Roll No. | | | | | | | | | | | | | **Total No. of Pages : 03**

Total No. of Questions : 09

B.Sc. (Hons.) (Physics) (Sem.–3)

Mathematical Physics-I

Subject Code : BSHP-211-21

M.Code : 92454

Date of Examination : 12-12-22

Time : 3 Hrs. **Max. Marks : 100**

INSTRUCTIONS TO CANDIDATES :

1. **SECTION-A is COMPULSORY consisting of TEN questions carrying THREE marks each.**
2. **SECTION - B & C. have FOUR questions each.**
3. **Attempt any FIVE questions from SECTION B & C carrying FOURTEEN marks each.**
4. **Select atleast TWO questions from SECTION - B & C.**

SECTION-A

1. Write briefly :

a) State Mean value theorem.

b) An approximate value of π is given by 3.14278152 and its true value is 3.14159265. Find the absolute and relative error in the value of π.

c) Use Descarte's rule of sign to show that the equation $x^{10} - 4x^8 + x^4 - 2x - 3 = 0$ has atleast 4 unreal roots.

d) Use the Horner's method to find the quotient and remainder when $f(x) = x^5 - 4x^4 - 7x^3 + 11x - 14$ is divided by $x - 5$.

e) Prove that $\beta(m, n) = \dfrac{\Gamma(m)\Gamma(n)}{\Gamma(m+n)}$.

f) Show that $\Gamma(1/2) = \sqrt{\pi}$.

g) Find all the values of z which satisfies $e^z = 1 + \iota$.

h) Separate the real and imaginary part of $\dfrac{1}{1+\iota\omega RC}$.

i) State normal equations to fit a second degree polynomial $a + bx + cx^2$.

j) Evaluate the integral $\int_0^1 \frac{dx}{\sqrt{1-x^4}}$ using beta function.

SECTION-B

2. a) Find the condition that the cubic equation $x^3 - lx^2 + mx - n = 0$ should has roots in geometric progression form.

   b) Find the equation whose roots are the roots of equation $f(x) = x^4 + x^3 - 3x^2 - x + 2 = 0$ each diminished by 3.

3. a) Derive the Newton-Raphson formula to find a square root of a given number C and hence find $\sqrt{10}$.

   b) Determine the root of the equation $x^3 - 3x - 5 = 0$ between $x = 2$ and $x = 3$ using bisection method.

4. If $\cosh x = \sec \theta$, prove that

   a) $\tanh^2 x/2 = \tan^2 \theta/2$

   b) $x = \log_e \tan\left(\frac{\pi}{4} + \frac{\theta}{2}\right)$.

5. a) Derive necessary condition for a function to be analytical.

   b) Show that the function $z^2 = (x^2 + y^2) + \iota 2xy$ satisfies the Cauchy-Riemann equations.

SECTION-C

6. a) Using the Gauss elimination method, solve the following set of equations :

   $x + 2y + 3z - u = 10$; $2x + 3y - 3z - u = 1$; $2x - y + 2z + 3u = 7$; $3x + 2y - 4z + 3u = 2$.

   b) Solve the following set of equation by using Jacobi's iteration method,

   $20x + y - 2z = 17$; $3x + 20y - z = -18$; $2x - 3y + 20z = 5$.

7. a) Find the least square fit of the following form $y = A + B + Cx^2$ to the following data:

x	0	1	2	3	4
y	1	1.8	1.3	2	6.3

b) Convert the following equation to their linear form :

i) $y = ax + bx^3$ ii) $y = \dfrac{b}{x(x-a)}$

8. a) Find the value of integral $\int_0^{\pi} \sqrt{\tan x}\, dx$.

b) Express the beta function in trigonometric functions form.

9. a) Evaluate the integral $\int_0^1 t^4(1-t)^3\, dt$. (4)

b) Show that $\delta(kx) = \dfrac{1}{|k|}\delta(x)$, where k is a non zero number. (5)

c) Show that $x\dfrac{d}{dx}(\delta(x)) = -\delta(x)$. (5)

NOTE : Disclosure of Identity by writing Mobile No. or Marking of passing request on any paper of Answer Sheet will lead to UMC against the Student.