

GATE 2014 – A Brief Analysis
(Based on student test experiences in the stream of ME on 15th
February, 2014 - Second Session)

Section wise analysis of the paper

	1 Mark	2 Marks	Total No of Questions
Engineering Mathematics	4	4	8
Engineering Mechanics	1	2	3
Strength of Materials	3	3	6
Design of Machine Elements	2	2	4
Theory of Machines	1	2	3
Vibrations	1	2	3
Fluid Mechanics	2	2	4
Thermal Science	4	4	8
Heat Transfer	2	3	5
Manufacturing Science	3	3	6
Industrial Engineering	2	3	5
Verbal Ability	2	2	4
Numerical Ability	3	3	6
	30	35	65

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Questions from the Paper

1. Find the missing number.
2, 3, 6, 15 ____ 157.5, 630

Ans: 45

$$2 \times 1.5 = 3$$

$$3 \times 2 = 6$$

$$6 \times 2.5 = 15$$

$$15 \times 3 = 45$$

$$45 \times 3.5 = 157.5$$

$$157.5 \times 4 = 630.$$

2. Following are the details of a Die as per probability is given below then the distribution is _____

Die	1	2	3	4	5	6
Probability	0.167	0.167	0.152	0.166	0.168	0.180

- (A) Irregular data (B) Biased (C) Gaussian (D) Insufficient

Ans: B

3. In a structure subjected to fatigue loading, the minimum and maximum stress developed in cycles is 200 MPa & 400 MPa the value of stress amplitude (in MPa) is _____.

Ans: 100

$$\text{Stress Amplitude} = \sigma_r = \frac{\sigma_{\max} - \sigma_{\min}}{2}$$

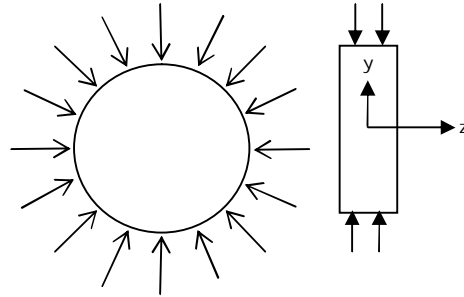
$$= \frac{400 - 200}{2} = 100 \text{ MPa.}$$

4. If there are m -sources, n – destinations in transportation matrix the total number of basic variable in a basic feasible solution is
(A) m+n (B)m+n+1 (C) m+n-1 (D) m

Ans: C

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5. A thin plate of uniform thickness is subjected to pressure as shown in figure. Under the assumption of plane stress, which one of the following is correct?



- (A) Normal stress is equal to zero in 'z' direction.
 (B) Normal stress is equal to tensile stress in 'z' direction.
 (C) Normal stress is equal to compressive stress in 'z' direction.
 (D) Normal stress varies in 'z' direction.

Ans: A

For plane stress criteria, the stresses in z direction are zero.

6. A four bar mechanism, with all revolute pair $l_f = 20$ mm, $l_{in} = 40$ mm, $l_{co} = 50$ mm, $l_{out} = 60$ mm where f, in, out, co are fixed, input, output, coupler respectively.
- (A) Both links can execute full circular motion.
 (B) Both links cannot execute full circular motion.
 (C) Only output link cannot execute full circular motion.
 (D) Only input link cannot execute full circular motion.

Ans: A

Since $S+L < P+Q$

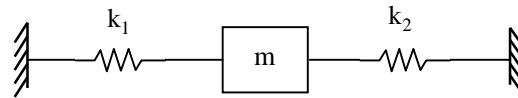
$20+60 < 50+40$

$80 < 90$

Hence if the smallest link is fixed then both links can execute full circular motion.

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7. The natural frequency of system shown below is



- (A) $\sqrt{\frac{k_1 + k_2}{2m}}$ (B) $\sqrt{\frac{k_1 + k_2}{m}}$ (C) $\sqrt{\frac{m}{k_1 + k_2}}$ (D) $\sqrt{\frac{2m}{k_1 + k_2}}$

Ans: B

$$K_e = K_1 + K_2$$

$$f = \omega_n = \sqrt{\frac{K_e}{m}} = \sqrt{\frac{K_1 + K_2}{m}}$$

8. Eigen values of matrix $\begin{bmatrix} 2 & 2 \\ 1 & 3 \end{bmatrix}$

- (A) $\begin{Bmatrix} 2 \\ -1 \end{Bmatrix}$ (B) $\begin{Bmatrix} 2 \\ 1 \end{Bmatrix}$ (C) $\begin{Bmatrix} 4 \\ 1 \end{Bmatrix}$ (D) $\begin{Bmatrix} 1 \\ -1 \end{Bmatrix}$

Ans: C

Sum of Eigen = Trace of the matrix
 $\Rightarrow 2 + 3 = 5$
 Option 'C' satisfies the condition

9. An analytic function of complex variable $z = x+iy$ is expressed as $f(z) = u(x,y) + i v(x,y)$ where $i = \sqrt{-1}$, if $u = xy$, the expression for V should be

(A) $\frac{(x+y)^2}{2} + \text{constant}$ (B) $\frac{x^2 - y^2}{2} + \text{constant}$
 (C) $\frac{y^2 - x^2}{2} + k$ (D) $\frac{(x-y)^2}{2} + k$

Ans: C

$u = xy$
 $dv = \frac{\partial v}{\partial x} dx + \frac{\partial v}{\partial y} dy = -\frac{\partial u}{\partial y} dx + \frac{\partial u}{\partial x} dy$
 Using C-R equation = $-x dx + y dy$
 Integrating
 $V = \frac{-x^2}{2} + \frac{y^2}{2} + \text{constant}$
 $= \frac{y^2 - x^2}{2} + \text{constant}$

10. A single die whose faces are colored with Red, blue, green such that other side is also same color. If the die is thrown thrice than the probability that it will be red at least twice is _____.

Ans: 0.259

$p = \frac{2}{6} = \frac{1}{3}$
 $q = 1 - \frac{1}{3} = \frac{2}{3}$
 using Binomial distribution
 $p(x \geq 2) = 3C_2 \left(\frac{1}{3}\right)^2 \left(\frac{2}{3}\right)^1 + 3C_3 \left(\frac{1}{3}\right)^3 \left(\frac{2}{3}\right)^0$
 $= \frac{6}{27} + \frac{1}{27}$
 $= \frac{7}{27}$

11. A solid steel cube constrained on all six faces is heated so that the temperature rises uniformly by ΔT . If the thermal coefficient of the material is α , young's Modulus is 'E' and the Poisson's ratio is ν , the thermal stress developed in the cube due to heating is

(A) $\frac{-\alpha(\Delta T)E}{1-2\nu}$ (B) $\frac{-2\alpha(\Delta T)E}{1-2\nu}$ (C) $\frac{-3\alpha(\Delta T)E}{1-2\nu}$ (D) $\frac{-\alpha(\Delta T)E}{3(1-2\nu)}$

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Ans: A

$$\varepsilon_x = \frac{\sigma_x}{E} - \frac{\nu(\sigma_y + \sigma_z)}{E}$$

$$\varepsilon_y = \frac{\sigma_y}{E} - \frac{\nu(\sigma_x + \sigma_z)}{E}$$

$$\varepsilon_z = \frac{\sigma_z}{E} - \frac{\nu(\sigma_x + \sigma_y)}{E}$$

from symmetry, $\varepsilon_x = \varepsilon_y = \varepsilon_z$ and $\sigma_x = \sigma_y = \sigma_z = \sigma$

$$\Sigma = \frac{(1-2\nu)}{E} \times \sigma \text{ and we know } \varepsilon = -\alpha\Delta T$$

$$\sigma = \frac{-\alpha\Delta T}{(1-2\nu)} \times E \text{ (negative sign implies it is compressive).}$$

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