CS/B.PHARM(N)/SEM-2/M-203/2012

2012

ADVANCED MATHEMATICS &
ENGINEERING MECHANICS

Time Allotted : 3 Hours   Full Marks : 70

The figures in the margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

Graph sheet(s) will be supplied by the Institution on demand.

GROUP – A

(Multiple Choice Type Questions)

1. Choose the correct alternatives for any *ten* of the following :

$10 \times 1 = 10$

   i)   If the events *A* and *B* are independent, then $P (AB)$ is

   a) $P (A) P (B)$ b) $P (A) P (A/B)$

   c) $P (A)$ d)   none of these.

   ii) The number 7·25945 when reounded off to 5 significant figures becomes

   a)   7·2595   b)   7·2593

   c)   7·2594   d)   none of these.

iii) Three unbiased coins are tossed simultaneously. The probability of obtaining exactly 2 heads is

a) $\dfrac{7}{8}$

b) $\dfrac{3}{8}$

c) $\dfrac{1}{2}$

d) none of these.

iv) The ratio of quartile deviation to standard deviation is equal to

a) $\dfrac{2}{3}$

b) 1

c) $\dfrac{3}{4}$

d) $\dfrac{3}{2}$.

v) Kurtosis measures the degree of

a) peakedness

b) asymmetry

c) dissymmetry

d) all of these.

vi) Laplace transform of ($\sin \beta t / t$) is equal to

a) $\tan^{-1} (\beta / s^2)$

b) $\cot^{-1} (\beta / s)$

c) $\tan^{-1} (\beta / s)$

d) $\cos^{-1} (\beta / s)$.

vii) Two opposite collinear forces have their ratio of magnitudes 2 : 1. If the smallest one is 15N, the resultant will be

a) 15 N

b) 30 N

c) – 30 N

d) 0.

viii) The kinetic energy of a body of mass m and velocity v is equal to

a) mv

b) $\frac{1}{2} mv^2$

c) $\frac{1}{2} mv^3$

d) none of these.

ix) When a body is in limiting equilibrium, frictional force acting on it is

a) least

b) greatest

c) zero

d) none of these.

x) The inverse Laplace transform of $1/[s^2 + 1)(s^2 + 2)]$ is

a) $\sin t + \frac{1}{\sqrt{2}} \sin \sqrt{2}\, t$

b) $\cos t + \frac{1}{\sqrt{2}} \cos \sqrt{2}\, t$

c) $\sin t + \cos \sqrt{2}\, t$

d) none of these.

xi) The probability density function must satisfy the two conditions

a) $f(x) \geq 1$ and $\int_{-\infty}^{\infty} f(x)\, dx = 1$

b) $f(x) \geq 0$ and $\int_{-\infty}^{\infty} f(x)\, dx = 1$

c) $f(x) \geq 0$ and $\int_{-\infty}^{\infty} f(x)\, dx = 0$

d) $f(x) \geq 1$ and $\int_{-\infty}^{\infty} f(x)\, dx = 0$.

xii) In positive skewness of distribution, the curve is more elongated in the

    a) left   b) right

    c) uniform on either side d) rectangular.

xiii) 3 equilibrium forces are acting along the sides of an isosceles triangle of vertex angle 30°. Then their ratio is

    a) $1 : \sqrt{3} : \sqrt{3}$ b) $1 : 2 : 3$

    c) $1 : \sqrt{3} : 2$ d) none of these.

GROUP – B

(Short Answer Type Questions)

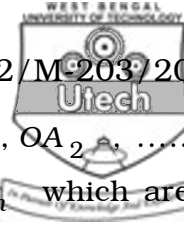Answer any *three* of the following. $3 \times 5 = 15$

2. Draw the Histogram for the following frequency distribution :

Age (in Years)	30-35	35-40	40-45	45-50	50-55
Number of Patients	1	2	8	7	2

3. Find the mean and standard deviation of the following data of body weights (in kg) of 10 men :

55   60   62   58   57   61   59   60   61   62

4. If a transversal cuts the lines of action OA_1, OA_2, ..., OA_n of the forces P_1, P_2, ..., P_n which are in equilibrium at the points A_1, A_2, ... , A_n, then prove that

$$\frac{P_1}{OA_1} + \frac{P_2}{OA_2} + \frac{P_n}{OA_n} = 0.$$

5. Evaluate $L\{ (1 + te^{-t})^2 \}$.

6. A random variable x has the following probability distribution :

X :	-2	-1	0	1	2	3
$p(X)$:	0·1	k	0·2	2k	0·3	k

Find the value of k and the mean of X.

GROUP – C

(Long Answer Type Questions)

Answer any *three* of the following. 3 × 15 = 45

7. a) Forces *P, Q, R* acting along $\vec{IA}$, $\vec{IB}$, $\vec{IC}$ when 'I' is the incentre of triangle *ABC* are in equilibrium, show that
$P : Q : R = \cos\dfrac{A}{2} : \cos\dfrac{B}{2} : \cos\dfrac{C}{2}$.   8

   b) A uniform plane lamina in the form of a rhombus of one base angle 120° is supported by two forces *P* and *Q* applied at the centre in the directions of the diagonals. If one side of the rhombus is horizontal; show that

$P^2 = 3Q^2$, if $P > Q$.   7

2059   5   [Turn over
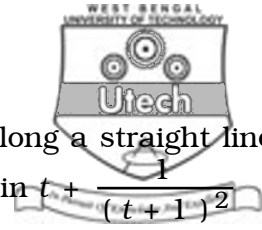
8. a) A particle starting from rest moves along a straight line so that its acceleration at time t is $\sin t + \dfrac{1}{(t+1)^2}$.

   Show that its distances from the origin at the end of π seconds is $2\pi - \log(\pi + 1)$. 8

   b) A stone is dropped into a well and the splash is heart after $2\dfrac{33}{56}$ sec. If the velocity of sound be 1120 ft/sec, find the depth of the well. 7

9. a) Use Laplace transform to solve the following system of equations : 8

   $\dfrac{dx}{dt} = x - 2y, \quad \dfrac{dy}{dt} = x - y$, where $x(0) = y(0) = 1$.

   b) Find the C.G. of an arc of a quadrant of the circle $x^2 + y^2 = a^2$ in the positive quadrant, the arc being homogeneous. 7

10. a) The frequency distribution of monthly income (in Rs.) of 200 families with average monthly income Rs. 7740 are as follows : 8

Income (Rs. "000") :	3-5	5-7	7-9	9-11	11-13	Total
Number of families :	32	?	57	?	25	200

   Find the missing frequencies.

   b) Find the regression line of y on x for the sample : 7

x	2	4	6	8	10
y	10	15	25	30	35

11. a) The chance that a doctor diagnose a certain disease correctly is 60%. The chance that a patient will die by his treatment after correct diagnosis is 40% and the chance of death by wrong diagnosis is 70%. One of the doctor's patients who had the disease died. What is the probability that the disease was diagnosed correctly ?

7

b) Psychological tests of intelligence and of engineering ability were applied to 10 students. Here is a record of ungrouped data showing intelligence ratio (I.R.) and engineering ratio (E.R.). Calculate the co-efficient of correlation. 8

Student :	A	B	C	D	E	F	G	H	I	J
I.R:	105	104	102	101	100	99	98	96	93	92
E.R:	101	103	100	98	95	96	104	92	97	94