



S-2606

M. Sc. (Physics) (Sem. I) Examination

March / April – 2011

PH-411 : Mathematical Methods in Physics

Time : 3 Hours]

[Total Marks : 70

Instructions :

(1)

नीचे दशांशों के निशानों की विंगतों उत्तरवही पर अवश्य कभवी. Fillup strictly the details of signs on your answer book.	Seat No. :
Name of the Examination :	<input type="text"/>
← M. SC. (PHYSICS) (SEM. 1)	<input type="text"/>
Name of the Subject :	<input type="text"/>
← PH-411 - MATHEMATICAL METHODS IN PHYSICS	<input type="text"/>
← Subject Code No. : <input type="text"/> 2 <input type="text"/> 6 <input type="text"/> 0 <input type="text"/> 6 ← Section No. (1, 2,.....) : <input type="text"/> NIL	<input type="text"/>
	Student's Signature

- (2) Symbols used have their usual meanings.
(3) Figures to the right indicate full marks.

1 Attempt any two questions :

- (a) Discuss the WKB method for approximate solution of 7
second order differential equation. Also derive the WKB
function and expressions to estimate the error.
- (b) (1) What is an exact differential equation ? State 4
necessary and sufficient condition for an exact
differential equation. check whether the given
differential equation is exact or not.
 $(x + y)dx + xdy = 0$
- (2) Solve : $xy' + (1 + x)y = e^x$ 3
- (c) (1) Define : Group and Subgroup. If $a = [4 \ 6 \ 1 \ 3 \ 5 \ 2]$ 4
and $g = [3 \ 5 \ 1 \ 4 \ 6 \ 2]$, calculate $b = g^{-1}ag$.
- (2) Obtain the general solution of $y'' - 2y' + y = 2x$. 3

- 2** Attempt any two questions :
- (a) Discuss Laplace transform and Laplace inverse integral. Find the Laplace transform of x^n and $\sin \lambda x$. **7**
- (b) (1) Prove that Fourier Transform of the Gaussian is another Gaussian. **4**
- (2) Find the Laplace transform of a function $f(x) = 1$. **4**
- (c) (1) Prove that $\mathcal{L}[f''(x)] = s^2 \mathcal{L}[f(x)] - sf(0) - f'(0)$. **4**
- (2) If $F(s) = \frac{n!}{s^{n+1}}$, find $f(x)$. **3**
- 3** Attempt any two questions :
- (a) What are Legendre polynomials ? Derive Rodrigues' formula for the Legendre polynomials. Find $P_n(x)$ for $n = 3, 4$ and 5 . **7**
- (b) (1) Discuss the orthogonality and normalization properties of the Legendre polynomials. **4**
- (2) Find the Bessel functions $J_{1/2}(x)$ and $J_{-1/2}(x)$. **3**
- (c) (1) Define Bessel function $J_m(x)$. Prove that **4**
- $$J_{m-1}(x) + J_{m+1}(x) = (2m/x)J_m(x).$$
- (2) Explain Kummer function. **3**

4 Answer any two questions :

(a) Discuss the method of separation of variables for solving a partial differential equation. 7

(b) (1) Discuss the different boundary conditions for partial differential equation. 4

(2) Find the residues of $\frac{z}{(z-a)(z-b)}$ at infinity. 3

(c) Find $\int_0^{\infty} \frac{1}{1+x^2} dx$ and $\int_0^{\infty} \frac{\sqrt{x}}{1+x^2} dx$ using Residues method. 7

5 Attempt any two questions :

(a) Derive the Newton's formula for forward interpolation. 7

(b) (1) Find approximate root, up to three significant places, of the equation. $x^3 - 5x^2 + 6x - 1 = 0$, at the point $x = 1$ using Newton-Raphson method. 4

(2) Explain Binomial Distribution. 3

(c) (1) Using Lagrange's interpolation formula, find the form of function $f(x)$ from the following data : 4

x	3	2	1	-1
$f(x)$	3	12	15	-21

(2) Explain the Regula falsi method to find out the roots of the equation. 3
