



K.R. MANGALAM UNIVERSITY

THE COMPLETE WORLD OF EDUCATION

Rollno.....

End Semester Examination, December 2024
Program – nth Semester
MATHEMATICAL PHYSICS-III (SCPH201)

Time: 2.5 hrs.

Max Marks: 50

Note: *All Questions are compulsory. Marks are indicated against each question.*

PART-A

Q.1

- (a) Find the modulus and argument of the complex no. $z = -\sqrt{3} - i$ [CO-1] [L-1] 2
- (b) Express the function into polar form : $z = \frac{1+i}{1-i}$ [CO-1] [L-1] 2
- (c) Define De Moivre's theorem [CO-1][L-1] 1
- (d) Find the square root of $1+i$ [CO-1] [L-1] 2
- (e) Draw an Argand diagram for the complex no. $z = 3+4i$ [CO-1] [L-1] 2
- (f) Express $\sin z$ and $\cos z$ in terms of exponential function e^{iz} [CO-1] [L-1] 2
- (g) Find the values of $(1+i)^{1/5}$ [CO-1][L-1] 2

2x5

PART-B

- Q.2 Explain a harmonic function. Prove that $u = x^2 - y^2 - 2xy - 2x + 3y$ is harmonic. Identify a function v such that $f(z) = u + iv$ is analytic. [CO-2] [L-2] 10

OR

Describe the concept of an analytic function? What is the necessary condition for an analytic function? Discuss the analyticity of the function $f = \sin z$ [CO-2] [L-2] 10

- Q.3 Solve the following complex integration using Cauchy's integral formula. [CO-3] [L-3] 10

$$\int \frac{4-3z}{z(z-1)(z-2)} dz \quad \text{where } C \text{ is the (i) circle } |z|=3/2 \quad \text{(ii) } |z|=3$$

OR

Apply Taylor's and Laurent series to expand functions $f(z) = \frac{1}{z^2 - 3z + 2}$ in the region given by $|z| < 1$ [CO-3] [L-3]

10

Q.4 Evaluate Laplace Transform of (i) $t e^t \cos ht$ (ii) $e^{2t} \cos t$ using properties of Laplace Transform. [CO-4] [L-4] **10**

OR

Calculate Inverse Laplace Transform of the following functions:

(i) $\frac{s}{(s^2+9)}$ (i) $\frac{2s-5}{9s^2-25}$ (ii) $\frac{s+4}{s(s-1)(s^2+4)}$ [CO- 4] [L-4] **10**

Q.5 Analyze and solve the following differential equation using Laplace Transform [CO-4] [L-4] **10**

$$y'' + 2y' + 5y = e^{-x} \sin x$$

$$y(0)=0, y'(0)=1$$

OR

Prove the time shifting property of Fourier Transform.

[CO-3] [L-3] **10**

Find the Fourier transform of the following functions:

- (i) Sine function
- (ii) Unit step function
- (iii) Gaussian function