B.Sc (Hons) PHYSICS

SEMESTER-6, SECTION-B

ADVANCED MATHEMATICAL PHYSICS-II

SUBMITTED BY: SEEMA TRAMA

The following are the REFERENCES for the 'CALCULUS OF VARIATIONS AND CLASSICAL DYNAMICS' section of the syllabus

H.Goldstein :Classical Mechanics**(HG)**

K. C. Gupta :Classical Mechanics of Particles and Rigid Bodies.**(KCG)**

Rana and Joag :Classical Mechanics**(RJ)**

Gupta and Kumar :Classical Mechanics **(GK)**

Patrick Hamill :A Student's Guide to Lagrangians and Hamiltonians**(PH)**

READING ASSIGNMENT FOR WEEK-2:

PH: Chapter-4(pg93-100)Chapter-5(109-110,117-120)

4.1(Legendre Transformations)

4.2(Application to the Lagrangian-The Hamiltonian)

4.3(Hamilton's Canonical Equations)

5.3(Poisson Brackets)

5.4(Rules for manipulating Poisson Brackets)

5.4.4(Angular Momentum (and Poisson Brackets))

NOTE : THE SYLLABUS SPECIFIC TOPICS ARE MENTIONED ABOVE. HOWEVER, IT WOULD BE IN YOUR BEST INTEREST TO READ THE WHOLE OF CHAPTER OF THE READING PH.

LEARNING OBJECTIVES

After going through the above concepts you will be able to answer the following questions:

1) Write down the definition of the Hamiltonian . Under what conditions is it equal to the total energy of the system.
2) After going through the reading you would be able to attempt part c) in the set 1 of problems given to you in the file "study _material_1".
3) Using the concept of Legendre Transformation write down the expression of the Hamiltonian $H(q_i, \dot{q}_i, t)$ from the Lagrangian $L(q_i, p_i, t)$.
   Then using the definition of canonical momenta and its time derivative and the above expression derive the Hamilton's Canonical Equations of Motion.
4) What are Poisson Brackets(define).What are the properties of Poisson Brackets.
5) What are Lagrange Brackets. Is there any relation between Poisson Brackets and Lagrange Brackets . If so , state it.
6) Using the following definition of the Poisson Bracket ,

[u,v] = $\sum_{1}^{n} \frac{\partial u}{\partial q_i}\frac{\partial v}{\partial p_i} - \frac{\partial u}{\partial p_i}\frac{\partial v}{\partial q_i}$

prove the following properties of Poisson Brackets:

6.1) $[q_i , q_i] = 0$

6.2) $[p_i , p_i] = 0$

6.3) $[q_i , p_i] = 1$

6.4) $[u , v] = - [v , u]$

6.5) $[au + bv , w] = a[u , w] + b[v , w]$

6.6) $[uv , w] = [u, w] v + u [v ,w]$

6.7) $[u , [v , w]] + [v , [w , u]] + [w , [u , v]] = 0$ (Jacobi Identity)

6.8) $[L_i , L_j] = \epsilon_{ijk} L_k$ OR $[L_x , L_y] = L_z$; $[L_y , L_z] = L_x$; $[L_z , L_x] = L_y$

6.9) $[p_z , L_y] = p_y$