

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

**SET
A**

Duration: 1:30 hrs.

Full Marks: 35

Time: 15 mins.

[Objective]

Marks: 10

Choose the correct answer from the following:

1×10=10

- The Laplace transform of x^0 is
 - $\frac{1}{s}$
 - S
 - 0
 - $\frac{1}{s^2}$
- The Laplace transform of e^{-2x}
 - $\frac{1}{s}$
 - $\frac{1}{s^2}$
 - $\frac{1}{s-2}$
 - $\frac{1}{s+2}$
- The Laplace transform of $\cosh 2x$ will be
 - $\frac{1}{s^2-2^2}$
 - $\frac{s}{s^2+2^2}$
 - $\frac{2}{s^2-2^2}$
 - $\frac{s}{s^2-2^2}$
- If $L[f(x)] = F(s)$ then $L[f(ax)]$ will be
 - $\frac{1}{s}F\left(\frac{s}{a}\right)$
 - $\frac{1}{a}F\left(\frac{s}{a}\right)$
 - $F\left(\frac{s}{a}\right)$
 - $F\left(\frac{s}{a}\right)$
- A "periodic function" is given by a function which
 - has a period $T = 2\pi$
 - satisfies $f(t+T) = f(t)$
 - satisfies $f(t+T) = -f(t)$
 - has a period $T = \pi$
- What are the conditions called which are required for a signal to fulfil to be represented as Fourier series?
 - Dirichlet's conditions
 - Gibbs phenomenon
 - Fourier conditions
 - 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. $\frac{1+i}{1-i} = ?$
- a. i
 - b. 1
 - c. $1+i$
 - d. $-i$

(Descriptive)

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 $L\{f(at)\} = \frac{1}{a} F\left(\frac{s}{a}\right)$ 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. a. If $L\{f(t)\} = F(s)$ then $L\{f(at)\} = \frac{1}{a} F\left(\frac{s}{a}\right)$ 5+5=10
 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	30°	60°	90°	12°	15°	18°	21°	24°	27°	30°	33°	360°
$f(x)$	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:

5+5=10

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

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

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

5+5=10

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

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