U.G. 5th Semester Examination-2020

PHYSICS

[HONOURS]

Discipline Specific Elective (DSE)

Course Code : PHY-H-DSE-T-01

(Advanced Mathematical Physics-II)

Full Marks : 60 Time : $2\frac{1}{2}$ Hours

The figures in the right-hand margin indicate marks.

Candidates are required to give their answers in their own words as far as practicable.

1. Answer any **five** questions : 2×5=10

a) State and explain Hamilton's principle.

b) What is generalized force? Write down the expression for generalized force.

c) Show that Poisson bracket of two constants of motion is a constant of motion.

d) What is the probability of an impossible event? What do you mean by mutually exclusive events?

e) Define the order of an element of a group.

f) Give an example of a quasi group but which is not a semi group.

g) If the function f : $f : R \to R$ be defined as $f(x) = x^2 + 1$, find the value of $f^{-1}(8)$.

h) What is meant by variance of a continuous function?

2. Answer any **four** questions: 5×4=20

a) Use Hamilton's principle to find the equation of motion of one dimensional harmonic oscillator.

b) What do you mean by canonical transformation? Show that the transformation

Q = q tan p and P = log(sin p) is canonical. 2+3

c) Show that the expectation of the product of two independent random variables is the product of their expectations. 5

d) Three coins are tossed. Find the probabilities of

(i) 2 heads; (ii) at least one head; and (iii) more than one head. 1+2+2

e) Show that the set {1, –1, I, –I} forms a cyclic group under multiplication. Find its generator. 3+2

f) Explain homomorphism of group with a suitable example. 5

g) State and proof Bayes' theorem. 5

3. Answer any **three** questions: 10×3=30

a) i) Using principle of variation show that the geodesics of a spherical surface are great circle.

ii) Derive Euler-Lagrange's equation of motion using the method of calculus of variations. 5+5

b) Define Euler's angles and find the complete transformation matrix. Discuss the force free motion of a symmetrical top. 5+5

c) i) Describe the different types of binary operations. Is square root a binary operation? Explain your answer.

ii) Let (G, *) be a group in which the square of every element is the identity. Show that G is abelian. (5+2)+3

d) i) Write down the expression for Poisson distribution. Find the mean and variance of Poisson distribution.

ii) Show that Poisson distribution may be obtained as a limiting case of binomial distribution under the following conditions:

1. the number of trials (n) is infinitely large,

2. the probability of success (p) is extremely small, and

3. The mean (np) is finite.

(1+2+3)+4

e) i) What do you mean by Normal distribution or Gaussian distribution? State some important properties of normal distribution.

ii) In a normal distribution, 10% of the items are under 40 and 15% are over 60. Find mean and standard deviation. (2+3)+5

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