Name: **Enrolment No:**	

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, May 2022

Course: **Mathematical Physics -III**
Semester: **IV**
Program: **50040095 B. Sc. (Hon.) Physics** **Time : 03 hrs.**
Course Code: 50048535 Mathematical Physics III **Max. Marks: 100**

Instructions:

SECTION A
(5Qx4M=20Marks)

S. No.		Marks	CO
	Attempt all Questions (Short answer type)		
Q.1	Draw the following curves in Z plane (Z is a complex variable) $a¿\|Z-3\|=5b¿Z=3+i$	**04**	**CO1**
Q.2	Draw simply and multiply connected regions	**04**	**CO1**
Q.3	A Fourier Series for a function f(x) is given as $f(x) = a_0/2 + \sum_{1}^{\square} a_n \cos(nx) + \sum_{1}^{\square} b_n \sin(nx)$ What should be the condition/conditions imposed on the above series/function f(x) so that we can perform term by term a) Integration and b) differentiation of the above equation.	**04**	**CO2**
Q.4	f(t) is a non-periodic function; write the expression for Fourier transform of f(t).	**04**	**CO3**
Q.5	Given L(s) is the Laplace Transform for a function f (t). Write the expression for the Laplace Transform of the function f (a.t); where 'a' is a constant.	**04**	**CO3**

SECTION B
(4Qx10M= 40 Marks)

	Attempt all questions. Please note that Q.9 has a choice.		
Q.6	Find the three roots of Equation $Z^3 = i$	**10**	**CO1**

Q.7	Given f (x) = |x| in the domain –a < x < a and f (x) = f (x+2a) a) Plot the function f (x) in the domain -2a < x <2a b) Is the function f (x) continuous in –a <x < a? c) Comment on differentiability of the function in the domain –a < x <a d) Is the function analytic in the domain –a < x < a.	**10**	**CO1**
Q.8	Expression for Fourier series expansion of a periodic function f (x) with periodicity 2a, is given below: $f(x) = a_0/2 + \sum_{1}^{\infty} a_n \cos(n\pi x/a) + \sum_{1}^{\infty} b_n \sin(n\pi x/a)$ a) Write the expressions for a_0, a_n and b_n b) Given f (t) = t; which of the term/terms a_0, a_n and b_n will be zero?	**10**	**CO2**
Q.9	**Attempt any one (Either I or II)** I. Find Laplace Transform of the function y(t), which satisfies the Ordinary Differential Equation: y'' – 10.y' +9.y = 5.t; where y' = dy(t)/dt. Etc. Initial Conditions: y(0) = -1 and y'(0) = 2 **OR** II. Find Fourier Transform (U (k, t)) of the function u(x, t), which satisfies the Partial Differential Equation: $u_{xx} = u_t$; where $u_{xx} = \frac{\partial^2 u(x,t)}{\partial x^2}$ and $u_t = \frac{\partial u}{\partial t}$ Given u (x,0) = δ (x), where δ (x) is the Dirac delta function.	**10** **10**	**CO4** **CO4**
SECTION-C (2Qx20M=40 Marks)			
	Attempt all questions. Please note that Q. 11 has a choice.		
Q.10	Use Laplace Transform to solve the following Ordinary Differential	**20**	**CO4**

	Equation: $2y'' + 3y' - 2y = t.\ e^{-2t}$; where $y' = dy(t)/dt$. Etc. and the Initial Conditions are $y(0) = 0$ and $y'(0) = -2$ NOTE: You may not evaluate the convolution function/functions		
Q.11	**Attempt any one (Either I or II):** I. Find the Fourier series for Saw Tooth Signal given by $f(x) = -x$ for $-\pi < x < 0$ $= \pi - x$ for $0 < x < \pi$ And, $f(x) = f(x+2\pi)$ **OR** II. Find the Fourier transform of the function $f(x) = \frac{1}{\sigma}$¿¿] Where, ν and σ are constants.	**20**	**CO2** **CO2**