Assignment 5

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GATE-2007:ME

Section-A- Carry one mark each

1) The minimum value of function $y = x^2$ in the interval $[1, 5]$ is

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a) 1 b) 1 c) 25 d) undefined

2) If a square matrix A is real and symmetric, then the eigenvalues

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a) are always real
b) are always real and positive
c) are always real and non-negative
d) occur in complex conjugate pairs

3) If $\varphi(x, y)$ and $\psi(x, y)$ are functions with continuous second derivatives, then $\varphi(x, y) + i\psi(x, y)$ can be expressed as an analytic function of $x + iy$ ($i = \sqrt{-1}$), when

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a) $\frac{\partial\varphi}{\partial x} = \frac{\partial\psi}{\partial y}, \quad \frac{\partial\varphi}{\partial y} = -\frac{\partial\psi}{\partial x}$
b) $\frac{\partial\varphi}{\partial y} = \frac{\partial\psi}{\partial x}, \quad \frac{\partial\varphi}{\partial x} = -\frac{\partial\psi}{\partial y}$
c) $\frac{\partial\varphi}{\partial y} = \frac{\partial\psi}{\partial x}, \quad \frac{\partial\varphi}{\partial x} = \frac{\partial\psi}{\partial y}$
d) $\frac{\partial\varphi}{\partial x} = \frac{\partial\psi}{\partial y}, \quad \frac{\partial\varphi}{\partial y} = \frac{\partial\psi}{\partial x}$

4) The partial differential equation $\frac{\partial^2\varphi}{\partial t^2} = \frac{\partial}{\partial x}\left(\alpha^2\frac{\partial\varphi}{\partial x}\right)$ has

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a) degree 1 order 2
b) degree 1 order 1
c) degree 2 order 1
d) degree 2 order 2

5) Which of the following relationships is valid only for reversible processes undergone by a closed system of simple compressible substance (neglect changes in kinetic and potential energy)?

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a) $\delta Q = dU + \delta W$
b) $Tds = dU + pdV$
c) $Tds = dU + \delta W$
d) $\delta Q = dU + pdV$

6) Water has a critical specific volume of 0.003155 m^3/kg. A closed and rigid steel tank of volume 0.025 m^3 contains a mixture of water and steam at 0.1 MPa. The mass of the mixture is 10 kg. The tank is now slowly heated. The liquid level inside the tank

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a) will rise
b) will fall
c) will remain constant
d) may rise or fall depending on the amount of heat transferred

7) Consider an incompressible laminar boundary layer flow over a flat plate of length L, aligned with the direction of an oncoming uniform free stream. If F is the ratio of the drag force on the front half of the plate to the drag force on the rear half, then

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a) $F < 1/2$
b) $F = 1/2$
c) $F = 1$
d) $F > 1$

8) In a steady flow through a nozzle, the flow velocity on the nozzle axis is given by $u = u_0(1 + 3x/L)$, where x is the distance along the axis of the nozzle from its inlet plane and L is the length of the nozzle. The time required for a fluid particle on the axis to travel from the inlet to the exit plane of the nozzle is

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a) $\frac{L}{u_0}$
b) $\frac{L}{3u_0} \ln 4$
c) $\frac{L}{4u_0}$
d) $\frac{L}{2.5u_0}$

9) Consider steady laminar incompressible, axi-symmetric fully developed viscous flow through a straight circular pipe of constant cross-sectional area at a Reynolds number of 5. The ratio of inertia force to viscous force on a fluid particle is

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a) 5
b) 1/5
c) 0
d) ∞

10) In a simply-supported beam loaded as shown, the maximum bending moment in Nm is

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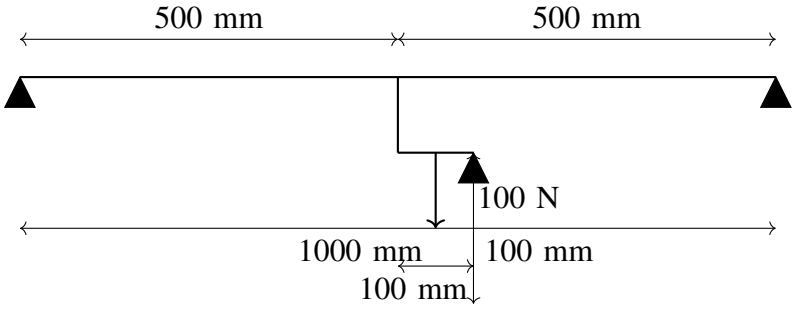

a) 25
b) 30
c) 35
d) 60

11) A ball bearing operating at a load F has 8000 hours of life. The life of the bearing, in hours, when the load is doubled to $2F$ is

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a) 8000
b) 6000
c) 4000
d) 1000

12) During inelastic collision of two particles, which one of the following is conserved?

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a) total linear momentum only
b) total kinetic energy only
c) both linear momentum and kinetic energy
d) neither linear momentum nor kinetic energy

13) A steel rod of length L and diameter D, fixed at both ends, is uniformly heated to a temperature rise of ΔT. The Young's modulus is E and the coefficient of linear expansion is α. The thermal stress in the rod is

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a) 0
b) $\alpha E \Delta T$
c) $E\alpha\Delta T$
d) $E\alpha\Delta TL$

14) For an undamped harmonic oscillator, resonance

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a) occurs when excitation frequency is greater than undamped natural frequency
b) occurs when excitation frequency is less than undamped natural frequency
c) occurs when excitation frequency is equal to undamped natural frequency
d) never occurs

15) If a particular Fe-C alloy contains less than 0.83% carbon, it is called

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a) high speed steel
b) hypoeutectoid steel
c) hypereutectoid steel
d) cast iron

16) Which of the following engineering materials is the most suitable candidate for hot chamber die casting?

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a) low carbon steel
b) titanium
c) copper
d) tin

17) Which one of the following is a solid-state joining process?

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a) gas tungsten arc welding
b) resistance spot welding
c) friction welding
d) submerged arc welding