



‘সমানো মন্ত্র: সমিতি: সমানী’

UNIVERSITY OF NORTH BENGAL

B.Sc. Major 3rd Semester Examination, 2025

PHYSMAJ305-PHYSICS

MATHEMATICAL PHYSICS-II

Time Allotted: 2 Hours 30 Minutes

Full Marks: 60

The figures in the margin indicate full marks.

GROUP-A

1. Answer any **four** questions from the following: 3×4 = 12
- (a) What are Dirichlet's conditions? Explain. 3
- (b) What is the singular point of a differential equation? Obtain the singular points and their type for the following differential equation 1+2
- $$(x+1)^2 y'' - y' = 0, \text{ where } y' = \frac{dy}{dx} \text{ and } y'' = \frac{d^2y}{dx^2}.$$
- (c) Show that $P_n(-1) = (-1)^n$, where P_n is a Legendre polynomial of n^{th} degree. 3
- (d) If $u = x^2 + t^2$ is a solution of $C^2 \frac{\partial^2 U}{\partial x^2} = \frac{\partial^2 U}{\partial t^2}$ then calculate the value of C . 3
- (e) Evaluate: $\int_0^{\pi/2} \sin^7 \theta \cos^4 \theta d\theta$ 3
- (f) If $f(x) = x^4$ for the range $(-1, 1)$, then calculate the Fourier coefficient b_n . 3

GROUP-B

Answer any **four** questions from the following

6×4 = 24

2. Find the Fourier series of the function $f(x) = |x|$, $-\pi \leq x \leq \pi$. 6
3. (a) State Fourier's Theorem. What is piecewise continuous function? Give example. 1+1
- (b) Prove Parseval's identity for Fourier series. 4
4. (a) Prove the following recurrence relation for a Legendre polynomial: 3
- $$(2n+1)P_n(x) = P'_{n+1}(x) - P'_{n-1}(x)$$
- (b) Consider the diffusion equation 3

$$\nabla^2 u = \frac{1}{k} \frac{\partial u}{\partial t},$$

where $u \equiv u(x, y, z, t)$. Show that this equation can be decoupled into temporal and spatial part. Find a general solution of the temporal part.

5. (a) Starting from the generating function for the Bessel's function, show that, 4

$$\frac{d}{dx}[x^n J_n(x)] = x^n J_{n-1}(x)$$

 (b) Prove that: $\Gamma(1) = 1$ 2
6. (a) Evaluate: $\int_0^\infty x^{n-1} e^{-h^2 x^2} dx$ 4
 (b) State the boundary conditions for a vibrating string of Length L , fixed at both ends. 2
7. (a) Solve the following boundary value problem $\frac{\partial u}{\partial x} = 4 \frac{\partial u}{\partial y}$, given $u(0, y) = 8e^{-3y}$ by 4
 a method of separation of variables.
 (b) Show that: $\frac{1}{\sqrt{\pi}} \int_0^{x^2} \frac{e^{-t}}{\sqrt{t}} dt = \text{erf}(x)$ 2

GROUP-C

Answer any two questions from the following

12×2 = 24

8. (a) Solve the following differential equation using Frobenius method: 6

$$(1+x^2)y'' + xy' - y = 0$$

 (b) Show that: $\int_{-1}^1 P_m(x)P_n(x)dx = \frac{2}{2n+1} \delta_{mn}$ 6
9. (a) Expand the following function in Legendre's polynomials: 5

$$f(x) = 5x^3 + 2x + 3, \quad -1 \leq x \leq 1$$

 (b) Prove that: $\int_{-1}^1 [P_n(x)]^2 dx = \frac{2}{2n+1}; \quad n = 0, 1, 2, \dots$ 4
 (c) Show that: $2xH_n(x) = 2nH_{n-1}(x) + H_{n+1}(x)$ 3
- 10.(a) Find the Fourier series to represent $f(x) = x - x^2$ from $x = -\pi$ to $x = \pi$. 6+2
 Hence, show that $1 - \frac{1}{2^2} + \frac{1}{3^2} - \frac{1}{4^2} + \dots = \frac{\pi^2}{12}$.
 (b) Express $f(x) = x$ as a half range sine series in the interval $0 < x < 2$. 4
- 11.(a) Write the wave equation for a rectangular membrane and obtain its solution by a 1+5
 separation of variable (without applying a boundary condition).
 (b) Find a solution to the following differential equation: 6

$$\frac{\partial^2 \psi}{\partial x^2} + \frac{\partial^2 \psi}{\partial y^2} = 0$$

inside an annulus bounded by the circles $x^2 + y^2 = r_1^2$ and $x^2 + y^2 = r_2^2$ that satisfies the conditions:

$$\psi = \psi_2 \text{ at } r = r_2 \text{ and } \left(\frac{\partial \psi}{\partial r}\right) = k/r_1 \text{ at } r = r_1.$$

—x—



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UNIVERSITY OF NORTH BENGAL

B.Sc. Major 3rd Semester Examination, 2025

PHYSMAJ306-PHYSICS

THERMAL PHYSICS

Time Allotted: 2 Hours 30 Minutes

Full Marks: 60

The figures in the margin indicate full marks.

GROUP-A

1. Answer any *four* questions from the following: 3×4 = 12
 - (a) Using the equipartition theorem, calculate the molar heat capacity at constant volume for a monoatomic and diatomic gas. 1 $\frac{1}{2}$ + 1 $\frac{1}{2}$
 - (b) ‘Temperature is the manifestation of total energy of an ideal gas’ — Explain. What do you mean by Boyle temperature? 2+1
 - (c) Explain the working of Carnot engine as refrigerator and find the coefficient of performance. 3
 - (d) What role does entropy have in adiabatic demagnetisation? 3
 - (e) Derive Clausius-Clapeyron equation from TdS equations. 3
 - (f) Using Maxwell’s thermodynamic relations, show that the ratio of adiabatic to isobaric volume expansivity is $\frac{1}{1-\gamma}$, where γ is the ratio of specific heat of a gas at constant pressure to that at constant volume. 3

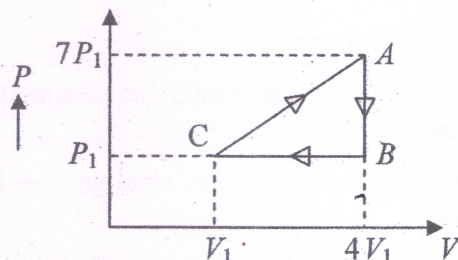
GROUP-B

Answer any *four* questions from the following

6×4 = 24

2. What are the critical constants of a gas? Obtain their expression from Van der Waals equation of state. 6
3. (a) Find the number of degrees of freedom for (i) H_2O and (ii) CO_2 molecule, assuming linear configuration of the molecules. 3
 - (b) Describe the experimentally observed deviations in the behaviour of real gas from ideal gas. 3
4. (a) State the 3rd law of thermodynamics. 1
 - (b) Why is it impossible to attain absolute zero temperature? 2
 - (c) A refrigerator works between 270 K and 300 K. Calculate its coefficient of performance if it removes 500 J of heat from the cold reservoir. 3

5. (a) Define phase transition. Differentiate clearly between first-order and second-order phase transitions. 1+3
- (b) The internal energy E of a system is given by $E = \frac{bS}{VN}$, where b is a constant and all the symbols have their usual meanings. Find the temperature of the system. 2
6. (a) Prove that, $H = G - T \left(\frac{\partial G}{\partial T} \right)_P = -T^2 \left[\frac{\partial}{\partial T} \left(\frac{G}{T} \right) \right]_P = \left[\frac{\partial (G/T)}{\partial (1/T)} \right]_P$ 3
- (b) Why does a paramagnetic material cool down during adiabatic demagnetization? Explain using TdS equation for a magnetic material. 3
7. (a) Derive the expression of work done in a reversible adiabatic process. 3
- (b) Find the work done by an ideal gas in one cycle from the figure given below: 3



Is the work done positive or negative?

GROUP-C

Answer any two questions from the following

12×2 = 24

8. (a) Derive Maxwell's law of distribution of velocities of molecules of a gas. 6
- (b) Find the ratio of the average velocity to r.m.s velocity of the molecules. 2
- (c) The Dieterici's equation of state is given by $P = \frac{RT}{V-b} e^{-a/RTV}$. Write down the equation in the virial form. Here the symbols have their usual meanings. 2
- (d) One mole of a Van der Waals gas at 0°C occupies a volume of 0.55 litre. Calculate the pressure it exerts. Given $a = 0.37 \text{ Nm}^4 \text{ mol}^{-2}$, $b = 43 \times 10^{-6} \text{ m}^3 \text{ mol}^{-1}$ and $R = 8.31 \text{ J mol}^{-1} \text{ K}^{-1}$. 2
9. (a) Explain why Gibbs free energy is considered as a thermodynamic potential. Prove Maxwell's thermodynamic relation $\left(\frac{\partial S}{\partial P} \right)_T = - \left(\frac{\partial V}{\partial T} \right)_P$ from the concept of Gibbs free energy, where notations have their usual meanings. 2+3
- (b) Prove the following equation for 1st order phase transition 4

$$\frac{dL}{dT} - \frac{L}{T} = (C_2)_{\text{Sat}} - (C_1)_{\text{Sat}}$$

where, C_2 and C_1 are the heat capacities of the two phases at temperature T and L is the latent heat.

(c) Prove that: $C_P - C_V = -T \left(\frac{\partial V}{\partial P} \right)_T \left(\frac{\partial P}{\partial T} \right)_V^2$

3

10.(a) State the Kelvin-Planck and Clausius statements of 2nd law of thermodynamics.

1+1

(b) Prove the equivalence of the above two statements.

$2 \frac{1}{2} + 2 \frac{1}{2}$

(c) 200 gm of water is heated from 25°C to 75°C. Calculate the change in entropy of the water. Given: Specific heat capacity of water = 1200 J/Kg-K.

2

(d) Plot the isotherms of CO₂ as obtained in Andrew's experiment. Explain the nature of the isotherms below critical temperature.

3

11.(a) Define Joule-Thomson effect.

2

(b) Obtain the expressions of Joule-Thomson coefficient for (i) ideal and (ii) Van der Waals' gas.

$2 \frac{1}{2} + 2 \frac{1}{2}$

(c) What is temperature of inversion? Explain its significance for Joule-Thomson cooling.

3

(d) Hydrogen gas has a critical temperature of -240°C. Is it possible to liquify it at room temperature? Explain.

2

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সমানা মন্ত্র: সমিতি: সমানী

UNIVERSITY OF NORTH BENGAL
B.Sc. Minor/Dsc 3rd Semester Examination, 2025

PHYSMIN303/PHYSDSC303-PHYSICS

WAVES AND OPTICS

Time Allotted: 2 Hours 30 Minutes

Full Marks: 60

The figures in the margin indicate full marks.

GROUP-A / বিভাগ-ক

1. Answer any **four** questions from the following: 3×4 = 12
 নিম্নলিখিত যে-কোন চারটি প্রশ্নের উত্তর দাও:
 कुनै चार प्रश्नहरूको उत्तर देऊ:
- (a) The equation of a plane sound wave is $y = 6.0 \times 10^{-6} \cos(1900t + 5.72x)$ m 3
 Find frequency, wavelength and velocity of the wave.
 একটি সমতল শব্দতরঙ্গের সমীকরণ হল $y = 6.0 \times 10^{-6} \cos(1900t + 5.72x)$ m
 তরঙ্গের কম্পাঙ্ক, তরঙ্গদৈর্ঘ্য এবং বেগ নির্ণয় কর।
 এক সমতল ধ্বনি তরঙ্গকো সমীকরণ নিম্ন চ: $y = 6.0 \times 10^{-6} \cos(1900t + 5.72x)$ m
 তরঙ্গকো আবৃত্তি, তরঙ্গদৈর্ঘ্য র বেগ পত্তা লগাউ।
- (b) The wind is blowing over some suspension cable on a bridge, causing a force $F = 0.02 \sin 21\pi t$ N. Is resonance possible (at fundamental or at some harmonic) if the tension in the cable is 49000 N, the cable has a mass of 10 kg/m, and it is 10 m long? 3
 একটি সেতুর উপর একটি সাসপেনশন তারের উপর দিয়ে বাতাস প্রবাহিত হচ্ছে, যার ফলে একটি বল $F = 0.02 \sin 21\pi t$ N উৎপন্ন হচ্ছে। অনুরণন কি সম্ভব (মূল অথবা অন্য কোন হারমোনিকে) যদি তারের উপর টান 49000 N, তারের ভর 10 kg/m এবং তারের দৈর্ঘ্য 10 m হয়?
 এক झोलुङ्गी पुलमा हावा बग्दा $F = 0.02 \sin 21\pi t$ N বল लाग्छ। यदि केबलमा तनाव 49000 N छ, यसको द्रव्यमान घनत्व प्रती लमाई 10 kg/m छ र लम्बाई 10 m छ भने, अनुनाद मौलिक सन्नादि मा सम्भव छ कि छैन?
- (c) Light waves can be polarized, but sound waves cannot be. Why? 3
 আলোকতরঙ্গ সমাবর্তিত হয়, কিন্তু শব্দতরঙ্গ হতে পারে না। কেন?
 প্রকাশ তরঙ্গহরু ধ্রুবীকৃত হুন সৰুচন্ তর ধ্বনি তরঙ্গহরু হুন সৰুদৈনন্। কিন?
- (d) Why do we need narrow source for Fresnel's biprism and extended source for Newton's ring experiment? 3
 ফ্রেনেলের যুগ্ম প্রিজমে সংকীর্ণ (narrow) উৎস এবং নিউটন রিং পরীক্ষায় বিস্তৃত (extended) উৎস দরকার হয় কেন?
 ফ্রেনেলকো বাইপ্রিজম র ন্যুটনকো বলয় প্রয়োগ কা লাগি সাঁধুরী স্রোত র বিস্তারিত স্রোত কিন আবহৃয়ক পঠ?
- (e) Show that a SHM can be considered as the superposition of two equal and opposite circular motions. 3
 দেখাও যে, একটি সরল দোলগতিকো দুটি সমান ও বিপরীত বৃত্তীয় গতির উপরিপাতন (superposition) হিসাবে বিবেচনা করা যেতে পারে।
 সরল আবর্ত গতিলাই বরাবর র বিপরীত দুই বৃত্তাকার গতিকো অধ্যারোপণ মান্ন সকিন্চ ভনী দেখাউ।
- (f) Does energy conservation get violated in case of interference phenomenon? Justify your answer with proper mathematical expression. 3

ব্যতিচारे कि शक्तिर संरक्षण सूत्रे लङ्घन घटे ? यथायथ गणितीय राशिमाना सहयोगे तोमार उत्तरेर सपक्षे युक्ति दाओ।
व्यतिकरण परिघटनाको अवस्थामा ऊर्जा संरक्षणको उल्लंघन हुन्छ र ? उपयुक्त गणितीय अभिव्यक्ति सँग आफ्नो उत्तर पुष्टि गर।

GROUP-B / विभाग-ब

Answer any four questions from the following

6×4 = 24

निम्नलिखित ये-कौन चारटि प्रश्नर उत्तर दाओ

कुनै चार प्रश्नहरूको उत्तर देऊ

2. Find the shape of the fringe pattern forms in Young's double slit experiment. How does it look like in realistic case and why? 5+1
 इयंग-एर द्विरेखाह्निद परीक्षाय गठित बालरेर आकृति निर्णय कर। वास्तव क्षेत्रे एटि केमन देखा याय एवं केन ?
 यंगको द्वि-छिद्र प्रयोग मा फ्रिन्जको आकृति पत्ता लगाऊ। वास्तविक अवस्थामा यो कस्तो देखिन्छ र किन ?
3. Define group velocity and phase velocity. The phase velocity of waves in a medium is given by, $v_p = \frac{c}{a + b/\lambda^2}$, where a, b, c are constants and λ is the wavelength. Obtain the expression of group velocity v_g and find the value of it at the limit of $\lambda \rightarrow \infty$. 1+5
 गोष्ठीवेग एवं दशावेग-एर संज्ञा दाओ। एकटि माध्यमे दशावेग $v_p = \frac{c}{a + b/\lambda^2}$, येथाने a, b, c हल श्वक एवं λ हल तरंगदैर्घ्य। गोष्ठीवेग v_g -एर राशिमाना निर्णय कर एवं $\lambda \rightarrow \infty$ सीमाय एर मान निर्णय कर।
 समूह वेग र कला वेग परिभाषित गर। यदि कुनै माध्यममा तरंगहरूको कला वेग निम्न अनुसार दिइएको छः

$$v_p = \frac{c}{a + b/\lambda^2}$$
 जहाँ a, b, c अचर हुन् र λ तरंगदैर्घ्य हो, तब समूह वेग v_g को अभिव्यक्ति प्राप्त गर अनि $\lambda \rightarrow \infty$ को सीमा मा यसको मान पत्ता लगाउनुहोस्।
4. (a) Mention two differences between Fraunhofer and Fresnel class of diffraction. 2
 फ्रनहोफर ओ फ्रेनेलेर अपवर्तनेर मध्ये दुटि पार्थक्य लेख।
 फ्रान्होफर र फ्रेस्नेल विवर्तनका दुई फरक उल्लेख गर।
 (b) Discuss the procedure to measure the distance between two virtual sources in Fresnel's biprism. 4
 फ्रेनेले युग्म प्रिजमेर क्षेत्रे दुटि अलीक उत्सरेर मध्ये दूरत्व निर्णयेर पद्धति आलोचना कर।
 फ्रेस्नेल बाइप्रिजम को प्रयोग मा दुई अवास्तविक स्रोतहरू को दुरी मापने विधी चर्चा गर।
5. (a) Explain the formation of circular fringes in Newton's ring experiment. 3
 निउटन रिंग परीक्षाय वृत्ताकार रिङ्गुलिर गठन आलोचना कर।
 न्युटनको वलय प्रयोग मा वृत्ताकार फ्रिन्जको निर्माण व्याख्या गर।
 (b) Deduce an expression for the diameter of n -th dark ring. 3
 n -तम कालो रिङ-एर व्यासेर राशिमाना निर्णय कर।
 n -औं अँध्यारी वलय को व्यास का लागि अभिव्यक्ति व्युत्पन्न गर।
6. (a) State and prove Stoke's law in reflection of lights. 1+3
 आलोर प्रतिफलनेर क्षेत्रे स्टोकसेर सूत्रटि विवृत ओ प्रमाण कर।
 प्रकाशको प्रतिसनण मा स्टोकसको नियम उल्लेख र प्रमाणित गर।

- (b) Write down two differences between the fringes formed by Fresnel's biprism and Lloyd's mirror. 2

फ्रेनेलको बाइप्रिज्म एवं लयर्ड दर्पण द्वारा गठित व्यतिचार बालरेर मध्ये दुटि पार्थक्य लेख।

फ्रेनेलको बाइप्रिज्म र लार्डको ऐना द्वारा बनेको फ्रिन्जहरु बीचका दुई फरक लेख।

7. Two simple harmonic oscillations $\psi_1 = A\cos(\omega_1 t)$ and $\psi_2 = A\cos(\omega_2 t)$ having slightly different angular frequencies ω_1 and ω_2 are superimposed. Find an expression for the resultant amplitude. Plot amplitude vs time graph and explain the formation of beats. 3+3

कौनिक कम्पाङ्कहरू सामान्य पार्थक्य विशिष्ट दुटि सरल दोलनगति, $\psi_1 = A\cos(\omega_1 t)$ एवं $\psi_2 = A\cos(\omega_2 t)$, यादेर कौनिक कम्पाङ्क यथाक्रमे ω_1 एवं ω_2 परस्परर सङ्गे उपरिपातित हल। लक्षि विस्तारेर राशिमाणा निर्णय कर। विस्तार बनाम समयेर लेखचित्र अङ्कन कर एवं स्वरकम्पेर सृष्टि व्याख्या कर।

स्वतःस्फूर्त आवृत्ति ω_1 र ω_2 भएका दुई सरल आवर्त दोलनहरु $\psi_1 = A\cos(\omega_1 t)$ र $\psi_2 = A\cos(\omega_2 t)$ अध्यारोपित छन्। परिणामी उपायामका लागि अभिव्यक्ति पत्ता लगाऊ। परिणामी आयम विरुद्ध समय रेखा चित्रको आरेखण गर अनि विस्पन्द को निर्माण व्याख्या गर।

GROUP-C / বিভাগ-গ

Answer any two questions from the following

12×2 = 24

নিম্নলিখিত যে-কোন দুটি প্রশ্নের উত্তর দাও

কোন দুই প্রশ্নের উত্তর দেও

8. (a) A string of a length ' l ' is fixed at two ends and is plucked at a distance ' a ' from one end through a distance ' h '. Find the expressions for the displacement and velocity at any point ' x ' on the string at time ' t '. 7+2

एकटि तार यार दैर्घ्य ' l ' दुई प्रान्ते स्थिर एवं एक प्रान्त थेके ' a ' दूरते ' h ' परिमाण दूरत Pluck करा हयेछे। समय ' t '-ए तारेर ये-कौन बिन्दु ' x '-एर जन्य स्थानछाति (displacement) एवं वेगेर राशिमाणा निर्णय कर।

लम्बाई ' l ' भएको एउटा तार दुई हेउमा स्थिर छ र एक हेउबाट ' a ' दूरीमा ' h ' दूरीसम्म टड्कार गरिएको छ। समय ' t ' मा तारको कुनै पनि बिन्दु ' x ' मा विस्थापन र वेगका लागि अभिव्यक्ति पत्ता लगाऊ।

- (b) State the Young's law and show that the vibration of plucked string obeys the law. 1+2

Young's-एर सूत्राटि लेख एवं देखाओ ये plucked तारेर कम्पन एहि सूत्राटि मेने चले।

यडको नियम उल्लेख गर साथैमा कर्षित गरिएको तारको कम्पनले यो नियम पालन गर्छ भनि देखाऊ।

9. (a) What are Fresnel's half-period zones? Prove that the area of half period zone on a plane wave-front is essentially independent of order of the zone. Hence show that the amplitude due to the entire wavefront at a point in front of it, is just half that due to the first half period zone alone. 2+2+4

Fresnel's half-period zones की ? प्रमाण कर ये एकटि plane wave-front-एर उपरे half period zone-एर क्षेत्रफल zone-एर क्रमाङ्क (order) उपर निर्भर करे ना। तारपर देखाओ ये एकटि बिन्दुते पुरो wave-front -एर कारणे उंगन amplitude शुधुमात्र प्रथम half period zone -एर अर्धेक।

फ्रेनेलको अर्ध-अवधि क्षेत्रहरु के हुन् ? समतल तरंग-मुखमा रहेको यी क्षेत्रहरुको क्षेत्रफल, क्षेत्रको क्रम अनुसार मूलतः परिवर्तन हुँदैन भनि देखाऊ। यसबाट, पूरै तरंग-मुखले कुनै एक बिन्दुमा दिने संयुक्त अधिकता पहिलो आधा-अवधि क्षेत्रबाट मात्र प्राप्त हुने अधिकता ठीक आधा हुन्छ भनि सिद्ध गर।

- (b) Write down two similarities and two differences between zone plate and convex lens. 2+2

मण्डल फलक एवं उड्डल लेन्स मध्ये दुटि सादृश्य एवं दुटि पार्थक्य लेख।

क्षेत्र-पाता र उत्तल लेन्स बीचका दुई समानता र दुई भिन्नताहरु लेख।

- 10.(a) Consider a simple harmonic oscillator that is subjected to a damping force and an external force given by

3+2

$$F(t) = F_0 \cos \omega t$$

where $\omega \neq \omega_0$, ω_0 being the natural frequency of the oscillator. Find the steady state solution of the differential equation and hence find an expression for amplitude and phase angle.

একটি সরল দোলক কল্পনা কর, যার উপর একটি মন্দন বল এবং একটি বাহ্যিক বল $F(t) = F_0 \cos \omega t$ ক্রিয়াশীল, যেখানে $\omega \neq \omega_0$, ω_0 হল দোলকটির স্বাভাবিক কম্পাঙ্ক। অবকল সমীকরণের থেকে স্থিতিাবস্থার (Steady state) সমাধান নির্ণয় কর, অতএব বিস্তার এবং দশাকোণের রাশিমালা নির্ণয় কর।

এতটা সরল আবর্ত দোলক মাথি এতটা শ্যামক বল র এতটা বাহ্য বল $F(t) = F_0 \cos \omega t$ কার্যরত চন্। যहाँ $\omega \neq \omega_0$, ω_0 দোলককো স্বভাবিক আবৃত্তি হো। यसको स्थिर-अवस्था समाधान प्राप्त गर तथा अधिकता र चरण कोणका लागि अभिव्यक्ति निकाल।

- (b) What do you understand by resonance? Distinguish between amplitude resonance and velocity resonance.

1+3

অনুনাদ বলতে কি বোঝ ? বিস্তারের অনুনাদ (amplitude resonance) এবং বেগের অনুনাদ (velocity resonance)-এর মধ্যে পার্থক্য কর।

अनुनाद भनी के बुझिन्छ ? अधिकता अनुनाद र वेग अनुनाद बीच भिन्नता स्पष्ट गर।

- (c) A particle oscillating simple harmonically has the displacements x_1 and x_2 when its velocities are v_1 and v_2 respectively. Show that its time period is given by

3

সরল দোলগতিযুক্ত একটি কণার বিস্তার x_1 এবং x_2 যখন কণাটির বেগ যথাক্রমে v_1 এবং v_2 । দেখাও যে, এর পর্যায়কাল

एउटा कण सरल आवर्त गति पालन गरिरहेको छ। यसका विस्थापनहरू x_1 र x_2 हुँदा, यसको वेगहरू क्रमशः v_1 र v_2 छन्। यसको आवर्तकाल तलको समीकरणले दिन्छ भनि देखाऊ :

$$T = 2\pi \left(\frac{x_2^2 - x_1^2}{v_1^2 - v_2^2} \right)^{1/2}$$

- 11.(a) Obtain the expression of intensity distribution function of a grating with N no. of slits having slit width ' a ' and separated by a distance ' b '. Obtain the conditions of maxima's and minima's.

6+3

একটি গ্রেটিং, যার N সংখ্যক ছিদ্র আছে, প্রতিটি ছিদ্রের প্রস্থ a এবং তাদের মধ্যবর্তী দূরত্ব b , এর তীব্রতা বন্টন অপেক্ষকের রাশিমালা নির্ণয় কর। চরম বিন্দু (maxima) এবং অবম বিন্দু (minima) শর্তগুলি নির্ণয় কর।

N वटा चिरा भएको कुनै विभर्तण रेखाचित्रसमूहको तीव्रता वितरण फलनको अभिव्यक्ति प्राप्त गर, जहाँ प्रत्येक चिराको प्वाल चौडाई ' a ' छ र दुई चिरामाझको अन्तर ' b ' छ। त्यसपछि अधिकतम तथा न्यूनतम प्राप्त हुने सर्तहरू प्राप्त गर।

- (b) Write down two major differences between grating spectra and prism spectra.

2

গ্রেটিং বর্ণালী এবং প্রিজম বর্ণালীর মধ্যে দুটি মূল পার্থক্য লেখ।

विभर्तण रेखाचित्रसमूह वर्णपट र प्रिज्म वर्णपट माझका दुई प्रमुख भिन्नताहरू लेख।

- (c) What do you mean by ghost lines?

1

ভূতুড়ে রেখা (ghost lines) বলতে কি বোঝ ?

घोष्ट लहरहरू भनी के बुझिन्छ ?

—x—