D 21537

(Pages : 2)

Name.....

Reg. No.....

THIRD SEMESTER B.Sc. DEGREE EXAMINATION, NOVEMBER 2011

(C.C.S.S.)

Physics—Complementary

PH 3C 05—OPTICS, LASER, ELECTRONICS AND COMMUNICATION

Time : Three Hours

Maximum Weightage : 30

I. Answer *all* the twelve questions :

1 Colours of thin film are explained using the phenomenon ———.

2 In Fresnel diffraction the source and screen are at ——— distances from the aperture.

3 Write down the expression for fringe width of interference pattern.

4 The phenomenon of superimposition of two or more waves to lose their identity is called ———.

5 Write down the equation for resolving power of a grating.

6 When an ordinary light is passed through a polaroid, what kind of light is obtained ?

7 The essential parts of an astronomical telescope are ——— and ———.

8 A Zener diode is working in ——— bias.

9 A device which converts a.c. into d.c. is called ———.

10 A NOR gate is obtained by the series combination of an OR gate and ——— gate.

11 In a full wave rectifier how many diodes are used ?

12 What is the condition for total internal reflection ?

(12 × ¼ = 3 weightage)

II. Answer *all* the nine questions :

13 State laws of refraction.

14 What is meant by distructive interference ?

15 What are coherent sources ?

16 Mention the parts of a spectrometer.

17 Write down an expression for magnifying power of a telescope.

18 What is optical activity ?

19 Draw the ray diagram for the image formation in a Galilean telescope.

20 Name the three possible transistor connections.

21 What is an analyser ?

(9 × 1 = 9 weightage)

Turn over

III. Answer any *five* from seven questions :

22 Distinguish between Fresnel and Fraunhofer diffractions.

23 How Newtons rings are formed ?

24 What will be the Brewster angle for a glass slab ($n = 1.5$) immersed in water ($n = 4/3$) ?

25 Discuss relative advantages and disadvantages of Huygen's and Ramsden's eyepieces.

26 Explain Huygen's principle.

27 Write down the characteristics of forward and reverse biasing.

28 Write a note on different kinds of filter circuits with examples.

($5 \times 2 = 10$ weightage)

IV. Answer any *two* from three questions :

29 Describe with theory Young's experiment to determine the wavelength of a monochromatic source of light.

30 Briefly explain the working of an astronomical telescope.

31 Explain LC and RC oscillators with neat diagram, explain the circuit operation of a Hartley oscillator.

($2 \times 4 = 8$ weightage)

D 31097

(Pages : 3)

Name.....

Reg. No.....

THIRD SEMESTER B.Sc. DEGREE EXAMINATION, NOVEMBER 2012

(CCSS)

Physics (Complementary Course)

PH 3C 05—OPTICS, LASER, ELECTRONICS AND COMMUNICATION

Time : Three Hours

Maximum : 30 Weightage

I. Objective type questions (Answer *all twelve* questions) :

1. The fringe width for the interference pattern obtained in the Young's double slit experiment is proportional to :

   (a) Square of the light wavelength.

   (b) The distance between the sources.

   (c) The square of the distance between the sources.

   (d) Cube of the light wavelength.

2. When white light is incident on thin films, the color appears on thin films depends on thickness and ———.

3. For Fraunhofer diffraction at a single slit, using white light, the central maximum is :

   (a) Green. (b) Red.

   (c) Yellow. (d) White.

4. The grating spectrum is caused by :

   (a) Dispersion. (b) Polarization.

   (c) Reflection. (d) Diffraction.

5. Which optical phenomenon proves that light waves are transverse in nature ?

   (a) Reflection. (b) Refraction.

   (c) Polarization. (d) Diffraction.

6. Which is the most lightly doped region in a transistor ?

   (a) Collector. (b) Emitter.

   (c) Base. (d) Battery.

7. Which transistor configuration is commonly used for impedance matching ?

   (a) CE. (b) CC.

   (c) CB. (d) None of these.

Turn over

8. Positive feedback ——— the gain of the amplifier.

(a) Increases. (b) Decreases.

(c) Does not change. (d) Increases or Decreases.

9. Which among the following is not a property of a laser beam ?

(a) Directionality. (b) Coherence.

(c) High intensity. (d) Low power.

10. In amplitude modulation, the bandwidth is ——— the audio signal frequency.

(a) Same as. (b) Twice.

(c) Thrice. (d) Four times.

11. The power of a Ramsdens eyepiece is ———.

(a) Zero. (b) Infinity.

(c) Positive. (d) Negative.

12. ——— of an amplifier is the range of frequency at the limits of which its voltage gain falls by 3 db from the maximum gain.

(a) Power. (b) Current amplification factor.

(c) Gain. (d) Bandwidth.

(12 × ¼ = 3 weightage)

II. Short answer type questions (Answer *all nine* questions) :

13. What are the conditions for *two* light sources to be coherent ?

14. Distinguish between the Newton's rings formed by reflected and transmitted monochromatic light.

15. What do you mean by double refraction ?

16. Using suitable reverse characteristic, show the difference in the breakdown voltage of an ordinary diode and a Zener diode.

17. Discuss the construction of a Ramsden eyepiece.

18. Discuss the principle of light propagation in an optical fiber.

19. Using a suitable figure, discuss the phenomenon of spontaneous emission.

20. Draw the energy level diagram showing the different transitions in a He-Ne laser.

21. What do you mean by frequency modulation ?

(9 × 1 = 9 weightage)

III. Short essay type questions (Answer any *five* questions from seven) :

22. A parallel beam of light of wavelength 589 nm is incident on a thin glass plate of refractive index 1.5 such that the angle of refraction into the plate is 60 degrees. What is the smallest thickness of the glass plate that appears dark by reflection ?

23. Determine the radius of the second zone in a zone plate of focal length 10 cm for light of wavelength 500 nm.

24. Estimate the minimum number of lines in a grating that will just resolve, in the second order, the lines whose wavelengths are 589 nm and 589.6 nm.

25. A plane polarized light passes through a uniaxial crystal with its optic axis parallel to the faces. Determine the least thickness of the plate for which the emergent beam is plane-polarized.

Given $\mu_e = 1.5533,\ \mu_0 = 1.5442,\ \lambda = 500\ nm.$

26. Verify the de Morgan's theorem "the complement of the sum of two variables is equal to the product of the complements of the variables" using a truth table.

27. Find the operating frequency of a Collpitt's transistor oscillator if $C_1 = 0.001\,\mu F$, $C_2 = 0.01\,\mu F$ and L = 15 μH.

28. A step index fiber has a core of refractive index 1.55 and clad of refractive index 1.5. Determine the numerical aperture and acceptance angle of the fiber. Assume the light enters the fiber from air.

(5 × 2 = 10 weightage)

IV. Essay questions (Answer any *two* questions from three) :

29. Discuss the laws of reflection and refraction. Verify the results using Fermat's principle.

30. Discuss the Fraunhofer diffraction pattern due to a single slit. Draw the intensity distribution.

31. What are universal gates ? Give truth tables for NOR and NAND gates. Construct OR, AND and NOT gates using NOR and NAND gates.

D 51512 (Pages : 3) Name.....

Reg. No.....

THIRD SEMESTER B.Sc. DEGREE EXAMINATION, NOVEMBER 2013

(UG–CCSS)

Physics—Complementary Course

PH 3C 05—OPTICS, LASER, ELECTRONICS AND COMMUNICATION

Time : Three Hours Maximum : 30 Weightage

I. Objective type questions. Answer *all* twelve questions :

1 When light enters from a medium of refractive index n_1 to another medium of refractive index n_2, with angle of incidence and angle of refraction are i and r, respectively, the Snell's law relating these quantities can be written as ———.

2 In the Young's double slit experiment, the fringe width of the interference pattern increases with :

(a) Increase of wavelength. (b) Decrease of wavelength.

(c) Separation of high sources. (d) Decreasing the distance between slit and screen.

3 For Newton's rings formed by reflected monochromatic light, the central ring is :

(a) Bright. (b) Dark.

(c) Coloured. (d) None of these.

4 The grating spectrum is caused by ———.

(a) Dispersion. (b) Polarization.

(c) Reflection. (d) Diffraction.

5 Which optical phenomenon proves that light waves are transverse in nature ?

(a) Reflection. (b) Refraction.

(c) Polarization. (d) Diffraction.

6 Which is the most heavily doped region in a transistor ?

(a) Collector. (b) Emitter.

(c) Base. (d) Battery.

7 The common collector transistor configuration is generally used for ———.

8 Negative feedback ——— the gain of the amplifier.

(a) Increases. (b) Decreases.

(c) Does not change. (d) Increases or decreases.

9 In a ruby laser, the energy levels used for laser action are of :

(a) Aluminium. (b) Chromium.

(c) Potassium. (d) Helium.

10 In television transmission, which modulation is used for sound signal ?

(a) Phase modulation. (b) Amplitude modulation.

(c) Frequency modulation. (d) No modulation.

11 Huygens eyepiece ——— be used in telescopes and other optical instruments with which distance and angles are to be measured.

(a) Can. (b) Cannot.

(c) Can or cannot. (d) None of these.

12 A negation following an AND gate is called :

(a) NOT. (b) XOR.

(c) AND. (d) NAND.

(12 × ¼ = 3 weightage)

II. Short Answer Type Questions. Answer all *nine* questions. Each question carries a weight of 1 :

13 What is Format's principle ?

14 Mention two differences between a zone plate and a convex lens.

15 Distinguish between Negative and Positive crystals.

16 Draw the circuit diagram of a basic Zener diode voltage regulator.

17 What do you mean by the angular magnification of a telescope ?

18 What is the principle of light propagation in an optical fiber ?

19 Using a suitable figure, discuss the phenomenon of stimulated emission.

20 What do you mean by population inversion ?

21 What is amplitude modulation ?

(9 × 1 = 9 weightage)

III. Short Essay Type Questions. Answer any *five* questions from seven :

22 A biprism is placed at a distance of 5 cm. in front of a narrow slit which is illuminated by a light of wavelength 589 nm. The distance between the two virtual sources is found to be 0.05 cm. Determine the width of the fringes observed in an eyepiece at a distance of 75 cm. from the biprism.

23 What is the radius of the first zone in a zone plate of focal length 25 cm. for light of wavelength 400 nm ?

24 Determine the minimum number of lines in a grating that will just resolve the sodium lines (589 nm and 589.6 nm) in the first order spectrum.

25 Determine the thickness of a quarter wave plate when the wavelength of light used in 589 nm. Given, the refractive indices of the extraordinary and ordinary light are $\mu_e = 1.553$ and $\mu_o = 1.544$, respectively.

26 Write down the Boolean expression and the truth table for an exclusive OR gate.

27 Calculate the frequency of a Hartley transistor oscillator having $L_1 = 100$ μH, $L_2 = 1000$ μH mutual inductance between the coils M = 20 μH and C = 20 pF.

28 A step index fiber has a core of refractive index 1.55 and clad of refractive index 1.5. Determine the numerical aperture and acceptance angle of the fiber. Assume that light enters the fiber from air.

(5 × 2 = 10 weightage)

IV. Essay Questions. Answer any *two* questions from three :

29 Discuss the interferences of two simple harmonic oscillations of constant phase difference. Obtain an expression for the intensity at a point on a screen placed at a distance.

30 What do you mean by a plane, circularly and plane polarized light ? Discuss briefly the production of plane, circularly and elliptically polarized light.

31 Briefly outline the working of an *npn* transistor. Discuss the different transistor connections using neat figures mentioning the current amplification factor in each case.

(2 × 4 = 8 weightage)

D 72402-A

(Pages : 3)

Name.....

Reg. No.....

THIRD SEMESTER B.Sc. DEGREE EXAMINATION, NOVEMBER 2014

(UG.—CCSS)

Complementary Course—Physics

PH 3C 05—OPTICS LASER, ELECTRONICS AND COMMUNICATION

(2013 Admissions)

Time : Three Hours

Maximum : 30 Weightage

Section A

Answer **all** *questions.*
Each carries ¼ weightage.

1. (i) Finger prints of a piece of paper may be detected by sprinkling fluorescent power on the paper and then looking into it under :

   (a) Yellow light
   (b) Brightness.
   (c) Infrared light.
   (d) Ultraviolet light.

   (ii) Colours of thin film is due to the phenomenon of _____.

   (iii) A grating has 5000 lines/cm. The maximum order visible with wavelength 6000 A

   (a) 2.
   (b) 3.
   (c) 4.
   (d) 0.

   (iv) Which of the following has the longest wavelength ?

   (a) Blue light.
   (b) Gamma ray.
   (c) X—Ray.
   (d) Red light.

2. (i) A point source emits ligh equally in all direction. Two point P and Q are at distances 9 m and 25 m respectively from the source. The ratio of the amplitudes of the waves P and Q is :

   (a) 9 : 25.
   (b) 25 : 9.
   (c) $9^2 : 25^2$
   (d) $25^2 : 9^2$.

   (ii) A Nicol prism is based on the action of :

   (a) Refraction.
   (b) Double refraction.
   (c) Dichroism.
   (d) Both (b) and (c).

   (iii) An optically active substance :

   (a) Produce polarized light.
   (b) Rotates the plane of polarization of polarized light.
   (c) Converts plane polarized light into circularly polarized light.
   (d) None of the above.

Turn over

(iv) In an *npn* transistor circuit, the collector current is 10 mA . If 90% of the electrons emitted reach the collector :

(a) The emitter current will be 9 mA

(b) The emitter current will be 11 mA.

(c) The base current will be 10 mA.

(d) The base current will be 0.1 mA.

3. (i) For a transistor the value of $\alpha = 0.9$, the value of $\beta =$ _____.

(ii) An oscillator is basically an amplifier with gain :

(a) Less than unity. (b) More than unity.

(c) Zero. (d) 0.5.

(iii) The modulation index of an AM wave is changed from 0 to 1 . The transmitted power is :

(a) Unchanged (b) Halved.

(c) Doubled. (d) Increased by 50 percent.

(iv) Which of the following is used for digital communication ?

(a) FM. (b) AM.

(c) PAM. (d) PCM.

(12 × ¼ = 3 weightage)

Section B

Answer **all** *nine questions.*
Each question carries a weightage of 1.

4. What is Fermat's principle ?
5. What is superposition principle ?
6. Write down the condition for brightness and darkness.
7. What is dispersive power ?
8. What is polarization ?
9. What is a zener diode ?
10. Explain population inversion. How it is achieved ?
11. What is modulation ?
12. What is Demorgan's theorem ?

(9 × 1 = 9 weightage)

Section C

Answer any **five** *questions.*
Each question carries a weightage of 2.

13. Discuss the laws of reflection and refraction.
14. Explain colours of thin film.
15. Distinguish between Fresnel diffraction and Fraunhofer diffraction.

16. State and explain Brewster's law.

17. Give a short account of He-Ne laser.

18. Obtain an expression for the total energy carried by amplitude modulated wave.

19. An optical fiber has a core of refractive index 1.52 and cladding of refractive index 1.42, calculate NA and acceptance angle.

(5 × 2 = 10 weightage)

Section D

Answer any **two** *questions.*
Each question carries a weightage of 4.

20. Explain the formation of spectra by a plane diffraction grating. What are its chief characteristics ?

21. Describe the method of producing linearly, circularly and elliptically polarized light.

22. Describe principle and working of any oscillator and explain how it produce sustained oscillation. Derive the necessary formula.

(2 × 4 = 8 weightage)

D 92288 (Pages : 2) Name.....

Reg. No.....

THIRD SEMESTER B.Sc. DEGREE EXAMINATION, NOVEMBER 2015

(CUCBCSS—UG)

Complementary Course

PH 3C 03—OPTICS, LASER AND COMMUNICATION

Time : Three Hours Maximum : 64 Marks

I. Answer *all* questions, each question carries 1 mark :

1 For elliptical reflectors light takes the ———— for all paths.

2 The relation between path difference and phase difference is ————.

3 Colours of thin film is due to the phenomenon of ————.

4 Wavelength of laser beam can be used as a standard of ————.

5 In the diffraction of light of wavelength λ at a single slit of small width e the angle θ between the central maximum and first minimum on either side is ————.

6 The expression for ripple factor of half wave rectifier is ————.

7 The relation between α and β of a transistor is ————.

8 Transistor works as an amplifier when it operates under ———— region.

9 In a CE amplifier phase difference between input and output is ————.

10 Optical fibers are based on the principle of ————.

(10 × 1 = 10 marks)

II. Answer *all* questions, each question carries 2 marks :

11 Draw the diagram of Fermat's principle in refraction.

12 Explain why no interference takes place in two independent light sources ?

13 Explain why very thin film appears black in reflected light ?

14 What is the principle of non-reflecting coating ?

15 What is Fraunhoffer class of diffraction ?

16 Why we need modulation in communication ?

17 Give the principle operation of a semiconductor laser.

(7 × 2 = 14 marks)

Turn over

III. Answer any *two* questions, each question carries 4 marks :

18 State and explain Fermat's principle of extreme path and analyze a case where the actual path of light may be a maximum.

19 What is Brewster's law ? How it can be used to find polarizing angles in crystals ?

20 Distinguish between resolving power and dispersive power of grating. What is meant by overlapping of spectra in the spectra of a diffraction grating ?

21 What is Meta stable state ? Explain the role which it plays in the operation of a laser.

22 Discuss the different types of modulations.

(2 × 4 = 8 marks)

IV. Answer any *three* questions, each question carries 4 marks :

23 A drop of oil of volume 0.2 cm^3 is dropped on the surface of a tank of area 1 m^2. The film spreads uniformly over the whole surface and white light reflected normally is observed through a spectrometer. The spectrum is seen to contain dark band whose centre has a wavelength of 550 nm in air. Find the refractive index of oil.

24 Newton's rings are formed in the reflected light of wavelength 600 nm with a liquid between the plane and curved surface. If the diameter of the 6^{th} bright ring is 3.1 mm and radius of curvature of the curved surface is 1m, calculate the refractive index of the liquid.

25 In a grating spectrum which spectral line in the 4^{th} order will overlap with the 3^{rd} order of 5461 Å.

26 80 grams of impure sugar when dissolved in a litre of water gives an optical rotation of 9.9° when placed in a tube of length of 20 cm. If the specific rotation of sugars is 66°, find the percentage purity of the sample.

27 A 50 V Zener diode is used to obtain a regulated output voltage across a load 10 kΩ. The series resistor is 5 kΩ. If the input changes from 80 to 120V, find the maximum zener current.

(3 × 4 = 12 marks)

V. Answer any *two* questions, each question carries 10 marks :

28 Discuss in detail the Fresnel's biprism. Explain how the wavelength of light can be determined with its help. Give a diagram showing clearly how coherent sources are produced in a biprism. Derive the formula for the fringe width in the biprism experiment.

29 Draw the circuit diagram of Colpitt's oscillator. Explain briefly how it operates. Compare its working with that of Hartley oscillator.

30 Give the basic structure of an optical fibre. How the various refractive indices have to be related to get better working of an optical fibre ?

(2 × 10 = 20 marks)

D 12430 (Pages : 2) Name.....

Reg. No.....

THIRD SEMESTER B.Sc. DEGREE EXAMINATION, NOVEMBER 2016

(CUCBCSS—UG)

Complementary Course

PHY 3C 03—OPTICS, LASER, ELECTRONICS AND COMMUNICATION

Time : Three Hours Maximum : 64 Marks

Section A (One Word)

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

1. In white light, thin films appear coloured due to ————.
2. LASER is the acronym for ————.
3. In a ruby laser ———— ions is responsible for lasing action.
4. When reflected from a transparent medium, the angle of incidence for which the reflected light is completely polarized is called ————.
5. In a double refracting crystal the ray which obeys the laws of refraction is called ————.
6. An amplifier with positive feedback is used in ————.
7. The power gain of a common emitter transistor amplifier is the product of voltage gain and ————.
8. Zener diode is used as a ————.
9. When the output of a NAND gate is connected to the input of a NOT gate it works as a ———— gate.
10. In Fraunhofer diffraction the source and the screen are effectively at ———— distance from the object causing the diffraction.

(10 × 1 = 10 marks)

Section B (Short Answer Questions)

Answer **all** *questions.*
Each question carries 2 *marks.*

11. What is Barkhausen criterion for oscillations ?
12. Define transistor α and β.
13. Explain why very thin films appear black in reflected light.
14. Briefly explain the transmission and reception of signals in radio broadcasting.
15. Write the conditions for constructive and destructive interferences.
16. Derive an expression for the dispersive power of a grating.
17. Compare between AM and FM modulation.

(7 × 2 = 14 marks)

Turn over

Section C (Paragraph Questions)

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

18. What is Population inversion ? Explain metastable state.
19. Deduce the laws of refraction using Fermat's principle.
20. Give the analytical theory of interference of light.
21. Briefly explain the working of a Colpitt's oscillator.
22. Distinguish between Fresnel Diffraction and Fraunhofer Diffraction.

(2 × 4 = 8 marks)

Section D (Problems)

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

23. Newton's rings are formed in reflected light of wavelength 600 nm with a liquid between the plane and the curved surface. If the diameter of the 6th bright ring is 3.1 mm and radius of curvature of the curved surface is 1 m, calculate the refractive index of the liquid.
24. A plane wave front of light of wavelength 500 nm falls on an aperture and the diffraction pattern is observed in an eye piece at a distance of 1m from the aperture. Find the radius of the 100th half period element and the area of the half period zone.
25. Find the thickness of a (a) quarter wave plate ; (b) half wave plate when light of wavelength 589 nm is used ($\mu_0 = 1.55$ and $\mu_E = 1.54$) .
26. The base current of a transistor is 105 μA and collector current is 2.05 mA. Determine the value of β, I_E and α. A change of 27 μA in the base current produced a change of 0.65 mA in the collector current. Find β_{ac}.
27. In Fraunhofer diffraction due to a narrow slit a screen is placed 2 m. away from the lens to obtain the pattern. If the slit width is 0.2 mm. and the first minima lie 5 mm. on either side of the central maximum, find the wavelength of light.

(3 × 4 = 12 marks)

Section E (Essays)

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

28. With the help of a circuit diagram explain the principle and working of a half wave and full wave rectifier. Show that the rectification efficiency of full wave is twice that of a half wave rectifier.
29. Derive an expression for the radius of the nth dark rings in a Newton's Ring arrangement in the reflected system. Describe an experiment to determine the wavelength of monochromatic light using Newton's rings arrangement.
30. Discuss with theory the production of (a) plane polarized ; (b) elliptically polarized ; and (c) circularly polarized light.

(2 × 10 = 20 marks)

C 31169

(Pages : 3)

Name.....

Reg. No.....

THIRD SEMESTER B.Sc. DEGREE EXAMINATION, NOVEMBER 2017

(CUCBCSS—UG)

Complementary Course

PHY 3C 03—OPTICS, LASER, ELECTRONICS AND COMMUNICATION

Time : Three Hours

Maximum : 64 Marks

The symbols used in this 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 time interval during which the phase of a wave train can be predicted reliably is known as ———.
2. The spectrum obtained with a ——— is said to be rational.
3. Negative feedback ——— the gain of the amplifier.
4. In a ruby laser, the energy levels used for laser action are of ———.
5. In television transmission, which modulation is used for sound signal ?

Questions **six** *to* **ten** *: Write whether the following statements are True* **or** *False.*

6. When light is reflected from a point, the incident ray and reflected ray are in a plane.
7. For Newton's rings formed by reflected monochromatic light, the central ring is bright.
8. Observation of Fresnel diffraction does not require any lenses.
9. Ordinary and extraordinary rays are linearly polarized in mutually perpendicular directions.
10. The common emitter transistor configuration is generally used for impedance matching.

(10 × 1 = 10 Marks)

Section B (Answer in two or three sentences)

Answer **all** *questions.*
Each question carries 2 *marks.*

11. What is Fermat's principle ?
12. What do you mean by a Fresnel biprism ?
13. What do you mean by a plane diffraction grating ?
14. Distinguish between positive and negative crystals.

Turn over

15. What do you mean by the ripple factor of a rectifier ? What is the ripple factor of a half-wave rectifier without filter ?

16. What do you mean by population inversion ?

17. What is amplitude modulation ?

(7 × 2 = 14 marks)

Section C (Answer in a paragraph of about half a page to one page)

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

18. Show that superposition of incoherent waves does not produce interference.

19. Compare prism and grating spectra.

20. Explain Brewster's Law. Write *two* applications of this law.

21. State de Morgan's theorems. Prove them using a Truth Table.

22. Explain the working principle of a semiconductor laser.

(3 × 4 = 12 marks)

Section D

(Problems-write all relevant formulas, all important steps carry separate marks)

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

23. A parallel beam of sodium light of wavelength 589 nm is incident on a thin glass plate of refractive index 1.5 such that the angle of diffraction into the plate is 60°. Calculate the smallest thickness of the plate that will make it appear dark by reflection.

24. Determine the minimum number of lines in a grating that will just resolve the sodium lines (589 nm and 589.6 nm) in the first order spectrum.

25. Determine the thickness of a quarter wave plate when the wavelength of light used is 589 nm. Given, the refractive indices of the extraordinary and ordinary light are $\mu_e = 1.553$ and $\mu_o = 1.544$, respectively.

26. How will you make an OR gate using three NAND gates ?

27. For a transistor circuit, the values of base current and emitter current are 50 μA and 2 mA, respectively. Find α and collector current.

(3 × 4 = 12 marks)

Section E (Essays-answer in about two pages)

Answer any **two** *questions.*
Each question carries 8 *marks.*

28. Using a neat diagram discuss a method by which Newton's rings are formed. Outline an experiment to determine the wavelength of a monochromatic light using Newton's rings.

29. Using suitable figure, explain the Fraunhoffer at a single slit and plot the intensity distribution.

30. What do you mean by circularly and plane polarized light ? Discuss briefly the production of circularly and elliptically polarized light.

31. Briefly explain the working of an *npn* transistor. Discuss the input and output characteristics of a transistor in CE configuration.

(2 × 8 = 16 marks)

D 51297 (Pages : 2) Name.....

Reg. No.....

THIRD SEMESTER B.Sc. DEGREE EXAMINATION, NOVEMBER 2018

(CUCBCSS—UG)

Complementary Course

PHY 3C 03—OPTICS, LASER, ELECTRONICS AND COMMUNICATION

Time : Three Hours Maximum : 64 Marks

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

Section A (Answer in a word or a Phrase)

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

1. When white light is incident on thin films, the color appears on thin films depends on thickness and ————.
2. For Fraunhofer diffraction at a single slit, using white light, the central maximum is ———— in color.
3. Along the ———— ordinary ray and extraordinary ray travels with the same velocity.
4. The line on the output characteristics of a transistor circuit, which gives the values of collector current and collector emitter voltage corresponding to zero signal conditions is called ————.
5. ———— is a device that converts sound signal to electrical signal.

Questions 6 *to* 10 *: Write whether the following statements are True* **or** *False.*

6. Coherence length is the length of the wave packet over which it has a predictable phase.
7. Diffraction spectrum arises from interference.
8. Divergence of laser beams is very small.
9. The most lightly doped region in a transistor is emitter.
10. In amplitude modulation, the bandwidth is same as the signal frequency.

(10 × 1 = 10 marks)

Section B

Answer in two **or** *three sentences.*

Answer **all** *questions. Each question carries* 2 *marks.*

11. Write down the law of refraction.
12. What are the conditions for two light sources to be coherent ?
13. What do you mean by the dispersive power of a grating ?
14. What do you mean by double refraction ?
15. What do you mean by the bandwidth of an amplifier ?

Turn over

16. Using a suitable figure, discuss the phenomenon of spontaneous emission.
17. What do you mean by frequency modulation ?

(7 × 2 = 14 marks)

Section C

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

18. Explain Fermat's principle of least time.
19. Explain the Fresnel's two mirror arrangement.
20. Give the Fresnel's explanation of optical activity of substances.
21. How will you use a Zener diode as a voltage regulator ?
22. Draw the energy level diagram of a He-Ne laser and indicate the transitions involved.

(3 × 4 = 12 marks)

Section D

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

23. Newton's rings are formed with red light of wavelength 670 nm. The radius of the 20^{th} ring is found to be 1.1×10^{-2} m. Find the radius of curvature of the lens and the radius of the 30^{th} ring.
24. Find the angular separation between the two sodium lines of wavelengths 589 nm and 589.6 nm, when a parallel beam of light is incident on a plane transmission grating of 6×10^5 lines per metre in the second order spectrum.
25. A plane polarized light passes through a uniaxial crystal with its optic axis parallel to the faces. Determine the least thickness of the plate for which the emergent beam is plane-polarized.
Given $\mu_e = 1.5533, \mu_o = 1.5442, \lambda = 500$ *nm.*
26. An amplifier has a gain 200. When negative feedback is applied, the gain is reduced to 50. What is the feedback fraction ?
27. Find the operating frequency of a Collpitt's transistor oscillator if
$C_1 = 0.001\ \mu F, C_2 = 0.01\ \mu F$ and $L = 15\ \mu H$.

(3 × 4 = 12 marks)

Section E

Essays-answer in about **two pages.**
Answer any **two** *questions. Each question carries* 8 *marks.*

28. Using suitable figures, discuss the interference in a plane parallel film by reflected light. Give the conditions for maxima and minima.
29. Discuss the Fraunhofer diffraction pattern due to a single slit. Draw the intensity distribution.
30. What do you mean by circularly and plane polarized light ? Discuss briefly the production of circularly and elliptically polarized light.
31. What are universal gates ? Give truth tables for NOR and NAND gates. Construct OR, AND and NOT gates using NOR and NAND gates.

(2 × 8 = 16 marks)

D 71699 (Pages : 3) Name.....

Reg. No.....

THIRD SEMESTER B.A./B.Sc. DEGREE EXAMINATION, NOVEMBER 2019

(CUCBCSS—UG)

Physics

PHY 3C 03—OPTICS, LASER, ELECTRONICS AND COMMUNICATION

Time : Three Hours Maximum : 64 Marks

Section A

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

1. The excited atom emits light waves in step with the incoming wave and increases its intensity. This is known as ———— of radiation.
2. ———— is a property applying to transverse waves that specifies the geometrical orientation of the oscillations.
3. The diode which operates in the reverse breakdown region with a sharp breakdown voltage is called a ————.
4. ———— is the process in which two or more waves of the same frequency - be it light, sound, or other electromagnetic waves - either reinforce or cancel each other.
5. Fermat state that "the actual path between two points taken by a beam of light is the one which is traversed in the ———— time".
6. Modulation is defined as ————.
7. Voltage regulation is the ability of a rectifier to ————.
8. If the two displacements are in phase, then the resultant amplitude will be the sum of the two amplitudes, this is known as ————.
9. ———— is method of producing optical images with full three dimension.
10. ———— in which the frequency is varied keeping amplitude and phase.

(10 × 1 = 10 marks)

Turn over

Section B

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

11. State Malu's Law.
12. Describe Fraunhoffer diffraction.
13. Describe Amplitude modulation.
14. State Fermat Principle.
15. Give an expression for efficiency of full wave rectifier.
16. Write an expression of resolving power in grating experiment.
17. Explain stimulated emission.

(7 × 2 = 14 marks)

Section C

Answer any **two** *questions.*
Each question carries 4 marks.
Answer in **one paragraph.**

18. Explain semiconductor laser.
19. Draw and explain frequency response curve of CE amplifier.
20. Distinguish positive and negative crystals in polarisation.
21. Define population inversion.
22. Distinguish Constructive and destructive interference.

(2 × 4 = 8 marks)

Section D

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

23. A carrier wave of 500 watts is subjected to 100% amplitude modulation. Determine power of modulated wave.
24. In a double slit interference arrangement one of the slits is covered by a thin mica sheet whose refractive index is 1.58. the distances between slits is 0.1 cm and distance between wave front to screen is 50 cm respectively. Due to the introduction of the mica sheet the central fringe get shifted by 0.2 cm. determine the thickness of the mica sheet.

25. For a typical He-Ne laser wavelength is 0.6328 micrometer and distance between spherical mirror and plane mirror is 50 cm. The radius of curvature of concave mirror is 100 cm. Calculate spot size of the beam ?

26. In a typical experimental arrangement of Weiner, the angle between the film and the mirror was about 10^{-3} radians. For $\lambda = 5 \times 10^{-5}$ cm what would be the distance between two consecutive dark bands?

27. The applied input a.c. power to a halfwave rectifier is 100 watt. The d.c. output power obtained is 40 wat. Calculate the rectification and power efficiency of the above circuit ?

(3 × 4 = 12 marks)

Section E

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

28. Discuss with theory the production of plane polarized and circularly polarized light.

29. Explain principle of laser production and also explain characteristics of ruby laser and Helium – neon laser.

30. With the help of circuit diagram explain the principle and working of a full wave rectifier. Show that the rectification efficiency of full wave rectifier is twice that of a half wave rectifier.

(2 × 10 = 20 marks)

D 92966 (Pages : 2) Name.....

Reg. No.....

THIRD SEMESTER (CBCSS—UG) DEGREE EXAMINATION, NOVEMBER 2020

Physics/Applied Physics

PHY 3C 03—MECHANICS, RELATIVITY, WAVES AND OSCILLATIONS

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. What do you mean by an inertial frame of reference ? Are all frames moving with constant velocity w.r.t. an inertial frame inertial ?
2. Write down the Galilean law of addition of velocities. Prove that the acceleration of a particle relative to two inertial frames are identical.
3. Discuss the Coriolis force effects caused by the rotation of earth.
4. Draw a potential energy versus distance curve to indicate stable and unstable equilibria.
5. Write down the relation between torque and angular momentum. What is the unit of torque ?
6. Write down the postulates of the special theory of relativity.
7. What is twin paradox ?
8. What do you mean by a simple pendulum ? Give an expression for its time period.
9. What do you mean the energy density of a wave ? Does it depend on time ?
10. What is Photoelectric effect ? Write down Einstein's photoelectric equation.
11. What is de Broglie hypothesis ? Give an expression for the de Broglie wavelength.
12. Give expressions for energy and momentum operators.

(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. What are Coriolis and centrifugal forces ? Give expressions for the same. Describe the terms involved.

Turn over

14. Verify whether the force $F = \left(2xy + yz^2\right)\hat{i} + \left(x^2 + xz^2\right)\hat{j} + 2xyz\,\hat{k}$ is conservative or not.

15. Amplitude of a damped harmonic oscillator is reduced to 1/10th of its initial value after 100 oscillations. If the time period of oscillation is 2 seconds, determine the damping constant.

16. What do you mean by a plane progressive harmonic wave ? Obtain an expression for a plane progressive harmonic wave.

17. Estimate the increase in relativistic mass of a particle of rest mass 1 gram when it is moving with velocity 0.8c.

18. The work function for barium is 2.5 eV. Check whether barium can be used as a photo cell to detect visible light. Note that the visible range of the electromagnetic spectrum is 400-700 nm.

19. The average period that elapses between the excitation of an atom and the time it emits radiati is 10^{-10} s. Determine the width of the excited state.

(5 × 5 = 25 marks)

Section C (Essay Type)

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

20. Explain the conservation theorems of energy, linear and angular momentum.

21. Obtain the Lorentz transformation equations for co-ordinates and time for two inertial frames.

(1 × 11 = 11 marks)

D 51772 (Pages : 2) Name.....

Reg. No.....

THIRD SEMESTER (CBCSS—UG) DEGREE EXAMINATION NOVEMBER 2023

Physics/Applied Physics

PHY 3C 03—MECHANICS, RELATIVITY, WAVES AND OSCILLATIONS

(2019—2022 Admissions)

Time : Two Hours Maximum : 60 Marks

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

Section A (Short Answer Type)

Answer **all** *questions in two* **or** *three sentences.*
Each correct answer carries a maximum of 2 marks.

1. Give the significance of mass energy relation.
2. Define with example, fictitious forces.
3. What is a conservative force ?
4. Explain length contraction.
5. What is the purpose of two stages in a rocket ?
6. Give one application of Newton's third law.
7. What is the relation connecting length and period of oscillation of a simple pendulum.
8. Give three examples for periodic motion.
9. Define a black body.
10. What are matter waves ?
11. What are the factors on which Photo electric current depends ?
12. Explain the term threshold potential.

(Ceiling - 20)

Turn over

Section B (Paragraph / Problem Type)

Answer **all** *questions in* **a paragraph** *of about* **half a page to one page.**
Each correct answer carries a maximum of 5 marks.

13. What is a conservative force ? Show that a central force is always conserved.
14. Show that a conservative force is represented by the relation F = -grad U, and curl of it is zero.
15. Find the momentum of an electron which is accelerated by a potential difference 20 volt.
16. Explain the principle of rocket propulsion.
17. With figure explain the scattering of a particle by a heavy nucleus.
18. Write the equation and explain the variation of mass with velocity.
19. Explain the terms Eigen values and Eigen vectors.

(Ceiling - 30)

Section C (Essay Type)

Answer any **one** *in about* **two pages.**
Answer carries 10 *marks.*

20. Define Damped harmonic oscillator. Derive the general equation.
21. Write law of conservation of angular momentum. Illustrate with :
    a) Satellite motion ;
    b) Scattering of α particle by a heavy nucleus ; and
    c) Shape of galaxy.

(1 × 10 = 10 marks)