

BANKIM SARDAR COLLEGE

Part – I (1+1+1) Examination 2020

B.Sc. (Honours)

Subject: Physics.....

Paper: I+II

Group: (1+2)

Time: 2 Hours

Full Marks: 25+25 = 50

(Answer each group in separate Answer-Sheets)

Group: 1

Paper -I (F.M-25)

Paper: IA (F.M-12.5)

(Answer in separate Answer-Sheets)

Answer any TWO Questions from Question 1 to 4. Question 5 is compulsory.

5x2=10

1. Write down the Taylor series expansion of a function $f(x,y)$ about the values x_0, y_0 . Prove the series $x + \frac{x^2}{2} + \frac{x^3}{3} + \dots$ is convergent for $0 < x < 1$ 2+3
2. (a) Evaluate $\iint xy dx dy$ around the quadrant of the circle with $x \geq 0, y \geq 0$.
(b) For a force defined by defined by, $F = \frac{(-xi+yj)}{x^2+y^2}$, evaluate the line integral along the semi circular path connecting the points $(-1,0)$ and $(1,0)$ with the origin at the center. 2+3
3. (a) By stokes theorem prove that $\vec{\nabla} \times \vec{\nabla} \varphi = 0$
(b) A particle moves along the curve $x=2t^2, y=4t^2-1$ and $z=5t-3$, where t denotes time. Find the component of acceleration at $t=1$ in the direction $(\hat{i} - 2\hat{j} + 2\hat{k})$. 2+3
4. Find the eigen values and the normalized eigen vector of the matrix $\begin{pmatrix} 1 & 1 \\ 4 & 1 \end{pmatrix}$. 2+3

5. Compulsory Question

2.5 × 1 = 2.5

(I) Show that infinite series $\sum \frac{1}{n^p}$ is convergent if $p > 1$.

OR

(II) Show that Hermitian matrix remain Hermitian under unitary transformation.

Paper: IB (F.M-12.5)

(Answer in separate Answer-Sheets)

Answer any TWO Questions from Question 6 to 9. Question 10 is compulsory.

5x2=10

6. (a) Define bandwidth and the quality factor with respect to the resonance.
(b) Use it to establish conjugate foci relation for refraction at a spherical surface. Define principal points and nodal points. 2+3
7. Draw a two input positive logic diode AND circuit. Design a two input XOR gate using NOR gates exclusively 2+3
8. (a) What is 'depletion region'?
(b) Explain the behavior of P-N junction diode under reverse bias 2+3
9. (a) Define Group velocity and the phase velocity.
(b) Establish Relation between them. 2+3
10. **Compulsory Question** $2.5 \times 1 = 2.5$
(I) Prove the Boolean Relation $(A+B)(A+C)=A+BC$
OR
(III) State and explain Fermat's Principle

Group: 2

Paper-II (F.M-25)

Paper: IIA (F.M-12.5)

(Answer in separate Answer-Sheets)

Answer any TWO Questions from Question 11 to 14. Question 15 is compulsory.

5x2=10

11. (a) What do you mean by pseudo force?
(b) How pseudo forces appear in a rotating frame of reference? 2+3
12. (a) What is center of mass of a body?
(b) Prove that position of centre of mass is unique for a system of particles 2+3
13. (a) What do you understand by degrees of freedom?
(b) State and explain the principle of 'Equipartition of Energy' among degrees of freedom. 2+3
14. (a) What is 'mean free path'?
(b) Find Boyle's temperature of a van der waal's gas? 2+3
15. **Compulsory Question** $2.5 \times 1 = 2.5$
(I) Estimate the average speed of molecules of a gas in terms of velocity of sound in the gas.

OR

- (II) Find the center of mass of a thin homogeneous semi circular disc of radius r and surface mass density σ .

Paper: IIB (F.M-12.5)

(Answer in separate Answer-Sheets)

16. (a) Draw the circuit diagram of a Zener diode to study the reverse characteristics curve.
(b) Write the formula of percentage of load regulation of a Zener diode.
(c) What is difference between a Zener diode and an ordinary P-N junction diode?
(d) Write three differences between Zener Breakdown and the avalanche breakdown?

4+3+3+2.5