FAROOK COLLEGE (AUTONOMOUS), KOZHIKODE

Sixth Semester B.Sc Physics Degree Examination, April 2025

BPH613 – Relativistic Mechanics and Astrophysics

(2022 Admission onwards)

Time: 2 hours   Max. Marks : 60

Section A - Short answer type
(Answer all questions in two or three sentences,
each carries a maximum of 2 marks)

1. Define luminosity. How it is related to the brightness of a star?

2. Balmer lines will be relatively weak in the spectra of hot stars. Why?

3. What is the effect of time dilation in atomic clocks?

4. State Hubble's law. What is the relevance of Hubble parameter?

5. What is meant by CMBR?

6. How are the temperature and color of a star related?

7. Explain Einstein's field equation in general relativity

8. What is meant by triple alpha process?

9. Differentiate between population I and population II stars

10. What is meant by Active galaxy?

11. Define parsec. How it is related to light year

12. What is meant by accretion disc?

(Ceiling: 20 marks)

Section B - Paragraph/problem type
(Answer all questions in a paragraph. Each carries a maximum of 5 marks)

13. Demonstrate that a moving rod undergoes both contraction and rotation.

14. Explain the internal structure of sun.

15. A star whose apparent magnitude 10 is at a distance of 25.3ly. Calculate its absolute magnitude.

16. Calculate the increase in mass when 2Kg is moving with a velocity of 0.75c. Hence find the kinetic energy

17. What are called main sequence stars? Explain their features.

18. Find the speed with which a clock should move so that it loses 1 minute in each hour.

19. Explain the stellar parallax method for measuring stellar distances.

(Ceiling: 30 marks)

20. Explain the mass dependence on velocity and derive the mass-energy relation.

21. Distinguish between special theory and general theory of relativity. What are the major predictions of general theory of relativity ?

(1x10=10 Marks)

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Name: ....

FAROOK COLLEGE (AUTONOMOUS), KOZHIKODE

Sixth Semester B.Sc Physics Degree Examination, April 2025

BPH6E03– Material Science

(2022 Admission onwards)

Time: 2 hours

Max. Marks : 60

The symbols used in the question paper have their usual meanings

Section A - Short Answer Type
(Answer all questions in two or three sentences, each correct answer carries a maximum of 2marks)

1. What is the atomic packing factor?
2. Draw the curve of dependence of repulsive, attractive, and net forces on interatomic separation for two isolated atoms
3. Discuss smart materials' role and influence on future developments.
4. Illustrate the Van der Waals bonding between two dipoles.
5. Explain the factors that affect diffusion
6. What are solid solutions and explain the type of solid solutions
7. Differentiate between the Schottky defect and Frenkel defect
8. What are carbon nanotubes and cite two applications of it
9. Write a note on Graphite
10. How a microscopic image is obtained using a TEM
11. Explain the principle of Scanning Electron Microscopy
12. Explain the advantages of electron microscopy over optical microscopy

(Ceiling 20 marks)

Section B - Paragraph / Problem type

13. Obtain the atomic packing factor for a face-centered cubic crystal system
14. Discuss the different types of defects and impurities in solids
15. Briefly discuss the properties and applications of Glass–Ceramics
16. Derive Bragg's law for X-ray diffraction and obtain the interplanar spacing for the first-order diffraction pattern at an angle of $32°$ (Given $\lambda=1.514Å$)
17. Sketch the structures of Common Hydrocarbon Groups (a) Methyl alcohol (b) Acetic acid (c) Formaldehyde
18. Discuss the methods for grain size determination of polycrystalline materials
19. Explain the diffusion mechanism in solids taking copper–nickel diffusion as an example, and sketch appropriate diagrams

(Ceiling: 30 marks)

(Essays - Answer any question in about two pages. Answer carries 10 marks)

20. Discuss briefly with illustration the primary interatomic bonding in crystals and molecules

21. Describe the fabrication and processing of glasses and glass ceramics

(1 x 10 = 10 marks)

FAROOK COLLEGE (AUTONOMOUS), KOZHIKODE

Sixth Semester B.Sc Physics Degree Examination, April 2025

BPH6B10 – Thermodynamics

(2022 Admission onwards)

Time: 2 hours   Max. Marks : 60

The symbols used in this question paper have their usual meanings
Section A - Short Answer type.

(Answer all questions in two or three sentences, each correct answer carries a maximum of 2 marks)

1. What is Quasistatic Process?

2. Explain why $C_p > C_v$ for a gas.

3. What is meant by thermodynamic equilibrium ?

4. State the Second law of thermodynamics.

5. What is the difference between an Otto engine and a diesel engine?

6. Discuss about the Clausius Clapeyron equation.

7. Explain Nernst heat theorem.

8. Explain the Clausius theorem.

9. The entropy of the Universe is increasing. Justify the Statement.

10. What is a Phase Change?

11. What is Helmholtz Free Energy ? Give two of its properties.

12. Explain Joule-Kelvin Coefficient.

(Ceiling-20)

Section B - Paragraph/Problem type.

(Answer all questions in a paragraph of about half a page to one page, each correct answer carries a maximum of 5 marks)

13. Derive Mayer's Relation.

14. Two moles of an ideal gas kept at a constant temperature of 20°C changes its volume from 4 litres to 1 litres. Calculate the work done.

15. State and prove Carnot's theorem.

16. Calculate the efficiency of engine that absorbs heat at 600K and exhausts it at 400K.

17. Calculate the change in entropy when 1 litre of water at 27°C is heated to 77° C.

18. Derive TdS equation.

19. Show that for a perfect gas $\left(\frac{\partial U}{\partial V}\right)_T = 0$.

(Ceiling-30)

20. What are the different thermodynamic processes? Derive the expression for work done in different thermodynamic processes.

21. Define Entropy.What are the significance of entropy? What will be the change in entropy for

    (i) Carnot cycle (ii) Reversible Cycle (iii) Irreversible process and (iv) free expansion.

    (1x10 = 10)

(Pages : 2)   Reg. No:.........................

Name: ....

FAROOK COLLEGE (AUTONOMOUS), KOZHIKODE

Sixth Semester B.Sc Physics Degree Examination, April 2025

BPH6B12 – Nuclear Physics & Particle Physics

(2022 Admission onwards)

Time: 2 hours

Max. Marks : 60

Section A-short answer type
Answer all questions in two or three sentences, each correct answer carries 2 marks.

1. What are magic numbers in nuclear physics?
2. What is meant by a chain reaction in nuclear fission?
3. What are synthetic elements?
4. What is neutron activation analysis?
5. How does the size of a nucleus depend on its mass number?
6. What is nuclear binding energy, and why is it important?
7. What are leptons? Give two examples.
8. What is the strangeness quantum number?
9. What is the Standard Model in Particle Physics?
10. Check any two conservation laws in this particle reaction $\pi^+ + P \rightarrow \pi^- + n$
11. What is the principle of the Cockcroft-Walton accelerator?
12. What is the working principle of a cloud chamber?

(Ceiling-20)

Section B -Paragraph/Problem type
Answer all questions in half a page to one page, each correct answer carries 5 marks.

13. Explain the four fundamental interactions in nature.
14. Discuss the quark model.
15. Explain the working of linear accelerators.
16. What is an alternating-gradient accelerator? Discuss its significance.
17. A 5 mg sample of polonium-210 ($^{210}P_0$) has an atomic mass of 210 u and a half-life of 138 days. Calculate its activity.
18. Discuss the production of radioisotopes in nuclear reactions.
19. What are the different types of β decay?

(Ceiling-30)

20. Describe the working principle, construction, and limitations of a cyclotron. How does it differ from a linear accelerator?

21. Describe the liquid drop model of the nucleus, its assumptions, and the semi-empirical mass formula. What are its limitations?

(1x10 = 10 Marks)

FAROOK COLLEGE (AUTONOMOUS), KOZHIKODE

Sixth Semester B.Sc Physics Degree Examination, April 2025

BPH6B11 – Statistical Physics, Solid State Physics, spectroscopy & Photonics

(2022 Admission onwards)

Time: 2 hours

Max. Marks : 60

Section A - Short Answer type.
(Answer all questions in two or three sentences, each correct answer carries a maximum of 2 marks)

1. What are symmetric tops and Asymmetric tops? Give one example for each.
2. What is signal –noise ratio in spectroscopy?
3. Give four differences between Unit cell and Primitive cell.
4. Define the term rotational constant.
5. What is packing fraction? Which structure has the highest packing fraction?
6. What is quantization of energy?
7. Differentiate between spontaneous and stimulated emission.
8. What is Born-Oppenheimer approximation?
9. What is population inversion?
10. Explain the terms pumping and metastable state.
11. What are the factors contributing to the width of spectral lines?
12. Write four important features of Miller indices.

                                                          (Ceiling -20)

Section B - Paragraph /Problem type.
(Answer all questions in a paragraph of about half a page to one page, each correct answercarries maximum of 5 marks)

13. What is Raman Effect? Explain the quantum theory of Raman Effect.
14. The first absorption spectral line of $^{12}C^{16}O$ is at 3.842 cm^{-1} while that of $^{13}C^{16}O$ is at3.673 cm^{-1}. Find the ratio of their moments of inertia.
15. Explain the structure of Sodium Chloride.
16. Write a short note about classical statistics and quantum statistics.
17. Write down the relations between lattice parameters and draw structure of the seven basic crystal structures.
18. Explain the structure and function of Ruby Laser
19. Explain the vibrational energy levels and spectrum of a simple harmonic oscillator.

                                                          (Ceiling-30)

20. State the features of Maxwell-Boltzmann distribution. Derive an expression for the average energy of an ideal-gas molecule.

21. Derive Bragg's Law. Explain Bragg's X-ray spectrometer

(1x10= 10 marks)