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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  $\lambda$  at a single slit of small width  $c$  the angle  $\theta$  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  $\alpha$  and  $\beta$  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 Fraunhofer class of diffraction ?
- 16 Why we need modulation in communication ?
- 17 Give the principle operation of a semiconductor laser.

(7 × 2 = 14 marks)

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)

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

- 23 A drop of oil of volume  $0.2 \text{ cm}^3$  is dropped on the surface of a tank of area  $1 \text{ m}^2$ . 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  $550 \text{ nm}$  in air. Find the refractive index of oil.
- 24 Newton's rings are formed in the reflected light of wavelength  $600 \text{ nm}$  with a liquid between the plane and curved surface. If the diameter of the 6<sup>th</sup> bright ring is  $3.1 \text{ mm}$  and radius of curvature of the curved surface is  $1 \text{ m}$ , calculate the refractive index of the liquid.
- 25 In a grating spectrum which spectral line in the 4<sup>th</sup> order will overlap with the 3<sup>rd</sup> order of  $5461 \text{ \AA}$ .
- 26 80 grams of impure sugar when dissolved in a litre of water gives an optical rotation of  $9.9^\circ$  when placed in a tube of length of  $20 \text{ cm}$ . If the specific rotation of sugars is  $66^\circ$ , find the percentage purity of the sample.
- 27 A  $50 \text{ V}$  Zener diode is used to obtain a regulated output voltage across a load  $10 \text{ k}\Omega$ . The series resistor is  $5 \text{ k}\Omega$ . If the input changes from  $80$  to  $120 \text{ V}$ , find the maximum zener current.

(3 × 4 = 12 marks)

7. 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)