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BNA-011

B.Sc. (NAUTICAL SCIENCE)
Term-End Examination
December, 2015

BNA-011 : APPLIED MATHEMATICS

Time : 2 hours *Maximum Marks : 70*

Note : *Attempt any* ***five*** *questions. Use of scientific calculator is allowed.*

1. (a) Find the vector of magnitude 7 units which is perpendicular to both the vectors $\vec{a} = i - 2j + 3k$ and $\vec{b} = 2i + 4j - k$. 7

(b) By Simpson's $\frac{1}{3}$ rule, evaluate $\int_0^4 2^x dx$ by taking n = 4. 7

2. (a) Three urns A, B and C contain 6 red and 4 black balls, 2 red and 6 black balls, 1 red and 8 black balls respectively. An urn is chosen at random and a ball is drawn from the urn. If the ball drawn is red, find the probability that the ball was drawn from urn A. 7

(b) The following data gives the marks obtained by the students of a class in two subjects, Mathematics (Maths.) and Statistics (Stats.) :

Maths.	56	55	58	58	57	56	60	54
Stats.	68	67	67	70	65	68	70	66

Estimate the marks of a student in Mathematics who scores 62 marks in Statistics, by using appropriate equation of line of regression. 7

3. (a) If $\sin y = x \sin (a + y)$, show that

$$\frac{dy}{dx} = \frac{\sin^2 (a+y)}{\sin a}.$$ 7

(b) If $y = a \cos (\log x) + b \sin (\log x)$, show that

$$x\frac{d^2y}{dx^2} + x\frac{dy}{dx} + y = 0.$$ 7

4. (a) Evaluate : 7

$$\int \frac{2x}{(x^2+1)(x^2+2)}\, dx$$

(b) Evaluate : 7

$$\int \frac{1}{x^2 + 8x + 20}\, dx$$

5. (a) In a spherical triangle PZX, $X = 85°18'$, $x = 90°00'$ and $z = 73°12'$. Calculate the side p and the angle P. 7

(b) In a spherical triangle PQR, $p = 62°10{\cdot}1'$, $q = 111°35{\cdot}2'$ and $r = 63°33'$. Find the angle P. 7

6. (a) Find the equation of a hyperbola referred to its principal axes, whose length of transverse axis is 8 and the distance between foci is 10. 7

(b) Find the coordinates of vertex, focus and end points of latus rectum, equation of directrix and length of latus rectum of a parabola whose equation is

$$y^2 - 4x - 4y = 0.$$

Note : It is not a standard parabola with vertex at origin but with shifted vertex. 7