

Assignment -2

Paper 202

UNIT 1 (Fourier Analysis)

Q-1. Represent Fourier series in complex form. Derive values of constants appearing in it for the interval $x = -\pi$ to $x = +\pi$ (OR $x = 0$ to $x = 2\pi$) (interval length 2π).

Q-2. Describe even and odd functions in detail. Also explain how Fourier series can be expressed for such functions.

Q-3. In each of the following problems, functions are given on the interval $-l < x < l$ (OR on interval length $2l$) **OR** $-\frac{l}{2} < x < \frac{l}{2}$ (OR on interval length l). Sketch several periods of the corresponding periodic function of period $2l$. Expand the periodic function in a sine-cosine Fourier series.

EX-1. $f(x) = 0,$ $-l < x < 0$

$$= 1, \quad 0 < x < \frac{l}{2}$$

$$= 0, \quad \frac{l}{2} < x < l$$

EX-2. $f(x) = -1,$ $-l < x < \frac{l}{2}$

$$= 1, \quad \frac{l}{2} < x < l$$

Q-4 In each of the following problems, functions are given on the interval $-l < x < l$ (OR on interval

length $2l$) **OR** $-\frac{l}{2} < x < \frac{l}{2}$ (OR on interval length l). Sketch several periods of the

corresponding periodic function of period $2l$. Expand the periodic function in an exponential Fourier series. (complex representation of Fourier series)

EX-1. $f(x) = 0,$ $0 < x < l$

$$= 1, \quad l < x < 2l$$

Unit – 2 Classical Mechanics

1. Define Scattering angle and Incident flux. Show that Incident flux $F = n v$
2. Explain in short differential scattering cross-section.
3. What is impact parameter ? Determine differential scattering cross-section in terms of impact parameter.
4. By giving necessary explanation on laboratory and centre of mass co-ordinate systems derive $\tan \theta_L = \frac{\sin \theta_C}{\cos \theta_C + \frac{v_{CM}}{v_1'}}$
5. By assuming equation $\tan \theta_L = \frac{\sin \theta_C}{\cos \theta_C + \frac{v_{CM}}{v_1'}}$ calculate K.E. before collision and after collision in C.M. co-ordinate system hence derive $\tan \theta_L = \frac{\sin \theta_C}{\cos \theta_C + \gamma}$
6. Derive relation between differential scattering cross-sections in L-system and C.M. co-ordinate system.

Unit 3 (Nuclear Physics)

1. Why charged particle accelerators are required?
2. Write a note on Van-de-Graaff generator. Also discuss its modification by Tandem.
3. Explain cyclotron in detail.
4. Write a note on synchrotron.
5. Explain β -ray spectrometer.

UNIT 4(Magnetostatics)

1. Derive the first law of magneto statics $\nabla \cdot \mathbf{B} = 0$
2. Write second law of magneto statics and prove Ampere's circuital law $\oint \mathbf{B} d\mathbf{l} = \mu I$
3. Derive the relation for the field $\mathbf{H} = \frac{\mathbf{B}}{\mu} - \mathbf{M}$, in magneto statics
4. What are magnetic susceptibility and permeability? Derive the relation $\mathbf{B} = \mu \mathbf{H}$ in magneto statics.
5. Derive the equation of continuity. Obtain ohm's law in the form $\mathbf{J} = \sigma \mathbf{E}$
6. (i) What do you mean by magnetic susceptibility?
 - (ii) For which substance susceptibility is positive?
 - (iii) For which substance susceptibility is negative?
 - (iv) Name three ferromagnetic materials.

