D 92476 (Pages : 4) Name.....

Reg. No.....

FIFTH SEMESTER U.G. DEGREE (SPECIAL) EXAMINATION NOVEMBER 2020

(CUCBCSS—UG)

Physics/Applied Physics

PHY 5B 06/APY 5B 07—ELECTRODYNAMICS—II

Time : Three Hours Maximum : 80 Marks

The symbols used in the question paper have their usual meanings.

Section A

Answer in a word **or** *a phrase.*

Answer ***all*** *questions.*

Each question carries 1 *mark.*

1. Unit of self inductance is ————.
2. $\frac{1}{\mu}$ (E X B) is the energy transported by the field per unit time per unit area and is known as ———— vector.
3. Energy stored in magnetic field B per unit volume in free space is given by ————.
4. A load draws maximum power from a circuit when its resistance ———— the circuit resistance.
5. The operator $+j$ indicates a phase advance of ————.

Write True *or* False :

6. Faraday's law gives the magnitude of induced e.m.f. due to changing magnetic field.
7. If there is no charge inside a closed surface then the Electric filed diverging out of the corresponding volume is equal to zero.
8. Time constant of LR circuit is given by R/L.
9. When A.C. flows through a resistor, the e.m.f and current are in phase.
10. In a purely inductive circuit the power consumed is infinite.

(10 × 1 = 10 marks)

Section B

Answer at least **six** *questions.*
Each question carries 2 *marks.*
All questions can be attended.
Overall Ceiling 12.

11. Does magnetic monopole exist ? Explain your answer with any *one* of the Maxwell's equations.

12. What is Neumann formula to find mutual inductance ? Give the factors on which mutual inductance depends.

13. Define time constant for the circuit containing resistance and capacitor when the capacitor charges. Explain with the relevant equation.

14. Give the conditions for the moving coil galavanometer to be ballistic.

15. Why an a.c. current carrying coil repels a metallic ring ?

16. State and illustrate Thevenin's theorem.

17. What are the requirements of a source to be an ideal voltage source ?

(6 × 2 = 12 marks)

Section C

Answer at least **four** *questions.*
Each question carries 5 *marks.*
All questions can be attended.
Overall Ceiling 20.

18. How did Maxwell fix Ampere's law ?

19. Show that electromagnetic waves are transverse in nature.

20. Relate energy stored per unit volume to momentum density stored in the electromagnetic field.

21. Discuss the performance of an A.C. through resistance and inductance in series. Find the current, e.m.f. power factor and impedance.

22. Write down the electric and magnetic field for a monochromatic plane wave of amplitude E_0, frequency ω and phase angle φ that is travelling in the positive y direction and polarized in the x direction.

23. A long cylindrical magnet of length L and radius r carries a uniform magnetisation M parallel to its axis. It passes through a circular ring of slightly larger diameter with a constant velocity v. Plot the graph with e.m.f. induced in the ring as a function of time.

24. Illustrate Norton's theorem from an example.

(4 × 5 = 20 marks)

Section D

Answer at least **three** *questions.*
Each question carries 6 *marks.*
All questions can be attended.
Overall Ceiling 18.

25. Find the Boundary conditions for electric and magnetic Fields at the interface between two media.

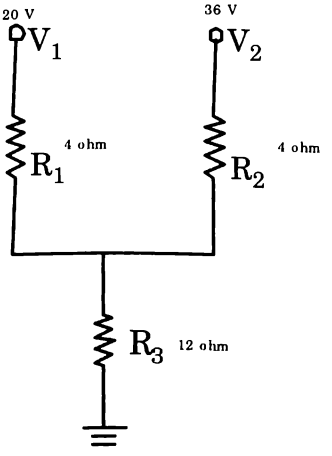
26. Derive the wave equation for electromagnetic waves in vacuum and hence find the velocity of propagation.

27. In an oscillatory circuit L = 0.4 henry and C = 0.6 μF.What is the maximum value of the resistance for the circuit to be oscillatory.

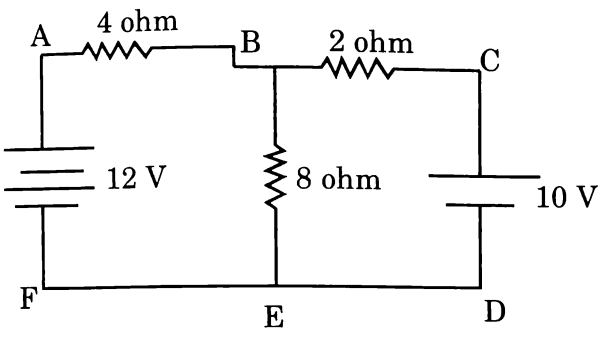
28. An alternating e.m.f. of 200 V , 50 Hz, is applied to a condenser in series with a 20 V 5 watt lamp. Find the capacity of the condenser.

29. Find the natural frequency of a circuit containing inductance of 40 micro henry and a capacity of 400 pF. To what wavelength it will be in tune ?

30. The circuit shown below is excited by two voltage sources of zero internal resistance. Use superposition principle to find the current flowing through the common resistance R_3 and voltage drop across it.



31. Using Kirchoff's law calculate the branch currents in the network of figure given below.



(3 × 6 = 18 marks)

Section E (Essays)

Answer any **two** *question.*
Each question carries 10 *marks.*

32. Describe the reflection and transmission of electromagnetic waves in matter at normal incidence.

33. Obtain Maxwell's equations in matter.

34. Discuss the growth of charge in a capacitor in a circuit containing resistance connected to a cell of steady e.m.f. Also find the time constant of the circuit.

35. How will you determine the self inductance by Raleigh's method ?

(2 × 10 = 20 marks)

D 92478 (Pages : 3) Name.....

Reg. No.....

FIFTH SEMESTER U.G. DEGREE [SPECIAL] EXAMINATION NOVEMBER 2020

(CUCBCSS—UG)

Physics/Applied Physics

PHY 5B 08/APY 5B 09—PHYSICAL OPTICS AND MODERN OPTICS

Time : Three Hours Maximum : 80 Marks

The symbols used in the question paper have their usual meanings.

Section A

Answer **all** *questions.*
Each question carries 1 *mark.*

1. Determinant of translation matrix is ————————.
2. The resultant maximum intensity when N coherent waves of equal intensities I_0 interfere is given by the equation ————————.
3. Interference in thin is observed if the thickness of the film is less than the ———————— of the incident light waves.
4. Interference fringes of equal inclination are called ————————.
5. Pulse dispersion is ———————— in graded index fibre than that of step index fibre.

Write True or False :

6. The four constants of system matrix are independent
7. To get Fraunhofer diffraction pattern the incident wave front must be plane.
8. The speed of extra ordinary ray is different in different directions.
9. Colour of soap bubble is mainly due to diffraction.
10. Holography is based on polarization of light.

(10 × 1 = 10 marks)

Section B

Answer at least **six** *questions.*
Each question carries 2 *marks.*
All questions can be attended.
Overall Ceiling 12.

11. How is Newton's rings formed ? Why it is circular ?
12. What is Blooming ? Explain the method.
13. Give the criterion of limit of resolution of two objects with respect to diffraction patterns.
14. What is a zone plate ?
15. How does the intensity vary along the screen when two light waves of equal intensities are interfered ?
16. What are the conditions for interference of light ?
17. Give the principle of light propagation through the optical fibre.

(6 × 2 = 12 marks)

Section C

Answer at least **four** *questions.*
Each question carries 5 *marks.*
All questions can be attended.
Overall Ceiling 20.

18. Use Fermat's principle to prove that for reflection, angle of incidence is equal to angle of reflection.
19. Consider a light ray refracts through a spherical surface of radius of curvature R and refractive index μ placed in air. Find the refraction matrix.
20. Explain the method of production of interference pattern using Fresnel's two mirror arrangement.
21. Describe Fresnel's diffraction. Intensity on the screen due to diffraction at the straight edge corresponding to the point of edge is $I_0/4$. Justify the answer.
22. Describe Fresnel's biprism. How is it used to find the wavelength of light ?
23. Describe the construction of graded index fibre. How is it different from step index fibre ?
24. Illustrate multimode Fibre optic sensors.

(4 × 5 = 20 marks)

Section D

Answer at least **three** *questions.*
Each question carries 6 *marks.*
All questions can be attended.
Overall Ceiling 18.

25. A thick lens having radii of curvature + 10 cm and – 10 cm is made up of a material of refractive index 1.5. If the thickness of the lens is 1 cm, find system matrix.

26. In a biprism experiment, interference fringes are observed at a distance of 80 cm away from it. The refractive index of the material of the biprism is 1.6. If the distance between the source and the biprism is 10cm, calculate the fringe width when wave length of light used is 6000 Å .Given that the biprism has refracting angle 2°.

27. In a Michelson interferometer 100 fringes cross the field of view when the movable mirror is moved though a distance of 0.03 mm. Calculate the wavelength of light used.

28. In a two slit diffraction pattern the width of each slit is given by 0.088 mm, wave length of light used is 6.328×10^{-7} m. Find the angle of diffraction for which first maximum is observed.

29. Assume a plane wave of wave length 5000 Å to be incident on a circular aperture of radius 0.25 mm. Calculate the positions of the brightest and darkest points on the axis.

30. Calculate the thickness of double refracting plane capable of converting plane polarized light into circularly polarized light. Given λ = 6000 Å , refractive index of e-ray = 1.6, refractive index of o-ray = 1.53.

31. A fibre optic cable has a core of refractive index 1.4 and has an acceptance angle of 45°. Calculate the refractive index of the cladding.

(3 × 6 = 18 marks)

Section E (Essays)

Answer any **two** *questions.*
Each question carries 10 *marks.*

32. Examine interference by a plane parallel film illuminated by a plane wave. Derive the cosine law.

33. Discuss single slit Fraunhofer diffraction pattern. Find the equations for maxima and minima.

34. Describe with theory the recording and reconstruction of a hologram. Give any *two* applications and any *two* properties of a hologram.

35. Discuss Huygene's explanation of double refraction. Give the method of production and analysis of circularly polarized light.

(2 × 10 = 20 marks)

D 92477 (Pages : 3) Name.....

Reg. No.....

FIFTH SEMESTER U.G. (CUCBCSS—UG) DEGREE [SPECIAL] EXAMINATION, NOVEMBER 2020

Physics/Applied Physics

PHY 5B 07/APY 5B 08—QUANTUM MECHANICS

Time : Three Hours Maximum : 80 Marks

Section A

Answer **all** *questions.*
Each question carries 1 *mark.*

1. Write down Planck's radiation formula.
2. The probability of finding the particle described by the wave function Ψ at the point (x, y, z) is ————.
3. Energy eigenvalue of a particle in a box of width L is.
4. Write down the name of the experiment that confirms the existence of atomic energy level.
5. The splitting of spectral lines by a magnetic field is called ————.

Write True *or* False :

6. Although they lack rest mass, photons behave as though they have gravitational mass.
7. A moving body behaves in certain ways as though it has a wave nature.
8. Wave function must be normalizable, single valued and piecewise continuous.
9. To every observable physical quantity there exists a Hamiltonian operator.
10. The quantization of angular momentum magnitude in the hydrogen atom is described by the principal quantum number.

(10 × 1 = 10 marks)

Section B (Short Answer Type)

Answer atleast **six** *questions.*
Each question carries 2 *marks.*
All questions can be attended.
Overall Ceiling 12.

11. State and explain uncertainty principle.
12. Mention the names of spectral series of hydrogen.
13. What is meant by expectation value of a dynamical variable ?

Turn over

14 A particle confined in a box must have a certain minimum energy called zero point energy. Comment.

15 What is quantum mechanical tunneling ?

16 State Exclusion principle

17 Write down the selection rules for allowed transitions in a hydrogen atom.

(6 × 2 = 12 marks)

Section C (Paragraph Type)

Answer atleast **four** *questions.*
Each question carries 5 *marks.*
All questions can be attended.
Overall Ceiling 20.

18 What is Photoelectric effect ? Write down the Einsteins equation. Define the terms work function and cut-off wavelength.

19 Explain Davisson and Germer experiment with proper diagram.

20 Write a short note on Frank - Hertz experiment.

21 Write the Schrodinger equation and find the form of the wave functions of a square well potential with rigid walls

22 Define a Hermition operator. Show that the eigenvalues of a Hermition operator are real.

23 What are the quantum numbers used in hydrogen atom ? Explain.

24 Discuss Stern Gerlach experiment.

(4 × 5 = 20 marks)

Section D (Problems)

Answer atleast **three** *questions.*
Each question carries 6 *marks.*
All questions can be attended.
Overall Ceiling 18.

25 From a sodium surface, light of wavelength 3125 A^0 and 3650 A^0 causes emission of electrons whose maximum KE is 2.128 eV and 1,595 eV, respectively. Estimate the Planck's constant and work function of sodium.

26. Find the de Broglie wavelength λ of an electron accelerated through a potential of 100 V.

27. A muon is an unstable elementary particle whose mass is $207m_e$ and whose charge is either +e or -e. A negative muon can be captured by a nucleus to form a muonic atom (a) A proton captures a negative muon. Find the radius of the first Bohr orbit of this atom, (b) Find the ionization energy of the atom.

28. A triply ionized beryllium (Be^{3+}) has the same orbital radius as the ground state of hydrogen. Find the quantum state n of Be^{3+}.

29. A particle constrained to move along x-axis in the domain $0 \leq x \leq L$ has a wave function $\psi(x) = \sin(n\pi x / L)$,where n is an integer. Normalize the wave function and evaluate the expectation value of its momentum.

30. An eigen function of the operator d^2/dx^2 is $\psi = e^{2x}$. Find the corresponding eigen value.

31. A sample of a certain element is placed in a 0.300 T magnetic field and suitably excited. How far apart are the Zeeman components of the 450 nm spectral line of this element ?

(3 × 6 = 18 marks)

Section E (Essays)

Answer any **two** *questions.*
Each question carries 10 *marks.*

32. What is Compton effect ? Obtain an expression for Compton shift. Also explain the experimental demonstration of Compton effect.

33. What is a wave packet ? How is it represented mathematically and diagrammatically ? Define phase velocity and group velocity.

34. Solve the Schrödinger equation for linear harmonic oscillator to find its eigen value and eigen function.

35. Write the Schrödinger equation for hydrogen atom and obtain the expression for Φ, Θ and R using separation of variables.

(2 × 10 = 20 marks)

D 92479 (Pages : 3) Name.....

Reg. No.....

FIFTH SEMESTER U.G. DEGREE (SPECIAL) EXAMINATION NOVEMBER 2020

(CUCBCSS—UG)

Physics/Applied Physics

PHY 5B 09/APY 5B 10—ELECTRONICS (ANALOG AND DIGITAL)

Time : Three Hours Maximum : 80 Marks

Section A (One Word)

Answer **all** *questions.*
Each question carries 1 *mark.*

1. Give the Barkhausen condition for oscillations.
2. What is rectifier ?
3. Why is collector wider than emitter and base ?
4. Give the schematic symbol of N-channel FET.
5. How much is the percentage of regulation of an ideal rectifier ?

Write True *or* False :

6. FET is a current controlled device
7. MOSFET has high input impedance.
8. Colpitt's oscillator is commonly used in radio receivers.
9. An oscillator employs positive feedback.
10. Digital circuits can be made by the repeated use of OR gate.

(10 × 1 = 10 marks)

Section B (Short Answer Type)

Answer at least **six** *questions.*
Each question carries 2 *marks.*
All questions can be attended.
Overall Ceiling 12.

11. Write a short note on active and passive filter.
12. Explain half wave and full wave rectifier.

13. What is modulation and what are the different types ?
14. What do you understand by multi and single stage transistor amplifiers ?
15. Explain operating point.
16. Draw the input and output characteristics of CB connection.
17. Explain l's complement method of binary subtraction with example.

(6 × 2 = 12 marks)

Section C (Paragraph type)

Answer at least **four** *questions.*
Each question carries 5 *marks.*
All questions can be attended.
Overall Ceiling 20.

18. How does a light emitting diode get its color ?
19. Write a short note on advantages of transistors
20. What is the utility of d.c. load line.
21. Give a brief account RC Oscillator.
22. What is direct coupling in amplifiers ? What are its advantages ?
23. Explain the term effective collector load.
24. What is a universal gate ? Why is it so named ?

(4 × 5 = 20 marks)

Section D (Problems)

Answer at least **three** *questions.*
Each question carries 6 *marks.*
All questions can be attended.
Overall Ceiling 18.

25. Find the value of β if : (a) $\alpha = 0.9$; (b) $\alpha = 0.98$.
26. A transistor has $\beta = 50$ and $I_B = 20\mu A$, $I_C = 2$ mA. Calculate I_{CBO}.
27. The voltage gain of amplifier without feedback is 3,000. Calculate the voltage gain of the amplifier if negative voltage feedback is introduced in the circuit. Given that feedback fraction $m_v = 0.01$.
28. A certain amplifier has voltage gain of 132 and $\beta = 200$. Determine the power gain and output power of the amplifier of the input power is 60 μW.

29. Calculate the modulation index of an FM wave whee the maximum frequency deviation is 50 kHz and the modulating frequency is 5 kHz.

30. Convert decimal number 372 to octal equivalent.

31. Convert octal number $(177)_{10}$ to 8-bit binary equivalent by first converting to octal.

(3 × 6 = 18 marks)

Section E (Essays)

Answer any **two** *question.*

Each question carries 10 *marks.*

32. What is modulation and demodulation ? Why modulation necessary in communication system ? What are the advantages of FM over AM ?

33. Give an account on the need of biasing in transistor amplifiers. Describe the different methods of biasing.

34. Draw the input and output characteristics of CB and CE connection. What do you infer from these characteristics ?

35. What is the importance of De Morgan's theorems in Boolean algebra and what are the advantages of Boolean theorems ? What are the disadvantages of digital circuits ?

(2 × 10 = 20 marks)

D 92480 (Pages : 2) Name.....

Reg. No.....

FIFTH SEMESTER U.G. (CUCBCSS—UG) DEGREE [SPECIAL] EXAMINATION, NOVEMBER 2020

Physics/Applied Physics

PHY 5D 01(1)—NON CONVENTIONAL ENERGY SOURCES

Time : Two Hours Maximum : 40 Marks

Part A (One Word Answer)

All questions to be attended.
Each question carries 1 *mark.*

1. Which country has second largest green house ?
2. Through which process the energy production is occurring in sun.
3. Write an example for renewable energy resources.
4. Write any disadvantage of geothermal energy.
5. Which gas cause global warming ?
6. What is the purpose of a solar cell ?

(6 × 1 = 6 marks)

Part B (Short Answer)

All questions can be attended and overall ceiling.
Answer **all** *questions in one* **or** *two sentences.*
Each question carries 2 *marks.*

7. Write any four disadvantages of wind energy.
8. Give two sources of energy available from the ocean.
9. List any two methods for energy storage.
10. What do you mean by solar constant ?
11. What are the two merits of a solar cooker ?

(5 × 2 = 10 marks)

Part C (Paragraph Answer)

All questions can be attended and overall ceiling.
Answer any **four** *questions.*
Each question carries 4 *marks.*

12. What are the main applications of geothermal energy ?
13. Distinguish between primary and secondary batteries. Give examples.
14. How are the biogas classified ?
15. Give a brief account on the basic processes involved in a solar cell.
16. Give the principle and application of solar energy collectors.
17. Discuss the wave energy conversion mechanism by floats.

(4 × 4 = 16 marks)

Part D (Essays)

All questions can be attended and overall ceiling.
Answer any **one** *question*
The question carries 8 *marks.*

18. Discuss the basic principles of tidal power generation.
19. Using a neat diagram explain the working principle of a solar distillation system. Discuss the applications of solar distillation system.
20. Discuss the different categories of biomass resources.

(1 × 8 = 8 marks)

D 10683 (Pages : 2) Name.....

Reg. No.....

FIFTH SEMESTER U.G. DEGREE EXAMINATION, NOVEMBER 2021

(CBCSS—UG)

Physics/Applied Physics

PHY 5B 08/APH 5B 08—OPTICS

(2019 Admissions)

Time : Two Hours Maximum : 60 Marks

The symbols used in question paper have their usual meanings.

Section A (Short Answer Type)

Answer at least **eight** *questions.*
Each question carries 3 *marks.*
All questions can be attended.
Overall Ceiling 24.

1. Explain Fermat's principle of stationary time.
2. Discuss the principle of superposition of waves.
3. Explain the terms coherence time and coherence length.
4. Discuss the Rayleigh criterion of resolution.
5. Write down the conditions for maxima and minima for the Newton's rings in the reflected system.
6. Distinguish between Fresnel and Fraunhofer kinds of diffractions.
7. Show a figure illustrating the Huygens wave surfaces produced by a point source embedded in a positive doubly refracting crystal.
8. How is an elliptically polarized light produced ?
9. Distinguish between dextrorotatory and laevorotatory substances.
10. Discuss the basic steps in holography.
11. Distinguish between step index and graded index optical fibers.
12. Discuss the basic parts of a fiber optic sensor.

(8 × 3 = 24 marks)

Section B (Paragraph/Problem Type)

Answer at least **five** *questions.*
Each question carries 5 *marks.*
All questions can be attended.
Overall Ceiling 25.

13. Obtain the Newtonian lens formula.

Turn over

14. Determine the separation between the coherent sources formed by a biprism whose inclined faces make angles of 2° with its base and the slit is 0.1 m away from the biprism. Given, the refractive index of the material of the prism is 1.5.

15. Calculate the radius of the first dark ring of the Fraunhofer diffraction pattern produced by a circular aperture of radius 0.02 cm at the focal plane of a convex lens of focal length 20 cm. Assume that the wavelength of light used is 600 nm.

16. Consider a Fresnel zone plate with radii $r_n = 0.1 \sqrt{n}$ cm. For $\lambda = 5 \times 10^{-5}$ cm, calculate the positions of the foci.

17. Determine the thickness of a half-wave plate of quartz for a wavelength 500 nm. Given, the refractive indices of the extra-ordinary and ordinary rays are $\mu_e = 1.553$ and $\mu_o = 1.544$, respectively.

18. Discuss the applications of holography.

19. Calculate the numerical aperture and hence the acceptance angle of an optical fiber having core and cladding refractive indices 1.45 and 1.40 respectively.

(5 × 5 = 25 marks)

Section C (Essay Type)

Answer any **one** *question.*
The question carries 11 *marks.*

20. Discuss the interference by a plane parallel film when illuminated by a plane wave and obtain the conditions for maxima and minima.

21. Obtain an expression for the intensity distribution for the Fraunhofer diffraction due to a single slit.

(1 × 11 = 11 marks)

D 10243 (Pages : 4) Name.....

Reg. No.....

FIFTH SEMESTER B.A./B.Sc. DEGREE EXAMINATION, NOVEMBER 2021

(CUCBCSS—UG)

Physics/Applied Physics

PHY 5B 06/APY 5B 07—ELECTRODYNAMICS—II

Time : Three Hours Maximum : 80 Marks

The symbols used in the question paper have their usual meanings.

Section A

Answer in a word **or** *a phrase.*
Answer **all** *questions.*
Each question carries 1 *mark.*

1. Magnetic field can be produced by a current or by a changing ————.
2. The average power per unit area transported by an electromagnetic wave is called its ————.
3. The smaller is the time constant CR, the ———— is the discharge of the capacitor in a series CR circuit.
4. The ratio of r.m.s. value of current to the mean value of current is called ————.
5. Higher the quality factor of a circuit, ———— is its bandwidth.

Write True *or* False :

6. Electromagnetic waves travel with the speed of light in vacuum.
7. The tangential component of H is continuous across the boundary between two media.
8. If the value of L/R in an LR series circuit increases, the time taken by the current to reach its maximum value decreases.
9. In pure inductive circuits, the current is lagging behind the e.m.f. by $\pi/2$ in phase.
10. Thevenin's theorem can be applied to networks with DC only.

(10 × 1 = 10 marks)

Section B

Answer **all** *questions in two* **or** *three sentences.*
Each question carries 2 marks.

11. State and explain Faraday's law in electromagnetic induction.

12. Write down the importance of displacement current in Maxwell's equations.

13. Define Poynting vector and give an expression for the same.

14. Give an explanation for ballistic galvanometer. What are the conditions for a moving coil galvanometer to be ballistic ?

15. Give and expression for the instantaneous current in a series LR circuit. What are the terms involved ?

16. Draw the basic circuit of an AC bridge and write down the condition to balance it.

17. State and explain maximum power transfer theorem.

(7 × 2 = 14 marks)

Section C

Answer any **five** *questions in* **a paragraph** *of about* **half a page** *to* **one page.**
Each question carries 4 marks.

18. Explain briefly about magnetic charge.

19. Obtain an expression for the energy stored in a magnetic field in terms of current.

20. Show that the energy flux density transported by the field is given by $\frac{1}{\mu_0} E \times B$.

21. Obtain an expression for the growth and decay of charge in a capacitor through a resistor.

22. Obtain equations for r.m.s. value of e.m.f. and current in an AC circuit.

23. What are the basic steps for converting a voltage source with a series resistance into an equivalent current source with a parallel resistance ?

24. State Norton's theorem. Give the different steps involved in Nortanizing a given circuit network.

(5 × 4 = 20 marks)

Section D

Problems-Write all relevant formulas, all important steps carry separate marks.

Answer any **four** *questions.*

Each question carries 4 *marks.*

25. Write down Neumann's formula for mutual induction. Explain its importance.

26. Find the magnetic flux through a solenoid of length l with number of turns per unit length N and radius R carrying a current I. Also calculate self inductance per unit length of the coil.

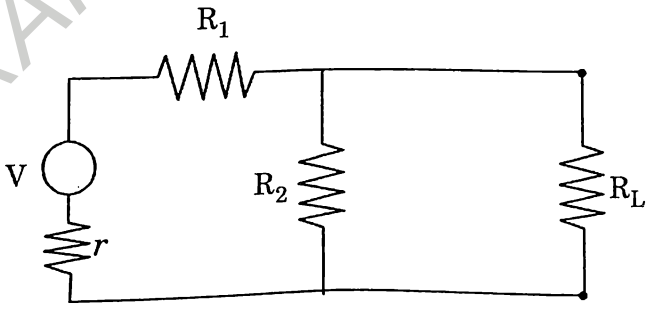
27. Find the energy stored in a long coaxial cable of length 'l' carries a current 'I' flowing down the surface of the inner cylinder of radius 'a' and back along the outer cylinder of radius 'b'.

28. Write down the boundary conditions for the electric and magnetic vectors E and B at an interface separating two linear dielectrics of permittivities ε_1 and ε_2 and permeabilities μ_1 and μ_2.

29. A capacitor of 0.2 μF is first charged and discharged through a resistance of 10 megaohms. Find the time, the potential takes to fall to ¼ of its original value.

30. An alternating voltage of 100 V at a frequency of 25 Hz is applied to a circuit consisting a resistance 1.5 Ω and an inductance of 0.01 Henry in series : (a) Find the current flowing ; (b) Phase difference between e.m.f. and current ; and (c) Potential drop across resistor and inductor.

31. Apply Thevenin's theorem to find the current through the load resistance, RL = 15 Ω in the following network. Given R_1 = 3 Ω, R_2 = 12 Ω, V = 24 Volts with an internal resistance r = 1 Ω :



(4 × 4 = 16 marks)

Section E (Essays)

Answer in about **two pages** *Answer any* **two** *questions.*
Each question carries 10 *marks.*

32. Derive the Maxwell's equations inside a polarized matter.

33. Find expressions for the transmission and reflection coefficients when a plane polarized monochromatic wave of angular frequency ω passes normally through the boundary between two linear dielectrics.

34. Discuss the growth of current in a circuit containing an inductance L and a resistance R connected in series with a cell of steady e.m.f. Explain the time constant of the circuit.

35. Obtain expressions for resultant e.m.f., impedence and power factor of an LCR series circuit when an alternating current is flowing through it. Explain the resonance in LCR series circuit.

(2 × 10 = 20 marks)

D 10681 (Pages : 2) Name.....

Reg. No.....

FIFTH SEMESTER U.G. DEGREE EXAMINATION, NOVEMBER 2021

(CBCSS—UG)

Physics/Applied Physics

PHY 5B 06/APH 5B 06—COMPUTATIONAL PHYSICS

(2019 Admissions)

Time : Two Hours Maximum : 60 Marks

The symbols used in question paper have their usual meanings.

Section A (Short Answer Type)

Answer at least **eight** *questions.*
Each question carries 3 *marks.*
All questions can be attended.
Overall Ceiling 24.

1. Identify the functional differences of the Compiler and the Interpreter in the context of high-level computer languages.
2. Write an algorithm to check whether a given number is odd or even.
3. List the different datatypes in Python.
4. Write a Python program to print the multiplication table of 9 having 20 rows using *while* loop.
5. What is a *tuple* ? How it is different from *list* ?
6. Discuss about the functional differences of *break* and *continue* statements in Python.
7. Write a Python program to plot the function $y = \sin x$ within the region 0 to 2π.
8. Write a Python program to create a 3 × 2 matrix having random numbers ranging between 0 and 1 as elements.
9. Explain the least squares curve fitting procedures.
10. Construct a forward difference table for the following data :

x	:	0	1	2	3	4
y	:	1	3	9	27	81

11. How the subintervals width is associated with the error in Trapezoidal rule and Simpson's 1/3 rule for numerical integration ?
12. Discuss the advantages of numerical methods over analytical methods.

(8 × 3 = 24 marks)

Turn over

Section B (Paragraph/Problem Type)

Answer at least **five** *questions.*
Each question carries 5 *marks.*
All questions can be attended.
Overall Ceiling 25.

13. Write a Python program to print the squares of the integer numbers within the range entered by the user.

14. Discuss about different built-in operations on *list* in Python with the help of examples.

15. Write a program to create two 3 × 3 matrices and add them.

16. The table below gives the temperature T (in °C) and length l (in mm) of a heated rod. If $l = a_0 + a_1 T$, find the best value for a_0 and a_1 :

T (in °C)	20	30	40	50	60	70
1 (in mm)	800.3	800.4	800.6	800.7	800.9	801.0

17. Using Newtons forward interpolation formula obtain y (2), given that, y (1) = 24, y (3) = 120, y (5) = 336, and y (7) = 720.

18. Explain the Bisection method for finding the solutions of algebraic equations.

19. Write a Python program to simulate the motion of a body dropped into a highly viscous medium.

(5 × 5 = 25 marks)

Section C (Essay Type)

Answer any **one** *question.*
The question carries 11 *marks.*

20. (a) Find y (0.2) for $y' = (x - y)/2$, y (0) = 1, with step length 0.1 using Runge-Kutta method.

    (b) Write a Python program to simulate a two-dimensional projectile motion using Euler's method in a table.

21. (a) Explain the Newton-Raphson method to find the roots of a function.

    (b) Write a Python program to simulate a freely falling body using Euler's method in a table.

(1 × 11 = 11 marks)

D 10686 (Pages : 2) Name.....

Reg. No.....

FIFTH SEMESTER U.G. DEGREE EXAMINATION, NOVEMBER 2021

(CBCSS—UG)

Physics/Applied Physics

PHY 5D 01 (2)/APH 5D 01 (2)—AMATEUR ASTRONOMY AND ASTROPHYSICS

(2019 Admissions)

Time : Two Hours Maximum : 60 Marks

The symbols used in question paper have their usual meanings.

Section A (Short Answer Type)

Answer at least **eight** *questions.*
Each question carries 3 *marks.*
All questions can be attended.
Overall Ceiling 24.

1. Which are the different branches of Astronomy ?
2. Which is our nearest star and how much is the distance to the same ?
3. Why do we have different seasons on earth ?
4. Which are the three different zones of earth's interior ?
5. Briefly discuss about meteors.
6. Define Solar constant.
7. Distinguish between the terms perigee and apogee.
8. Which are the different layers of Sun's atmosphere ?
9. Which are inferior and superior planets and why are they called so ?
10. According to the standard model, how did the universe come into existence ?
11. Define parsec. How is it related to a light year ?
12. Briefly describe asteroids.

(8 × 3 = 24 marks)

Section B (Paragraph/Problem Type)

Answer at least **five** *questions.*
Each question carries 5 *marks.*
All questions can be attended.
Overall Ceiling 25.

13. Write a short note on the planet Saturn.
14. Star A is about 100 times brighter than Star B. If the magnitude of star B is +3, what is the magnitude of star A ?

Turn over

15. What are the properties of the photosphere ?

16. State Kepler's laws of planetary motion.

17. What are the characteristics of Comets ?

18. Define longitude and latitude in geographic co-ordinate system.

(5 × 5 = 25 marks)

Section C (Essay Type)

Answer any **one** *question.*
The question carries 11 *marks.*

20. Explain the star formation and life cycle of stars.

21. Where is the solar system located in Milkyway ? Briefly discuss about the planets of solar system.

(1 × 11 = 11 marks)

D 10684 (Pages : 3) Name.....

Reg. No.....

FIFTH SEMESTER U.G. DEGREE EXAMINATION, NOVEMBER 2021

(CBCSS—UG)

Physics/Applied Physics

PHY 5B 09/APH 5B 09—ELECTRONICS (ANALOG AND DIGITAL)

(2019 Admissions)

Time : Two Hours Maximum : 60 Marks

The symbols used in this question paper have their usual meanings.

Section A

Answer at least **eight** *questions.*

Each question carries 3 *marks.*

All questions can be attended.

Overall Ceiling 24.

1. Define ripple factor of a rectifier. What is its value for a full wave rectifier ?
2. Explain the working of a π -filter.
3. Mention the merits of R-C coupled amplifiers.
4. Explain the decibel system of expressing power gain.
5. What is the role of a coupling capacitor in a multistage transistor amplifier ?
6. List down the advantages of negative feedback.
7. Define Common Mode Rejection Ratio (CMRR).
8. Explain the principle of an op-amp differentiator.
9. Convert the following decimal numbers into its binary equivalents.
   (a) 13.7. (b) 0.85.
10. Subtract 1010 from 1101 using 1's complement method.
11. Why NAND gate is called '*a*' miversal gate ?
12. What is meant by toggle condition in JK flip flops ?

(8 × 3 = 24 marks)

Section B

Answer at least **five** *questions.*

Each question carries 5 *marks.*

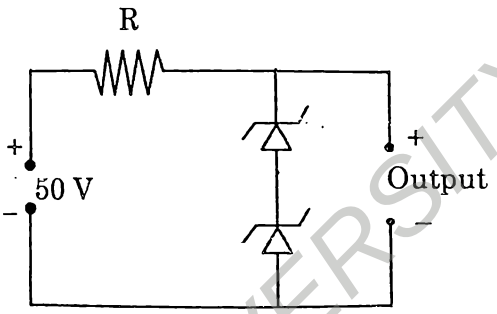
All questions can be attended.

Overall Ceiling 25.

13. The circuit uses two zener diodes, each rated 15 V, 200 mA. If the circuit is connected to a 50 Volt unregulated d.c. supply. Determine

    (a) The regulated output voltage.

    (b) The value of series resistance R.



14. Draw the input and output characteristics of Common Emitter (CE) configuration. What are the inferences ?

15. For the transistor amplifier shown in figure

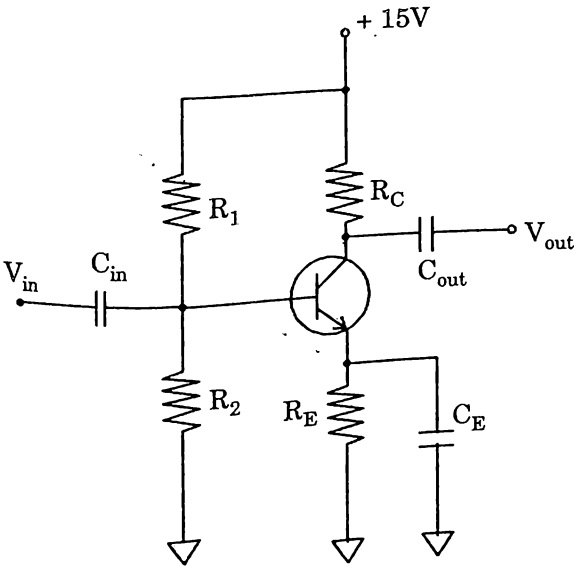
$R_1 = 10\ k\Omega$

$R_2 = 5\ k\Omega$

$R_C = 1\ k\Omega$

$R_E = 2\ k\Omega$

$V_{BE} = 0.7$ Volt



(i) Draw the d.c. loadline.

(ii) Determine the operating point.

16. With a negative voltage feedback, an amplifier gives an output of 10 V with an input of 0.5 V. When feedback is removed, it requires 0.25 V input for the same output. Calculate : (i) Gain without feedback ; (ii) Gain with feedback ; and (iii) Feedback fraction.

17. A phase shift oscillator uses 0.01 μF capacitors. Find the value of Resistance R to produce a frequency of 800 Hz.

18. Describe the principle of a summing amplifier using op-amp.

19. Compute the following using 2's complement method :

(a) 25 - 18. (b) 9 - 12.

(5 × 5 = 25 marks)

Section C (Essay Type)

Answer any **one** *question.*

The question carries 11 *marks.*

20. Describe voltage divider biasing in detail. Explain how stability is achieved in this method.

21. Explain the principle of a full adder with suitable diagrams and truth table.

(1 × 11 = 11 marks)

D 10246 (Pages : 3) Name.....

Reg. No.....

FIFTH SEMESTER B.A./B.Sc. DEGREE EXAMINATION, NOVEMBER 2021

(CUCBCSS–UG)

Physics/Applied Physics

PHY 5B 09/APY 5B 10—ELECTRONICS (ANALOG AND DIGITAL)

Time : Three Hours Maximum : 80 Marks

Section A

Answer **all** *questions.*
1 *mark each.*

1. What is the value of ripple factor of a full wave rectifier ?
2. A zener diode is used as ————————.
   (i) an amplifier. (ii) a voltage regulator.
   (iii) a rectifier. (iv) a multi vibrator.
3. Draw the out put wave form of full wave rectifier.
4. In a practical biasing circuit, the value of RE is about ————————.
5. What is the use of Input capacitor Cin in an amplifier circuit ?
6. Write expression of zero signal collector current.
7. Define phase reversal.
8. 1 db corresponds to ———————— change in voltage or current level.
9. (i) 40% ; (ii) 80% ; (iii) 20% ; (iv) 25%.
10. What is a feed back circuit ?

(10 × 1 =10 marks)

Section B

Answer **all** *questions.*
Write in two or three sentences.

11. Mention two disadvantages of a centre tap full wave rectifier.
12. Define ripple factor.
13. Explain Zener Diode as Voltage Stabiliser.
14. Draw the symbol of npn and pnp transistor and specify the leads.

15. Explain Zener Diode as Voltage Stabiliser.
16. Distinguish between ordinary diode and zener diode.
17. Define bel power gain.

(7 × 2 =14 marks)

Section C

Write any **five** *questions.*
Write in one paragraph 4 *marks each.*

18. Discuss the importance of peak inverse voltage in rectifier service
19. How will you determine the input and output characteristics of CE connection experimentally ?
20. Write short notes on the following : (i) advantages of transistors (ii) operating point (iii) a.c. load line.
21. Compare different types of coupling.
22. Explain the working of a Hartley oscillator.
23. Write a note on flipflops.
24. Explain the following terms : (i) Frequency response ; (ii) Decibel gain ; (iii) Bandwidth.

(5 × 4 =20 marks)

Section D

Solve any **four** *problems.*
4 marks each.

25. A half-wave rectifier is used to supply 50V d.c. to a resistive load of 800 Ω. The diode has a resistance of 25 Ω. Calculate a.c. voltage required.
26. In a common base connection, IC = 0.95 mA and IB = 0.05 mA. Find the value of α.
27. A change of 200 mV in base-emitter voltage causes a change of 100 μA in the base current. Find the input resistance of the transistor.
28. A transistor uses potential divider method of biasing. R1 = 50 kΩ, R2 = 10 kΩ and RE = 1 kΩ. If VCC = 12 V, find :
    (i) the value of IC; given VBE = 0.1V
    (ii) the value of IC; given VBE = 0.3V.
29. In a transistor circuit, collector load is 4 kΩ whereas quiescent current (zero signal collector current) is 1mA.
    (i) What is the operating point if VCC = 10 V ?
    (ii) What will be the operating point if RC = 5 kΩ ?

30. Find the gain in db in the following cases :

    (i) Voltage gain of 30 ; (ii) Power gain of 100.

31. The applied input a.c. power to a half-wave rectifier is 100 watts. The d.c. output power obtained is 40 watts.

    (i) What is the rectification efficiency ?

    (ii) What happens to remaining 60 watts ?

(4 × 4 = 16 marks)

Section E

Write any **two**.
10 *marks each.*

32. With figure explain common emitter transistor circuit. What are its characteristics ?

33. What is phase reversal.? Explain with figure.

34. Analyse DC and AC load lines.

35. With figure explain half wave and full wave rectifiers and their ripple factors. Compare.

(2 × 10 = 20 marks)

D 10247 (Pages : 2) Name.....

Reg. No.....

FIFTH SEMESTER B.A./B.Sc. DEGREE EXAMINATION, NOVEMBER 2021

(CUCBCSS–UG)

Physics/Applied Physics

PHY 5D 01 (1)—NON CONVENTIONAL ENERGY SOURCES

Time : Two Hours Maximum : 40 Marks

Section A (One Word Answer)

Answer **all** *questions.*
Each question carries 1 *mark.*

1. Which cycle is the most economical one is generating ocean thermal electric power ?
2. What is the major drawback for the extensive use of solar energy ?
3. Which country has second largest green house ?
4. Write any advantage of solar energy.
5. Which is the major component of extra-terrestrial radiation ?
6. Which solar cooker design provides the highest temperature for cooking ?

(6 × 1 = 6 marks)

Section B (Short Answer)

Answer **all** *questions in one or two sentences.*
Each question 2 *carries marks.*

7. Give the working principle of a pyranometer.
8. Mention any to application of fuel cell.
9. What are the major solar radiation measuring instruments ?
10. What are the causes of local winds ?
11. Write down the problems associated with storage of hydrogen fuel in motor vehicles.

(5 × 2 = 10 marks)

Section C (Paragraph Answer)

Answer any **four** *questions.*
Each question carries 4 *marks.*

12. Draw the schematic of a horizontal axis wind mill indicating the essential parts.
13. List three advantages and disadvantages of a photovoltaic energy.
14. Briefly describe any two types of solar houses.

Turn over

15. Discuss the applications of wind energy.

16. Discuss the problems associated with storage of hydrogen fuel in motor vehicles.

17. Explain the source of energy in waves. Discuss a method for converting wave energy to mechanical energy.

(4 × 4 = 16 marks)

Section D (Essays)

Answer any **one** *question.*
The question carries 8 marks.

18. Give an account on the fundamental process used in conversion of solar radiation to heat. Explain the essential part of a flat plate oscillator using a suitable schematic diagram.

19. Classify the geothermal fields of earth? Write short notes on the different geothermal sources. Discuss the different applications of geothermal energy.

20. Explain the working principle of ocean thermal energy conversion system. Also discuss the open and closed cycle methods of ocean thermal electric power generation.

(1 × 8 = 8 marks)

D 10685 (Pages : 2) Name.....

Reg. No.....

FIFTH SEMESTER U.G. DEGREE EXAMINATION, NOVEMBER 2021

(CBCSS—UG)

Physics/Applied Physics

PHY 5D 01 (1)/APH 5D 01 (1)—NON-CONVENTIONAL ENERGY SOURCES

(2019 Admissions)

Time : Two Hours Maximum : 60 Marks

The symbols used in question paper have their usual meanings.

Section A (Short Answer Type)

Answer at least **eight** *questions.*
Each question carries 3 *marks.*
All questions can be attended.
Overall Ceiling 24.

1. List any *four* advantages of renewable energy sources.
2. What is the working principle of a pyrheliometer ?
3. Give the advantages of a solar furnace.
4. What do you mean by global warming ? Write the names of any *two* green-house gases.
5. List any *four* environmental impacts of wind energy.
6. What are the basic components of a wind energy conversion system ?
7. Discuss briefly the wind electricity economics.
8. What is the form of geothermal energy ?
9. What are the limitations of utilizing biomass ?
10. Explain the basic biochemical conversion processes.
11. Explain Thomson effect.
12. List any *four* disadvantages of nuclear power plants.

(8 × 3 = 24 marks)

Turn over

Section B (Paragraph/Problem Type)

Answer at least **five** *questions.*
Each question carries 5 *marks.*
All questions can be attended.
Overall Ceiling 25.

13. Using a suitable figure, discuss the working of a low temperature solar power plant.
14. List any *four* advantages and disadvantages of a wind energy conversion system.
15. Discuss the principle of wind energy conversion.
16. Explain the structure of earth's interior.
17. Using a suitable figure, explain the flash steam open hydro-geothermal energy resource.
18. Discuss the main components of a biogas plant.
19. Explain the working principle of a typical fuel cell.

(5 × 5 = 25 marks)

Section C (Essay)

Answer any **one** *question.*
The question carries 11 *marks.*

20. Explain the working principle of a solar cooker. Explain the different types of solar cookers.
21. What is the working principle of Ocean Thermal Energy Conversion (OTEC) ? Discuss the closed cycle system.

(1 × 11 = 11 marks)

D 10687 (Pages : 2) Name.....

Reg. No.....

FIFTH SEMESTER U.G. DEGREE EXAMINATION, NOVEMBER 2021

(CBCSS—UG)

Physics/Applied Physics

PHY 5D 01 (3)/APH 5D 01 (3)—ELEMENTARY MEDICAL PHYSICS

(2019 Admissions)

Time : Two Hours Maximum : 60 Marks

Section A

Answer at least **eight** *questions.*
Each question carries 3 *marks.*
All questions can be attended.
Overall Ceiling 24.

1. What do you mean by an isomeric transition ?
2. Explain the Rayleigh scattering process.
3. Discuss the pair production process.
4. What do you mean by non-ionizing radiation? Give two examples.
5. What are radiopharmaceuticals ? Give two uses of them.
6. Discuss the basic principle of electro-cardiography (ECG).
7. What do you mean by blood pressure ?
8. Explain the working principle of electro-encephalography (EEG) ?
9. What is electro-myography (EMG) ? What are its uses ?
10. What do you mean by X-ray imaging in tissues ?
11. What do you mean by an ultrasound? What is the frequency range of ultrasound waves used in clinical diagnosis ?
12. Explain the different components of an ultrasound transducer.

(8 × 3 = 24 marks)

Section B

Answer at least **five** *questions.*
Each question carries 5 *marks.*
All questions can be attended.
Overall Ceiling 25.

13. Distinguish between natural and artificial radioactivity.
14. Write short note on the genetic effects of radiation.
15. Discuss the basic functions of a heart.
16. Discuss the artifacts on an ECG trace.
17. Explain normal and abnormal cardiac rhythms.
18. Discuss the principle of x-ray fluoroscopy.
19. Explain the attenuation mechanism of an ultrasound wave in matter.

(5 × 5 = 25 marks)

Section C

Answer any **one** *question.*
The question carries 11 *marks.*

20. Discuss the interaction processes of electrons in matter.
21. Explain the different presentation modes in ultrasound imaging.

(1 × 11 = 11 marks)

FIFTH SEMESTER B.A./B.Sc. DEGREE EXAMINATION
NOVEMBER 2021

(CUCBCSS–UG)

Physics/Applied Physics

PHY 5B 08/APY 5B 09—PHYSICAL OPTICS AND MODERN OPTICS

Time : Three Hours Maximum : 80 Marks

Section A

Answer in a word **or** *a phrase.*

Answer **all** *questions.*

Each question carries 1 *mark.*

1. The system matrix of a lens system is given by $\begin{bmatrix} 9/5 & 1/100 \\ 8 & 3/5 \end{bmatrix}$. The focal length of the combination is _____ units.
2. The inner part of optical fiber is called _____.
3. The construction of hologram made use of the principle of _____.
4. Two or more waves of the same frequency can maintain the same phase or constant phase difference over a distance and time are called _____.
5. The principal focal length of a zone plate is given by the equation _____.

True *or* False :

6. In N-slit Fraunhoffer diffraction pattern the principal maximum becomes sharper as N decreases.
7. The light ray incident at an angle of incidence greater than acceptance angle on a step index fiber will be refracted through cladding.
8. In order to observe good interference pattern, the distance of the screen from the sources must be large.
9. Colour appear on a thin film and on a soap bubble due to dispersion.
10. In a negative uniaxial crystal, velocity of O-ray is less than velocity of E-ray.

(10 × 1 = 10 marks)

Section B

Answer any **seven** *questions.*

Each question carries 2 *marks.*

11. Explain Fermat's principle of least time.
12. What are the advantages of using matrix method in paraxial optics?

13. Describe the conditions to obtain sustained interference pattern.
14. What is the idea behind colour of thin films?
15. What is meant by overlapping spectra in the spectra of a grating?
16. Explain pulse dispersion in step index fiber.
17. Explain any two applications of holography.

(7 × 2 = 14 marks)

Section C

Answer any **five** *questions in paragraph of about* **half-a-page** *to* **one page**.
Each question carries 4 *marks.*

18. Obtain system matrix for thin film and hence obtain thin lens formula.
19. Describe Fresnel's biprism. Explain how the wavelength of light can be determined with the help of it.
20. With neat diagram, explain Michelson's interferometer. Describe how it can be used to determine the difference in wavelength of two waves.
21. Explain the principle and construction of a zone plate.
22. Draw the intensity distribution curve of Fresnel's diffraction at a straight edge and explain it.
23. Write brief note on (a) Quarter wave plate ; (b) Half wave plate.
24. Give the necessity of cladding in the optical fiber. Also mention any four applications of optical fiber.

(5 × 4 = 20 marks)

Section D

Answer any **four** *questions.*
Each question carries 4 *marks.*

25. Obtain a system matrix for a lens placed in air made of glass of refractive index 1.6 and radii of curvature 60 cm each. Find the focal length of the lens?
26. Two coherent sources are 0.2 mm apart and the fringes are observed on a screen 100 cm away. It is found that with a monochromatic source of light, the fourth bright fringe is situated at a distance of 10.8 mm from the central fringe. Calculate the wavelength of light.
27. Light of wavelength 5839 Å is reflected at near normal incidence from a soap bubble of refractive index 1.42. What is the least thickness of the film that will appear bright by reflection?
28. Newton's rings are formed with red light of $\lambda = 670$ nm. The radius of the 20^{th} dark ring is found to be 1.1×10^{-2} m. Find the radius of curvature of the lens and the radius of 30^{th} ring.

29. A plane transmission diffraction grating has 40,000 lines in all with grating element 12.5×10^{-5} cm. Calculate the maximum resolving power for which it can be used in the range of wavelength 5000 Å.

30. Find the thickness of (a) Quarter wave plate ; (b) Half wave plate, when light of wavelength 559 nm is used. Given $\mu_o = 1.55$, $\mu_E = 1.54$.

31. A step index fiber has a core diameter of 200 μm, its numerical aperture is 0.29. Calculate the number of propagating modes of an optical fiber with an operating wavelength of 859 nm.

(4 × 4 = 16 marks)

Section E

Answer in about **two pages.**

Answer any **two** *questions.*

Each question carries 10 *marks.*

32. Explain with necessary theory, the formation of Newton's rings in reflected light. How can we use this arrangement to determine the wavelength of light.

33. Give the construction and theory of plane transmission grating. Obtain the condition for absent spectra.

34. Explain the rectilinear propagation of light on the basis of Fresnel's half period zones.

35. What is the principle of holography? Describe the recording and reconstruction process in holography with the help of suitable diagrams.

(2 × 20 = 20 marks)

D 10248 (Pages : 2) Name.....

Reg. No.....

FIFTH SEMESTER B.A./B.Sc. DEGREE EXAMINATION, NOVEMBER 2021

(CUCBCSS—UG)

Physics/Applied Physics

PHY 5D 01(2)—AMATEUR ASTRONOMY AND ASTROPHYSICS

Time : Two Hours Maximum : 40 Marks

Section A (One Word Answers)

Answer **all** *questions.*
Each question carries 1 *mark.*

1. Name the point in the orbit of a planet nearest to the Sun.
2. Which planet is called the red planet ?
3. Difference in magnitude between two stars is A and B is 2.5. How many time will be star A brighter than star B ?
4. Who is the author of the book *Vedanga Jyotisha* ?
5. What is the radius of a black hole called ?
6. Name the biggest natural satellite in the solar system.

(6 × 1 = 6 marks)

Section B (Short Answers)

Answer **all** *questions in one* **or** *two sentences.*
Each question carries 2 marks.

7. What are neutron stars ?
8. Define parsec.
9. Define sidereal day.
10. What are asteroids ?
11. Define solar constant.

(5 × 2 = 10 marks)

Section C (Paragraph)

Answer any **four** *questions.*
Each question carries 4 *marks.*

12. Write a note on the contributions of Ptolemy to astronomy.
13. Explain the birth of the universe according to the Big Bang theory.

Turn over

14. Astronomy is mainly an observational science. Explain.

15. What are black holes ? Explain.

16. State Kepler's laws of planetary motion.

17. Explain Chandrasekhar limit.

(4 × 4 = 16 marks)

Section D (Essays)

Answer any **one** *question.*
The question carries 8 *marks.*

18. Explain the concept of expanding Universe, based on Hubble's law.

19. Describe the structure of the Sun with neat diagram, explaining the salient features of the various layers.

20. Give a description on the various latitude and longitude zones of the earth.

(1 × 8 = 8 marks)

FIFTH SEMESTER U.G. DEGREE EXAMINATION, NOVEMBER 2021

(CUCBCSS—UG)

Physics/Applied Physics

PHY 5B 07/APY 5B 08—QUANTUM MECHANICS

Time : Three Hours Maximum : 80 Marks

Section A

Answer **all** *questions in a word* **or** *phrase.*
Each question carries 1 *mark.*

1. Einstein's photoelectric equation is ————.
2. Write down the energy eigen value of particle in a one dimensional box.
3. Write down the uncertainty relation between energy and time.
4. Write down the selection rules for allowed transitions in a hydrogen atom.
5. Write down the one dimensional time dependent Schrodinger equation.

Write true *or* false :

6. Although they lack rest mass, photons behave as though they have gravitational mass.
7. A group of waves need have the same velocity as the waves themselves.
8. An electron can circle a nucleus only if its orbit contains an integral number of de Broglie wavelengths.
9. For a harmonic oscillator the lowest energy will be E = 0.
10. The quantization of electron energy in the hydrogen atom is described by the principal quantum number.

(10 × 1 = 10 marks)

Section B (Short Answer Type)

Answer **all** *questions in two* **or** *three sentences.*
Each question carries 2 *marks.*

11. Define group velocity.
12. State the postulates of Bohr atom model.
13. Write down the eigen value equation and define eigen value and eigen function.

Turn over

14. What are Hermition operators ? Write one example.

15. Write down the validity conditions of wave functions.

16. State Exclusion principle.

17. Bring out the conclusion of Stern Gerlach experiment.

(7 × 2 = 14 marks)

Section C (Paragraph Type)

Answer any **five** *questions in a paragraph of about* **half a page to one page.**
Each question carries 4 *marks.*

18. Write a short note on Compton effect.

19. Discuss the principle and working of electron microscope.

20. Discuss Correspondence principle.

21. Write a short note on tunnel effect.

22. Write a note on scanning tunneling microscope.

23. Briefly discuss Zeeman effect.

24. What are the quantum numbers used in hydrogen atom ? Explain.

(5 × 4 = 20 marks)

Section D (Problems)

Answer any **four** *questions.*
Each question carries 4 *marks.*

25. The threshold frequency of a certain metal is 3.3×10^{14} Hz. If light of frequency 8.2×10^{14} Hz is incident on the metal, then find the cut off voltage for photo electric emission.

26. An electron has a speed of 500m/s with an accuracy of 0.004%. Calculate the certainty with which we can locate the position of the electron.

27. A Positronium atom is a system that consists of a positron and an electron that orbit each other. Compare the wavelengths of the spectral lines of positronium with those of ordinary hydrogen.

28. Find the shortest and longest wavelength in the Balmer series.

29. Prove that commuting operators have common set of eigen functions.

30. A particle limited to the x-axis has the wave function $\psi = ax$ between $x = 0$ and $x = 1$; $\psi = 0$ elsewhere : (a) find the probability that the particle can be found between $x = 0.45$ and $x = 0.55$; (b) find the expectation value of the position of the particle.

31. A sample of a certain element is placed in a 0.300T magnetic field and suitably excited. How far apart are the Zeeman components of the 450nm spectral line of this element ?

(4 × 4 = 16 marks)

Section E (Essays)

Answer any **two** *questions in about* **two pages.**
Each question carries 10 *marks.*

32. Explain ultraviolet catastrophe. With reference to Planck's formula explain how Max Planck solve this discrepancy.

33. What do you mean by de Broglie waves ? Explain the experiment that confirms the existence of de Broglie waves.

34. Explain the different postulates of quantum mechanics in detail.

35. Write the Schrodinger equation for hydrogen atom and obtain the expression for Φ, Θ and R using separation of Variables.

(2 × 10 = 20 marks)

D 10682 (Pages : 2) Name.....

Reg. No.....

FIFTH SEMESTER U.G. DEGREE EXAMINATION, NOVEMBER 2021

(CBCSS—UG)

Physics/Applied Physics

PHY 5B 07/APH 5B 07—QUANTUM MECHANICS

(2019 Admissions)

Time : Two Hours Maximum : 60 Marks

The symbols used in question paper have their usual meanings.

Section A (Short Answer Type)

Answer at least **eight** *questions.*
Each question carries 3 *marks.*
All questions can be attended.
Overall Ceiling 24.

1. Give an expression for the Poynting vector. What is its dimension ?
2. Write down the Compton scattering formula. Explain the terms involved.
3. Draw the schematic of the Franck-Hertz experiment indicating the parts involved.
4. Write down the Balmer formula and explain the terms involved.
5. Discuss the Bohr's correspondence principle.
6. Write down the energy-time uncertainty principle and explain the terms involved.
7. Write and explain the normalization condition of a wavefunction.
8. Explain the term degeneracy of eigen states.
9. Write down the Schrödinger equation for a free particle and give its solution.
10. Write down the form of hydrogen atom wavefunction, indicating the variables and the quantum numbers involved.
11. Explain the purpose of Stern-Gerlach experiment.
12. What is normal Zeeman effect ?

(8 × 3 = 24 marks)

Turn over