}{(s^2+1)}$
   d. $e^{-3s}\frac{4}{(s^2-1)}$

11. The integral of $\int_0^\infty \int_0^\infty e^{-(x^2+y^2)}dx\,dy$ is
    a. $\frac{\pi}{2}$
    b. $\frac{\pi}{4}$
    c. $\frac{\pi}{8}$
    d. $\frac{\pi}{6}$

12. The $\int y^2 dx - 2x^2\,dy$ along the parabola $y = x^2$ from (0, 0) to (2, 4) is
    a. 48/5
    b. -48/5
    c. 8/5
    d. 48

13. If T: $R^3 \rightarrow R^3$ is given by T(x, y, z) = (x + y + z, y + z, z) for (x, y, z)∈R^3 then T^{-1}(x, y, z) is
    a. (x - y, y - z, z - x)
    b. (x, y - z, z - x)
    c. (x - y, y −z, z)
    d. (x + y, y + z, z)

14. If C is the midpoint of AB and P is a point outside AB, then
    a. PA+PB=PC
    b. PA+PB+PC=0
    c. PA+PB=2PC
    d. PA+PB+2PC=0

15. If A be a 3 x 3 matrix with Eigen values 1,-1,0 then the determinant of $I+A^{100}$ is
    a. 6
    b. 4
    c. 9
    d. 100

16. The radius of curvature for the curve $y=e^x$ at (0,1) is
    a. $\sqrt{2}$
    b. $2\sqrt{2}$
    c. $\frac{1}{\sqrt{2}}$
    d. $\frac{1}{2\sqrt{2}}$

17. The mean value of a sine wave over half a cycle is
    a. 0.318 x maximum value
    b. 0.707 x maximum value
    c. Peak value
    d. 0.637 x maximum value

18. Regula Falsi method is used for
    a. Solution of ordinary differential equation
    b. Differential of a function
    c. Integration of a function
    d. Solution off an algebraic (or) transcendental equation

19. The order of the pole of $\frac{(e^x - 1)}{z^4}$ is
    a. 3
    b. 1
    c. 2
    d. 4

20. If C is unit circle $|z| = 1$ then $\int_c \bar{z} \, dz =$
    a. 0
    b. 1
    c. $2\pi i$
    d. $4\pi i$

MECHANICAL

1. One kilogram force is equal to
   (a) 4.9 N
   (b) 7.9 N
   (c) 1.0 N
   (d) 9.81 N

2. Inertia of a body is defined by
   (a) Newton's first law of motion
   (b) Newton's second law of motion
   (c) Newton's third law of motion
   (d) Newton's law of gravitation

3. Frictional force depends upon
   (a) Area of contact
   (b) Velocity of object
   (c) Inclination of the object
   (d) Normal reaction

4. Leverage is the ratio of
   (a) load arm to effort arm
   (b) effort arm to load arm
   (c) effort arm to total length of lever
   (d) total length of lever to effort arm

5. The path of a projectile is
   (a) Straight
   (b) Elliptical
   (c) Parabolic
   (d) Circular

6. The maximum resultant of two forces of magnitudes 8 N and 6 N is
   (a) 2 N
   (b) 10 N
   (c) 14 N
   (d) 20 N

7. Tension force in a member is assumed to be positive, if
   (a) it is pushing the joint
   (b) it is pulling the joint
   (c) it is bending the member
   (d) it is pushing the member

8. Stress-strain analysis is conducted to know which of the following properties of material?
   (a) Physical properties
   (b) Optical properties

(c) Magnetic properties
(d) Mechanical properties

9. The working stress is obtained by
   (a) multiplying ultimate stress with the factor of safety
   (b) dividing ultimate stress by the factor of safety
   (c) multiplying yield stress with the factor of safety
   (d) adding ultimate stress to the factor of safety

10. The limit of proportionality of a material is the
    (a) minimum value of stress for which the stress is still proportional to the strain
    (b) maximum value of stress for which the stress is still proportional to the strain
    (c) average value of stress for which the stress is still proportional to the strain
    (d) average value of strain

11. A shaft runs at 150 rpm under a torque of 1500 Nm. The power transmitted is
    (a) 15π kW
    (b) 10π kW
    (c) 7.5 π kW
    (d) 5π kW

12. The critical load is the load at which, the column
    (a) breaks
    (b) loses its strength
    (c) buckles
    (d) can take minimum load

13. Modulus of rigidity is defined as the ratio of
    (a) shear strain to volumetric strain
    (b) shear stress to shear strain
    (c) normal stress to shear strain
    (d) normal stress to linear strain

14. The deformation produced in the spring is said to be
    (a) semi-elastic
    (b) plastic
    (c) elastic
    (d) visco-elastic

15. Rain drops are usually spherical in shape due to
    (a)pressure
    (b)viscosity
    (c)surface tension
    (d)specific gravity

16. Stoke is the unit of
    (a)surface tension
    (b)specific viscosity

(c)dynamic viscosity
(d)kinematic viscosity

17. A manometer is used to measure
    (a)specific viscosity
    (b)pressure difference
    (c)fluid velocity
    (d)surface tension

18. Laminar flow through a pipe turns into turbulent flow, when Reynolds number exceeds
    (a) 50
    (b) 100
    (c) 1000
    (d) 2300

19. Francis, Kaplan and propeller turbines are categorised as
    (a)impulse turbines
    (b)reaction turbines
    (c)impulse reaction turbines
    (d)axial flow turbines

20. Priming is required in
    (a)reciprocating pump
    (b)centrifugal pump
    (c)axial flow pump
    (d)rotary pump

21. The average value of co-efficient of discharge is
    (a) 0.32
    (b) 0.62
    (c) 0.52
    (d) 0.82

22. Isentropic process is one in which
    (a)temperature is constant
    (b)volume is constant
    (c)enthalpy is constant
    (d)entropy is constant

23. Consider the following statements:
    1. A closed system does not allow mass transfer but allows energy transfer
    2. An open system allows both mass transfer and energy transfer
    3. An isolated system does not allow mass as well as energy transfer
    4. Isolated system is of fixed mass and fixed energy
    Of these statements
    (a) 1 and 3 are true
    (b)1 and 2 are true
    (c)1,2 and 3 are true

(d) 1,2,3 and 4 are true

24. The internal energy of a perfect gas is a function of
    (a) pressure change and temperature
    (b) temperature change and specific heat
    (c) pressure and work supplied
    (d) temperature

25. The area under the curve on temperature entropy diagram represents
    (a) work done during the process
    (b) heat exchanged during the process
    (c) change in internal energy during the process
    (d) change in entropy during the process

26. A process becomes irreversible due to
    (a) work performed by the system
    (b) work performed upon the system
    (c) heat supplied to the system
    (d) friction in the system

27. The second law of thermodynamics defines
    (a) heat
    (b) enthalpy
    (c) internal energy
    (d) entropy

28. Choose the incorrect statement
    (a) isentropic process is adiabatic
    (b) adiabatic process has no heat exchange
    (c) hyperbolic process is isothermal
    (d) no work is done in constant process

29. The cross-section of a V-belt is
    (a) circular
    (b)rectangular
    (c)trapezoidal
    (d)elliptical

30. At the extreme positions of a simple pendulum, there is
    (a)only potential energy
    (b)only kinetic energy
    (c)both potential and kinetic energies
    (d)pressure energy

31. Select a turning pair from the following kinematic pairs:
    (a)nut and bolt
    (b)roller bearing

(c)cross head and guides of reciprocating engine
(d)crankshaft moving in a journal bearing

32. A point on a link connecting double slider crank chain traces a
    (a) parabolic path
    (b) straight line path
    (c) elliptical path
    (d) hyperbolic path

33. An epicyclic gear has
    (a) single degree of freedom
    (b) two degrees of freedom
    (c) three degrees of freedom
    (d) four degrees of freedom

34. The type of brakes commonly used in automobiles is
    (a) hydraulic brake
    (b) band brake
    (c) band and block brake
    (d) internal expanding shoe brake

35. A kinematic chain is known as a mechanism when
    (a) one of the links is fixed
    (b) two of the links are fixed
    (c) none of the links are fixed
    (d) none of these

36. When two shafts are neither parallel nor intersecting, power can be transmitted by using
    (a) a pair of spur gears
    (b) a pair of helical gears
    (c) an Oldham's coupling
    (d) a pair of spiral gears

37. In gears, interference takes place when
    (a) the tip of a tooth of a mating gear digs into the portion between base and root circles
    (b) gears do not move smoothly in the absence of lubrication
    (c) pitch of the gear is not same
    (d) gear teeth are undercut

38. The working surface above the pitch surface of the gear tooth is termed as
    (a) addendum
    (b) dedendum
    (c) flank
    (d) face

39. In the assembly of pulley, key and shaft
    (a)pulley is made the weakest
    (b)key is made the weakest

(c)key is made the strongest
(d)all the three are designed for equal strength

40. A static load is mounted at the centre of a shaft rotating at uniform angular velocity. This shaft will be designed for
    (a)maximum compressive stress (static)
    (b)maximum tensile stress (static)
    (c)maximum bending moment (static)
    (d)fatigue loading

41. In flange coupling, the flanges are coupled together by means of
    (a) bolts and nuts
    (b) studs
    (c) rivets
    (d) welding

42. Ball and roller bearings in comparison to sliding bearings have
    (a) low starting and low running friction
    (b) small overall dimensions
    (c) more accuracy in alignment
    (d) All of the above

43.Investment casting is useful for
    (a) large size castings
    (b) very large size castings
    (c) small size castings
    (d) small size castings having intricate details

44. Fusion process is very much similar to
    (a) spinning
    (b) forging
    (c) casting
    (d) rolling

45. Which of the following heat source is used in gas welding?
    (a) resistance heating
    (b) gas flame heating
    (c) arc heating
    (d) explosion heating

46. Machining centre is
    (a)an automatic tool changing unit
    (b)a group of automatic machine tools
    (c)a next logical step beyond NC machine
    (d)an NC machine tool

47. Draft
    (a)takes care of shrinkage in casting

(b)facilitates withdrawal of casting from the mould

(c)increases stability of the casting in the mould

(d)is used to create holes in the casting

48. Dynamometer is a device used for the measurement of

(a)chip thickness ratio

(b)forces during metal cutting

(c)wear of the cutting tool

(d)deflection of the cutting tool

49.Extrusion force does not depend upon

(a)extrusion ratio

(b)type of extrusion process

(c)material of the die

(d)working temperature

50. Superheating is carried out at

(a)constant volume

(b)constant pressure

(c)both constant volume and constant pressure

(d)constant entropy

51. Mollier diagram consists of the following components:

(a)temperature and entropy

(b)enthalpy and entropy

(c)pressure and volume

(d)pressure and temperature

52. Which cycle finds use in spark ignition engine?

(a) Diesel cycle

(b) Otto cycle

(c) Dual cycle

(d)Brayton cycle

53. Petrol engines are used in

(a) tractors

(b) scooters

(c) trucks

(d)buses

54. The unit of specific fuel consumption is

(a) kW/kgh

(b) kg/kWh

(c) kg/kWm

(d) kg/h

55. The compression ratio is expressed as (V_s = swept volume, V_c = Clearance volume)

(a) $V_s /(V_s + V_c)$

(b) $(V_s + V_c)/ V_s$

(c) $(V_s + V_c)/ V_c$
(d) $(V_s - V_c)/ V_c$

56. A connecting rod executes
   (a) rotary motion
   (b) reciprocating motion
   (c) simple harmonic motion
   (d) oscillating motion

57. The coefficient of performance value of a refrigerator
   (a) is always less than unity
   (b) is always greater than unity
   (c) may be less than unity or greater than unity
   (d) is equal to unity

58. One ton of refrigeration is equal to
   (a) 5.5 kW
   (b) 2.5 kW
   (c) 3.5 kW
   (d) 4.5 kW

59. For saturated air, degree of saturation is
   (a) 0
   (b) 1
   (c) 2
   (d) 3

60. A double acting reciprocating air compressor, compresses air
   (a) in two cylinders simultaneously to the same pressure
   (b) in two cylinders in succession
   (c) on both sides of the piston in the same cylinder
   (d) in two piston strokes

61. The critical pressure at which latent heat of evaporation becomes zero for water is (nearest value)
   (a) 273 bar
   (b) 225 bar
   (c) 200 bar
   (d) 107 bar

62. If steam is throttled, its
   (a) pressure and enthalpy remain unchanged
   (b) temperature and entropy remain unchanged
   (c) enthalpy remains unchanged and pressure may or may not change
   (d) enthalpy remains unchanged but other properties change

63. A sample coal contains carbon, sulphur, hydrogen, nitrogen and ash. The ultimate analysis of the coal will describe percentage of
   (a) carbon and hydrogen

(b) carbon, sulphur, hydrogen and nitrogen
(c) carbon, sulphur, hydrogen, nitrogen and ash
(d) carbon, hydrogen, nitrogen and ash

64. A fuel has higher and lower calorific values because the fuel contains
    (a) Sulphur which burns to SO_2
    (b) O_2 which helps in combustion
    (c) H_2 that burns to H_2O which absorbs some heat as its latent heat of evaporation
    (d) ash which does not burn and thus does not release any heat energy

65. In steam power plants where artificial draft is used, the flue gases is extracted by
    (a) superheater
    (b) economiser
    (c) air preheater
    (d) chimney

66. The purpose of compounding in impulse steam turbine is to
    (a) reduce the speed of rotor to reasonable limit
    (b) increase the speed of rotor for higher efficiency
    (c) increase the pressure of steam
    (d) decrease the pressure of steam

67. In which of the following reactors, ordinary water is used as both coolant and moderator ?
    (a) boiling water reactor
    (b) fast breeder reactor
    (c) candu reactor
    (d) gas cooled reactor

68. In steam cycle the process of removing non-condensables is called
    (a) scavenging process
    (b) deaeration process
    (c) exhaust process
    (d) condensation process

69. The maximum efficiency of De-laval turbine is achieved when
    (a) the exit velocity of steam is twice the speed of the blades upon which it impinges
    (b) the exit velocity of steam is less than the speed of the blades
    (c) the exit velocity of steam is equal to the speed of the blades
    (d) the exit velocity of steam becomes independent of the speed of the blades

70. The degree of reaction of a turbine is the ratio of enthalpy drop in
    (a) moving blades to enthalpy drop in stage
    (b) fixed blades to enthalpy drop in stage
    (c) moving blades to enthalpy drop in fixed blades
    (d) fixed blades to enthalpy drop in moving blades

71. Metals are good conductors since
    (a) they have free electrons
    (b) their atoms are relatively closer

(c) their surface reflect
(d) their atoms are larger size

72. Heat will transfer from one body to another only if
      (a) materials of two bodies are different and they are in contact
      (b) thermal conductivities of two bodies are different and they are in contact
      (c) there must be a source of heat in one of the bodies
      (d) two bodies must be at different temperatures

73. Nusselt number is the function of
      (a) Reynolds number and dynamic viscosity
      (b) dynamic viscosity Prandtl number
      (c) Prandtl number and Reynolds number
      (d) Reynolds number and thickness of boundary layer

74. In convective heat transfer when convective fluid is flowing over a solid surface, the heat transfer begins as soon as
      (a) hydrodynamic boundary layer begins to form at the leading edge
      (b) thermal boundary layer begins to form slightly ahead of the leading edge
      (c) thermal boundary layer begins to form at the leading edge
      (d) thermal boundary layer attains a constant thickness

75. In radiative heat transfer a gray surface is the one
      (a) which appears gray to the eye
      (b) whose emissivity is independent of wavelength
      (c) which has reflectivity equal to zero
      (d) which appears equally bright from all directions

76. Upto the critical radius of insulation
      (a) addition of insulation will increase heat loss
      (b) addition of insulation will decrease heat loss
      (c) convective heat loss will be less than conductive heat loss
      (d) heat flux will decrease

77. LMTD in case of counter flow heat exchanger as compared to parallel flow heat exchanger is
      (a) higher
      (b) lower
      (c) same
      (d) Depends on the area of heat exchanger

78. The rate of energy emission from unit surface area through unit solid angle, along a normal to the surface, is known as
      (a) emissivity
      (b) transmissivity
      (c) reflectivity
      (d) intensity of radiation

79. Transient heat conduction depends upon

(a) Time and space

(b) Temperature and time

(c) Time, temperature and space

(d) Time, pressure and space

80. According to Fick's law of diffusion, the molar flux due to diffusion is proportional to the

(a) temperature gradient

(b) pressure gradient

(c) velocity gradient

(d) concentration gradient