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1B5N23476

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Reg. No:.....

Name: .....

FAROOK COLLEGE (AUTONOMOUS), KOZHIKODE

Fifth Semester B.Sc Physics Degree Examination, November 2023

BPH5B06 – Computational Physics

(2019 Admission onwards)

Time: 2hours

Max. Marks: 60

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

(Ceiling 20)

1. Identify the functional differences of the compiler and interpreter in the context of high-level computer language.
2. Briefly explain the use of range ( ) function in python.
3. Write a python program to add an element 10 to a list A = [1, 2, 7] and to print that LIST.
4. Explain the difference between list and tuple.
5. What is meant by indentation and what is the its importance in python?
6. Write a python program to create 2 x 2 matrix and multiply by 3 and print results.
7. Write a note on break and continue statements.
8. Write a program to print the sum of the following series

$$1+\frac{1}{2}+\frac{1}{3}+\frac{1}{4}+\frac{1}{5}+\ldots\ldots\ldots\ldots\ldots+\frac{1}{n}$$

9. Explain the principle of least square linear curve fitting.
10. Estimate the values using Taylor series expansion of *cos* (15) and *s in* (22)
11. Explain the term discretization.
12. What are the source of error in numerical computation? Explain

SECTION B: Answer the following questions. Each carries *five* marks

(Ceiling 30)

13. Write a program to find the largest among three numbers.
14. Explain various array operations with examples.
15. Write a python program to create a 3 × 3 matrix and find its inverse.
16. Use the Newton-Raphson method to estimate the root of $f(x) = e^{-x} - x$, employing an initial guess of $x_0 = 1.0$

17. Explain how the problem of a body moving under inverse square law force is solved numerically.

18. A rocket is launched from the ground. Its acceleration measured every 5 seconds and is tabulated below. Find the velocity and the position of the rocket at t=40 seconds by using Trapezoidal and Simpson rule.

t	0.0	5	10	15	20	25	30	35	40
a(t)	40.0	45.25	48.50	51.25	54.35	59.48	61.5	64.3	68.7

19. From the following table of values x and y, obtain dy/dx and d^2y/dx^2 for x=1.2.

x	1.0	1.2	1.4	1.6	1.8	2.0	2.2
y	2.7183	3.3201	4.0552	4.9530	6.0496	7.3891	9.0250

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

20. (a) Explain second order Runge-Kutta method for solving differential equations.

(b) Write a python program to simulate a two-dimensional projectile motion using Euler method.

21. Obtain Newton's forward difference interpolation formula. Construct a difference table and find the value of y(4) : y(1) =24, y(3)=120, y(5) =336, and y(7) = 720

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Reg. No:.....

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FAROOK COLLEGE (AUTONOMOUS), KOZHIKODE

Fifth Semester B.Sc Physics Degree Examination, November 2023

BPH5B07 – Quantum Mechanics

(2019 Admission onwards)

Time: 2hours

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 any two laws of photoelectric effect.
2. How Rydberg constant is changed when reduced mass taken instead of mass.
3. What is distance of closest approach of a projectile to nucleus ?
4. Write the equation for energy of electron in n^{th} state of Hydrogen atom.
5. What is the probability amplitude of matter wave ?
6. Mention any two properties of matter wave.
7. State uncertainty principle for energy and time.
8. What is the zero point energy of Harmonic oscillator?
9. Write time dependent Schrodinger equation.
10. Explain the correspondence principle.
11. What is Normal Zeeman effect ?
12. Write down the possible l values and m_l values for n=6. **(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. Find the wavelength of spectral line that corresponds to transition from n=4 to n=1 of Hydrogen atom.
14. With the help of diagram, explain Frank-Hertz experiment.
15. Find the expectation value <x> of the position of particle in a box of length L.
16. Show that radial probability, P(r) dr for ground state electron in hydrogen atom has its maximum at Bohr radius.
17. Calculate the group velocity of wave whose phase velocity is $v_p = \sqrt{\frac{k\lambda}{4\pi}}$ where λ is the wavelength of the wave.
18. In a simultaneous determination of the position and momentum of an electron of kinetic energy 6 Mev, the position is determined by an accuracy of 3 nm. Calculate the percentage of uncertainty in the momentum of the electron.
19. Derive the expression for magnetic potential energy.

SECTION C – Essay type

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

20. A) What are the characteristics of well-behaved wave function ? (2 marks)

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

OR

21. A) Explain the phenomenon of Compton effect (2 marks)

    B) Derive the expression for change in wavelength occurred during the scattering process (6 marks)

    C) Calculate the maximum possible wavelength change that may occur during the process (2 marks)

(1 × 10 = 10 marks)

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Reg. No:.....

Name: .....

FAROOK COLLEGE (AUTONOMOUS), KOZHIKODE

Fifth Semester B.Sc Physics Degree Examination, November 2023

BPH5B08 – Optics

(2019 Admission onwards)

Time: 2hours

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 and explain Fermat's principle of least time.
2. What is meant by destructive interference? Give the condition.
3. What are coherent sources? Give two examples.
4. Write the cosine law for interference by division of amplitude.
5. How will you determine the refractive index of a liquid by Newton's rings?
6. Explain the diffraction by a circular aperture
7. Define the resolving power of a grating. Write down an expression for it.
8. Compare a zone plate and a convex lens.
9. Explain the phenomenon of polarisation by double refraction.
10. What are negative and positive crystals? Give two examples for each.
11. Give two advantages of optical fibre communication system over conventional telecommunication system.
12. Briefly explain how image is constructed from a hologram.

(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 the laws of reflection from Fermat's principle.
14. Interference fringes are produced by Fresnels biprism in the focal plane of a reading microscope which is 1m from the slit. A lens interposed between the biprism and microscope give two images of the slit in two positions. The images of the slits are 4.05 mm in one position and 2.90 mm in another position and the wavelength of sodium light is $5893A^0$. Find the fringe width.
15. In a wedge shaped film, the distance between the successive fringes is measured to be 1.25mm. The angle of the wedge is 40 seconds. Calculate the wavelength of light used $\mu = 1.4$.
16. A parallel beam of monochromatic light is allowed to be incident normally on a plane transmission grating having 5000 lines / cm and the third order spectral line is found to be diffracted through 45^0. Calculate the wavelength of light.
17. The radius of the first zone on the zone plate is 0.05 cm. A plane wavefront of light of wavelength $5000A^0$ is incident on it. Find the distance of the screen from the zone plate so that light is focused to bright spot.
18. Calculate the thickness of (i) a quarter wave plate and (ii) a half wave plate. Given that $\mu_o = 1.973$, $\mu_e = 2.656$, $\lambda = 590$ nm
19. Derive the expression for acceptance angle of an optical fibre.
    In an optical fibre, the core has a refractive index of 1.6 and the cladding has a refractive index of 1.3. Find the values of critical angle and acceptance angle for the fibre.

(Ceiling - 30)

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

20. Derive expression for the condition of brightness and darkness produced under oblique incidence of light on a plane film producing interference, due to reflected light.
21. Derive the theory of plane diffraction grating and explain how it is used to measure the wavelength of a given source of light.

(1 x 10 =10 marks)

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(Pages : 2)

Reg. No:.....

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FAROOK COLLEGE (AUTONOMOUS), KOZHIKODE

Fifth Semester B.Sc Physics Degree Examination, November 2023

BPH5B09 – Electronics

(2019 Admission onwards)

Time: 2hours

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. Explain capacitor filter.
2. What are the advantages and disadvantages of a full wave bridge rectifier?
3. What is transistor biasing?
4. Define I_{CBO} and I_{CEO}. How are they related?
5. Explain transformer coupled amplifier.
6. What is frequency response?
7. What is meant by gain in dB?Write equation for decibel power gain and decibel voltage gain.
8. Explain Barkhausen criterion.
9. Distinguish between differential mode and common mode signals.
10. What is meant by virtual ground?
11. Explain octal number system.
12. Convert decimal number 98.5 into a binary number.

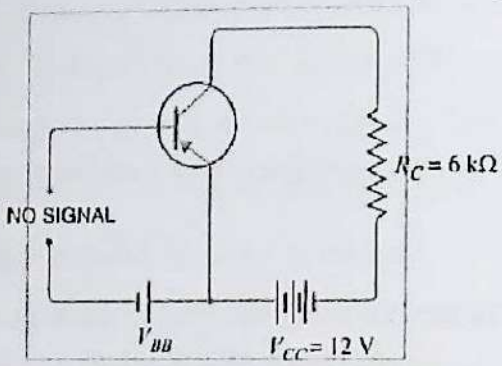
(Ceiling –20)

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. Explain the equivalent circuits of a zener diode. How it is used as a voltage stabilizer?

14. In the circuit diagram shown, Vcc =12V, Rc = 6kΩ. Draw the dc load line. What will be the Q point if zero signal base current is 20μA and β=50 ?



15. Explain the working of a Hartley oscillator.

16. A phase shift oscillator uses 5pF capacitors in the RC network. Find the value of resistance to produce a frequency of 800kHz.

17. Explain the working of an ideal opamp integrator.

18. Subtract 23 from 48 using 2's complement method.

19. Prove $(A+B)\overline{(\overline{A}(\overline{B}+\overline{C}))}+\overline{A}(B+C)=A+B+C$

(Ceiling –30)

SECTION C – Essay type

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

20. Discuss the construction and working of a single stage CE amplifier. Explain ac and dc equivalent circuits and derive the voltage gain.

21. Explain the working of a positive edge triggered JK flip flop. How it is converted into a master-slave JK flip flop ?

(1 x 10 = 10 Marks)

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1B5N23480

(Pages : 2)

Reg. No:.....

Name: .....

FAROOK COLLEGE (AUTONOMOUS), KOZHIKODE

Fifth Semester B.Sc Physics Degree Examination, November 2023

(Open Course)

BPH5D01 – Non Conventional Energy Sources

(2019 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. What is diffuse radiation?
2. What is a solar greenhouse?
3. How are solar collectors classified?
4. Explain the principle of conversion of solar energy into heat.
5. What are the advantages and disadvantages of conventional & non-conventional energy sources?
6. Write any four disadvantages of wind energy.
7. What are the causes of wind?
8. What is biomass and why it is considered asrenewable energy?
9. What are the advantages and disadvantages of wave energy?
10. What are the possible sources of geothermal pollution? How these are avoided?
11. What are the main advantages and disadvantages of biomass energy?
12. Name the three main components of tidal power plants.

(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. What are the difficulties in tidal power development?
14. With the help of a diagram, explain the operation of wave energy conversion.
15. Discuss the sources of geothermal energy.
16. What are the factors that determine the output from a wind energy converter?
17. Briefly explain the OTEC system
18. Give any three applications of wind energy technologies.
19. Describe briefly a solar still or solar distillation.

(Ceiling 30)

SECTIONC –Essay type

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

20. Explain any two techniques used to derive useful energy from biomass.
21. (a) Explain the different aspects of solar radiation reaching the surface of the earth.
    (b) What are the basic instruments used for the measurement of solar radiation?

(1 x 10 = 10 marks)