AvinashilingamInstituteforHomeScienceandHigherEducationforWomen

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Continuous Internal Assessment Test II - October 2024

Semester III

Class: II PG **Time : 2 Hrs**

Major: Mathematics **Max. Marks: 60**

23MMAC17 – Advanced Mechanics

Course Outcomes:

CO1: Identify the static and dynamic characteristics of mechanical systems.

CO2: Analyze different systems in integrals of motion.

CO3: Apply Lagrange's and Hamilton's equations in relevant fields.

CO4: Utilize Hamilton-Jacobi Method in physical science.

CO5: Explore the theory of canonical transformations and its application to dynamical theory.

Part – A

Circle the correct answer **6 x 1 = 6**

1. The Hamilton principle is valid for _____ CO3 K1

   a. holonomic system only b. both holomonic and non-holomonic system

   c. non-holonomic system only d. orthogonal system

2. The modified Hamilton- Jacobi equation is CO4 K2

   a. $H\left(q,\frac{\partial W}{\partial q}\right)=\alpha_n$ b. $H(q,p)=\alpha_n$

   c. $H\left(q,\frac{\partial W}{\partial q}\right)=0$ d. $H\left(q,\frac{\partial W}{\partial p}\right)=\alpha_n$

3. The difference of two Pfaffian differential forms is equal to CO4 K2

   a.0 b. an exact differential form

   c. a constant d. Hamilton form

4. Liouville's conditions are sufficient for the separability of a/anCO4 K2

   a. non- holonomic system b.holonomic system

   c.scleronomic system d. orthogonal system

5. The generating function $F_2(q,p,t)=$ CO5 K1

   a. $F_1(q,p,t)+\sum_{i=1}^{n}Q_iP_i$ b. $F_1(q,Q,t)+\sum_{i=1}^{n}Q_iP_i$

   c. $F_1(q,p,t)-\sum_{i=1}^{n}Q_iP_i$ d. $F_1(q,Q,t)-\sum_{i=1}^{n}Q_iP_i$

6. The bilinear covariant for canonical transformation is CO5 K3

   a. $\delta P\,dQ+dP\,\delta Q=\delta p\,dq-dp\,\delta q$ b. $\delta P\,dQ-dP\,\delta Q=\delta p\,dq-dp\,\delta q$

   c. $\delta P\,dQ+dP\,\delta Q=\delta p\,dq+dp\,\delta q$ d. $\delta P\,dQ-dP\,\delta Q=\delta p\,dq+dp\,\delta q$

Part – B

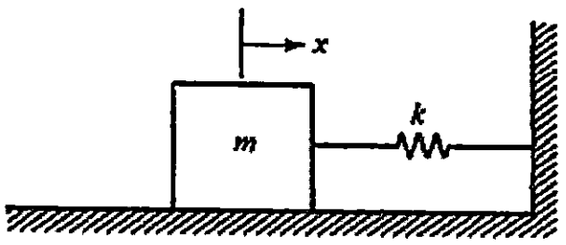
Answer all questions3 x 6 = 18

7.aState and derive Hamilton's principle.

CO3K4

(or)

7. b.Given a mass-spring system consisting of a mass m and a linear spring of stiffness k, as shown in the figure. CO3 K4



Find the equations of motion using the Hamiltonian procedure. Assume that the displacement x is measured from the unstressed position of the spring.

8. a.Show that the Hamilton's principal function is the generating function of the canonical transformation. CO4K4

(or)

8. b. State and prove Jacobi's theorem. CO4 K4

9. a.State and prove Stakel's theorem. CO4 K3

(or)

9. b.Derive the relationship between Lagrange and Poisson brackets.CO5 K4

Part – C

Answer all question 3 x 12 = 36

10. a.Obtain Hamilton equation from Lagrange's equation using Legendre's transformation. CO3 K5

(or)

10. b. State and prove the principle of least action for classical dynamic systems. CO3 K5

11.a. Derive the principal forms of generating functions. CO4 K5

(or)

11. b.Obtain the four major types of generating functions associated with the transformation $Q = log\left(\frac{\sin P}{q}\right)$ and $P = q\cot p$. CO4 K4

12. a. State and prove Poisson theorem and also show that Lagrange's and Poisson brackets are reciprocal quantities. CO5 K4

(or)

12. b.Briefly explain about bilinear covariant. CO5 K4

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