COLLEGE OF ENGINEERING ,PUNE
DEPRTMENT OF MATHEMATICS

Class: S.Y.B.Tech(Mechanical) MA 227 MAX. MARKS:50
END SEMESTER EXAMINATION 5/5/2012 Time: 3hrs.

N.B. 1. All questions carry equal marks.
2. Read the instructions carefully.
3. Use of non-programmable calculators are allowed.
4. Answer Tow Sections SEPARATELY.

SECTION I

Q.1 A Define unbiased estimator and show that S^2 is an unbiased estimator of the parameter σ^2. 03

B Many cardiac patients were implemented pacemakers to control their heartbeat. A plastic connector module mounts on the top of the pacemaker. Assuming a std. dev. Of 0.0015 and an approximate normal distribution; (1) Find a 95% confidence interval for the mean of all connector modules made by a certain manufacturing company. A random sample of 75 modules has an avg. of 0.310 inch. (2) How large a sample is needed in above example if we wish to be 95% confidence that our sample mean will be within 0.0005 inch of the true mean. 04

OR

B. A machine is producing metal piece that are cylindrical in shape. A sample of piece is taken and the diameters are 1.01,0.97,1.03,1.04,0.89,0.98,0.99,1.01 and 1.03 cm. Find a 99% confidence interval for the mean diameter of piece from this machine, assuming an approximate normal distribution.

Q.2 A A random sample of 12 shearing pins is taken in a study of the Rockwell hardness of head on the pin. Measurements on the Rockwell hardness were made for each of the 12, yielding an average value of 48.50 with a sample std. dev. Of 1.5. Assuming the measurements to be normally distributed; construct a 90% confidence interval for the mean Rockwell hardness. 03

B A manufacturer of car batteries claims that his batteries will last on average 3 years with a variance of 1 year. If 5 of these batteries have lifetimes of 1.9, 2.4, 3.0, 3.5 & 4.2 years, construct a 90% confidence interval for σ^2 and decide if the manufacturer's claim that $\sigma^2 = 1$ is valid. Assume the population of battery lives to be approximately normally distributed. 04

OR

B Given a standard normal distribution, find the value of k such that (a)$P(Z > k) = 0.3015$ and (b) $P(k < Z < -0.18) = 0.4197$

Section II

Q3 A Discuss the difference in Curve fitting and Interpolation 2

B Evaluate the following double integration 4

$$\int_{-2}^{2}\int_{0}^{4}(x^3 - 3y^2 + xy^3)$$

Using Simpsons $1/3^{rd}$ rule.

Q4 The velocity distribution of a fluid near a flat surface is given below 6

x	0.1	0.3	0.6	0.8
V	0.72	1.81	2.73	3.47

X is the distance from the surface (mm) and V is the velocity (mm/sec)
Fit an interpolating polynomial using Lagrange's Interpolation method. Also find the velocity at x=0.4

OR

Q4 Find the interpolating polynomial fitting the given data points using Newtons divided difference method. Also find y (1.45). 6

x	0	2	3	4	6
y	1	13	34	73	229

Q5A Draw a flowchart and write a computer sub program to fit a first degree curve using least square technique 4

B The values of x and y found experimentally are given below. If the relation between x & y is of the type $y = ax^b$. Using least square technique find the values of a & b. 4

x	1	1.5	2	2.5	3	3.5	4
y	1.36	3.7	7.6	13.3	21	31	42.9

Q6 A Using Taylors series method of third order, find y at x=1.1 and 1,2 by solving the equation $\frac{dy}{dx} = x^2 + y^2$; y (1) = 2. 3

B Solve the following differential equation to get y(0.1). 5

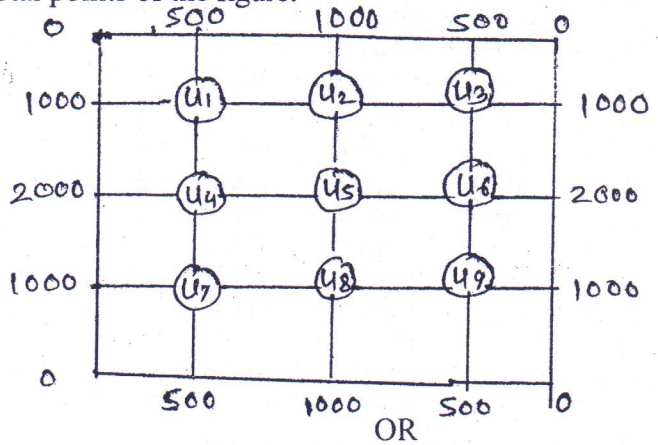
$$\frac{dy}{dx} = x + y + xy\,;\; y(0) = 1$$

Use Modified Euler method with h=0.05 **OR** Runge Kutta 4th order with h=0.1

OR

B Solve simultaneous differential equations $\frac{dy}{dx} = 2y + z$; $\frac{dz}{dx} = y - 3z$; y (0) = 0; z (0) = 0.5 for y(0.1); Using Runge-Kutta method of fourth order. 5

Q7 Given the values of u(x,y) on the boundary of the square as shown in the figure below. Evaluate the function u(x,y) satisfying the Laplace equation $\nabla^2 u = 0$ at the pivotal points of the figure. 8



OR

Q7 Solve $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = 0$ correct to two decimal places, at the nodal points of square grid using the boundary values indicated. 8