

B.Sc. Sem-2 Honours Examination, 2020

Sub. - PHSA Paper – CC4 FM – 50 Duration – 2 hrs.

Modalities

1. An examinee shall not attend her/his college in person to sit for the examination of a practical paper. Examinee shall
 - (a) write her/his answer with BLACK INK only.
 - (b) must attach a scanned copies of her/his admit card of previous examination and the registration certificate at the end of the answer script.
 - (c) scan the whole answer script in a single .pdf file. If it is instructed to use separate answer scripts for different modules/units, if any, examinee must do accordingly, but she/he shall create a single .pdf file for the answer script. There will be exactly one .pdf file for each examinee.
 - (d) upload her/his answer script through proper web portal to submit.
2. The full marks and duration of examination of a paper shall be in accord with those specified by the University of Calcutta. The examination of a paper shall consist of three parts, viz., Internal, Theory and Practical. An examinee must use separate answer scripts for the three parts but scan the whole answer script (answers, admit card and registration certificate) in a single .pdf file and upload.
3. For examinations of a practical paper, examinees need not submit their laboratory work book, neither they have to face any viva. Examinees shall have to answer the questions following the instructions given in the question paper. Examinees shall use her/his own graph-papers to draw graphs(if any) and attach them at proper positions of the answer script. Examinees shall draw circuits and graphs with BLACK INK only.

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Use separate answer scripts for Internal, Theory and Practical examinations.

Internal - 10 : Answer any five questions. Each question carry 2 marks.

1.
 - (a) What is forced oscillation ?
 - (b) Define amplitude resonance.
 - (c) Why is the amplitude of a simple harmonic oscillator left to itself decreases with time ?
 - (d) What is meant by temporal coherence ?
 - (e) What are Haidinger fringes ?
 - (f) Write down the expression of the intensity distribution produced by Michelson interferometer.

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Theory – 25 : Answer any five questions. Each question carry 5 marks.

2. Define simple harmonic motion. Set up differential equation of motion of a simple harmonic oscillator and solve the equation. 1+2+2
3. The displacement of any particle at any instant of time t is given by $x = 3 \cos(\omega t) + 4 \sin(\omega t)$. Show that the motion is simple harmonic. Show that the kinetic energy oscillates with an angular frequency 2ω . 3+2
4. What are beats? Give an analytical expression of phenomenon of beats. Show that the beat frequency is equal to the difference of the frequencies of the component oscillations. 1+2+2
5. Explain Stokes' treatment to determine whether any phase change of light occurs during propagation, reflection and/or refraction. How is it possible to measure the refractive index of the material of thin transparent plate in terms of its thickness, by employing Michelson interferometer ? 2+3
6. Obtain the conditions of maximum and minimum intensity in case of interference on a thin film of non-parallel surfaces. 5
7. Write down the intensity distribution produced by diffraction through a single slit. Explain, with a graph, the positions of maxima and minima. 1+4

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Practical – 15 : Answer any one question.

8. Given the following data-table in the Newton-Ring experiment.

Ring no.	P ₀	P ₅	P ₁₀	P ₁₅	P ₂₀	P ₂₅	P ₃₀	P ₃₅	P ₄₀
Diameter ² (cm)	0.079	0.32	0.57	0.84	1.03	1.32	1.59	1.82	2.07

- (a) Draw ring no vs Diameter²(cm) graph from the above data table. 6
- (b) Write down the formula of the radius of curvature of the plano-convex lense used in the Newton's ring experiment. 3
- (c) From the graph calculate the radius of curvature of the plano-convex lense (wavelength of the light to be used: $5890 \times 10^{-8} \text{cm}$) 4
- (d) What is the cause of formation of circular rings in Newton's ring experiment? 2
9. (a) Define refractive index. 2
- (b) Why is it necessary to carry on the Schuster's method in specrometer related experiments. 3
- (c) Write down the dispersion relation between the wavelength(λ) and the refractive index(μ) of the material of the prism. 2
- (d) Draw the following curves from this relation.
(i) μ vs λ (ii) μ vs $\frac{1}{\lambda^2}$ 4
- (e) How is the value of the constants (which appear in the μ - λ relation) calculated from the) μ vs $\frac{1}{\lambda^2}$ graph ? 4
10. (a) How is it possible to determine the distance(d) between the virtual sources produced by a Fresnel biprism ? Write down the working formula. 4+2
- (b) Knowing 'd', how is it possible to determine the wavelength of a monochromatic light source by using the Fresnel biprism ? Obtain the necessary working formula. 5+4