



Name : .....

Roll No. : .....

Invigilator's Signature : .....

**CS/B.PHARM/SEM-2/M-203/2013  
2013**

**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.*

**GROUP - A**

**( Multiple Choice Type Questions )**

1. Choose the correct alternatives for any *ten* of the following :  
 $10 \times 1 = 10$

i) The Arithmetic Mean of the numbers

1, 3, 5, .....,  $2n - 1$  is

a)  $n - 1$

b)  $n$

c)  $\frac{n^2}{2}$

d) none of these.

ii) The number 1.9955 when rounded off to 4 decimal  
places becomes

a) 1.9955

b) 1.9956

c) 1.9954

d) none of these.

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iii) Ratio chart is

- a) semi-logarithmic      b) logarithmic  
c) line      d) pie diagram.

iv) Median of the series 4, 6, 9, 4, 2, 8, 10 is

- a) 4      b) 9  
c) 6      d) none of these.

v) Coefficient of variation ( C.V. ) is the best measure of

- a) central tendency      b) dispersion  
c) relative dispersion      d) none of these.

vi) If  $P ( A ) = \frac{1}{4}$  ,  $P ( B ) = \frac{1}{3}$  ,  $P ( A \cup B ) = \frac{1}{2}$  , then

$P ( A/B )$  is

- a)  $\frac{1}{2}$       b)  $\frac{1}{6}$   
c)  $\frac{2}{3}$       d)  $\frac{5}{6}$  .

vii) The statement

“Mean of a binomial distribution = its standard deviation = 2”

is,

- a) False      b) True.



viii) Laplace Transform of  $(1 - e^{-t}) / t$  is equal to

a)  $\log(s - 1) / s$                       b)  $\log(s / s - 1)$

c)  $s^2 / (s - 1)$                       d)  $(s + 1) / s$ .

ix) The inverse Laplace Transform of  $\frac{1}{s^2(s^2 + 1)}$  is,

a)  $t$     b)  $1 - \cos t$

c)  $t - \sin t$                                   d) none of these.

x) Lami's theorem is deduced from

a) triangle of forces                      b) polygon of forces

c) equilibrium of force                  d) none of these.

xi) A particle of mass  $m$  is allowed to fall from rest at any height  $h$  above the ground. Then the sum of its kinetic energy and potential energy, throughout the motion is

a)  $0$     b)  $mg$

c)  $mgh$     d) none of these.





3. The probability density function  $f(x)$  of a random variable  $X$  is given as follows :

$$f(x) = 2x, \quad 0 < x < 1$$

$$= 0, \quad \text{otherwise}$$

find  $P\left(\frac{1}{4} < X < \frac{1}{2}\right)$

4. Evaluate  $L\{e^{2t} \cos t \sin t\}$ .
5. Find centre of gravity of a homogeneous solid hemisphere of radius 'a'.
6. A stone dropped into a well touches water with a velocity of 19.60 m/sec and the sound of striking water is heard in 2.50 sec after it is let fall. Find the velocity of sound. ( $g = 9.80 \text{ m/sec}^2$ ).

### GROUP - C

#### ( Long Answer Type Questions )

Answer any *three* of the following.  $3 \times 15 = 45$

7. a) The following table shows monthly wage distribution of 130 workers in a factory. Obtain the mode of the distribution : 8

Monthly wage ( in Rs. )	No. of workers
1500 — 1700	25
1700 — 1900	30
1900 — 2100	37
2100 — 2300	27
2300 — 2500	11



- b) A box contains 5 red and 10 white balls. 2 balls are drawn at random from the box one after another without replacement. Find the probability that both the balls drawn are white. 7

8. a) Find a suitable measure of the coefficient of skewness for the following distribution : 7

<b>Variable</b>	0 - 20	20 - 50	50 - 100	100 - 250	250 - 500	500 - 1000
<b>Frequency</b>	20	50	69	30	25	19

- b) Fit a straight line to the following data :

<b>Year</b>	1951	1961	1971	1981	1991
<b>Productivity ( in thousand tons )</b>	8	10	12	10	16

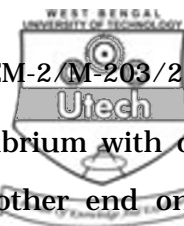
Also find the expected production in 1996. 8

9. a) Find  $L^{-1} \left\{ \frac{6s - 4}{s^2 - 4s + 20} \right\}$  7

- b) Using Laplace transform method solve the ordinary differential equation :

$$\frac{d^2x}{dt^2} - 2 \frac{dx}{dt} + x = e^t$$

with initial conditions  $x(0) = 2, x'(0) = -1$ . 8



10. a) A uniform ladder rests in limiting equilibrium with one end against a rough vertical wall and other end on a rough horizontal plane having angle of friction  $\lambda_1$  and  $\lambda_2$  respectively. Show that inclination " $\theta$ " of the ladder to the horizon is given by

$$\theta = \tan^{-1} \left[ \frac{\cos(\lambda_1 + \lambda_2)}{2 \sin \lambda_1 \cdot \cos \lambda_2} \right] \quad 8$$

- b) Forces  $P$ ,  $Q$ ,  $R$  acting at a point are in equilibrium. If the angle between  $P$  and  $Q$  be double of the angle between  $P$  and  $R$ , then prove that  $R^2 = Q(Q - P)$ . 7

11. a) If a bomb dropped from an aeroplane rising vertically with uniform velocity, reaches the ground in 5 seconds. Find the height of the aeroplane when the bomb reaches the ground. 7

- b) A rocket ascending vertically from the ground with an initial velocity  $\sqrt{2gy}$  ft/sec explodes when it reaches the greatest height, and the interval between the sound reaching the place of starting and a place distant  $x$  ft from it, is  $\frac{1}{n}$  th of a second. Show that the velocity of sound is  $n(\sqrt{x^2 + y^2} - y)$  ft/sec. 8

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