B.SC. PHYSICS
FOURTH SEMESTER
MATHEMATICAL PHYSICS- III
BSP – 942 IDMn

SET
A

Duration: 1:30 hrs.

Full Marks: 35

(**Objective**)

Time: 15 mins.

Marks: 10

Choose the correct answer from the following:

$1\times10=10$

1. The Laplace transform of x^0 is

   a. $\dfrac{1}{s}$
   b. S

   c. 0
   d. $\dfrac{1}{s^2}$

2. The Laplace transform of e^{-2x}

   a. $\dfrac{1}{s}$
   b. $\dfrac{1}{s^2}$

   c. $\dfrac{1}{s-2}$
   d. $\dfrac{1}{s+2}$

3. The Laplace transform of $\cosh 2x$ will be

   a. $\dfrac{1}{s^2-2^2}$
   b. $\dfrac{s}{s^2+2^2}$

   c. $\dfrac{2}{s^2-2^2}$
   d. $\dfrac{s}{s^2-2^2}$

4. If $L[f(x)] = F(s)$ then $L[f(ax)]$ will be

   a. $\dfrac{1}{s}F\left(\dfrac{s}{a}\right)$
   b. $\dfrac{1}{a}F\left(\dfrac{s}{a}\right)$

   c. $F\left(\dfrac{s}{a}\right)$
   d. $F\left(\dfrac{s}{a}\right)$

5. A "periodic function" is given by a function which

   a. has a period $T = 2\pi$
   b. satisfies $f(t + T) = f(t)$

   c. satisfies $f(t + T) = -f(t)$
   d. has a period $T = \pi$

6. What are the conditions called which are required for a signal to fulfil to be represented as Fourier series?

   a. Dirichlet's conditions
   b. Gibbs phenomenon

   c. Fourier conditions
   d. Fourier Transformation

7. A function f(x) is called skew symmetric function if

    a. $f(-x) = -f(x)$ b. $f(-x) = f(x)$

    c. $f(-x) = -f(-x)$ d. $f(-x) = 0$

8. Conjugate of $(6 + 5i)^2$ is

    a. 60+11i   b. 11-60i

    c. 60-11i   d. 11+60i

9. If $(1 + i)(x + iy) = 2 + 4i$ then 5x is

    a. 10   b. 6

    c. 15   d. 4

10. $\dfrac{1 + i}{1 - i} = ?$

    a. i   b. 1

    c. 1+i   d. -i

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Time : 1 hr. 15 min.   Marks : 25

[Answer question no.1 & any two (2) from the rest]

1. If $L\{f(t)\} = F(s)$ then $L\{f(at)\} = \dfrac{1}{a}F(\dfrac{s}{a})$ 5

2.   a.   Find Laplace transform of $ax^2 + bx^3$ 3+3+4
     b.   Find $L[\sin at]$.   =10
     c.   State and prove the change of scale property of Laplace Transform.

3.   5+5=10
     a.   If $L\{f(t)\} = F(s)$ then $L\{f(at)\} = \dfrac{1}{a}F(\dfrac{s}{a})$

     b.   A machine completes its cycle of operations every time as certain pulley completes a revolution. The displacement $f(x)$ of a point on a certain portion of the machine is given in the table below for twelve positions of the pulley, x being the angle in degree turned through by the pulley. Find the first harmonic to represent $f(x)$ for all values of x

x	30⁰	60⁰	90⁰	120⁰	150⁰	180⁰	210⁰	240⁰	270⁰	300⁰	330⁰	360⁰
$f(x)$	7.976	8.026	7.204	5.674	3.674	1.764	0.552	0.262	0.904	2.492	4.736	6.824

5. **a.** Represent the following function by a Fourier series: $\qquad$ 5+5=10

$$f(t) = \begin{cases} t, & 0 < t \le \dfrac{\pi}{2} \\ \dfrac{\pi}{2}, & \dfrac{\pi}{2} < t \le \pi \end{cases}$$

b. Write the Fourier constant to evaluate the Harmonic analysis.

5. $\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad$ 5+5=10

a. If $x + iy = \dfrac{1}{a + ib}$ prove that $(x^2 + y^2)(a^2 + b^2) = 1$.

b. If $z = x + iy$, prove that $\dfrac{z}{\bar{z}} + \dfrac{\bar{z}}{z} = 2\dfrac{x^2 - y^2}{x^2 + y^2}$.

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