DIPLOMA IN NAUTICAL SCIENCE

Term-End Examination

June, 2006

BNA-011 : APPLIED MATHEMATICS

Time : 2 hours   *Maximum Marks : 70*

Note : *Question no. 1 is **compulsory**. Attempt any **four** of the remaining ones. No calculator is allowed. Use log tables if necessary.*

1. (a) In a spherical triangle PZY, given Z = 60°, P = 135°, Y = 120°, find p and z.   5

    (b) Use De Moivre's theorem to find the seventh roots of $\overline{(3 - 5i)}$.   5

    (c) Which of the following statements are true ? Give reasons for your answer.

        (i) The binomial distribution is a continuous distribution.

        (ii) The direction ratios of $\dfrac{x-2}{3} = \dfrac{y-5}{5}$, z = 3 are 3, 5, 3.   5

(d)   Find all the values of x for which

$$\begin{vmatrix} x-1 & 2 & 3 \\ 5 & 0 & x \\ -1 & x & -3 \end{vmatrix} = 19$$

            5

(e)   Solve :   5

$$\frac{dy}{dx} + x \sin 2y = x^3 \cos^2 y$$

(f)   If $\cos^{-1}\left(\dfrac{y}{b}\right) = \log\left(\dfrac{x}{n}\right)^n$, prove that

$$x^2 y_2 + x y_1 + n^2 y = 0.$$

            5

2.   A ship's load water-plane is 60 metres long. The lengths of the half-ordinates commencing from forward are as follows :

       0·1, 3·5, 4·6, 5·1, 5·2, 5·1, 4·9, 4·3, 0·1

metres respectively. Calculate the area of the water-plane and the TPC in salt water, and the position of the centre of floatation.   *10*

3.   (a)   Find the value of $(\vec{a} \times \vec{b}) \times \vec{c}$ if

$$\vec{a} = 3\hat{i} - \hat{j} + 2\hat{k}; \quad \vec{b} = 2\hat{i} + \hat{j} - \hat{k};$$

$$\vec{c} = \hat{i} - 2\hat{j} + 2\hat{k}.$$

            5

(b) In a bolt factory, machines A, B and C manufacture 25, 35 and 40 percent of the total output. Of their total output 5, 4 and 2 percent, respectively, are defective. A bolt is drawn at random and is found to be defective. What are the probabilities that it was manufactured by the machines A, B and C respectively ?   5

4. (a) Find the equations of the tangents to the circle $x^2 + y^2 = 10$ from the point (2, — 4). Also check whether or not these tangents are mutually orthogonal.   5

(b) In a quadrantal triangle ABC, side a = 90°, side b = 75°, side c = 50°. Find angles A and B.
[The following values may be of use to you :
tan 75° = 3·732, tan 50° = 1·1918,
sin 125° = 0·819]   5

5. (a) Find the equation of the cone on which the perpendiculars drawn from the origin to the tangent planes to the cone $19x^2 + 11y^2 + 6yz = 0$ lie.   5

(b) Use an appropriate Maclaurin's series for finding the approximate value of $(1·01)^{99}$ upto 4 decimal places.   5

6. (a) Find the volume of the solid obtained by revolving about the x-axis that portion of the curve $48x = y^2$ which lies between $x = 1$ and $x = 2$.   5

(b) Find the line of regression for the data given below :   5

x	1	2	3	4	5	6
y	14	19	20	26	30	32