

ASSIGNMENT-5

GATE ME-2019

EE24BTECH11019 - DWARAK A

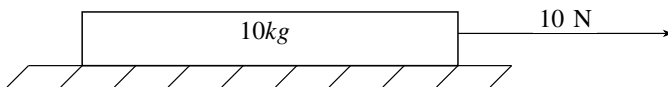
Q.1 to Q.25 carry one mark each.

- 1) The table presents the demand of a product. By simple three-months moving average method, the demand-forecast of the product for the month of September is

Month	Demand
January	450
February	440
March	460
April	510
May	520
June	495
July	475
August	560

- a) 490
- b) 510
- c) 530
- d) 536.67

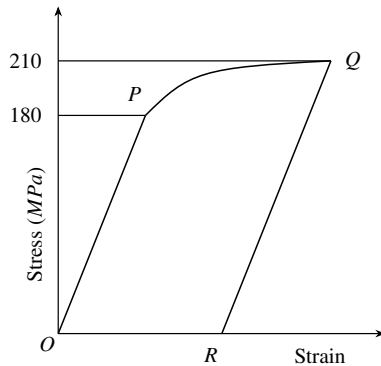
- 2) Evaluation of $\int_2^4 x^3 dx$ using a 2-equal-segment trapezoidal rule gives a value of _____
- 3) A block of mass 10kg rests on a horizontal floor. The acceleration due to gravity is 9.81m/s^2 . The coefficient of static friction between the floor and the block is 0.2. A horizontal force of 10N is applied on the block as shown in the figure. The magnitude of force of friction (in N) on the block is _____



- 4) A cylindrical rod of diameter 10mm and length 1.0m is fixed at one end. The other end is twisted by an angle of 10° by applying a torque. If the maximum shear strain in the rod is $p \times 10^{-3}$, then p is equal to _____ (round off to two decimal places).
- 5) A solid cube of side 1m is kept at a room temperature of 32°C . The coefficient of linear thermal expansion of the cube material is $1 \times 10^{-5}/^\circ\text{C}$ and the bulk modulus is

200GPa. If the cube is constrained all around and heated uniformly to 42°C , then the magnitude of volumetric (mean) stress (in MPa) induced due to heating is _____

- 6) During a high cycle fatigue test, a metallic specimen is subjected to cyclic loading with a mean stress of $+140\text{MPa}$, and a minimum stress of -70MPa . The R -ratio (minimum stress to maximum stress) for this cyclic loading is _____ (round off to one decimal place).
- 7) Water flows through a pipe with a velocity given by $\mathbf{V} = \left(\frac{4}{t} + x + y\right)\hat{j}\text{m/s}$, where \hat{j} is the unit vector in the y direction, $t(>0)$ is in seconds, and x and y are in meters. The magnitude of total acceleration at the point $(x, y) = (1, 1)$ at $t = 2\text{s}$ is _____ m/s^2
- 8) Air of mass 1kg , initially at 300K and 10bar , is allowed to expand isothermally till it reaches a pressure of 1bar . Assuming air as an ideal gas with gas constant of 0.287kJ/kgK , the change in entropy of air (in kJ/kg.K , round off to two decimal places) is _____
- 9) Consider the stress-strain curve for an ideal elastic-plastic strain hardening metal as shown in the figure. The metal was loaded in uniaxial tension starting from **O**. Upon loading, the stress-strain curve passes through initial yield point at **P**, and then strain hardens to point **Q**, where the loading was stopped. From point **Q**, the specimen was unloaded to point **R**, where the stress is zero. If the same specimen is reloaded in tension from point **R**, the value of stress at which the material yields again is _____ MPa



Q.26 to Q.55 carry one mark each.

- 10) The set of equations

$$x + y + z = 1$$

$$ax - ay + 3z = 5$$

$$5x - 3y + az = 6$$

has infinite solutions if $a =$

- a) -3

- b) 3
- c) 4
- d) -4

11) A harmonic function is analytic if it satisfies the Laplace equation.

If $u(x, y) = 2x^2 - 2y^2 + 4xy$ is a harmonic function, then its conjugate harmonic function $v(x, y)$ is

- a) $4xy - 2x^2 + 2y^2 + \text{constant}$
- b) $4y^2 - 4xy + \text{constant}$
- c) $2x^2 - 2y^2 + xy + \text{constant}$
- d) $-4xy + 2y^2 - 2x^2 + \text{constant}$

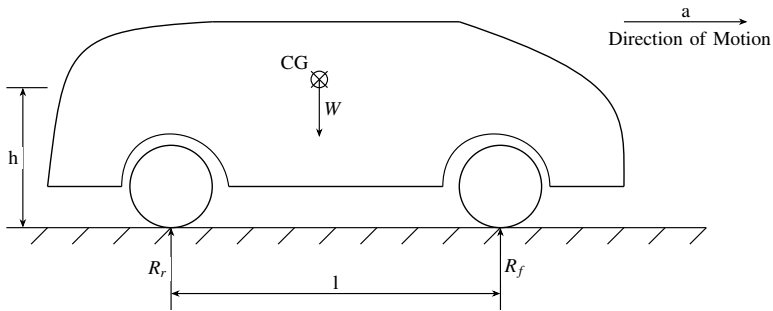
12) The variable x takes a value between 0 and 10 with uniform probability distribution.

The variable y takes a value between 0 and 20 with uniform probability distribution.

The probability of the sum of variables $(x + y)$ being greater than 20 is

- a) 0
- b) 0.25
- c) 0.33
- d) 0.50

13) A car having weight W is moving in the direction as shown in the figure. The center of gravity (CG) of the car is located at height h from the ground, midway between the front and rear wheels. The distance between the front and rear wheels is l . The acceleration of the car is a , and acceleration due to gravity is g . The reactions on the front wheels (R_f) and rear wheels (R_r) are given by



- a) $R_f = R_r = \frac{W}{2} - \frac{W}{g} \left(\frac{h}{l} \right) a$
- b) $R_f = \frac{W}{2} + \frac{W}{g} \left(\frac{h}{l} \right) a; R_r = \frac{W}{2} - \frac{W}{g} \left(\frac{h}{l} \right) a$
- c) $R_f = \frac{W}{2} - \frac{W}{g} \left(\frac{h}{l} \right) a; R_r = \frac{W}{2} + \frac{W}{g} \left(\frac{h}{l} \right) a$
- d) $R_f = R_r = \frac{W}{2} + \frac{W}{g} \left(\frac{h}{l} \right) a$