



Name : .....

Roll No. : .....

Invigilator's Signature : .....

**CS/M.Tech(BT)/SEM-1/MBT-104/2012-13**

**2012**

**NUMERICAL ANALYSIS & BIOSTATISTICS**

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 the following :  $10 \times 1 = 10$

i) Relative error is measured by which of the following expressions ?

a)  $\text{Mod} \left[ \frac{\text{absolute error}}{\text{approximate error}} \right]$

b)  $\text{Mod} \left[ \frac{\text{absolute error}}{\text{exact error}} \right]$

c)  $\text{Mod} (\text{exact value} - \text{approximate value})$

d) None of these.



ii)  $\Delta^3(y_0)$  may be expressed as which of the following terms ?

- a)  $y_3 - 3y_2 + 3y_1 = y_0$       b)  $y_2 - 2y_1 + y_0$   
c)  $y_3 + 3y_2 + 3y_1 + y_0$       d) none of these.

iii) The  $(n+1)^{th}$  order forward difference of the  $n$  th degree polynomial is

- a)  $n!$       b)  $(n+1)!$   
c) 0      d) none of these.

iv) Lagrange's interpolation formula deals with

- a) equispaced arguments only  
b) unequispaced arguments only  
c) both (a) and (b)  
d) none of these.

v) Runge-Kutta method is used to solve

- a) an algebraic equation  
b) a first order ordinary differential equation  
c) a first order partial differential equation  
d) none of these.



vi) The variance of binomial distribution is

- a)  $\sqrt{npq}$                       b)  $npq$
- c)  $np$                       d)  $\sqrt{np}$ .

vii) The standard deviation calculated from two values  $x_1$  and  $x_2$  of a variable  $x$  is equal to half their difference.

- a) True                      b) False.

viii) Find the median of the following data :

4, 7, 10, 7, 9, 15, 12, 7, 9, 6

- a) 7                      b) 8
- c) 9                      d) 10.

ix) Normal distribution is symmetrical and mesokurtic if

- a) skewness = 0 and kurtosis = 1
- b) skewness = 1 and kurtosis = 1
- c) skewness = 0 and kurtosis = 0
- d) skewness = 1 and kurtosis = 0.



x) When  $r = 0$ , the regression lines are ..... to each other.

- a) perpendicular
- b) parallel
- c) coincident
- d) the angle between them being zero.

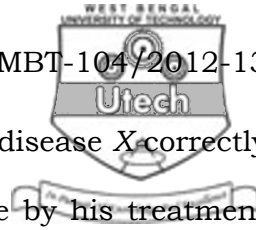
### GROUP – B

#### ( Short Answer Type Questions )

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

2. Find the mean and the standard deviation of the first  $n$  natural numbers.
3. If the first quartile is 142 and the semi-interquartile range is 18, find the median (assuming the distribution to be symmetrical about mean or median).
4. Compute the value of  $\pi$  from the formula  $\frac{\pi}{4} = \int_0^1 \frac{dx}{1+x^2}$  using trapezoidal rule with 10 sub-intervals.
5. Using appropriate interpolation formula, find the value of the function  $f(x)$  when  $x = 7$  from the following data :

$x :$	2	4	6	8
$f(x) :$	15	28	56	89



6. The chances that doctor  $A$  will diagnose a disease  $X$  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%. A patient of doctor  $A$ , who has disease  $X$ , died. What is the probability that his disease was diagnosed correctly ?

**GROUP – C**

**( Long Answer Type Questions )**

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

7. a) For jointly distributed random variables  $X$  and  $Y$  and constants  $a, b, c, d$ , prove that
- $\text{cov}(aX + b, cY + d) = ac \text{cov}(X, Y)$
  - $\text{var}(X + Y) = \text{var}(X) + \text{var}(Y) + 2\text{cov}(X, Y)$
- b) The heights of 500 soldiers are found to have normal distribution. Of them 258 are found to be within 2 cm of the mean height of 170 cm. Find standard deviation of  $X$ .
- c) The probability distribution of a finite random variable  $X$  is given by the following table :

$x_i$	- 2	- 1	0	1	2	3
$P(x_i)$	0.1	$k$	0.2	$2k$	0.3	$k$

Find the value of  $k$  and calculate the mean.

$$(3 + 3) + 6 + 3$$



8. a) Find  $y(1.1)$  using Runge-Kutta method of fourth order, given that  $\frac{dy}{dx} = y^2 + xy$ ,  $y(1) = 1$ .

- b) Given  $\frac{dy}{dx} + \frac{y}{x} = \frac{1}{x^2}$ ,  $y(1) = 1$ . Evaluate  $y(1.2)$  by modified Euler's method correct up to 4 decimal places.

7 + 8

9. a) In the following table,  $S$  is the weight of potassium bromide which will dissolve in 100 gms of water at  $T^\circ \text{C}$ . Fit an equation of the form  $S = mT + b$  by the method of least squares. Use this relation to estimate  $S$ , when  $T = 50^\circ$ .

$T$	0	20	40	60	80
$S$	54	65	75	85	96

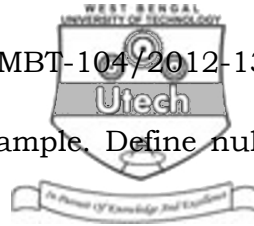
- b) Calculate the coefficient of correlation and obtain the lines of regression for the following data :

$X:$	1	2	3	4	5	6	7	8	9
$Y:$	9	8	10	12	11	13	14	16	15

Obtain an estimate for  $Y$  which corresponds to  $X = 6.2$ .

- c) Distinguish between absolute and relative measures of dispersion.

6 + 6 + 3



10. a) Define Statistical hypothesis with example. Define null hypothesis and alternate hypothesis.
- b) What is Scatter Diagram ? Explain how this can be used to indicate the degree and type of association between two variables.
- c) In his experiments on pea-breeding, Mendel obtained the following frequencies of seeds :  
 Round and yellow-315; Wrinkled and yellow-101;  
 Round and green-108; Wrinkled and green-32;  
 Total-556. Theory predicts that the frequencies should be in the proportion 9 : 3 : 3 : 1. Estimate the correspondence between theory and observations.  
 (Given that 5% value of  $\chi^2$  for 3 d.f. is 7.815).

$$4 + (2 + 4) + 5$$

11. a) i) What is interpolation ?  
 ii) Prove that

$$Y = y_0 + \frac{u}{1!} \Delta y_0 + \frac{u(u-1)}{2!} \Delta^2 y_0 + \frac{u(u-1)(u-2)}{3!} \Delta^3 y_0 + \dots + \frac{u(u-1)(u-2)\dots(u-n+1)}{n!} \Delta^n y_0$$

- b) Find the value of  $\log 2^{1/3}$  from  $\int_0^1 \frac{x^2}{1+x^2} dx$ , using

Simpson's 1/3rd rule with  $h = 0.25$ .

- c) What is quadrature ? Find the equation of the cubic curve that passes through the points (0,5), (1,-10), (2,9), (3, 4) and (4, 35).

$$(1 + 4) + 5 + (1 + 4)$$

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