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2B5N20306 (Pages : 3) Reg. No:.....

Name: .....

FAROOK COLLEGE (AUTONOMOUS), KOZHIKODE

Fifth Semester B.Sc Physics Degree Examination, November 2020

BPHY5B06 – Electrodynamics II

(2018 Admission onwards)

Time: 3 hours Max. Marks: 80

SECTION A

(Answer in a word or phrase)

Answer ALL questions: Each question carries 1 mark

1. The value of the coupling constant for magnetically isolated coils is.....
2. What is the dielectric constant of a glass having refractive index 1.5?
3. For a series LCR circuit the condition for it to be damped oscillatory is.....
4. If the parameters of a circuit depend on the voltage/current in the circuit, then the circuit is called.....
5. Write down the expression for the voltage in a pure capacitive circuit when a current of $I=I_0 Sin\omega t$ is flowing through it.

Questions 6 to 10: Write True or False

6. Node is that part of the network lies between two junctions.
7. For a series RC circuits, the transient time depends on the product RC only.
8. The function f(x,t) = g(x-vt) will represent a wave propagating in the x direction.(f,g are any arbitrary functions and x, v, t represents position, velocity, time respectively)
9. For a series LR circuit connected to alternating current, impedance of the circuit depends on the circuit parameters only.
10. The induced electric field is non-conservative.

(10x1 = 10 marks)

SECTION B

(Answer in two or three Sentences)

Answer ALL questions: Each question carries 2 marks.

11. What is mutual induction?
12. What do you meant by ideal constant current source? What will be its internal resistance?
13. Current through a circuit containing an inductor having negligible ohmic resistance is represented by $I=I_0 Sin\omega t$. What are the expressions for the applied voltage and back emf?
14. What is plane polarized wave? Write down the expression for electric field intensity of a monochromatic plane polarized electromagnetic wave.
15. State laws of electromagnetic induction.
16. Define the time constant of a series LR circuit.
17. From Faraday's law, show that electric field fluctuations represents a wave motion.

(7x2 = 14 marks)

SECTION C

(Answer in a paragraph of about half a page to one page)
Answer any FIVE questions: Each question carries 4 marks.

18. Design an experiment to measure the figure of merit of a Ballistic Galvanometer.
19. State and explain Norton's theorem. Considering any arbitrary network, explain the different steps involved in Nortonising a circuit.
20. Obtain the expression for energy stored in the magnetic field.
21. Show that a stretched string supports wave motion.
22. Obtain the phase relation between the applied alternating voltage and current passing through a series LC circuit and hence obtain the expression for the impedance of the circuit.
23. State and prove superposition theorem in electrical networks using any arbitrary network containing two emf sources.
24. Explain how Maxwell's equations can be modified to fit for the case of materials and hence write down the Maxwell's equations in materials.

(5x4 = 20 marks)

SECTION D

(Problems – Write all relevant formulas. All important steps carry separate marks)
Answer any FOUR questions: Each question carries 4 marks.

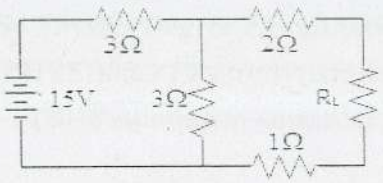
25. There is a uniform magnetic field straight up through a circular horizontal region. If the magnetic field is decreased from 0.8 to 0.2 T in 0.3seconds, what is the induced electric field 0.4m away from the centre of the region?
26. A lamp having hot resistance of 15 Ω is not allowed to pass more than 5A. Find the value of inductance of an inductor which must be connected in series with the lamp which is supplied by an alternating current of maximum r.m.s 320 V at 60 cycles/second.
27. The electric field in free space is given by

    $\mathbf{E} = 50 \cos (10^8 t + kx)\, \hat{y}$ V/m.

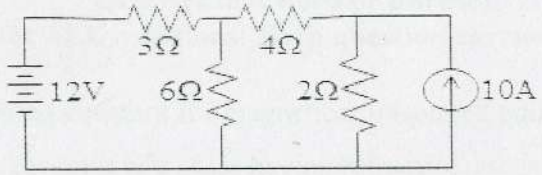
    a) Find the direction of the wave propagation.

    b) Calculate 'k' and the time it takes to travel a distance of $\lambda/2$ (λ is the wavelength)
28. A solenoid has a length of 1m. The number of turns per metre is 50000 and diameter is 5cm. Find the magnetic flux when a current of 2A flows through it. Also, calculate the self-inductance of the coil.
29. A circular coil of 20 turns and radius 10cm is placed in a uniform magnetic field of 0.1T parallel to the plane of the coil. When a current of 5A is send through the coil, what is the torque on the coil?

30. In the network shown below, find the value of R_L such that maximum possible power will be transferred to R_L. Find also the value of the maximum power and the power supplied by the source under these conditions.



31. Find the current through 4Ω resistor using Thevenin's theorem for the circuit shown below.



(4x4 = 16 marks)

SECTION E

(Answer in about two pages)

Answer any TWO questions: Each question carries 10 marks.

32. Explain resonance in a series LCR circuit and obtain the expression for the resonance frequency and quality factor by considering an alternating current of $I=I_0 Sin\omega t$ flows through it.
33. Discus decay of charge in a series LCR circuit
34. Starting from Maxwell's equations, discuss Poynting vector. Using it deduce the expression for the intensity of electromagnetic wave.
35. Explain the four electro-dynamic boundary conditions.

(2x10 = 20 marks)

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2B5N20307 (Pages : 3) Reg. No:.....

Name: .....

FAROOK COLLEGE (AUTONOMOUS), KOZHIKODE

Fifth Semester B.Sc Physics Degree Examination, November 2020

BPHY5B07 – Quantum Mechanics

(2018 Admission onwards)

Time: 3 hours Max. Marks: 80

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

Section A

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

1. The important mechanism of energy loss in radioactive gamma ray is_____
   (a) Photoelectric effect (b) Compton effect (c) Pair production (d) Rayleigh Scattering
2. A particle whose wave function is given by $\Psi=2x$ is limited to x axis between x=0 and x=1. The expectation value $\langle x \rangle$ of particle is_____
3. X-rays are not used in microscope because _____
4. Franck Hertz experiment is to verify _____
5. The Hamiltonian operator is given by _____

Write True or False

6. All the three components of L are quantized.
7. As long as the electron remains in an orbit, $\langle x \rangle$ is independent of time
8. In anomalous Zeeman effect, each spectral line splits into three lines.
9. X ray production is called the inverse of photo electric effect.
10. Davisson and Germer experiment confirms the particle nature of waves.

(10 x 1=10 marks)

Section B

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

11. Write down Bohr's correspondence principle.
12. Why the dark lines in absorption spectra are never totally dark?
13. Compare the energies of particle in a box and particle in a finite potential well
14. Differentiate gravitational and recessional red shifts.
15. Show that $n\lambda=2\pi r_n$ is equivalent to the Bohr condition for orbital stability.
16. State and explain Pauli's exclusion principle.
17. What do you meant by Zero point energy of a quantum harmonic oscillator?

(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 4marks.

18. Explain the effect of nuclear motion on the spectral lines.
19. Give the quantum interpretation of photoelectric effect.
20. Explain tunnel effect with examples.
21. Compare classical and quantum harmonic oscillators.
22. What are allowed and forbidden transitions? Give the selection rules?
23. What are the four quantum numbers of an atomic electron and explain the quantization they represent?
24. What are the limitations of Bohr model?

(5 x 4 =20 marks)

Section D

Answers any four questions.
Each question carries 4 marks.
Problems- Write all relevant formulas, all important steps carry separate marks.

25. The relation between angular velocity ω and wave number k for a given type of wave is $\omega^2=\alpha k+\beta k^3$. Find the wave number for which phase velocity equals group velocity?
26. 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.
27. The lowest energy possible for a certain particle trapped in a certain box is 1 eV. What are the next two higher energies the particle can have? If the particle is an electron, how wide is the box?
28. Show that the de Broglie wavelength of a particle of mass m and kinetic energy KE is given by $\lambda=hc/[KE(KE+2mc^2)]^{1/2}$
29. The longest wavelength in Lyman series is 121.5 nm. Use this wavelength together with the values of h and c to find the ionization energy of hydrogen.
30. Find the eigen functions for the operator x^3+d/dx with eigen value 5.
31. The azimuthal wave function for the hydrogen atom is $\Phi(\phi)=Ae^{im_l\phi}$. Find the value of the normalization constant A.

(4 x 4 =16 marks)

Section E (Essays)

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

32. Explain Compton Effect. Derive an expression for Compton shift.
33. State and prove Uncertainty principle using the concept of wave packets. Using uncertainty principle, show that the electrons cannot exist inside the nucleus.
34. Arrive at the time dependent Schrodinger's equation. Hence derive the steady State Schrodinger's equations?
35. Explain space quantization of spin. Show that the Stern- Gerlach experiment confirms the space quantization of spin angular momentum.

(2 x 10 =20 marks)

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2B5N20308 (Pages : 3) Reg. No:.....

Name: .....

FAROOK COLLEGE (AUTONOMOUS), KOZHIKODE

Fifth Semester B.Sc Physics Degree Examination, November 2020

BPHY5B08 – Physical Optics & Modern Physics

(2018 Admission onwards)

Time: 3 hours Max. Marks: 80

Section A

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

1. Diffraction will completely absent when wave length value is .....
2. The determinant value of system matrix is always .....
3. Shape of interference pattern on a screen resulting from Young's double slit experiment is .....
4. If 'r' and 't' are respectively the reflection and transmission coefficient of light when it transit from first medium to second, then the expression for transmission coefficient when light reverses its direction is .....
5. Two parallel polaroids with 45^0 inclination between transmission axes has exposed normally to an ordinary light, then the intensity of transmitted light is .....:%

Write whether the statement is True *or* False

6. Dimension of pulse dispersion is same as that of distance.
7. Interference pattern formed by Fresnel's bi-prism is due to division of amplitude.
8. Laser beam is essential for creation of hologram.
9. Paraxial rays reflected from a paraboloidal reflector correspond to a stationary optical path.
10. Radio telescope has more resolution than same by visible light.

(10 x 1 =10 marks)

Section B

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

11. What is system matrix? Why it is a 2x2 matrix?
12. Whether the interference happens for two independent light sources or not? If yes, why not seeing?

13. What is meant by *blooming*?
14. How does directionality depend of wavelength and aperture of a source?
15. What is a *zone plate* ?
16. How can represent mathematically an object wave, that is, light coming from an extended object?
17. What is meant by the acceptance angle of an optical fibre?

(7x2 = 14 marks)

Section C

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

18. Write the Fermat's principle. Express mathematically in time and optical path.
19. Explain the Fresnel's bi-prism arrangement.
20. Derive the expression for path difference of light reflected from upper and lower surface of a film in oblique incidence.
21. What is meant by resolving power of a telescope? Write Rayleigh's criteria for resolution.
22. Determine the intensity distribution of diffraction pattern by a straight edge, which is illuminated by a slit arrangement.
23. Write a note on double refraction along with Huygens explanation.
24. Briefly explain theory of Holography with diagram.

(5x4 = 20 marks)

Section D

Answer any* four *questions.
Each question carries* 4 *marks.
Problems- write all relevant formulas, all important steps carry separate marks.

25. A biprism is kept at a distance of 5 cm from slit illuminated by sodium light of wave length 5893 Å. The fringe formed on screen at a distance of 75 cm from biprism is 0.0942 cm width. Calculate separation between two virtual coherent sources.
26. In Newton's ring arrangement if incident light consists of two wavelengths 4000 Å and 4002 Å calculate distance at which the will disappear. The radius of curvature of curved surface is 400 cm.

27. When a wedge shaped film having refractive index 1.3 has illuminated by a monochromatic light arrangement, fringes were observed. When microscope moved 12.5mm, ten fringes are covered. Then what is the value of wavelength used? The angle of wedge is 40 seconds.
28. Calculate the radii of the first two dark rings of Fraunhofer diffraction pattern produced by a circular aperture of radius 0.02 cm at the focal plane of a convex lens of focal length 10 cm. Assume $\lambda = 6000$ Å.
29. Show that the first order and second order spectra will never overlap when the grating is used for studying a light beam contains wavelength components from 4000 Å to 7000Å.
30. Consider a circular aperture of diameter 2 mm illuminated by a plane wave. The most intense point on the axis is at a distance of 200 cm. from the aperture. Calculate the wavelength.
31. Quartz plate of thickness 0.03mm works as a phase retardation plate for light of wavelength 6000Å. Calculate the value of retardation in phase. Value of refractive index for ordinary and extraordinary ray respectively as 1.55 and 1.54.

(4x4 = 16 marks)

Section E (Essays)

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

32. Discuss with the sufficient mathematics, the production and detection of different polarized lights.
33. Describe the Fresnel's theory of half period zones. Show that intensity produced by entire zone is one half of intensity by first zone.
34. Determine the expression for intensity distribution produced by N-slit diffraction by deriving the same from single slit and also plot the pattern of both distribution.
35. With the neat diagram, discuss the theory of Michelson interferometer. And also discuss briefly on determination of wavelength and difference in wavelength.

(2x10 = 20 marks)

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2B5N20309 (Pages :3) Reg. No:.....

Name: .....

FAROOK COLLEGE (AUTONOMOUS), KOZHIKODE

Fifth Semester B.Sc Physics Degree Examination, November 2020

BPHY5B09 – Electronics(Analogue & Digital)

(2018 Admission onwards)

Time: 3 hours Max. Marks: 80

Section A

Answer all questions.

Each question carries 1 mark

1. Output frequency of full wave rectifier is ---------
2. The gain of a cascaded amplifier is equal to ------
3. An oscillator converts -----
4. At 100% modulation power in each side band is ------- of that carrier wave
5. Compared to CB amplifier the CE amplifier has-------

Write True or False :

6. Negative feedback in an amplifier increases the stability of its voltage gain.
7. E MOSFET can work both in depletion mode and enhancement mode.
8. Stability factor of base resistor method is less than that of feedback resistor method.
9. The decimal equivalent of binary no 110.101 is 6.625.
10. The coupling capacitors and bypass capacitors are responsible for the decrease of voltage gain at high frequencies in a multistage amplifier.

(10 x 1=10 marks)

Section B

Answer all questions in two or three sentences.

Each question carries 2 marks.

11. Draw the diagram of capacitor input filter.
12. Define the terms cut off and saturation point of transistor.
13. State Demorgan's theorem.
14. What is intrinsic Stand- off ratio.
15. Define the unit decibel for expressing a) voltage b) current c) power.
16. Why modulation is necessary in communication.
17. Subtract 8 from 24(in binary form) using 2's compliment method.

(7 x 2 = 14 marks)

Section C

Answer any five questions.

Each question carries 4 marks.

18. Explain the advantages of negative feedback amplifier.
19. With the help of a neat diagram explain op amp as an integrator.
20. Discuss the theory of frequency modulation.
21. Write a short note on negative number representation in binary number system.
22. Describe the working of transformer coupled amplifier with its advantages.
23. Explain the working of half adder
24. What is faithful amplification? Explain the conditions to be satisfied to achieve faithful amplification in a transistor amplifier.

(5 x 4=20 Marks)

Section D

Answer any four questions.

Each question carries 4 marks.

Problems – write all relevant formula, all important steps carry separate marks.

25. For a zener regulator if V_Z= 10V, R_S = 1KΩ,R_L= 2KΩ and the input voltage varies from 22 to 40V, find the maximum and minimum value of Zener current.
26. In a single stage amplifier circuit Vcc = 30V, R_1 = 2KΩ R_2 = 1KΩ R_C = 2 KΩ, R_E = 1 KΩ, R_L = 2KΩ. Draw DC and AC load line.
27. The maximum peak to peak voltage of an AM wave is 16mV, while minimum peak to peak voltage is 8mV. Find the percentage of modulation.
28. For JFET I_{DSS} =9mA V_{GS}(OFF) = -3.5 V. Determine I_D for V_{GS}=0V and V_{GS}= -2V.
29. Draw the Karnaugh map of Y=F(A,B,C,D) = $\sum m(1,2,5,6,8,,10,11,12,13,15)$ and find the simplified expression using sum of product method.
30. In a transistor circuit I_E = 5mA I_C= 4.95 mA and I_{CEO} = 200μA.calculate β and leakage current I_{CBO}
31. Convert the following real numbers to binary and represent it in bytes using floation point number representation

    a) 29.36 b) 45.8

(4 x 4 = 16 marks)

Section E

Answer any two questions.

Each question carries 10 marks.

32. With the help of neat diagram explain the working of bridge rectifier. Hence derive the expression for efficiency.
33. Draw the circuit diagram of single stage amplifier. Explain the function of each component and operation.
34. What is Barkhausen criterion? Describe the working of phase shift oscillator and write down its expression for frequency.
35. Define flip flop. Using block diagram distinguish the actions of RS& JK FLIP FLOP.

(2 x 10=20 Marks)

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2B5N20310 (Pages : 2) Reg. No:.....

Name: .....

FAROOK COLLEGE (AUTONOMOUS), KOZHIKODE

Fifth Semester B.Sc Physics (Open Course)Degree Examination, November 2020

BPHY5D01 – Nonconventional/ Energy Sources

(2018 Admission onwards)

Time: 2 hours Max. Marks: 40

Section A

Very short answer type question. (One word to Maximum 1 sentences).
Answer all. Each carries One (1) mark.

1. The value of solar constant is.....
2. The fundamental effect that is used in the conversion of solar energy to heat is.....
3. ---------- is an example for primary battery.
4. The organic matter produced by terrestrial and aquatic plants and their derivatives is called.....
5. The working fluid used in "closed cycle OTEC power plant is .....
6. The molten material mixed with gases in the mantle of the earth is called.....

(6 ×1 = 6 Marks)

Section B

Short answer type question. Answer all question.
Each carries Two (2) marks

7. Write down two merits and two demerits of solar cooker.
8. What are the reason for variation in solar radiation reaching earth than received at outside of the atmosphere?
9. What do you mean by biomass?
10. List out four applications of wind energy.
11. Mention two advantages and two limitations of tidal power generation.

(5 × 2 = 10 Marks)

Section C

Short Essay Questions (Not to exceed 120 words).
Answer any Four. Each Carries 4 Mark

12. List different types of concentrating collectors. Explain working any one of them with a neat sketch.

13. Explain briefly the harnessing of Tidal Energy.

14. What do you mean by photovoltaic effect ? List three advantages and disadvantages of a photovoltaic power conversion system.

15. Describe horizontal axis type aerogenerators.

16. What is the basic principle of Ocean Thermal Energy Conversion system (OTEC) ?

17. What are the different methods of obtaining energy from biomass? Explain briefly?

(4 × 4 = 16 Marks)

Section D

Long Essay Question. Answer any One. Each carries 8 Mark

18. What is the source of geothermal energy? Explain each. What are the advantages and disadvantages of geothermal energy over other forms of energy ? Discuss the applications of geothermal energy.

19. What are the various instruments used to measure Solar radiation? Explain working of each devices with a neat sketch.

20. Explain the principle of wind energy conversion. With the help of block diagram, discuss the basic components of a wind energy conversion system.

(1 × 8 = 8 Marks)