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UG/5th Sem/Phys(H)/P/19

2019

B.Sc. (Honours)

5th Semester Examination

PHYSICS

Paper - DSE-1P

Full Marks : 20

Time : 3 Hours

*The figures in the margin indicate full marks.  
Candidates are required to give their answers  
in their own words as far as practicable.*

[ADVANCED MATHEMATICAL

PHYSICS – LAB I]

Answer any *one* question from the following.

15×1=15

1. Write a program in SCILAB/MATLAB to multiply any two  $3 \times 3$  matrices.

[ Turn Over ]

( 2 )

2. Write a program in SCILAB/MATLAB to find eigenvalue and eigen vectors of

$$\begin{pmatrix} 2 & 1 & 1 \\ 1 & 3 & 2 \\ 3 & 1 & 4 \end{pmatrix}$$

3. Write a program in SCILAB/MATLAB to find eigenvalue and eigen vectors of the matrix.

$$\begin{pmatrix} 2 & -i & 2i \\ +i & 4 & 3 \\ -2i & 3 & 5 \end{pmatrix}$$

4. Write a program in SCILAB/MATLAB to determine the principal axes of moment of inertia through diagonalization.
5. Write a program in SCILAB/MATLAB to study geodesics in Euclidean space.
6. Write a program in SCILAB/MATLAB for the orthogonal polynomials as eigen functions of Hermitian differential operators.
7. Write a program in SCILAB/MATLAB to estimate the ground state energy and wave function of any quantum system.

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8. Write a program in SCILAB/MATLAB for Lagrangian formulation in classical mechanics with constraints.

**Distribution of Marks**

Experiment	:	15 Marks
Laboratory Note Book	:	2 Marks
Viva-voce	:	3 Marks
Total	:	20 Marks

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**[APPLIED DYNAMICS LAB]**

Answer any *one* question from the following.

15×1=15

1. Determine the coupling coefficient of coupled pendulums.
- (a) Theory
  - (b) Working Formula
  - (c) Determination of length and the spring constant.

[ Turn Over ]

( 4 )

- (d) Calculation of  $\omega_a$  and  $\omega_b$
  - (e) Determine the frequency of oscillation for both pendulums.
  - (f) Compare the frequencies observed in the parallel and anti-parallel cases with those
  - (g) Calculation of beating case
  - (h) Determine the beat frequency and carrier frequencies.
  - (i) Discussion
2. Determination of coupling coefficient of coupled oscillators.
- (a) Theory
  - (b) Working Formula
  - (c) Circuit diagram
  - (d) Calculation of normal modes, coupling strength, energy transfer
  - (e) Graph for normal modes, coupling strength, energy transfer
  - (f) Discussion
  - (g) Error calculation

3. Determination of coupling and damping coefficient of damped coupled oscillator.
  - (a) Theory
  - (b) Working Formula
  - (c) Calculation of resonance, coupling coefficient, damping coefficient
  - (d) Discussion
  - (e) Error calculation
  
4. Calculation of population models e.g. exponential growth and decay, logistic growth, species competition, predator-prey dynamics, simple genetic circuits.
  - (a) Theory
  - (b) Working Formula
  - (c) Verification of exponential growth and decay, logistic growth, species competition, predator-prey dynamics, simple genetic circuits
  - (d) Draw the curves
  - (e) Discussion
  - (f) Error calculation

*[ Turn Over ]*

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5. Compute the computational visualization of trajectories in the Sinai Billiard.
6. Compute the computational visualization of trajectories Electron motion in mesoscopic conductors as a chaotic billiard problem.
7. Compute the computational visualization of fractal formations of Deterministic fractal.
8. Compute the computational visualization of fractal formations of self-similar fractal.
9. Compute the computational visualization of fractal formations of Fractals in nature-trees, coastlines, earthquakes.
10. Compute the computational Flow visualization-streamlines, Pathlines, Streaklines.

[LNB : 2 Viva-voce : 3]

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[ATMOSPHERIC PHYSICS LAB]

Answer any *one* question from the following.

15×1=15

(C++ based simulations experiments)

1. Compute Numerical Simulation for atmospheric gravity waves (AGW) using dispersion relations.
2. Compute Numerical Simulation for Kelvin waves using dispersion relations.
3. Compute Numerical Simulation for Rossby waves, and mountain waves using dispersion relations.
4. Process Offline and online data of any one radars.
  - (a) VHF radar.
  - (b) X-band radar, and
  - (c) UHF radar
  - (d) Offline and online processing of LIDAR data
6. Processing of Radiosonde data and its interpretation in terms of atmospheric parameters using vertical profiles in different regions of the globe.

[ Turn Over ]

( 8 )

7. Plotting of different atmospheric parameters from Satellite data using radio occultation technique. (Parameter will be chosen by examiner).
8. Time series analysis of temperature using long term data over metropolitan cities in India.

Practical : 15 Marks

Lab : 2 Marks

Viva-Voce : 3 Marks

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