INDIAN MARITIME UNIVERSITY

(A Central University, Government of India)

Time Bound Assignment

B.Sc(Nautical Science)-Arrear Examinations

September/October 2020

Semester – I

Nautical Mathematics

(UG11T3102)

Date: 22-09-2020 Maximum Marks: 70

Time: 3 Hrs Pass Marks: 35

Note: **1. Question No. 1 is compulsory.**

2. Answer any 6 questions from remaining 8 questions.

3. Scientific Calculator is permitted if required.

Q.1 **(2 x 5 =10 marks)**

(a) Find the nth derivative of $\frac{x}{(x+9)(x+5)}$.

(b) Evaluate $\int_0^1 \int_0^y x^2 y \, dxdy$

(c) Simplify $\frac{(\cos 5\theta - i\sin 5\theta)^2 (\cos 7\theta + i\sin 7\theta)^{-3}}{(\cos 4\theta - i\sin 4\theta)^9 (\cos \theta + i\sin \theta)^5}$

(d) Evaluate $\lim_{x\to 0} \left\{\frac{1}{x} - \frac{1}{\sin x}\right\}$

(e) Verify Lagrange's Mean value theorem for $f(x) = (x-1)(x-2)(x-3)$ in $[0,4]$.

Q.2 (a) Change to polar coordinates and hence evaluate $\int_0^a \int_y^a \frac{x}{\sqrt{x^2+y^2}} dxdy$ **(5 marks)**

(b) Evaluate $\int_0^1 \int_0^{1-x} \int_0^{x-y} \frac{dxdydz}{(1+x+y+z)^3}$ **(5 marks)**

Q.3 (a) Evaluate the volume bounded by cylinder $x^2 + y^2 = 4$ and the planes y + z = 4, z = 0. **(5 marks)**

(b) Change the order of integration and hence evaluate the integral $\int_0^1 \int_x^{2-x} \frac{x}{y} dxdy$ **(5 marks)**

Q.4 (a) In spherical triangle PZX, right angled at Z, p = 110^0 20' and z = 84^0 12'. Find the value of P. **(5 marks)**

(b) In spherical triangle ABC, a = 49^0 08', b = 58^0 23.0', C = 71^0 20'. Find c . **(5 marks)**

Q.5 (a) In a spherical triangle CDE, calculate the angle C, D, if c = 87^0 10', d = 62^0 37' and e = 100^0 10'. **(5 marks)**

(b) In spherical triangle PQR, P = $57^0$30.5', Q = 95^0 17', R = 70^0 11'. Calculate p. **(5 marks)**

Q.6 (a) If $y=\left(x^2-1\right)^n$, prove that $\left(x^2-1\right)y_{n+2}+2xy_{n+1}-n\left(n+1\right)y_n=0$

(5 marks)

(b) Verify whether (- 1 , 0) is a stationary value of $z=x^3+3xy^2-3x$

(5 marks)

Q.7 (a) Find the value of $x\frac{\partial u}{\partial x}+y\frac{\partial u}{\partial y}$ if $u=\tan^{-1}\left(\frac{x^3+y^3}{x+y}\right)$ **(5 marks)**

(b) If z = x+y and if $x=e^u+e^{-v}$ and $y=e^{-u}-e^v$ then find the value of $\frac{\partial z}{\partial u}-\frac{\partial z}{\partial v}$

(5 marks)

Q.8 (a) If α and β are roots of equations $x^2-2x+4=$ then show that

$$\alpha^n+\beta^n=2^{n+1}.\cos\left(\frac{n\pi}{3}\right)$$ **(5 marks)**

(b) Find the values of $\left(1-i\sqrt{3}\right)^{1/4}$ **(5 marks)**

Q.9 (a) Separate into real and imaginary parts $\sqrt{i}^{\sqrt{i}}$ considering the principal value. **(5 marks)**

(b) Express $\sin^5\theta$ in terms of multiplies of θ. **(5 marks)**