Reg. No.

DEPARTMENT OF SCIENCES, I SEMESTER M.Sc (PHYSICS)
END SEMESTER EXAMINATIONS, November 2017
PHY4101 - Mathematical Methods of Physics
(REVISED CREDIT SYSTEM-2017)

Time: 3 Hours   November 2017   MAX. MARKS: 50

Note: (i) Answer all **FIVE FULL** questions
       (ii) Draw diagrams, and write equations wherever necessary

1(a)	Express velocity and acceleration of a particle in cylindrical coordinate system	**3 Marks**
1(b)	Obtain Laurent's expansion for $f(z) = 1/(z^2 - z - 6)$ around $z_0 = 0$ which is valid in the region $2 < |z| < 3$	**3 Marks**
1(c)	Prove that, for Legendre polynomial $P_n(x)$, $$nP_n(x) = x(dP_n(x)/dx) - (dP_{n-1}(x)/dx)$$	**4 Marks**
2(a)	Evaluate the following integral using residues $$\int_{-\infty}^{\infty} \frac{\sin x}{x}\, dx$$	**2 Marks**
2(b)	Show that heat conduction equation for a circular metal disk reduces to Bessel differential equation	**4 Marks**
2(c)	Find Eigen vectors and Eigen values of the following $$A = \begin{bmatrix} 2 & 0 & 1 \\ 0 & 2 & 0 \\ 1 & 0 & 2 \end{bmatrix}$$	**4 Marks**
3(a)	Use Cramer's rule and solve the following system of equations $$x + 5y + 3z = 1 \qquad 3x + y + 2z = 1 \qquad x + 2y + z = 0$$	**4 Marks**
3(b)	A coordinate system (u, v, w) is related to (x, y, z) system by following equations. Find the metric tensor for (u, v, w) system $$x = vw, \quad y = uw, \quad z = uv$$	**4 Marks**
3(c)	Show that velocity is a contravariant tensor	**2 Marks**
4(a)	Expand $f(x) = x^2$ using Fourier series in the interval $0 \leq x \leq 2$	**5 Marks**
4(b)	Obtain complex representation of Fourier series	**5 Marks**
5(a)	If A_i and B_j^i are two tensors, write down all the components of their inner product in (x, y, z) system	**2 Marks**
5(b)	Obtain multiplication table of C_{3v} group	**4 Marks**
5(c)	Obtain an isomorphic representation for C_{3v} group	**4 Marks**

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