

FAROOK COLLEGE (AUTONOMOUS), KOZHIKODE
Fifth Semester B.Sc Physics Degree Examination, November 2018

PH5B06 – Electrodynamics - II

(2015 Admission onwards)

Max. Time: 3 hours

Max. Marks: 80

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. The differential form of Faradays Law is.....
- 2. The unit of Self Inductance is.....
- 3. The time constant of CR circuit is.....
- 4. When the frequency increases in a capacitance circuit, reactance.....
- 5. A constant Current source has internal resistance.

State whether true or false:

- 6. The Mutual inductance is measured by Anderson Bridge.
- 7. Blue light has the lowest frequency in electromagnetic spectrum.
- 8. Inductance is an intrinsically positive quantity
- 9. When AC flows through inductance e.m.f lags the current by 90°.
- 10. Velocity of electromagnetic waves in vaccum is that of light.

(10 x 1 = 10 marks)

Section B

Answer in one or two sentences.

Answer all questions.

Each question carries 2 marks.

- 11. Explain Kirchhoff's Voltage law.
- 12. What is Skin effect?
- 13. What is an ideal Voltage source?
- 14. State Faradays Law in electromagnetic induction.
- 15. What is Phase velocity of e.m. waves?
- 16. Why eddy currents are reduced in B.G.?
- 17. Show that the curl of E (electric field) is zero.

(7 x 2 = 14 marks)

Section C

Answer in a *paragraph* of about half to one page.

Answer *any five* questions.

Each question carries **4** marks.

18. What is jumping ring experiment?
19. What is Maxwell's displacement current?
20. What is damping correction?
21. Derive an expression for momentum and energy of electromagnetic waves.
22. What is the importance of j operator?
23. Show that the electric vector E and magnetic vector B in electromagnetic waves are perpendicular to each other.
24. Discuss the decay of current through Resistance and capacitance.

(5 x 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. A $100 \mu\text{f}$ capacitance in series with a 40Ω resistance is connected to a 110 V , 60 Hz supply. What is the maximum current through the circuit? What is the time lag between maximum current and potential?
26. A solenoid 100 cm in length and 4 cm in diameter is wound with 2000 turns. Calculate the inductance, energy stored in the magnetic field when a current of 2 A flows through it.
27. Calculate the current through galvanometer in a Wheatstone's bridge when it is connected to a 6 V source. $P=80 \Omega$, $Q=20 \Omega$, $R=40 \Omega$, and $S=10 \Omega$.
28. An e.m.f of 50 V is applied in a circuit containing a resistance 50Ω and inductance H . Find the time required for the current to attain 60% of its maximum value. Also find the time constant.
29. A coil of inductance 0.5 H and resistance 100Ω is connected to a 240 V , 50 Hz supply. Find the maximum current, and the time lag between current and voltage.
30. The refractive index of a crystal is 2.4 . Calculate the Brewster's angle and the ratio of intensities at normal incidence.
31. A circular coil of radius 10 cm , 500 turns and resistance 2Ω is placed with its plane perpendicular to the earth's horizontal field. It is rotated about the vertical diameter through 180° in 0.25 s . Estimate the magnitude of induced e.m.f and current.

(4 x 4 = 16 marks)

Section E

Answer in two or three pages.

Answer *any two* questions.

Each question carries **10** marks.

32. State Thevenin's theorem and Norton's theorem and explain with appropriate diagrams.
33. Derive the wave equation for E and B vectors in free space. Show that electromagnetic waves are transverse in nature and E and B are in phase and perpendicular to each other.
34. Derive Maxwell's equations from fundamental laws.
35. Discuss the growth and decay of current through CR circuit.

(2 x 10 = 20 marks)

FAROOK COLLEGE (AUTONOMOUS), KOZHIKODE

Fifth Semester B.Sc Physics Degree Examination, November 2018

PH5B07 – Quantum Mechanics

(2015 Admission onwards)

Max. Time: 3 hours

Max. Marks: 80

Section A

Answer all questions in a word or phrase.

Each question carries 1 mark.

- Rayleigh-Jeans formula for black body radiation shows discrepancy:
 - For small frequencies
 - For High frequencies
 - For medium frequencies
 - For all frequencies
- The maximum wavelength change in Compton effect is (λ_c is the Compton wavelength):
 - λ_c
 - $2 \lambda_c$
 - $\frac{1}{2} \lambda_c$
 - $4 \lambda_c$
- The ___ nature of moving electron is made use in electron microscope.
- The square of the absolute value of wave function is called ___.
- Owing to the motion of the nucleus, the energy levels of electrons:
 - Remains same
 - Increases
 - Decreases
 - Depends on the atom
- The momentum operator is:
 - $\frac{\hbar}{i} \frac{\partial}{\partial x}$
 - $i\hbar \frac{\partial}{\partial x}$
 - $\frac{\hbar}{i} \frac{\partial}{\partial t}$
 - $i\hbar \frac{\partial}{\partial t}$
- Schrödinger's equation is linear in the wave function. True or false?
- Schrödinger's equation can be derived from other basic principles of physics. True or false?
- Stern Gerlach experiment demonstrates the ___ of electron spin.
- The principal quantum number is related to:
 - Quantization of energy
 - Quantization of angular momentum magnitude
 - Quantization of angular momentum direction
 - All the above

(10 x 1 = 10 Marks)

Section B

Answer all questions in two or three sentences.

Each question carries 2 marks.

- State uncertainty principle. Is it a limitation of measurement?
- What was the significance of Frank Hertz experiment?
- Explain the concept of wave function.
- What do you mean by the super position of wave function?
- Classical mechanics is an approximation to quantum mechanics. Comment.
- Does the concept of Bohr orbit violate the uncertainty principle?
- What is Zeeman Effect.

(7 x 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. Show that pair production cannot occur in empty space.
19. Give a brief explanation about the Davisson- Germer experiment and its significance.
20. Derive the expression for electron orbital radii of Hydrogen atom.
21. Explain the origin of line spectra of hydrogen atom.
22. Obtain the wave function of a particle in a square potential well with finite barriers.
Assume that the energy of the particle is less than the potential of the boundary.
23. Explain Tunnel effect.
24. Why is only one component of electron's angular momentum quantized?

(5 x 4 = 20 Marks)

Section D

Answer any four questions.
Each question carries 4 marks

25. A metal surface illuminated by 8.5×10^{14} Hz light emits electrons whose maximum energy is 0.52 eV. The same surface illuminated by 12.0×10^{14} Hz light emits electrons whose maximum energy is 1.97 eV. From these data find Planck's constant and the work function of the surface.
26. An electron is in a box 0.10 nm across, which is the order of magnitude of atomic dimensions. Find its first two permitted energies.
27. Find the wavelength of the spectral line that corresponds to a transition in hydrogen from the $n = 6$ state to the *first excited* state. In what part of the spectrum is this?
28. A particle limited to the x axis has the wave function $\Psi = ax$ between $x = 0$ and $x = 1$ and $\Psi = 0$ elsewhere. Find the probability that the particle can be found between $x = 0.4$ and $x = 0.55$.
29. Find the expectation value $\langle x \rangle$ for the first two states of a harmonic oscillator.
30. Find the minimum magnetic field needed for the Zeeman effect to be observed in a spectral line of 400-nm wavelength when a spectrometer whose resolution is 0.010 nm is used?
31. What are the angles between \mathbf{L} and the z axis for $l = 1$ and $l = 2$?

(4 x 4 = 16 Marks)

Section E (Essays)

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

32. Explain the effect of gravity on photons. Derive an expression for gravitational red shift. State the criterion for a star to be a black hole.
33. Explain the concept of de Broglie waves. Explain the terms phase velocity and group velocity. Show that the group velocity of a moving particle is equal to particle velocity.
34. Write Schrödinger's equation for a particle trapped in one dimensional box. Obtain the wave function of the particle. Also find the momentum Eigen values and momentum Eigen functions for the trapped particle.
35. Write the time-independent Schrodinger wave equation for the hydrogen atom in spherical polar co ordinates and separate it into three differential equations for the three parts of the total wave function.

(2 x 10 = 20 Marks)

FAROOK COLLEGE (AUTONOMOUS), KOZHIKODE
Fifth Semester B.Sc Physics Degree Examination, November 2018
PH5B08 – Physical Optics & Modern Optics
(2015 Admission onwards)

Max. Time: 3 hours

Max. Marks: 80

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. Colours in thin films are formed due to.....
2. Resolving power of a telescope with increase in diameter of the aperture.
3. Refractive index of glass is 1.5, then its critical angle is.....
4. In a quarter wave plate the thickness is such that the optical path difference between e ray and o ray is.....
5. The principle of holography is diffraction and

State whether true or false:

6. The optical path length may be less than the geometrical path.
7. If biprism experiment is performed in water instead of air the fringe width will increase.
8. When unpolarised light pass through a polaroid the intensity is reduced to half.
9. Pulse dispersion is measured in time.
10. For an optical active liquid the angle of rotation is inversely proportional to concentration.

(10 x 1 = 10 marks)

Section B

Answer in one or two sentences.

Answer all questions.

Each question carries 2 marks.

11. State and explain Fermat's principle of least time.
12. Give are two methods of obtaining coherent sources.
13. What are the uses of Michelson's Interferometer?
14. Why a grating spectrum is called a normal spectrum?
15. What is a zone plate? What are the two types of it?
16. State and explain Brewster's Law.
17. What is meant by V number of an optic fibre?

(7 x 2 = 14 marks)

Section C

Answer in a **paragraph** of about half to one page.

Answer **any five** questions.

Each question carries **4marks**.

18. Show that the phenomenon of interference obeys the law of conservation of energy.
19. Derive an expression for fringe width of interference pattern in a wedge shaped film.
20. What are missing orders? Find out the condition for missing order in double slit diffraction pattern.
21. Derive an expression for the dispersive power of grating.
22. Explain the working of a Laurent's half shade.
23. Derive an expression for numerical aperture of an optic fibre.
24. Explain how a plane polarised and an elliptically polarised light are detected.

(5 x 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. Two waves having intensity in the ratio 4:9 interfere. Find the ratio of intensity minima to that at maxima.
26. Light of wavelength 588 nm is incident on a thin film of glass $\mu = 1.5$, such that the angle of refraction in the plate is 60° . Calculate the smallest thickness of the plate that will make it dark by reflection.
27. Newton's rings are formed with red light of wavelength 670nm. The radius of the 2nd ring is found to be 1.1×10^2 m. Find the radius of the 30th ring.
28. With diffraction grating arranged for normal incidence, it is found that spectral line of 600nm in second order overlaps a spectral line in third order. Find the wavelength of the latter.
29. A monochromatic light of wavelength 500nm from a distant object falls on slit 0.5m wide. What is the distance between the two dark bands on each side of the central bright band of the diffraction pattern observed on a screen placed 2m from the slit.
30. Two polaroids are oriented with their planes normal to incident light and transmission axis making an angle 30° with each other. What fraction of the incident unpolarised light is transmitted?
31. In a step index fibre refractive index of core is 1.6 and that of cladding is 1.55. Determine the numerical aperture if the fibre is kept inside water. $n_{\text{water}} = 1.33$.

(4 x 4 = 16 marks)

Section E

Answer in two or three pages.

Answer **any two** questions.

Each question carries **10 marks**.

32. Derive the system matrix for a thick lens and hence arrive at the lens maker's formulae.
33. Describe an experiment to determine the wavelength of sodium light using Fresnel's biprism.
34. Explain the rectilinear propagation of light on the basis of Fresnel's half period zone.
35. With necessary theory explain the construction of a hologram.

(2 x 10 = 20 marks)

FAROOK COLLEGE (AUTONOMOUS), KOZHIKODE
Fifth Semester B.Sc Physics Degree Examination, November 2018
PH5B09 – Electronics (Analogue & Digital)
(2015 Admission onwards)

Max. Time: 3 hours

Max. Marks: 80

SECTION A

Answer all questions in a word or a phrase

Each question carries 1 mark

1. Two's complement of 1110110 is
2. Barkhausen criteria for oscillation is
3. Knee Voltage of silicon diode is about
4. What is the value of γ if $\beta=150$.
5. Bandwidth of an ideal op-amp is.....

Write true or false

6. Gain of the amplifier decreases as negative feedback increases.
7. In a transistor amplifier collector base junction is more forward biased with respect to emitter base junction.
8. In a full wave rectifier output frequency is twice that of input signal frequency.
9. FET is a current controlled device.
10. $A + B + C = A.B.C$

(10 x 1=10 marks)

SECTION B

Answer all questions in two or three sentences.

Each question carries 2 marks

11. What is Q-point ?
12. Derive the relation between α and β .
13. Draw circuit diagram of π filter.
14. What do you mean by phase reversal?
15. What is UJT ? Mention one of its applications.
16. Define modulation factor.
17. Draw the truth table of RS flip flop.

(7 x 2 = 14 marks)

SECTION C

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

18. Briefly explain a voltage Tripler circuit with output waveforms.
19. Differentiate between BJT and FET.
20. Explain how RC network is helpful to produce oscillations in a phase shift oscillator?
21. Why biasing networks are required in transistors? Explain voltage divider biasing network.
22. Discuss the input and output characteristics of CE configuration.
23. Compare between frequency modulation and amplitude modulation.
24. What is zener breakdown? How zener diodes act as a voltage regulator?
25. What are the advantages of negative feedback? Derive an expression for voltage gain with negative feedback.

(5 x 4 = 20 marks)

SECTION D

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

26. A certain amplifier has voltage gain of 18 db. If the input signal voltage is 1.3V, what is the output voltage?
27. Simplify the logic expression $\bar{A}\bar{B}C + A\bar{B}C + AB\bar{C} + ABCD$ and draw the logic diagram.
28. In a base bias method a transistor with $\beta=250$ is used. Given $R_B=470\text{ k}\Omega$, $R_C=2.2\text{ k}\Omega$ & $V_{CC}=12\text{V}$. Draw dc load line and determine operating point. What is the stability factor?
29. Convert (i) $(247.36)_8$ to equivalent hexadecimal.
(ii) $(4E5)_{16}$ to binary
30. The collector leakage current in a transistor is $320\mu\text{A}$ in CE arrangement. If the transistor is connected in CB arrangement, what will be its value? Given $\beta=140$.
31. How functions are minimized using K-map. Obtain the simplified SOP form of the function $Y(A,B,C) = \sum m(1,2,6,7)$ using K-map

(4 x 4 = 16 marks)

SECTION E

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

32. With neat circuit diagram explain the working of a full wave bridge rectifier hence derive an expression for calculating ripple factor. How ripple factor of a bridge rectifier can be reduced?
33. What are the essentials of transistor oscillators? Explain the working of Colpitts Oscillator.
34. Explain the working of a two stage RC coupled transistor amplifier. Draw its frequency response and write down its advantages and disadvantages.
35. What are the characteristics of an ideal op-amp? What do you mean by CMRR? Describe how op-amp act as (i) differentiator (ii) integrator

(2 x 10 = 20 marks)

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(Pages : 2)

Reg. No:.....

Name:

FAROOK COLLEGE (AUTONOMOUS), KOZHIKODE

Fifth Semester B.Sc Physics (Open Course) Degree Examination, November 2018

PH5D01 – Non Conventional/Energy Sources

(2015 Admission onwards)

Max. Time: 2 hours

Max. Marks: 40

Section A (One Word Answer)*Answer all questions**Each question carries 1 mark*

1. In biomass, solar energy is stored in the form of chemical energy by the process of
2. An example of material for phase change energy storage is
a) Hydrogen b) Carbon c) Honey d) Water
3. Which one of the following is a non-renewable energy source?
a) Biomass b) Coal c) Wind energy d) Geothermal Energy
4. energy is stored as thermal energy in the earth's crust
5. Power of a battery is measured in.....
a) Watts b) Volts c) Ampere d) Joule
6. Which among the following turns the turbine in a geothermal plant?
a) Heat b) Water c) Steam d) Brine

(6 x 1=6marks)**Section B (Short Answer)***Answer all questions in one or two sentences**Each question carries 2 marks*

7. 'A solar green house is a growth chamber which offers the possibilities of year round plant production'. Justify the statement
8. What do you mean by anaerobic digestion?
9. List four disadvantages of wave energy.
10. What is Neap tide and Spring tide?
11. 'Biomass is a form of solar energy'. Comment

(5 x 2=10 marks)

Section C (Paragraph Answer)
Answer any four questions
Each question carries 4 marks

12. Enumerate the problems and prospects of a solar furnace.
13. Discuss the applications of wind energy
14. What is the difference between open cycle and closed cycle OTEC systems?
15. Compare the merits and demerits of concentrating collectors over flat plate type collectors
16. What is a Pyranometer? How is it used to measure solar radiation?
17. Discuss the advantages and disadvantages of tidal power generation

(4 x 4 = 16 marks)

Section D (Essay)
Answer any one question
The question carries 8 marks

18. What is the principle of wind energy conversion? With the aid of a block diagram discuss the basic components of a wind energy conversion system. List the advantages and disadvantages of wind energy conversion.
19. What is the source of geothermal energy? What are the merits and demerits of geothermal energy? Discuss the applications of geothermal energy.
20. Give an account on

a) Solar Cooker

b) Solar Distillation

(1 x 8 = 8 marks)