2017

(6th Semester)

PHYSICS

NINTH PAPER

(Method of Mathematical Physics—II)

(Pre-revised)

Full Marks : 75

Time : 3 hours

(PART : B—DESCRIPTIVE)

(*Marks* : 50)

The figures in the margin indicate full marks for the questions

1. *(a)* Using the definition of -function, show that

$$\frac{1}{2} \quad \sqrt{} \qquad 6$$

(b) Find the value of

$$\frac{1}{n} \quad \frac{2}{n} \quad \ldots \quad \frac{n \quad 1}{n}$$

where n is an integer. 4

Or

(a) Show that

$$(m, n) \quad \frac{(m) \quad (n)}{(m \quad n)} \qquad 5$$

(b) Prove that

$$(m) \quad m \quad \frac{1}{2} \quad \frac{\sqrt{}}{2^{2m \quad 1}} \quad (2m) \qquad 5$$

2. *(a)* Obtain Fourier series for the function

$$f(x) \quad \begin{matrix} \sin x; & 0 \quad x \\ \sin x; & x \quad 2 \end{matrix} \qquad 7$$

(b) Find the inverse sine transform of $e^{\quad n}$. 3

Or

(a) Express the function $f(x) \quad x \sin x$ in the Fourier series in the interval x . Hence, show that

$$\frac{}{4} \quad \frac{1}{2} \quad \frac{1}{1 \ 3} \quad \frac{1}{3 \ 5} \quad \frac{1}{5 \ 7} \quad \ldots \qquad 6+1$$

(b) Find the finite cosine transforms of

$$f(x) \quad \frac{}{3} \quad x \quad \frac{x^2}{2}$$

in the interval (0,). 3

3. *(a)* Find the Laplace transform of

$$f(t) \quad t^2 e^t \sin 4t$$

4

(b) Obtain the Laplace transform for half-wave rectifier wave function

$$F(t) \quad \begin{array}{ll} \sin t; & 0 \quad t \quad - \\ 0 \; ; & - \quad t \quad \frac{2}{} \end{array}$$

with period $T \quad \frac{2}{}$. 6

Or

(a) Find the inverse Laplace transform of

$$\frac{s^2 \quad 2s \quad 3}{s(s \quad 3)(s \quad 2)}$$

3

(b) Find Laplace transform of

$$f(t) \quad \begin{array}{ll} a \text{ for } 0 \quad t \quad \frac{T}{2} \\ 0 \text{ for } \frac{T}{2} \quad t \quad T \end{array}$$

and $f(t \quad T) \quad f(t)$. 2

(c) Using Laplace transform, evaluate the integral

$$_0 \cos x^2 \, dx$$

5

4. *(a)* What do you mean by symmetry elements and symmetry operations? 2

(b) Show that the H_2O molecule belongs to the point group C_{2v}. 8

Or

(a) Show that NH_3 molecule belongs to the point group C_{3v}. 5

(b) What do you mean by representation of groups? Explain the representation of the group C_{2v}. Hence obtain the group multiplication table. 2+2+1

5. *(a)* What do you mean by DO loop? Explain the rules for writing DO loop. 1+5

(b) Write a FORTRAN program to find the mean of two numbers. 2

(c) Find the value of the expression $(A**2*2 \quad I/3 \quad 13)*J$, if $A \quad 3 \quad 0$, $B \quad 5 \quad 0$, $I \quad 8$ and $J \quad 3$. 2

Or

(a) Write a FORTRAN program to read x and n and evaluate the sum of the series $1 \quad x \quad x^2 \quad \ldots \quad x^n$. 5

(b) Write a FORTRAN program to determine the magnitude of a vector. 3

(c) Given that $A \quad 123 \quad 78$, $B \quad 84 \quad 10^{23}$, $C \quad 18 \quad 10^{35}$, $I \quad 857$, $J \quad 95$, $K \quad 1$. Write the appropriate READ statements with FORMAT statements to read A, B, C, I, J and K. 2

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Subject Code : PHY/VI/09 (PR)

Booklet No. A

Date Stamp .....

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To be filled in by the Candidate

DEGREE 6th Semester
(Arts / Science / Commerce / .....) Exam., **2017**

Subject .....

Paper .....

INSTRUCTIONS TO CANDIDATES

1. **The Booklet No. of this script should be quoted in the answer script meant for descriptive type questions and vice versa.**
2. **This paper should be ANSWERED FIRST and submitted within 1 (one) Hour of the commencement of the Examination.**
3. **While answering the questions of this booklet, any cutting, erasing, over-writing or furnishing more than one answer is prohibited. Any rough work, if required, should be done only on the main Answer Book. Instructions given in each question should be followed for answering that question only.**

To be filled in by the Candidate

DEGREE 6th Semester
(Arts / Science / Commerce / .....) Exam., **2017**

Roll No. .....

Regn. No. .....

Subject .....

Paper .....

Descriptive Type

Booklet No. B .....

Signature of Scrutiniser(s)

Signature of Examiner(s)

Signature of Invigilator(s)

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(6th Semester)

PHYSICS

NINTH PAPER

(Method of Mathematical Physics—II)

(Pre-revised)

(PART : A—OBJECTIVE)

(*Marks* : 25)

The figures in the margin indicate full marks for the questions

SECTION—I

(*Marks* : 10)

Tick (✓) the correct answer in the brackets provided : 1×10=10

1. The value of $\int_0^\infty e^{-t^2} dt$ is

(a) $\sqrt{\pi}$ ( )

(b) 1 ( )

(c) $\frac{\sqrt{\pi}}{2}$ ( )

(d) 0 ( )

2. The value of $\Gamma(0)$ is

(a) 1 ( )

(b) 0 ( )

(c) ∞ ( )

(d) n ( )

3. The value of $f(x)\delta(x-a)$ is

(a) 0 ( )

(b) a ( )

(c) $f(x)$ ( )

(d) $f(a)\delta(x-a)$ ( )

4. The Fourier transform of $\frac{df}{dt}$ i.e., F.T. $\left[\frac{df}{dt}\right]$ is

(a) $\frac{\omega}{\sqrt{2\pi}}\int_{-\infty}^{\infty}\frac{df}{dt}e^{-i\omega t}dt$ ( )

(b) $\sqrt{\frac{\omega}{2\pi}}\int_{-\infty}^{\infty}\frac{df}{dt}e^{i\omega t}dt$ ( )

(c) $\frac{i\omega}{\sqrt{2\pi}}\int_{-\infty}^{\infty}\frac{df}{dt}e^{-i\omega t}dt$ ( )

(d) $\frac{1}{i\omega\sqrt{2\pi}}\int_{-\infty}^{\infty}\frac{df}{dt}e^{i\omega t}dt$ ( )

5. Laplace transform of $\sqrt{t}$ is

(a) $\frac{1}{2s}\sqrt{\frac{s}{\pi}}$ ( )

(b) $\frac{s}{2}\sqrt{\frac{\pi}{s}}$ ( )

(c) $\frac{s}{2}\sqrt{\frac{s}{\pi}}$ ( )

(d) $\frac{1}{2s}\sqrt{\frac{\pi}{s}}$ ( )

6. Inverse Laplace transform of $\frac{1}{s^2 + a^2}$ is

(a) $\sin at$ ( )

(b) $\sinh at$ ( )

(c) $\cos at$ ( )

(d) $\cosh at$ ( )

7. The classes of D_3 group are

(a) (*E*), (*AB*) and (*CDF*) ( )

(b) (*EA*), (*BC*) and (*DF*) ( )

(c) (*E*), (*ABC*) and (*DF*) ( )

(d) (*EAB*), (*CD*) and (*F*) ( )

8. If $l_1, l_2, \ldots$ are the dimensions of an irreducible representation of a finite group of order n, then $l_1^2 + l_2^2 + \ldots + l_n^2$ is equal to

(a) n ( )

(b) $\sqrt{n}$ ( )

(c) n^2 ( )

(d) $\frac{n(n+1)}{2}$ ( )

9. The final value of K in the DO statement DO 20 $K = 1, 10, 3$ is

(a) 1 ( )

(b) 10 ( )

(c) 3 ( )

(d) 20 ( )

10. If $I = 3$, $J = 8$ and $K = 4$, then the value of A in the following statement

$$A = 3 * J / I * K - 4 / J$$

is

(a) $\frac{1}{2}$ ( )

(b) $\frac{3}{2}$ ( )

(c) 1 ( )

(d) 0 ( )

SECTION—II

(*Marks* : 15)

Answer the following questions : 3×5=15

1. Prove that

$$\int_0^{\pi/2} \sqrt{\tan\theta}\, d\theta = \frac{\Gamma(\frac{1}{4})\Gamma(\frac{3}{4})}{2}$$

2. Find the Fourier sine transform of $f(x) = x$ such that $0 < x < 2$.

3. If $f(s)$ is the Laplace transform of $F(t)$, then show that

$$f'(s) = \frac{df}{ds} = \mathscr{L}[-tF(t)]$$

4. Show that the group formed by the set $\{1, \omega, \omega^2\}$, ω being the cube root of unity i.e., $\omega^3 = 1$, is a cyclic group of order 3 with respect to multiplication.

5. Suppose $A = 2 \cdot 5$, $B = 3 \cdot 5$, $J = 5$ and $K = 10$. What will be the value of J after the following program segment is executed :

```
      IF (2*K.LE.3*J) GO TO 50
      J = J + 1
      GO TO 60
50    J = K
60    J = J + K
```

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