

Compute

- (i) $E(X)$
 (ii) $E(2X \pm 3)$
 (iii) $E(4X + 5)$
 (iv) $E(X^2)$
 (v) $V(X)$
 (vi) $V(2X \pm 3)$

8. Obtain the m.f.g of random variable X having p.d.f:

$$f(x) = \begin{cases} x & \text{for } 0 \leq x < 1 \\ 2-x & \text{for } 1 \leq x < 2 \\ 0 & \text{elsewhere} \end{cases}$$

Determine

$\mu_1, \mu_2, \mu_3, \mu_4, \mu_1, \mu_2, \mu_3,$ and $\mu_4.$

B.Sc.3rd Semester (Hons) New Scheme Examination,

December-2015

PHYSICS

Paper-PHY-305

Mathematics-III

Time allowed : 3 hours] [Maximum marks : 40

Note : Attempt five questions in all, selecting at least two questions from each unit. All questions carry equal marks.

Unit-I

1. (a) $\forall n \in \mathbb{N}$ and $\forall x \in \mathbb{R}$, define $f_n(x) = \frac{\sin nx}{\sqrt{n}}$. Prove

that

(i) $\{f_n\}$ converges to the 0 function on $(-\infty, +\infty)$

(ii) $\{f'_n\}$ does not converge point wise to f' on $(-\infty, \infty)$

(b) Prove that $\sum_{k=1}^{\infty} \frac{(-1)^k}{x^2 + k}$ on $(-\infty, \infty)$ converges

uniformly but not absolutely on the given interval.

2. (a) Use known power series to find Maclaurin series for

$$(i) \frac{1}{1+x^3}$$

$$(ii) \frac{x^2}{1+x^3}$$

- (b) Examine the convergence of the improper integral

$$\int_0^4 \frac{dx}{x(4-x)}$$

3. (a) Discuss the convergence of the Beta function.

- (b) Examine the convergence of

$$\int_0^{\infty} \frac{\cos ax - \cos bx}{x} dx.$$

4. (a) Evaluate $\int_0^{\pi} \frac{\log(1+\alpha \cos x)}{\cos x} dx$ for $|\alpha| < 1$.

$$(b) \text{ Prove that } \Gamma\left(n + \frac{1}{2}\right) = \frac{\sqrt{\pi} \Gamma(2n+1)}{2^{2n} \Gamma(n+1)}$$

Unit-II

5. (a) A can hit a target 3 times in 6 shots; B 2 times in 6 shots and C 4 times in 4 shots. They fire a volley. What is the probability that at least 2 shots hits?
- (b) A, B and C, in order, toss a coin. The first one to throw a head wins. If A starts, find their respective chances of winning.
6. (a) State and prove Bayes theorem.

- (b) A random variable X has the following probability function:

x	-2	-1	0	1	2	3
p(x)	0.1	K	0.2	2K	0.3	K

- (i) find the value of k
- (ii) calculate mean and variance

7. Given the following table

x	-3	-2	-1	0	1	2	3
p(x)	0.05	0.10	0.30	0	0.30	0.15	0.10