Roll. No.

Signature of Invigilators

(in figures as in Hall Ticket)

**Mechanical Engineering
(19/38)**

Roll No. _____

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(in words)

Maximum Marks: 50   **No. Of Printed Pages : 8**

Instruction for the Candidate:

1. Write your Roll Number in the space provided on the top of this page.
2. This paper consists of **FIFTY (50)** multiple choice type questions. Each Question carries **ONE (1)** mark.
3. At the commencement of examination, the question booklet will be given to you. In the first 5 minutes, you are requested to open the booklet and compulsorily examine it as below:
   a. To have access to the Question Booklet, tear off the paper seal on the edge of this cover page, Do not accept a booklet without sticker seal and do not accept an open booklet.
   b. Tally the number of pages and number of questions in the booklet with the information printed on the cover page. Faculty booklets due to pages/questions missing or duplicate or not in serial order or any other discrepancy should be got replaced immediately by a correct booklet from the invigilator within the period of 5 minutes. Afterwards, neither the Question Booklet will be replaced nor any extra time will be given.
   c. After this verification is over, the Test Booklet Number should be entered on the OMR Answer Sheet and the OMR Answer Sheet Number should be entered on this Test Booklet.
4. Each item has four alternative responses marked (A), (B), (C) and (D). You have to darken the circle as indicated below on the correct response against each item.
   Example: Ⓐ ● Ⓒ Ⓓ where (B) is correct response.
5. Your responses to the items are to be indicated on the OMR Answer Sheet under Paper – II only. If you mark your response at any place other than in the circle in the OMR Answer Sheet, it will not be evaluated.
6. Read instructions given inside carefully.
7. Rough Work is to be done in the end of this booklet.
8. If you write your Name, Roll Number, Phone Number or put any mark on any part of the OMR Answer Sheet, except for the space allotted for the relevant entries, which may disclose your identity, or use abusive language or employ any other unfair means, such as change of response by scratching or using white fluid, you will render yourself liable to disqualification.
9. You have to return the original OMR Answer Sheet to the invigilator at the end of the examination compulsorily and must not carry it with you outside the Examination Hall. You are however, allowed to carry original question booklet and duplicate copy of OMR Answer Sheet on conclusion of examination
10. Use only Blue/ Black Ball point pen.
11. Use of any calculator or log table etc., is prohibited.
12. There shall be no negative marking.

Mechanical Engineering

Note: This paper contains **FIFTY (50)** multiple-choice questions. Each Question carries **ONE (1)** mark.

01) Find the diameter and height of a cylinder of maximum volume which is can be cut from a sphere of radius 120 mm.
   A) Diameter=196 mm, Height=139 mm
   B) Diameter=240 mm, Height=139 mm
   C) Diameter=120 mm, Height=120 mm
   D) Diameter=96 mm, Height=139 mm

02) The function $f(x)=x^3-6x^2+9x-25$ has
   A) A maxima at x=1 and a minima at x=3.
   B) A maxima at x=3 and a minima at x=1.
   C) No maxima but a minima at x=1.
   D) A maxima at x=1 but no minima.

03) If a matrix $A=\begin{bmatrix}1 & 2\\3 & 4\end{bmatrix}$ then A^{-1}=
   A) $\begin{bmatrix}1 & 2\\3 & 4\end{bmatrix}$
   B) $\begin{bmatrix}1 & 1/2\\1/3 & 1/4\end{bmatrix}$
   C) $\begin{bmatrix}-2 & 1\\3/2 & -1/2\end{bmatrix}$
   D) $\begin{bmatrix}2 & 1\\3/2 & 1/2\end{bmatrix}$

04) What is the rate of increase of diagonal of the rectangular solid, if the sides x, y and z increase at 6 mm/s, 5 mm/s and 4 mm/s when these sides are 50 mm, 40 mm and 30 mm respectively.
   A) 8.8 mm/s
   B) 7.5 mm/s
   C) 12 mm/s
   D) 15 mm/s.

05) The equation of the motion for the free vibration of spring mass system without damping is given by(c = viscous damping co-efficient, m = mass of the vibrating body, k = spring stiffness)
   A) $\ddot{x} + \frac{c}{m}\dot{x} + \frac{k}{m}x = 0$
   B) $\ddot{x} + \frac{k}{m}x = 0$
   C) $\ddot{x} + \frac{c}{m}\dot{x} + \frac{k}{m}x = F\sin\omega t$
   D) $\ddot{x} + \frac{k}{m}x = F\sin\omega t$

06) High Frequency magnetic fields are used in
   A) Induction hardening
   B) Age hardening
   C) Flame hardening
   D) Precipitation hardening.

07) Method of protecting a steel surface from corrosion
   A) Parkerizing
   B) Annealing
   C) Normalizing
   D) None

08) The advantage of centrifugal casting is
   A) Core elimination
   B) Accurate internal diameter
   C) Suitable for Job Production
   D) All.

09) For all metal forming processes, the important property is
   A) Ductility
   B) Plasticity
   C) Strength
   D) Toughness

10) The maximum possible draft in cold rolling of sheet, increases with the
   A) Decrease in roll radius
   B) Increase in coefficient of friction
   C) Decrease in coefficient of friction
   D) Increase in rolling velocity

11) Which cutting process uses mild steel tool
   A) Honing
   B) Broaching
   C) Planning
   D) Milling

12) A fly cutter is used in
   A) Shaper Machine
   B) Milling Machine
   C) Slotter Machine
   D) Lathe

13) The Cemented carbide tools are poor in
    A) Tension
    B) Compression
    C) Shear
    D) All

14) In gas welding, Oxidizing flame is used to weld
    A) Iron
    B) Steel
    C) Brass
    D) All

15) Projection welding is
    A) Continous seam welding
    B) Electron beam welding
    C) Multispot welding
    D) None

16) Dye penetrant test is not capable of testing
    A) Porosity
    B) Cracks
    C) Weld strength
    D) Flaws

17) The closest fit that permits assembling parts by hand among the following is
    A) Press fit
    B) Driving fit
    C) Selective fit
    D) Push fit

18) Twisted strip comparator are
    A) Pneumatic type
    B) Electrical type
    C) Optical type
    D) Mechanical type

19) Gears on the shafts of a concrete mixer are assembled by
    A) Tight fit
    B) Push fit
    C) Force fit
    D) None

20) Statistical method which indicates overall growth or decline of the business overtime
    A) Irregular variations
    B) cyclical Fluctuation
    C) Seasonal Variations
    D) Trend

21) Which type of compressor is new in refrigeration industry as compared to others?
    A) Scroll
    B) Centrifugal
    C) Reciprocating
    D) Rotary

22) What is not true about outdoor air in summer air conditioning?
    A) Its induction can help to decrease power consumption of an air conditioning system
    B) Its induction is required to maintain required oxygen level in conditioned space
    C) It is used to keep indoor pollutants in check
    D) It can enter conditioned space by infiltration

23) What is not true for high effectiveness of a heat exchanger
    A) Lower relative heat capacity is desirable
    B) Higher LMTD is desirable
    C) Higher NTU is desirable
    D) It is high if one of the fluids condenses or boils

24) Following is not true about Kaplan turbine
    A) Runner blades are fixed
    B) It works at low heads
    C) It has high specific speeds
    D) It is an axial flow turbine

25) The blackbody temperature of the sun is around 5800 K and the radiation from the sun has highest emissive power in wavelength spectrum of green colour. Which of the following law is most useful to show this?
A) Wein's displacement law
B) Kirchoff's law
C) Stephan-Boltzman's law
D) Planck's law

26) Which of the following statement is not true?
A) Viscosity of air decrease as temperature increases
B) Thermal conductivity of air increase as temperature increases
C) Viscosity of water decrease as temperature increases
D) Thermal conductivity of copper decrease as temperature increases

27) A chilled water bottle is taken out from a refrigerator. Which of the following statement is wrong as per first law of thermodynamics?
A) Heat gained by water is equal to heat lost by surroundings
B) Heat gained by surroundings is equal to heat lost by water
C) Change of internal energy of water is equal to the heat gained by it
D) None of above

28) If parameters are measured just at inlet and outlet of a device, in which of the following device can the change in potential energy be neglected?
A) Turbine
B) Pump
C) Throttle valve
D) All of above

29) What is not true for a gas turbine power plant?
A) Compressor intercooling may not increase net work in the cycle
B) Reheating increases net work in the cycle
C) Regenerator always increases theoretical efficiency of the cycle
D) Combination of above three give best positive results on efficiency

30) Reheating is done in Rankine cycle power plants
A) To increase dryness fraction at the exit of turbines in high pressure cycles
B) To increase efficiency of the plant
C) To reduce flow rate of working fluid for given capacity of plant
D) All of above

31) Reynolds number, Mach number and Specific heat ratio; all three ratios should be same between prototype and model for dynamic similarity for
A) Compressible flow
B) Incompressible flow
C) Incompressible flow with free surface
D) All of above

32) In case of a cylinder in cross-flow
A) Separation occur later in laminar flow as compared to turbulent flow
B) Drag coefficient is smaller in laminar flow as compared to turbulent flow
C) Wake region is smaller for turbulent flow
D) All of above are correct

33) The transient heat transfer from a copper sphere can be analyzed using lumped capacitance method because
A) If it has small diameter
B) Its thermal conductivity is high
C) If it is kept in a fluid with low convective heat transfer coefficient
D) All of above

34) 200 kJ heat is rejected by steam/saturated water at 100°C to ice/saturated water at 0°C. Which of the following statements is not correct about the process?
A) Entropy of the universe does not change in this process
B) The entropy rise of ice is 0.7322 kJkg^{-1}K^{-1}
C) The entropy drop of steam is 0.5360 kJkg^{-1}K^{-1}
D) The entropy rise of the universe is 0.1962 kJkg^{-1}K^{-1}

35) For same inlet conditions and compression ratio, comparing Otto and Diesel cycle
A) Otto cycle has higher heat input
B) Otto cycle has higher work output
C) Otto cycle has higher efficiency
D) All of above

36) The principal stresses for the state of stress given below would be
$$\tau_{ij} = \begin{bmatrix} 1 & 1 \\ 1 & 1 \end{bmatrix} \text{units}$$
A) $\sigma_1 = 1$, $\sigma_2 = 1$
B) $\sigma_1 = 0$, $\sigma_2 = 2$
C) $\sigma_1 = 1.5$, $\sigma_2 = 1.5$
D) $\sigma_1 = 0$, $\sigma_2 = 0$

37) A link OA is 1 m long and rotates about O with angular velocity 1 rad/sec. The direction of acceleration of A relative to O is at 45° to OA. The angular acceleration of the link will be
A) 1 rad/sec^2
B) 10 rad/sec^2
C) 1.50 rad/sec^2
D) 100 rad/sec^2

38) If the resultant of two equal forces has the same magnitude as either of the forces, then the angle between the two forces is
A) 30°
B) 60°
C) 90°
D) 120°

39) In the assembly of pulley, key and shaft
A) all the three are designed for equal strength
B) key is made the weakest
C) pulley is made the weakest
D) Shaft is made the weakest

40) A thin cylinder of inner radius d and thickness t is subjected to an internal pressure of p. For the same thickness and internal pressure, if the diameter is doubled, the average circumferential (hoop) stress in will
A) Remain same
B) reduce to half
C) Be doubled
D) Increase by 4 times

41) An assemblage of links makes a structure when
A) Degree of freedom <=0
B) Degree of freedom >0
C) Degree of freedom = infinite
D) Degree of freedom =1

42) The product of diametral pitch and module is equal to
A) 1
B) 0
C) Π
D) Infinity

43) The secondary force due to reciprocating mass has
A) Same frequency as the primary force
B) Double the frequency of the primary force
C) Half the frequency of the primary force
D) One fourth the frequency of the primary force

44) Critical speed of a shaft with a disc supported in between is equal to the natural frequency of the system in a
A) Transverse Vibrations
B) Longitudnal Vibrations
C) Longitudinal vibrations provided the shaft is vertical
D) Torsional Vibrations

45) In a mechanism having 1 degree of freedom, if one pair is higher pair, what is the minimum number of links required
A) 2
B) 3
C) 4
D) 6

46) In the force Analysis of spur gears which component of force assists the rotation of driven gear.
A) Axial
B) Tangential
C) Radial
D) All of the above

47) What is the SI unit of kinematic viscocity.
A) m^2/s
B) $N\text{-}s/m^2$
C) $Ns\text{-}m^2$
D) N/m

48) Thermal stress is not a function of
A) Change in temperature
B) Co-efficient of thermal expansion
C) Modulus of elasticity
D) None of the above

49) For longitudinal joint in boilers, the type of joints used is
A) Butt joint with single cover plate
B) Butt joint with double cover plate
C) Lap joint with one ring overlapping with the other.
D) Any of the above

50) What is the advantage of using the spherical vessel to store fluids at low temperature?
A) heat transfer in sphere is restricted in all direction by insulation
B) sphere has the smallest volume per unit surface area
C) sphere has the largest volume per unit surface area
D) none of the above
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Rough Work: