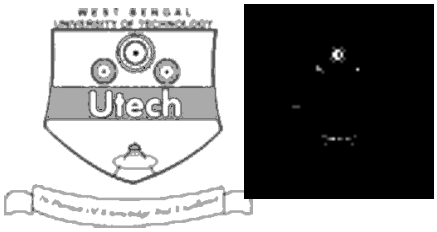
MATHEMATICS-II (SEMESTER - 4)

CS/B.Tech(CE)/SEM-4/CE-401/09



1. .....
Signature of Invigilator

2. .....
Signature of the Officer-in-Charge

Reg. No. | | | | | | | | | | | | | | |

Roll No. of the Candidate | | | | | | | | | | | | | | |

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CS/B.Tech(CE)/SEM-4/CE-401/09

ENGINEERING & MANAGEMENT EXAMINATIONS, JUNE – 2009

MATHEMATICS-II (SEMESTER - 4)

Time : 3 Hours] [Full Marks : 70

INSTRUCTIONS TO THE CANDIDATES :

1. This Booklet is a Question-cum-Answer Booklet. The Booklet consists of **36 pages**. The questions of this concerned subject commence from Page No. 3.
2. a) In **Group – A**, Questions are of Multiple Choice type. You have to write the correct choice in the box provided **against each question**.
   b) For **Groups – B** & **C** you have to answer the questions in the space provided marked 'Answer Sheet'. Questions of **Group – B** are Short answer type. Questions of **Group – C** are Long answer type. Write on both sides of the paper.
3. **Fill in your Roll No. in the box** provided as in your Admit Card before answering the questions.
4. Read the instructions given inside carefully before answering.
5. You should not forget to write the corresponding question numbers while answering.
6. Do not write your name or put any special mark in the booklet that may disclose your identity, which will render you liable to disqualification. Any candidate found copying will be subject to Disciplinary Action under the relevant rules.
7. **Use of Mobile Phone and Programmable Calculator is totally prohibited in the examination hall.**
8. You should return the booklet to the invigilator at the end of the examination and should not take any page of this booklet with you outside the examination hall, **which will lead to disqualification**.
9. Rough work, if necessary is to be done in this booklet only and cross it through.

No additional sheets are to be used and no loose paper will be provided

FOR OFFICE USE / EVALUATION ONLY

Marks Obtained

	Group – A										Group – B				Group – C				
Question Number																	***Total Marks***	***Examiner's Signature***
Marks Obtained																		

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Head-Examiner/Co-Ordinator/Scrutineer

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MATHEMATICS-II

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Time : 3 Hours] [Full Marks : 70

GROUP – A

(Multiple Choice Type Questions)

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

i) Newton's backward interpolation formula is used for

a) equal interval

b) unequal interval

c) both equal and unequal interval

d) none of these. ☐

ii) If "A" be the actual value and "T" be the estimated value, the formula for relative error is

a) A/T b) $(A - T) / T$

c) $(A - T) / A$ d) $(|A - T|) / T$. ☐

iii) The nth forward difference of a polynomial of degree n is

a) constant b) polynomial of degree one

c) polynomial of degree two d) none of these. ☐

iv) A matrix (x_{ij}) in which $x_{ij} = 0$ for $i \neq j$, is called

a) upper triangular matrix b) lower triangular matrix

c) diagonal matrix d) none of these. ☐

v) An approximate polynomial which passes through $(n+1)$ data points is of degree

a) $n+1$ b) n

c) n or less d) $n+1$ or less.

vi) If the interval of differencing is unity and $f(x) = ax^2$ ('a' is constant), find which one of the following choices is wrong ?

a) $\Delta f(x) = a(2x+1)$ b) $\Delta^2 f(x) = 2a$

c) $\Delta^3 f(x) = 2$ d) $\Delta^4 f(x) = 0$.

vii) Which of the following represents the Newton – Gregory formula for n arguments ?

a) $f(x+nh) = Ef(x)$

b) $f(x+nh) = \sum_{i=0}^{n} \left(\frac{n}{i}\right) \Delta^i f(x)$

c) $f(x+h) = (1+\Delta) f(x)$

d) None of these.

viii) If the two variables x and y are related by the equation $y = \frac{x-c}{d}$, where c and d are positive constants, then arithmetic mean of y is

a) $\bar{x}$ b) $\frac{\bar{x}}{\mathrm{d}}$

c) $\frac{\bar{x}-c}{\mathrm{d}}$ d) $\frac{c}{d}$.

ix) The distribution for which mean and variance are equal is

a) Normal b) Poisson

c) Binomial d) None of these.

x) The modal heights from the heights 63 cm, 65 cm, 66 cm, 65 cm, 64 cm, 65cm, 65 cm, 61 cm, 65 cm, 68 cm, is

a) 68 cm b) 61 cm

c) 65 cm d) 64 cm. ☐

xi) Iterative method is convergent for $x = \phi(x)$ if

a) $|\phi'(x)| = 1$ b) $|\phi'(x)| > 1$

c) $|\phi'(x)| < 1$ d) None of these. ☐

xii) Solution of simultaneous non-linear equations can be obtained by using

a) method of Iteration b) Newton – Raphson method

c) Chord method d) none of these. ☐

xiii) The Newton – Raphson method formula for finding the square root of a real number R from the equation $x^2 - R = 0$ is

a) $x_{i+1} = \frac{x_i}{2}$ b) $x_{i+1} = \frac{3x_i}{2}$

c) $x_{i+1} = \frac{1}{2}\left(x_i + \frac{R}{x_i}\right)$ d) $x_{i+1} = \frac{1}{2}\left(3x_i - \frac{R}{x_i}\right)$. ☐

xiv) Simpson's $\frac{1}{3}$ formula can be used to integrate numerically for

a) odd number of intervals only

b) even number of intervals only

c) both odd and even number of intervals only

d) none of these. ☐

GROUP – B

(Short Answer Type Questions)

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

2. Find the missing terms in the following table using difference table :

x :	10	15	20	25	30	35
$f(x)$:	19·97	21·51	...	23·52	24·65	...

3. Find the moment generating function of the binomial distribution with parameters n and p and from it determine the mean and variance of the distribution.

4. Using the Taylor's series method solve the equation :

$$\frac{dy}{dx} = -xy$$

given that $y = 1$ when $x = 0$.

5. Compute $\sqrt[3]{2}$ using Newton – Raphson method correct upto 4 significant figures.

6. Compute $f'(1{\cdot}1)$ and $f''(1{\cdot}1)$ from the following data :

x :	1	2	3	4
$f(x)$:	6	9	17	29

7. Evaluate $\int_2^{10} \frac{dx}{1+x}$ by Simpson's $\frac{1}{3}$ rule by taking the number of sub-intervals as 8.

GROUP – C

(Long Answer Type Questions)

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

8. a) Find the value of $f(0{\cdot}5)$ and $f(2{\cdot}8)$ from the following table :

x :	0	1	2	3
$f(x)$:	1	2	11	34

b) Use Lagrange's interpolation formula to compute $f(5)$ from the following data :

x :	1	2	3	4	7
$f(x)$:	2	4	8	16	128

c) Evaluate $\int_0^1 (4x - 3x^2)\, dx$ by Trapezoidal rule where the number of sub-intervals is 10. Compute the exact value and also find the absolute and relative error. 5 + 5 + 5

9. a) Find the largest eigen-value and the corresponding eigen-vector of the matrix using Power method :

$$\begin{bmatrix} 1 & 2 & 3 \\ 0 & -4 & 2 \\ 0 & 0 & 7 \end{bmatrix}$$

b) The mean and S.D of 20 items is found to be 10 and 2 respectively. At the time of checking it was found that one item 8 was incorrect. Calculate the mean and S.D if

i) the wrong item is omitted

ii) it is replaced by 12. 10 + 5

10. a) Find the missing frequencies in the following frequency distribution, when it is known that $A.\ M = 11{\cdot}09$:

Class limits	9·3-9·7	9·8-10·2	10·3-10·7	10·8-11·2	11·3-11·7	11·8-12·2	12·3-12·7	12·8-13·2	Total
Frequency	2	5	f_3	f_4	14	6	3	1	60

b) Solve the system of equation using Jacobi's iteration method :

$$3x + 4y + 15z = 54{\cdot}8$$

$$x + 12y + 3z = 39{\cdot}66$$

$$10x + y - 2z = 7{\cdot}74.$$

8 + 7

11. a) The following table shows the marks obtained by 100 candidates in an examination. Calculate the mean, median and standard deviation :

Marks obtained :	1-10	11-20	21-20	31-40	41-50	51-60
No. of Candidates :	3	16	26	31	16	8

b) Using Euler's method, solve the following differential equation :

$\frac{dy}{dx} - 1 = y^2$, $y\ (0)\ = 0$ taking $h = 0{\cdot}1$ and obtain $y\ (0{\cdot}1\ )$, $y\ (0{\cdot}2\ )$ and $y\ (0{\cdot}3\ )$.

c) The function $f\ (x\ )$ is tabulated below, for different values of x

x :	0	5	10	15	20
$f\ (x\ )$	1·5708	1·5738	1·5828	1·5981	1·62000

Compute the first and second derivative of $f\ (x\ )$ at $x = 0$. 5 + 5 + 5

12. a) Explain the Regula-Falsi method for the numerical computation of a real root of an equation $f(x) = 0$. Write the advantages and disadvantages of this method.

b) Find the approximate root of the equation $X^3 - X - 1 = 0$, between $x = 1$ and $x = 2$, correct to four decimal places, using Regula-Falsi method.

c) Estimate the missing terms from the table :

x	1	3	5	7	9	11
y	2	*	27	64	*	216

5 + 5 + 5

13 a) Derive Simpson's one-third integration formula from Newton-Cotes formula.

b) An incomplete distribution is given below :

Class	Frequency
0 – 10	10
10 – 20	20
20 – 30	?
30 – 40	40
40 – 50	?
50 – 60	25
60 – 70	15
Total	170

The median is 35. Find the missing frequencies. 5 + 10

14. a) Solve the following tri-diagonal system of equations by LU factorization method :

$$x_1 + x_2 = 3$$

$$2x_1 + x_2 + x_3 = 5$$

$$x_2 + x_3 = 3$$

b) Find a root of the equation $e^{-x} - x = 0$ by Secant method in between 0 and 1 correct to 2 decimal places. 10 + 5

END