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)