

III B.Tech I Semester Supplementary Examinations, November 2006
COMPUTATIONAL METHODS
(Aeronautical Engineering)

Time: 3 hours

Max Marks: 80

Answer any FIVE Questions
All Questions carry equal marks

1. (a) Find the finite difference analogue of the parabolic equation $u_t = c^2 u_{xx}$ and hence solve $u_{xx} - 2u_t = 0$ subject to $u(0,t)=0$, $u(4,t)=0$, $u(x,0)=x(4-x)$. Assume $h=1$ and find the values up to $t = 5$. [8]
 (b) Explain Gauss-Seidal and Jacobi methods to solve numerically the partial differential equations. [8]
2. (a) What is an implicit method and explain it with the help of a parabolic equation $u_t = c^2 u_{xx}$ [8]
 (b) Determine by iteration method the values at the interior points of the square region of an harmonic function. The values on the boundary are given in the following figure 1. [8]

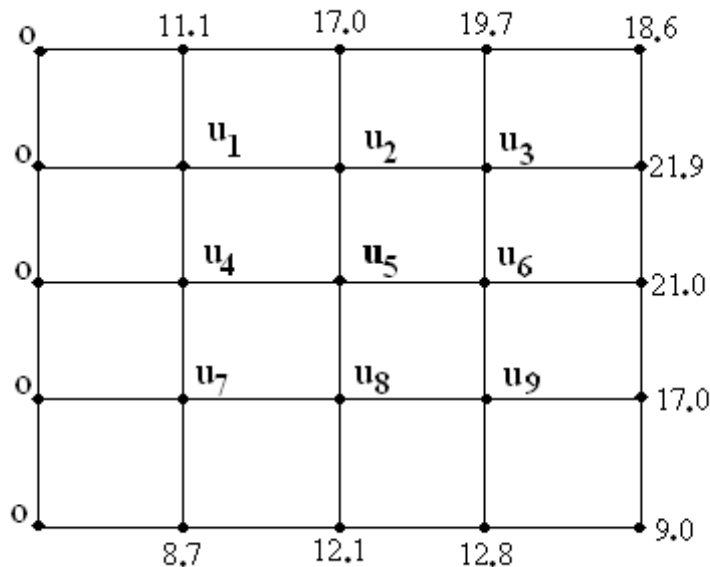


Figure 1:

3. (a) Show that the Kronicker delta is a mixed tensor of rank two. [8]
 (b) Find the metric tensor and the expression for the line element in cylindrical coordinates. [8]
4. (a) Certain ball bearings have a mean weight of 5.02 ounces and the standard deviation 0.30 ounces. Find the probability that a random sample of 100 bearings have a combined weight between 496 and 502 ounces. [8]

- (b) Show that the sum of the squared deviations of the observations $X_i, i = 1, 2, \dots, N$ is minimum when they are taken about the mean. [8]
5. (a) Explain an unbiased estimator and show that the sample mean \bar{X} , is an unbiased estimator for the parameter α , where the sample has been drawn from population $\frac{1}{\alpha}e^{-x/\alpha}, \alpha > 0, x \geq 0$ [8]
- (b) Two micro-circuit designs are tested whether they produce equivalent current flow. Two samples of $n_1 = 5$ and $n_2 = 10$ are drawn from each population and obtained the following data. Test whether there is a significant difference in the designs? [8]

Design-1	$n_1 = 15$	$\bar{x} = 24.2$	$s_1^2 = 10$
Design-2	$n_2 = 10$	$\bar{y} = 23.2$	$s_2^2 = 20$

6. (a) In a random sample 136 of 410 persons given a flu vaccine have experienced discomfort. Construct a 95% confidence interval for true proportion of persons feeling discomfort. [8]
- (b) Show that type I and type II errors cannot be minimised simultaneously by using a single mean test $H_0: \mu = 20$ against $H_1: \mu = 21$. [8]
7. (a) Obtain the normal equations of the least square parabola. $y = ax^2 + bx + c$ for the data $(x_i, y_i), i = 1, 2, \dots, N$. [8]
- (b) Fit a power curve $y = ax^b$ to the following data [8]

x	2	3	4	5	6
y	144	172.8	207.4	248.8	298.6

8. For the following data obtain two least square regression lines and hence compute correlation coefficient. [16]

x	5	2	1	4	3
y	5	8	4	2	10
