Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER– IV(NEW) EXAMINATION – SUMMER 2015

Subject Code: 2140606 Date:26/05/2015

Subject Name: Numerical and Statistical Methods for Civil Engineering

Time: 10:30am-1.30pm Total Marks: 70

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

Q.1 **(a)** Using fourth order Runge- Kutta method, find y at x= 0.1 given differential equation $\frac{dy}{dx} = 3e^x + 2y$, y(0) = 0 by taking h = 0.1 and also compare the solution with exact solution. **07**

(b) (i) Dividing the range into 10 equal parts, evaluate $\int_0^{\pi} \sin x \, dx$ by simpson's 3/8 rule. **04**

(ii) A person is known to hit the target in 3 out of 4 shots, whereas another person is known to hit the target in 2 out of 3 shots. Find the probability of the target being hit at all when they both try. **03**

Q.2 **(a)** (i)The area A of a circle of diameter d is given for the following values **04**

d	80	85	90	95	100
A	5026	5674	6362	7088	7854

Calculate the area of a circle of diameter 105 using Newton's interpolation.

(ii) Define the term interpolation and prove that $E = 1 + \Delta$ **03**

(b) (i) Ten competitors in a music competition are ranked by three judges in the following order **04**

1st judge	1	6	5	10	3	2	4	9	7	8
2nd judge	3	5	8	4	7	10	2	1	6	9
3rd judge	6	4	9	8	1	2	3	10	5	7

Use the rank correlation to discuss which pair of judges has the nearest approach to common tastes in music.

(ii) What is correlation? Give methods to measure it. **03**

OR

(b) (i) The following data give the experience of machine operators and their performance rating as given by the number of good parts turned out per 100 piece **04**

Operator	1	2	3	4	5	6
Performance rating (x)	23	43	53	63	73	83
Experience (y)	5	6	7	8	9	10

Calculate the regression line of performance rating on experience and also estimate the probable performance if an operator has 11years experience.

(ii) Define regression coefficients and give its properties. **03**

Q.3 **(a)** (i) A simply supported beam carries a concentrated load P(lb) at its mid-point. Corresponding to various values of P, the maximum deflection Y(in) is measured. The data are given below **04**

P	100	120	140	160	180	200
Y	0.45	0.55	0.60	0.70	0.80	0.85

Find a law of the form Y = a + bP using least square method.

(ii) Evaluate y(0.1) correct to four decimal places using Taylor's series method if $\frac{dy}{dx} = y^2 + x$, y(0)=1 **03**

(b) (i) Find a second degree polynomial passing through the points (0, 0), (1, 1) and (2, 20) Using Lagrange's interpolation. **04**

(ii) Derive an iterative formula for finding cube root of any positive number using Newton Raphson method and hence find an approximate value of $\sqrt[3]{58}$ **03**

OR

Q.3 **(a)** (i) Fit the exponential curve $y = a e^{bx}$ to the following data. **04**

X	0	2	4	6	8
Y	150	63	28	12	5.6

(ii) Solve the differential equation $\frac{dy}{dx} = \log_{10}(x + y)$ with initial condition y(0)=2 **03**
compute y(0.4) and h = 0.2 by Euler's method.

(b) (i) Using Newton's divided difference interpolation compute the value of f(6) from the table given below **04**

x	1	2	7	8
f(x)	1	5	5	4

(ii) Perform three iterations of Bisection method to obtain root of the equation $2\sin x - x = 0$ **03**

Q.4 **(a)** Solve the following system of linear equation by Gauss Seidel method **07**

$$8x + y + z = 5$$
$$x + 8y + z = 5$$
$$x + y + 8z = 5$$

(b) A multiple choice test consist of 8 questions with 3 answer to each question(of which only one is correct). A student answers each question by rolling a balanced dice and checking the first answer if he gets 1 or 2, the second answer if he gets 3 or 4 and the third answer if he gets 5 or 6. To get a distinction, the student must secure at least 75% correct answers. If there is no negative marking, what is the probability that the student secures a distinction? **07**

OR

Q.4 **(a)** Solve the following system of equations using partial pivoting by Gauss Elimination method **07**

$$2x_1 + 2x_2 + x_3 = 6$$
$$4x_1 + 2x_2 + 3x_3 = 4$$
$$x_1 + x_2 + x_3 = 0$$

(b) (i) In sampling a large number of parts manufactured by a machine, the mean number of defectives in a sample of 20 is 2. Out of 1000 such samples, how many would be expected to contain exactly two defective parts? **04**

(ii) A machine produces on average of 500 items during the first week of the month and on average of 400 items during the last week of the month. The probability for these being 0.68 and 0.32. Determine the expected value of the production. **03**

Q.5 **(a)** (i) Two automatic filling machines A and B are used to fill mixture of cement concrete in beam. A random sample of beam on each machine showed following **04**

Machine A	32	28	47	63	71	39	10	60	96	14
Machine B	19	31	48	53	67	90	10	62	40	80

Find standard deviation of each machine and also comment on the performance of the two machines.

(ii)Define Mutually exclusive event and Exhaustive event with suitable example **03**

(b) Apply False Position method to find the negative root of the equation $x^3 - 2x + 5 = 0$ correct to four decimal places. **07**

OR

Q.5 **(a)** (i) From the following data calculate median **04**

Marks	< 5	< 10	<15	< 20	< 25	<30	<35	<40	<45
No. of students	29	224	465	582	634	644	650	653	655

(< indicates less than)

(ii) A company has two plants to manufacture hydraulic machine. Plat I manufactures 70% of the hydraulic machines and plant II manufactures 30%. At plant I, 80% of hydraulic machines are rated standard quality and at plant II, 90% of hydraulic machines are rated standard quality. A machine is picked up at random and is found to be of standard quality. What is the chance that it has come from plant I? **03**

(b) Find a real positive root of equation $x\sin x + \cos x = 0$ which is near x = π correct to four significant digits using Newton –Raphson method. **07**

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