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1B5N25076 (Pages : 2) Reg. No:.....

Name: .....

FAROOK COLLEGE (AUTONOMOUS), KOZHIKODE

Fifth Semester B.Sc Physics Degree Examination, November 2025

BPH5B06 - Computational Physics

(2022 Admission onwards)

Time: 2 hours Max. Marks : 60

SECTION A: Answer the following questions. Each carries *two* marks

(Ceiling 20)

1. Name different **data** types in Python with one example each.
2. Write an algorithm to find the largest of two numbers.
3. What is pickling in Python?
4. Write the syntax and example for list append () and list insert () methods.
5. How are infinite loops implemented in Python?
6. Write a Python program to open a file in write mode and store the string "Hello World".
7. Write a Python program to create a 3×3 matrix using NumPy and compute its inverse.
8. Write Newton forward interpolation formula. Under what conditions is this formula most effective for interpolation?
9. Explain the fundamental difference between analytical and numerical methods for solving a mathematical problem. Provide one example for each approach.
10. Explain the concept of discretization.
11. Describe and differentiate between the two main types of errors in numerical methods.
12. Explain the purpose of the reshape function in NumPy with proper Python syntax.

SECTION B: Answer the following questions. Each carries *five* marks (Ceiling 30)

13. Write a Python program to find the factorial of a given number entered by the user.
14. Write a Python program to generate and plot the following functions using subplots for $x \in [0,2\pi]$ (a) $y = \sin(x)$ (b) $y = \sin(x^2)$ (c) $y = \cos(x)$ (d) $y = \cos^2(x)$
15. Find the negative root of the equation $x^3 - 21x + 35 = 0$ correct to two decimal places using Newton-Raphson method
16. Explain the numerical method for simulating the motion of a freely falling object in a viscous medium that experiences a resistive force proportional to its velocity. Describe the governing differential equations for this problem.
17. Evaluate the integral of the following tabular data with (a) the trapezoidal rule and (b) Simpson's 1/3 rule

x	0.00	0.25	0.50	0.75	1.00
y=f(x)	1.00	0.800	0.6667	0.5714	0.500

18. Using Runge-Kutta second order formula to find the y(0.2)

$$\frac{dy}{dx} = xy + y^2, \quad y(0) = 1, \text{ Take h=0.1}$$

19. Elucidate the difference between if ... else and if.....elif statements. Write a Python program to check the given year is leap year or not.

SECTION C: Answer any *one* question (1 × 10 = 10 Marks)

20. What is curve fitting? Discuss the principle of least square straight line fitting. Obtain the best linear fit for the following data

X	0	0.2	0.4	0.6	0.8	1.0
Y	1.357	3.501	5.805	8.012	10.335	12.689

21. Explain the numerical method for solving the motion of a projectile under gravity. Develop a step-by-step algorithm and provide a Python program to simulate the projectile's trajectory, including the necessary calculations.

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1B5N25077 (Pages : 2) Reg. No:.....

Name: .....

FAROOK COLLEGE (AUTONOMOUS), KOZHIKODE

Fifth Semester B.Sc Physics Degree Examination, November 2025

BPH5B07 - Quantum Mechanics

(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 work function in photoelectric effect ?
2. How photoelectron current related to the energy of irradiated light on metal?
3. State the Heisenberg uncertainty principle relating the energy and the time interval for a microscopic particle.
4. Mention any two characteristics of De Broglie wave
5. Write the Bragg equation for maxima in the diffraction pattern
6. Write the equation for radius of orbit in Hydrogen atom
7. What is ionization energy? Write its value for hydrogen atom
8. Write the time dependent Schrodinger equation in one dimension. Explain each term
9. If the wave function of the system is known, how we can find the expectation value of any operator $\hat{G}$?
10. What you mean by degeneracy of eigenstates ?
11. Define Bohr magneton.
12. Write down the possible l values and m_l values for $n=5$

(Ceiling-20 marks)

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. Find the value of the normalization constant A for the wave function $\phi = Axe^{-x^2/2}$
14. Show that the most likely distance of an electron from the nucleus is $4a_0$, where a_0, is the Bohr radius and radial probability $P(r) = \frac{r^4}{24a_0^5} e^{\frac{-r}{a_0}}$
15. Find the de Broglie wavelength of (a) a 5-MeV proton; (b) a 50-GeV electron; (c) an electron moving at velocity v = 1.00×10^6 m/s.
16. Explain the space quantization of angular momentum
17. With the help of diagram, explain Frank-Hertz experiment
18. Find the shortest and longest wavelengths of spectral lines in Paschen series of Hydrogen atom
19. Explain Davisson-Germer experiment to prove that particles show wave-particle duality

(ceiling:30 marks)

SECTION C – Essay type

(Essays - Answer in about two pages, any one question. Answer carries l0 marks)

20. a) Define the probability density (2 marks)

    b) Write the Schrodinger equation for quantum mechanical Harmonic oscillator and derive the expression for energy in n^{th} quantum state (8 marks)

21. a) A beam of photons passes through a block of matter. What are the three ways that the photons can lose energy in interacting with the material (3marks)

    b) Derive the expression for change in the wavelength occurred during the Compton scattering process (7 marks)

(1 × 10 = 10 marks)

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1B5N25078 (Pages : 2) Reg. No:.....

Name: .....

FAROOK COLLEGE (AUTONOMOUS), KOZHIKODE

Fifth Semester B.Sc Physics Degree Examination, November 2025

BPH5B08 - Optics

(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. State laws of refraction.
2. What will happen to the Newtons rings if we introduce a liquid in between the glass plate and lens?
3. Give one practical application of non-reflecting films.
4. Draw a neat sketch of Fresnel's Double mirror arrangement and show the formation of virtual sources.
5. What is meant by missing orders in double slit diffraction pattern?
6. What do half period zones mean?
7. State Brewsters Law.
8. What is meant by pulse dispersion in optical fibres?
9. Distinguish between step-index fibre and graded-index fibre.
10. What is hologram ?
11. List the applications of holography
12. How does holography differ from conventional photography?

(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. Obtain the system matrix for a thin lens placed in air and made of refractive index 1.5 and radii of curvature 50cm each.
14. Newtons rings are formed in reflected light using a plano convex lens of radius of curvature 1m and a plane glass plate. Find the radius of the 10^{th} dark ring is sodium light of wavelength 590nm is used.
15. The first order maximum of maximum of wavelength 600nm is formed at an angle 20^{0} with a grating of width 2.5cm. Find the total number of rulings on the grating.
16. Calculate the thickness of a quarter wave plate to be used with light of wavelength of 600nm if the refractive index of extraordinary light is 1.553 and that of ordinary light is 1.544.
17. An Optic Fiber has a core of refractive index 1.5 and a cladding of refractive index 1.4. Calculate the numerical aperture and acceptance angle.
18. Using neat diagram explain the reconstruction of image in holography.

(Ceiling - 30)

Section C - Essay type

(Answer in about two pages, any one question. Answer carries 10 marks)

19. Explain the Fresnel's biprism method for producing interference bands. How the distance between the coherent sources is found experimentally ?
20. Discuss the Fraunhofer diffraction of light on a single slit and deduce a relation for the intensity variation of the diffraction pattern produced on a screen.

(1 x 10 =10 marks)

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Name: .....

FAROOK COLLEGE (AUTONOMOUS), KOZHIKODE

Fifth Semester B.Sc Physics Degree Examination, November 2025

BPH5B09 – Electronics

(2022 Admission onwards)

Time: 2 hours Max. Marks : 60

The Symbols used in this question paper have their usual meaning

Section A- Short Answer Type

(Answer all question in two or three sentences. Each correct question carries a maximum of 2 Marks)

1. With neat circuit explain working of a voltage tripler.
2. Draw the circuit of a full wave bridge rectifier.
3. Explain why amplifiers generally use negative feedback while oscillators require positive feedback.
4. Sketch the static output and input characteristics of common-base transistor configuration.
5. Explain collector-emitter leakage current (I_{CEO}). How it is related to collector-base leakage current (I_{CBO}) ?
6. How will you draw the dc load line on the output characteristics of a transistor? What is its importance?
7. A transistor has β is 100. If the collector current is 40 mA, find the value of emitter current.
8. State and explain the Barkhausen criterion for oscillation
9. How is positive feedback established in a phase-shift oscillator? Explain the principle involved.
10. Convert the binary number 11010112 to its decimal and hexadecimal equivalents
11. Subtract 10102 from 11112 using 2's complement method
12. Explain phase reversal in common emitter amplifier.

(Ceiling -20 Marks)

Section B- Paragraph/Problem Type

(Answer all questions in a paragraph. Each correct question carries a maximum of 5 Marks)

13. A Zener diode with a Zener voltage (V_Z) of 5.6 V and a maximum Zener current (I_{Zmax}) of 50 mA is used in a voltage regulator circuit. The unregulated input voltage (V_{in}) varies from 10 V to 15 V. The load resistor (R_L) is fixed at 200 Ω. (a) Calculate value of the series resistor R_S (b) Load Current I_L. Assume that minimum Zener current I_{Zmin} is 1 mA.
14. With a neat circuit diagram, explain the base-resistor method of transistor biasing. Discuss the limitations of this method in terms of thermal stability.
15. Draw DC and AC equivalent circuit for a single stage CE amplifier.
16. A single stage transistor employed with voltage divider bias with following circuit parameters. V_{CC} =15 V, R_1=10 KΩ, R_2= 2 KΩ, R_C=1 KΩ, R_E= 500Ω, and R_L= 1 KΩ. (a) draw dc load line (b) Calculate operating point. Assume V_{BE} =0.7 V
17. An amplifier has a voltage gain of Av=2000 without feedback. A negative feedback loop is implemented using a feedback network with a feedback factor of β=0.01. Calculate (a) gain of the amplifier with feedback (A_{vf})
    (b) The output voltage with feedback (V_{outf}).
18. Draw the logic diagram of an RS flip-flop using NOR gates. Explain its truth table.
19. Simplify the given equations and implement the results with logic gates
    (i) $\overline{A} + \overline{A}B + AB\overline{C}$
    (ii) $A + \overline{A}B + AB\overline{C} + \overline{AB}$

(Ceiling -30 Marks)

Section C

(Answer any question. Each correct question carries a maximum of 10 Marks)

20. With the help of neat diagrams, describe the basic operation of an operational amplifier. Highlight its ideal and practical characteristics. Construct inverting and summing amplifier using op-amp. Obtain the gain
21. (a) What are Exclusive OR (XOR) gate? Explain its logical function, truth table and construction.
    (b) With neat logic diagrams, explain the construction and working of a Half Adder. Write its truth table and Boolean expression

(1 ×10 - 10 Marks)

1B5N25080 (Pages : 2) Reg. No:.....

Name: .....

FAROOK COLLEGE (AUTONOMOUS), KOZHIKODE

Fifth Semester B.Sc Physics Degree Examination, November 2025

(Open Course)

BPH5D01 – Non Conventional Energy sources

(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 in two or three sentences
Each correct answer carries a maximum of 2 marks)

1. Mention two applications of geothermal energy?
2. What are the different types of batteries?
3. Explain advantages of WECS.
4. What is the advantage of a solar greenhouse?
5. What are the major components of the extra-terrestrial solar radiation?
6. Briefly explain the main components of a biogas plant.
7. What are the four geothermal resources?
8. Mention the working principle of OTEC.
9. What are the main devices used to measure the solar radiations?
10. Differentiate renewable and non-renewable energy sources with example.
11. What are the problems in operating large wind power generators?
12. Define solar distillation.

(Ceiling 20)

Section B - Paragraph / Problem type.
(Answer in a paragraph of about half a page to one page
Each correct answer carries a maximum of 5 marks)

13. Explain advantages of non-conventional energy sources with example.

14. With help of a diagram explain briefly the solar greenhouse effect.

15. What are the aadvantages and disadvantages of wind energy.

16. Explain the essential parts of a photovoltaic system.

17. What are the basic processes involved in a solar cell?

18. Define Ocean Energy and Ocean Energy Sources.

19. Explain the solar cooker.

(Ceiling 30)

SECTIONC -Essay type
(Essays - Answer in about two pages, any one question. Answer carries 10 marks)

20. Explain different biomass Conversion processes.

21. a) Explain the Principle of wind energy conversion and wind power.

    b) What are the basic components of wind energy conversion system (WECS)?

(1 x 10 = 10 marks)