Karunya University
(Karunya Institute of Technology and Sciences)
(Declared as Deemed to be University under Sec.3 of the UGC Act, 1965)

End Semester Examinations - 2015-16 Even Semester - May 2016

15PH3008 Mathematical Physics II

Set B

Time : 3 hrs
Total Marks: 100

1. (a) Let $f(z) = \frac{1}{z} = u(x,y) + iv(x,y)$. (15)

a) Show explicitly that the Cauchy-Reimann conditions are satisfied.
b) Show explicitly that both real part and imaginary part satisfy Laplace equations.

(b) Find the value of the integral $\int_0^{1+i} z^2 dz$. (5)

OR

2. (a) Evaluate the integral $\oint_C f(z)dz$ for

$$f(z) = \frac{5z-2}{z(z-1)}$$

where C is along the circle $|z| = 2$ in the counterclockwise direction. (a) Use Cauchy's residue theorem. (b). Use the second residue theorem. (15)

(b) State Cauchy's Residue Theorem . (5)

3. (a) Obtain Fourier's series for the expansion f(x) $f(x) = x \sin x$ in the interval $-\pi < x < \pi$. Hence deduce that

$$\frac{\pi}{4} = \frac{1}{2} + \frac{1}{1.3} + \frac{1}{3.5} + \frac{1}{5.7} + \ldots\ldots$$ (15)

(b) Find the finite Fourier cosine transform of x. (5)

OR

4. (a) Find the finite Fourier sine transform and finite Fourier cosine transform of $\frac{\partial^2 U}{\partial x^2}$ where U is a function of x and t for $0 < x < L$, $t > 0$. (15)

(b) Find the value of $\sum_{n=1}^{\infty} \frac{1}{n^2}$ using Fourier's Series. (5)

5. (a) Evaluate $I = \int_0^1 \frac{1}{1+x} dx$ correct to 3 decimal points by Simpson's 1/3 rule. (15)

(b) Given $\frac{dy}{dx} = 1 + y^2$ where y=0 when x=0. Find y(0.2). (Runge-Kutta IV order). (5)

OR

6. (a) Find the solution of inhomogeneous differential equation $\frac{d^2\psi}{dx^2} = f(x)$ subject to the homogeneous boundary conditions $\psi(0)=\psi(1)=0$. (15)

(b) Write down the basic properties of Green's function. (5)

7. (a) Prove that $(Z_5, +_5)$ forms an Abelian group. (15)

(b) For any group (G, *), prove that the identity element is unique. (5)

OR

8. (a) Prove that the two left cosets aH and bH of a subgroup H of a group G are either identical or disjoint. (15)

(b) Prove that the center of a group G is a subgroup of G. (5)

9. (a) The number of students in a prestigious central university for every ten years starting from 1965 was as given below. Estimate the number of students in that university for the years 1969 and 1999. (15)

Year	1965	1975	1985	1995	2005
Number of students (x 100)	46	66	81	93	101

(b) Using Central Difference Formula (Gauss's Forward Formula), find the value of $e^{2.17}$ from the following table. (5)

x	2.00	2.05	2.10	2.15	2.20	2.25	2.30
$y=e^x$	7.3891	7.7679	8.1662	8.5849	9.0250	9.4877	9.9742

Wishing you All the Best