

**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 x 4 = 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 x 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  $\mu_e = 1.5533$ ,  $\mu_o = 1.5442$ ,  $\lambda = 500 \text{ nm}$ .
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  $C_1 = 0.001 \mu\text{F}$ ,  $C_2 = 0.01 \mu\text{F}$  and  $L = 15 \mu\text{H}$ .
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 x 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.