

Assignment -1

Paper 202

UNIT 1 (Fourier Analysis)

1. What is Harmonic analysis? Discuss in detail.
2. What is Fourier series? State Fourier series and obtain values of constants appearing in Fourier series using orthogonal conditions.
3. State Dirichlet conditions and explain it. Also explain how these conditions are useful for the change of interval.

➤ **In each of the following problems, functions are given on the interval $-\pi < x < \pi$ (OR on interval length 2π). Sketch several periods of the corresponding periodic function of period 2π . Expand the periodic function in a sine-cosine Fourier series.**

EX-1 $f(x) = 1, \quad -\pi < x < 0$
 $= 0, \quad 0 < x < \pi$

EX-2 $f(x) = 0, \quad -\pi < x < 0$
 $= 1, \quad 0 < x < \pi$

EX-3 $f(x) = 0, \quad -\pi < x < 0$
 $= 1, \quad 0 < x < \frac{\pi}{2}$
 $= 0, \quad \frac{\pi}{2} < x < \pi$

EX-4 $f(x) = x, \quad -\pi < x < \pi$

EX-5 $f(x) = 0, \quad -\pi < x < \frac{\pi}{2}$
 $= 1, \quad \frac{\pi}{2} < x < \pi$

EX-6 $f(x) = -1, \quad -\pi < x < \frac{\pi}{2}$
 $= 1, \quad \frac{\pi}{2} < x < \pi$

EX-7 $f(x) = 1, \quad 0 < x < \pi$
 $= -1, \quad \pi < x < 2\pi$

Unit 2 (Classical Mechanics)

1. Suppose a rigid body is executing rotational motion along with translational motion. Define space and body co-ordinate system. Hence obtain general expression of velocity for the motion of a body.
2. Write general expression of velocity when body is executing rotational & translational motion. Derive equation of motion if body is executing translational motion only and discuss it.
3. Write general expression of velocity when body is executing rotational & translational motion. Derive equation of motion if body is executing rotational motion only and discuss it.
4. Write a brief note on centrifugal acceleration.
5. Write expression of coriolis force. Give explanation on direction of coriolis force acting on a particle in Northern and Southern hemisphere.
6. With necessary figure give explanation of a coriolis force. Using necessary figure describe direction of wind whirling in Northern & Southern hemisphere.
7. Discuss coriolis force acting on a freely falling particle and derive equation of deflection of particle.

Unit 3 (Nuclear Physics)

1. Discuss the interaction of heavy particles with matter and derive Geiger's rule.
2. Write a note on proportional counter.
3. Explain Geiger counter in detail.
4. Write a note on scintillation counter.
5. Explain semiconductor detector.
6. Discuss i) Cloud chamber ii) Bubble chamber and iii) spark chamber.

Unit 4 (Electrostatics)

1. Explain polarization of dielectric slab and prove that surface charge density is equal to polarization density inside the material.
2. Describe how electric field decrease and capacitance increase when dielectric is placed inside the capacitor?
3. Obtain the Gauss's law in presence of dielectric.
4. When dielectric medium changes at boundary obtain boundary condition for displacement vector and electric field.
5. Derive the relation between atomic polarizability and dielectric constant (Clausius- Mossoti Equation) for non polar substances.