GATE - 2013 - ME

EE1030 : Matrix Theory
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1) The partial differential equation $\frac{\partial u}{\partial t} + u\frac{\partial u}{\partial x} = \frac{\partial^2 u}{\partial x^2}$ is a
   a) linear equation of order 2
   b) non-linear equation of order 1
   c) linear equation of order 1
   d) non-linear equation of order 2

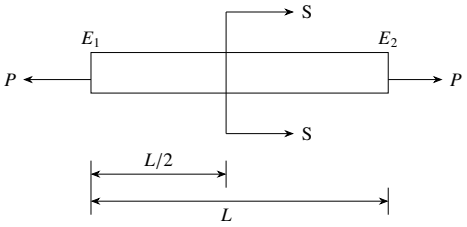
2) The eigenvalues of a symmetric matrix are all
   a) complex with non-zero positive imaginary part.
   b) complex with non-zero negative imaginary part.
   c) real.
   d) pure imaginary.

3) Match the **CORRECT** pairs.

Numerical Integration Scheme	**Order of Fitting Polynomial**
P. Simpson's $\frac{3}{8}$ Rule	1. First
Q. Trapezoidal Rule	2. Second
R. Simpson's $\frac{1}{3}$ Rule	3. Third

   a) P-2, Q-1, R-3
   b) P-3, Q-2, R-1
   c) P-1, Q-2, R-3
   d) P-3, Q-1, R-2

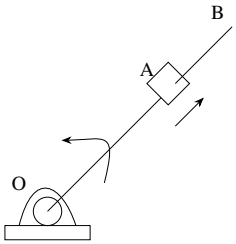
4) A rod of length L having uniform cross-sectional area A is subjected to a tensile force P as shown in the figure below. If the Young's modulus of the material varies linearly from E_1 to E_2 along the length of the rod, the normal stress developed at the section-SS is



a) $\frac{P}{A}$
b) $\frac{P(E_1-E_2)}{A(E_1+_2)}$
c) $\frac{PE_2}{AE_1}$
d) $\frac{PE_1}{AE_2}$

5) Two threaded bolts A and B of same material and length are subjected to identical tensile load. If the elastic strain energy stored in bolt A is 4 times that of bolt B and the mean diameter of bolt A is 12 *mm*, the mean diameter of bolt B in *mm* is
   a) 16
   b) 24
   c) 36
   d) 48

6) A link OB is rotating with a constant angular velocity of 2 rad/s in counter clockwise direction and a block is sliding radially outward on it with an uniform velocity of 0.75 m/s with respect to the rod, as shown in the figure below. If OA = 1 m, the magnitude of the absolute acceleration of the block at location A in m/s^2 is



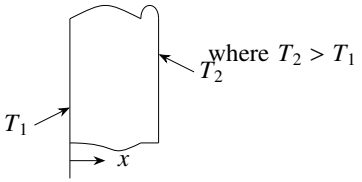
   a) 3
   b) 4
   c) 5
   d) 6

7) For steady, fully developed flow inside a straight pipe of diameter D, neglecting gravity effects, the pressure drop Δp over a length L and the wall shear stress τ_w are related by
   a) $\tau_w = \frac{\Delta pD}{4L}$

b) $\tau_w = \frac{\Delta p D^2}{4L^2}$
c) $\tau_w = \frac{\Delta p D}{2L}$
d) $\tau_w = \frac{4\Delta p L}{D}$

8) The pressure, dry bulb temperature and relative humidity of air in a room are 1 *bar*, 30°C and 70%, respectively. If the saturated steam pressure at 30°C is 4.25 *kPa*, the specific humidity of the room air in *kg water vapour*/*kg dry air* is
a) 0.0083
b) 0.0101
c) 0.0191
d) 0.0232

9) Consider one-dimensional steady state heat conduction, without heat generation, in a plane wall; with boundary conditions as shown in the figure below. The conductivity of the wall is given by $k = k_0 + bT$; where k_0 and b are positive constants, and T is temperature. As x increases, the temperature gradient $\left(\frac{dT}{dx}\right)$ will



a) remain constant
b) be zero
c) increase
d) decrease

10) In a rolling process, the state of stress of the material undergoing deformation is
a) pure compression
b) pure shear
c) compression and shear
d) tension and shear

11) Match the **CORRECT** pairs.

Processes	**Characteristics / Applications**
P. Friction Welding	1. Non-consumable electrode
Q. Gas Metal Arc Welding	2. Joining of thick plates
R. Tungsten Inert Gas Welding	3. Consumable electrode wire
S. Electroslag Welding	4. Joining of cylindrical dissimilar materials

a) P-4, Q-3, R-1, S-2

b) P-4, Q-2, R-3, S-1
c) P-2, Q-3, R-4, S-1
d) P-2, Q-4, R-1, S-3

12) A metric thread of pitch 2 *mm* and thread angle 60°is inspected for its pitch diameter using 3-wire method. The diameter of the best size wire in *mm* is

a) 0.866
b) 1.000
c) 1.154
d) 2.000

13) Customers arrive at a ticket counter at a rate of 50 per *hr* and tickets are issued in the order of their arrival. The average time taken for issuing a ticket is 1 *min*. Assuming that customer arrivals form a Poisson process and service times are exponentially distributed, the average waiting time in queue in *min* is

a) 3
b) 4
c) 5
d) 6