D 103781 **(Pages : 2)** **Name.....**

Reg. No.....

SECOND SEMESTER (CBCSS-UG) DEGREE EXAMINATION
APRIL 2024

Physics/Applied Physics

PHY 2C 02—OPTICS, LASER, ELECTRONICS

(2019—2023 Admissions)

Time : Two Hours Maximum : 60 Marks

Section A (Short Answer Type)

Answer **all** *questions in two* **or** *three sentences.*
Each correct answer carries a maximum of 2 *marks.*
Ceiling 20.

1. What are the conditions for two light sources to be coherent ?
2. Distinguish between the Newton's rings formed by reflected and transmitted monochromatic light.
3. For interference in thin films in the reflected system, write down the condition for constructive and destructive interferences.
4. Write any two differences between Interferences and Diffraction patterns.
5. What is diffraction ? Write down the condition for diffraction.
6. What do you mean by double refraction ? What do you mean by the optic axis of an anisotropic crystal ?
7. Explain the term optical activity. Give two examples of optically active substances.
8. Draw the current-voltage characteristics of a Zener diode. What is the use of a Zener diode ?
9. State the working principle of a transistor amplifier.
10. What are the basic requirements of an oscillator ?
11. What do you mean by population inversion ? Mention any two mechanisms to achieve population inversion.
12. Draw the energy level diagram showing the different transistions in a ruby laser.

(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.*
Overall ceiling 30.

13. Light of wavelength 6000 Å from a narrow slit is incident on a double slit. If the overall separation of 10 fringes on a screen placed 100 cm. away is 1 cm., determine the fringe separation.
14. Newton's rings are formed with red light of wavelength 670 nm. The radius of the 20th ring is found to be 1.1×10^{-2} m. Find the radius of curvature of the lens and the radius of the 30th ring.
15. Find the angular separation between the two sodium lines of wavelength 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 meter in the second order spectrum.
16. Explain Brewster's law. Give two applications of Brewster's law.
17. 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 $\mu_e = 1.5533$, $\mu_o = 1.5442$ and $\lambda = 500$ nm.
18. For a transistor circuit, the values of base current and emitter current are 50 μA, 2 mA, respectively. Find α and the collector current.
19. Explain the processes spontaneous emission, stimulated absorption and simulated emission using suitable figures.

(Ceiling 30)

Section C (Essay Type)

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

20. Discuss the Fraunhofer diffraction pattern due to a single slit. Draw the intensity distribution.
21. What are universal gates ? Give truth tables for NOR and NAND gates. Construct OR, AND and NOT gates using NOR and NAND gates.

(1 × 10 = 10 marks)

C 43201 **(Pages : 2)** **Name.....**

Reg. No.....

SECOND SEMESTER (CBCSS—UG) DEGREE EXAMINATION
APRIL 2023

Physics/Applied Physics

PHY 2C 02—OPTICS, LASER, ELECTRONICS

(2019—2022 Admissions)

Time : Two Hours Maximum : 60 Marks

Section A (Short Answer Type)

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

1. What are the conditions for obtaining sustained interference ?
2. What is the origin for colors exhibited by thin films ?
3. What is diffraction? What is the condition for obtaining a noticeable diffraction effect ?
4. Mention two features of Fresnel diffraction.
5. In the Fraunhoffer diffraction at a single slit, draw the intensity distribution.
6. Distinguish between transmission and reflection gratings. Give an expression for the principal maximum of order, say *n,* in the diffraction spectrum.
7. Write any *two* differences between interference and diffraction patterns.
8. What do you mean by double refraction ? Distinguish between positive and negative crystals.
9. What do you mean by a plane polarized light ? When a plane polarized light is passed through a polarizer, how many times will it be extinguished in one full rotation of the polarizer ?
10. What do you mean by a filter circuit ? Explain the construction of a π-section filter.
11. What do the Einstein's co-efficients stand for ?
12. List any three essential characteristics of spontaneous emission.

(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. In Newton's rings experiment with reflected light, the diameter of 15^{th} ring is 0.6 cm and that of 5^{th} ring is 0.3 cm. If the radius of the plano-convex lens is 100 cm, what is the wavelength of light used in the experiment. ?

14. In Fraunhoffer diffraction pattern due to a narrow slit, a screen is placed 2 m away from the lens to obtain the pattern. If the wavelength of light used is 5×10^{-5} cm and the first minimum lie at 5 mm on either side of the central maximum, what is the slit width ?

15. Using suitable figures, explain the term optical activity.

16. Calculate the minimum thickness of a calcite plate which would convert a plane polarized light to circularly polarized. Given, the wavelength of light λ =5890 Å, refractive index of ordinary ray = 1.658 and the refractive index of extra ordinary ray =1.486.

17. A transistor has α = 0.98, I_B = 100 μA and I_{CBO} = 5 μA. Determine emitter current, collector current and the amplification factor β.

18. Give the truth table of an exclusive OR gate. How will you construct it using basic gates ?

19. Give the construction and the basic details of a He-Ne laser.

(Ceiling 30)

Section C (Essay Type)

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

20. Give the analytical treatment of interference of two sinusoidal waves. Discuss the conditions for maximum and minimum intensity. Plot the energy distribution as a function of phase angle.

21. Discuss the working principle of a centre-tapped full wave bridge rectifier using suitable figures. Obtain an expression for its efficiency.

(1 × 10 = 10 marks)

C 23889 (Pages : 2) Name.....

Reg. No.....

SECOND SEMESTER (CBCSS—UG) DEGREE EXAMINATION
APRIL 2022

Physics/Applied Physics

PHY 2C 02—OPTICS, LASER, ELECTRONICS

(2019—2020 Admissions)

Time : Two Hours Maximum : 60 Marks

The Symbols used in the 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. What is meant by constructive interference ?
2. Why don't thick films exhibit interference ?
3. What is the phenomenon of diffraction ? Give an example.
4. Obtain an expression for the dispersive power of a grating.
5. State and explain Malu's law.
6. Write different methods to produce polarized light.
7. Explain the reverse characteristics of a zener diode.
8. Define rectifier efficiency. Write down the expression for the efficiency of a half wave rectifier.
9. Define transistor α and β.
10. Describe the action of a π-filter circuit.
11. Explain AND function with a two input AND gate.
12. What is a coherent source of light ? Give example.

(Ceiling - 20)

Section B (Paragraph/Probem 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. Obtain an expression for fringe width, β using Fresnel's double mirror arrangement.
14. Explain the theory of population inversion. What is the significance of metastable state in lasing action.

Turn over

15. State and explain Brewster's law. How it can be used to find polarizing angles in crystals.

16. Distinguish between a quarter wave plate and a half wave plate.

17. With a neat diagram, explain the working of a full wave bridge rectifier.

18. Light of wavelength 500 nm. is incident normally on a plane transmission grating. A second order spectral line is observed at an angle of 30°. Calculate the number of lines per meter on the grating surface.

19. Determine the Q-point of the transistor circuit in CE configuration in which collector load is 4 kΩ, zero signal collector current is 1 mA and V_{cc} = 10 V. what will be the Q-point if R_c = 5 kΩ.

(Ceiling - 30)

Section C (Essay Type)

Essays-Answer about two pages, any one question.

Answer question carries 10 *marks.*

20. Explain the construction and working of : (a) Ruby laser ; and (b) He-Ne laser.

21. 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.

(1 × 10 = 10 marks)

C 22102 **(Pages : 2)** **Name.....**

Reg. No.....

SECOND SEMESTER (CBCSS—UG) DEGREE EXAMINATION
APRIL 2022

Physics/Applied Physics

PHY 2C 02—OPTICS, LASER AND ELECTRONICS

(2021 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 is meant by constructive interference ?
2. Explain why very thin film appears black in reflected light ?
3. What is the phenomenon of diffraction ? Give an example.
4. What is meant by resolving power of a grating ?
5. State and explain Brewster's law.
6. Write different methods to produce polarized light.
7. What is a zener diode ? Explain its characteristics.
8. Define rectifier efficiency. Write down the expression for the efficiency of a half wave rectifier.
9. What are the different types of transistor configurations ? Explain.
10. Describe the action of a π-filter circuit.
11. Explain OR function with a two input OR gate.
12. What is a coherent source of light ? Give example.

(8 × 3 = 24 marks)

Turn over

Section B (Paragraph/Probem Type)

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

13. Explain constructive and destructive interference using Young's experiment.

14. Explain the theory of population inversion. What is the significance of metastable state in lasing action ?

15. Describe a quarter wave plate and a half wave plate.

16. Distinguish between positive and negative crystals.

17. With a neat diagram, explain the working of a full wave bridge rectifier.

18. Light of wavelength 500 nm is incident normally on a plane transmission grating. A second order spectral line is observed at an angle of 30°. Calculate the number of lines per meter on the grating surface.

19. A transistor is connected in common emitter (CE) configuration in which collector supply is 8 V and voltage drop across resistance $R_C = 800\Omega$ connected in the collector circuit is 0.5 V and $\alpha = 0.96$. Determine the collector-emitter voltage and base current.

(5 × 5 = 25 marks)

Section C (Essay Type)

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

20. Explain the construction and working of a) Ruby laser ; and b) He-Ne laser.

21. Describe principle and working of any oscillator with neat diagram and explain how it produces sustained oscillation. Derive the necessary formula.

(1 × 11 = 11 marks)

C 4394 **(Pages : 2)** **Name.....**

Reg. No.....

SECOND SEMESTER (CBCSS—UG) DEGREE EXAMINATION, APRIL 2021

Physics/Applied Physics

PHY 2C 02—OPTICS, LASER, ELECTRONICS

Time : Two Hours Maximum : 60 Marks

The symbols used in the 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 is meant by destructive interference ?
2. Explain, why very thin film appears black in reflected light ?
3. What is Fraunhofer class of diffraction ?
4. What is meant by resolving power of a grating ?
5. State and explain Brewster's law.
6. Define optical activity.
7. What is a zener diode ? Explain its characteristics.
8. Define ripple factor of rectifier circuit. What is the value of ripple factor for full wave rectification ?
9. What are the different types of transistor configurations ? Explain.
10. Describe the action of a capacitor-filter circuit.
11. Explain OR function with a two input OR gate.
12. Explain population inversion. How it is achieved ?

(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. Explain constructive and destructive interference using Young's experiment.
14. Describe the principle and working of He-Ne laser.

Turn over

15. How are unpolarized, plane circularly polarized and elliptically polarized light distinguished ?

16. Distinguish between Positive and Negative crystals.

17. Obtain the relation between current amplification factors α , β and γ .

18. A diffraction grating has 0.15 m of surface ruled with 6×10^5 lines per meter. What is its resolving power in the first order ?

19. A transistor is connected in common emitter (CE) configuration in which collector supply is 8 V and voltage drop across resistance $R_C = 800\,\Omega$ connected in the collector circuit is 0.5V and $\alpha = 0.96$. Determine the collector-emitter voltage and base current.

(5 × 5 = 25 marks)

Section C (Essay Type)

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

20. Derive an expression for the radius of n^{th} ring in a Newton's ring arrangement in the reflected system. Describe an experiment to determine the wavelength of monochromatic light using Newton's ring arrangement.

21. Describe principle and working of any oscillator with neat diagram and explain how it produces sustained oscillation. Derive the necessary formula.

(1 × 11 = 11 marks)

C 82451 (Pages : 2) Name.....

Reg. No.....

SECOND SEMESTER (CBCSS—UG) DEGREE EXAMINATION, APRIL 2020

Physics

PHY 2C 02—OPTICS, LASER, ELECTRONICS

Time : Two Hours Maximum : 60 Marks

Section A (Short Answer Type)

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

1. What do you mean by the term coherence length ?
2. For interference in thin films in a reflected system, write down the condition for constructive and destructive interferences.
3. Compare Fresnel and Fraunhofer types of diffractions.
4. What do you mean by the grating constant of a plane transmission grating ?
5. It is possible to polarize a sound wave ? Why ?
6. What is Brewster's law ?
7. Distinguish between positive and negative doubly refracting crystals.
8. What are polaroids ? Mention two applications.
9. Write down de Morgan's theorems.
10. What do you mean by the term ripple factor ? Give its value for a half wave rectifier.
11. Distinguish between spontaneous and stimulated emission processes.
12. What do you mean by population inversion in a laser ? Name a mechanism to attain the same.

(Ceiling-20)

Section B (Paragraph/Problem Type)

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

13. Light of wavelength 5000 Å from a narrow slit is incident on a double slit. If the overall separation of 10 fringes on a screen placed 100 cm away is 0.5 cm, determine the fringe separation.
14. Calculate the minimum number of lines on a grating that will just resolve the sodium lines 5890 Å and 5896 Å in the first order spectrum.

Turn over

15. Show that when unpolarized light is passed through a polarizer, the intensity of the transmitted light is half that of the incident light.

16. Calculate the thickness of doubly refracting glass plate capable of producing a path difference of $\lambda/4$ between the ordinary and extraordinary waves. Given, the wavelength of light used λ = 5890 Å, refractive index for the ordinary ray = 1.54 and the refractive index for the extra ordinary ray = 1.53.

17. A 10 V Zener diode along with a series resistance is connected across a 40 V supply. Calculate the minimum value of the resistance required, if the maximum Zener current is 50 mA.

18. Show how an OR operation be realized using three NAND gates.

19. Using a suitable energy level diagram, explain the working principle of a Ruby laser.

(Ceiling-30)

Section C (Essay Type)

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

20. Using a neat diagram, discuss the method of forming Newton's rings by reflected light. Write down the condition for bright and dark rings. Obtain an expression for the radii of the rings formed.

21. What do you mean by the CE configuration of a transistor ? Drawing suitable figures, explain the input and output characteristics of a transistor in CE configuration.

(1 × 10 = 10 marks)