MADURAI KAMARAJ UNIVERSITY
University with Potential for Excellence
Re Accredited by NAAC with "A++" Grade in the 4^{rd} Cycle
DIRECTORATE OF DISTANCE EDUCATION
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Mathematical Physics Assignment – PPHYC01

1. (a) State and Prove Gauss's Divergence Theorem in Vector analysis.
   (b) Prove the following vector identities :
   $$\nabla.(A\times B) = B.(\nabla\times A) - A.(\nabla\times B)$$
   Curl Curl A = grad div A - $\nabla^2 A$

2. (a) State and Prove Stoke's Theorem in Vector analysis.
   (b) Obtain an expression for the Curl, grad, div and Laplacian in cylindrical polar co-ordinates

3. (a) Define "adjoint" and "inverse" of a matrix. Also find the "adjoint" and "inverse" of the following matrix. $\begin{pmatrix} 2 & 3 & 1 \\ 1 & 2 & 2 \\ 3 & 1 & 2 \end{pmatrix}$
   (b) Illustrate Cayley-Hamilton theorem using the matrix $\begin{pmatrix} 1 & 2 & 0 \\ 2 & -1 & 0 \\ 0 & 0 & 1 \end{pmatrix}$

4. (a) Diagonalize the following matrix $\begin{pmatrix} 1 & 2 \\ 2 & 1 \end{pmatrix}$
   (b) Find the eigen-values and eigen-vectors of the matrix $\begin{pmatrix} 1 & 1 & 1 \\ 1 & 2 & 3 \\ 1 & 3 & 6 \end{pmatrix}$

5. (a) Derive an expression for Fourier coefficients a_o, a_n and b_n.
   (b) Find the Fourier Series representation of $f(x) = x \ (-\pi \text{ to } +\pi)$.

6. (a) What is meant by Fourier Transform? Find the Fourier Transform of the function $f(x) = \{^4_0 \ \ |x| \le 5, \ |x| \ge 5$
   (b) Explain Fourier sine and cosine transform of derivatives.

7. (a) Define Gamma and beta functions. Give its relation.
   (b) Deduction using the following generating function for $Pn(x)$
   (i) $P_n(1) = 1$ and (ii) $P_n(-1) = (-1)^n$

8. (a) Explain Rodrigue's formula for Legendre polynomials.
   (b) Find the value of (i) $J_{1/2}(x)$ and (ii) $J_{-1/2}(x)$

9. (a) Discuss Green's function.
   (b) Explain about heat equation, Laplace equation and Poisson equations in Partial differential equation.

10. (a) Solve Laplace equation in Cartesian coordinates.
    (b) Derive Poisson equations using Green's function.

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Assignment – Classical Mechanics – PPHYC02

1. Derive the Lagrangian equation of motion
2. Write the following application of Lagrangian equation

    i) moving of one single particle: using Cartesian coordinates

    ii) Atwood's Machine
3. State and explain Hamilton's principle
4. Derive the expression of Legrangian equation from Hamilton's principle
5. Derive the Hamiltonian equation of motion
6. Explain the principle of least action
7. State and prove the Liouville's theorem.
8. Explain the equation of Canonical Transformations
9. Write the short notes Hamilton –Jacobi equation for Hamilton's characteristic's function
10. Describe the Lagrange and Poisson bracket

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Assignment – ELELCTRONICS – PPHYC02

1. Common emitter circuits and it's configurations

   or

   Thevenin's Theorem and its application

2. MOSFET – Preparation and it characterizations

   or

   FET – amplifier - Common Sources Emitter and Collector of significance

3. Working principles operation Amplifier – Inverting, Non - inverting Addition and Subtractors

   or

   OPAMP – Low pass, High Pass and Band rejection with circuits

4. Boolean Laws and Theorem with example (each 3)

   or

   Karnaugh maps – 3 and 4 variables with two examples

5. RS - Clocked flip lop working principles

   or

   3- and 5-bits counter and 10-digit decade counter