	Utech
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Invigilator's Signature :	

CS/B.TECH (CE/OLD)/SEM-4/CE-401/2013 2013

MATHEMATICS - II

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) In Simpson's one-third formula for the integration

 $\int_{a}^{b} f(x) dx$, the degree of precision is

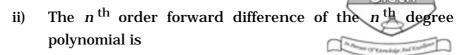
a) 0

b) 1

c) 2

d) 3.

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a) n!

b) (n+1)!

c) 0

d) none of these.

iii) The rate of convergence of the Newton-Raphson method for solving f(x) = 0 is

- a) quadratic
- b) biquadratic

c) cubic

d) linear.

iv) The inherent error for Simpson's $\frac{1}{3}$ rule of integration is as (the notations have their usual meanings)

a)
$$-\frac{nh^{5}}{180} f'' (x_0)$$

b)
$$-\frac{nh^{5}}{140} f'' (x_0)$$

c)
$$-\frac{nh^3}{12} f''(x_0)$$

d) none of these.

v) If a number be rounded to m-decimal places, then for the absolute error (E_A) ,

a)
$$E_A > \frac{1}{2} \times 10^{-m}$$

b)
$$E_A \le \frac{1}{2} \times 10^{-m}$$

c)
$$E_A = 10^{-m}$$

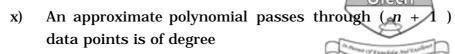
d)
$$E_A \ge \frac{1}{2} \times 10^{-m}$$
.

- vi) In fixed point interation method [$x = \phi$ (x)] for the equation $\pi x = \sin$ (x), the appropriate choice of ϕ (x) such that sequence x_0 , x_1 , x_2 , ..., x_n converges to the root is
 - a) $\frac{\sin(x)}{\pi}$
- b) $\frac{\cos(x)}{\pi}$
- c) $\cos(x)$
- d) none of these.
- vii) The condition of convergence of approximations for a real foot $\phi(x) = x$ by method of iteration is
 - a) $max[|\phi'(a)|, |\phi'(b)|] = 0 in (a, b)$
 - b) $max[|\phi'(a)|, |\phi'(b)|] < 1 in (a, b)$
 - c) $min[|\phi'(a)|, |\phi'(b)|] = 0 in (a, b)$
 - d) $min[|\phi^{l}(a)|, |\phi^{l}(b)|] < 1 in (a, b).$
- viii) Runge-Kutta method is used to
 - a) interpolate
 - b) solve a transcendental equation numerically
 - c) integrate a definite integral numerically
 - d) solve a first order ordinary differential equation numerically.
- ix) Which of the following numbers has greatest precision?

4.3201, 4.32, 4.320106, 4.3.

a) 4·3201

- b) 4.32
- c) 4·320106
- d) 4.3.



a)
$$n+1$$

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

If E_a is the absolute error in a quantity whose true and approximate values are given by x_t and x_a , then the relative error is given by

a)
$$\frac{E_a}{X_a}$$

b)
$$\frac{E_a}{x_t}$$

a)
$$\left| \frac{E_a}{x_a} \right|$$
 b) $\left| \frac{E_a}{x_t} \right|$ c) $\left| \frac{E_a}{x_t - x_a} \right|$ d) $\left| E_a \right|$.

d)
$$|E_a|$$

 $(\Delta - \nabla) x^2$ is equal to (the notations have their usual meanings)

a)
$$h^2$$

b)
$$-2h^2$$

c)
$$2 h^2$$

xiii) Rounding off the number 0.0063945 correct up to 4 significant figures is

0.0064a)

- 0.0063 b)
- c) 0.006395
- 0.006394.d)

xiv) To find out the numerically largest eigenvalue of a matrix which of the following methods is used?

- a) Newton-Raphson method
- Trapezoidal rule b)
- Runge-Kutta method of second order c)
- Power method. d)



(Short Answer Type Questions)

Answer any three of the following.

 $3 \times 5 = 15$

2. Assuming that the following values of y belong to a polynomial of degree 4, compute the next three values :

	X	0	1	2	3	4	5	6	7
3	y	1	- 1	1	- 1	1		_	_

- 3. If $\Delta x = 0.005$ and $\Delta y = 0.001$ be the absolute errors in x = 2.11 and y = 4.15, find the relative error in computation of x + y.
- 4. Find out the integration value, correct up to 5 decimal places of the integration $\int_{0}^{1} \frac{1}{1+x^2} dx$, taking number of sub-intervals n = 10 by Simpson's $\frac{1}{3}$ rule.
- 5. Use inverse interpolation formula to find out x when $f\left(x \right) = 0.645 \text{ correct up to one decimal place from the}$ following table :

<i>x</i> :	0.3	0.5	0.6
f(x):	0.6179	0.6915	0.7257



$$-2x + 2y + z + 2t = 7$$

$$-x + 2y = -2$$

$$-3x + y + 2z + t = -3$$

$$x + 2t = 0.$$

7. Find the moment generating function of the Binomial distribution and from it determine its mean and variance.

GROUP - C

(Long Answer Type Questions)

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

- 8. a) Derive Trapezoidal integration formula from Newton-Cotes formula.
 - b) Evaluate $\int_{0}^{1} \frac{1}{1+x^{2}} dx$, by Trapezoidal rule taking

number of sub-intervals n = 10, correct to 4 decimal places.

- c) Write down the inherrent error formula for trapezoidal rule for numerical integration. 7 + 7 + 1
- 9. a) Derive Newton's Backward difference interpolation formula.
 - b) Find a real root of the equation $x^3 x 11 = 0$ correct up to 4 decimal places using Newton-Raphson in the interval (2, 4) and estimate the error in this method.

$$5 + (7 + 3)$$

- 10. a) Derive the Newton-Raphson formula for computing the real root of an equation f(x) = 0.
 - b) Explain the geometrical significance of Newton-Raphson method.
 - c) Show that Newton-Raphson method has a quadratic convergence. 5 + 5 + 5
- 11. a) Use Euler's method to find an approximate value of y corresponding to x = 1, given that, $\frac{dy}{dx} = x + y$ and y = 1, when x = 0.
 - b) With usual notations, prove that,

$$\Delta^{n}\left(\frac{1}{x}\right) = (-1)^{n}, \frac{n! h^{n}}{x(x+h)...(x+nh)}$$
 5 + 10

12. a) Given that the mode of the following frequency distribution of 70 observations is 58.75. Find the missing frequencies f_1 and f_2 .

Class	Frequency
52 - 55	15
55 - 58	f_1
58 - 61	25
61 - 64	f_2

b) Find one real root of $10^{x} + \sin(x) + 2x = 0$, by the bisection method in the interval (-1, 0), correct up to 3 significant figures. 5 + 10

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13. Use the method of least squares to fit the curve

$$f(x) = c_0 x + \left(\frac{c_1}{\sqrt{x}}\right)$$
 for the following data:

x:	0.2	0.3	0.5	1	2
f(x):	16	14	11	6	3

Find also the least square errors (correct up to 3 decimal places).
