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Name.....

Reg. No.....

THIRD SEMESTER B.Sc. DEGREE (SUPPLEMENTARY/IMPROVEMENT)  
EXAMINATION, NOVEMBER 2015

(UG—CCSS)

Complementary Course

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

(2009—2012 Admissions)

Time : Three Hours

Maximum : 30 Weightage

Section A

Answer all questions.

Each question carries  $\frac{1}{6}$  weightage.

- In Fresnel's double mirror, the angle between the mirrors is :  
(a)  $1^\circ$ . (b)  $17^\circ$ .  
(c)  $179^\circ$ . (d)  $197^\circ$ .
- The phase change suffered by light when it undergoes a reflection at the boundary of a rarer to denser medium is :  
(a) 0. (b)  $2\pi$ .  
(c)  $\pi$ . (d)  $\frac{\pi}{2}$ .
- If the odd zones are transparent in a zone plate, it is said to be \_\_\_\_\_.
- In Fraunhofer diffraction, the incident wave front is :  
(a) Spherical. (b) Plane.  
(c) Cylindrical. (d) Paraboloidal.
- An example of a biaxial crystal is :  
(a) Aragonite. (b) Calcite.  
(c) Quartz. (d) Tourmaline.
- In negative crystals :  
(a)  $v_o < v_e$ . (b)  $v_o > v_e$ .  
(c)  $v_o = v_e$ . (d) None of these.

Turn over

7. In full wave rectifier, if the input frequency is 50 Hz, the output frequency is :  
 (a) 50 Hz. (b) 100 Hz.  
 (c) 25 Hz. (d) 200 Hz.
8. A properly doped crystal diode which has a sharp breakdown voltage is known as \_\_\_\_\_.
9. Very high peak power pulses from the Ruby laser can be obtained by \_\_\_\_\_.
10. In He-Ne laser, the pressure maintained in the discharge tube is of the order of :  
 (a) 1 mm. of Hg. (b) 100 mm. of Hg.  
 (c) 76 cm. of Hg. (d) 38 cm. of Hg.
11. If  $n_1$  and  $n_2$  are the refractive indices of the core and cladding respectively, the critical angle  $\theta_c$   
 (a)  $\sin^{-1} \left( \frac{n_1}{n_2} \right)$ . (b)  $\sin \left( \frac{n_1}{n_2} \right)$ .  
 (c)  $\sin^{-1} \left( \frac{n_2}{n_1} \right)$ . (d)  $\sin \left( \frac{n_2}{n_1} \right)$ .
12. The maximum value of incident angle to propagate the light through the fiber is called \_\_\_\_\_

(12 × ¼ = 3 weights)

### Section B (Short answer type questions)

*Answer all questions.*

*Each question carries 1 weightage.*

13. Two independent sources are not coherent. Why ?
14. Draw the ray diagram for the image formation in Fresnel's biprism.
15. Define grating element.
16. What is meant by plane of polarization ?
17. Define specific rotation.
18. Cross-wires are not used in Huygen's eyepiece. Why ?
19. Define the efficiency of a rectifier.
20. What is meant by the active region in common emitter transistor circuit ?
21. Draw the energy level diagram of Ruby laser.

(9 × 1 = 9 weights)

**Section C (Short essay or paragraph questions)**

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

22. In a Newton's ring experiment the diameters of the 15<sup>th</sup> ring and 5<sup>th</sup> ring were 0.590 cm. and 0.336 cm. If the radius of the plano-convex lens is 100 cm, calculate the wavelength of the light used.
23. What is the highest order spectrum which may be seen with monochromatic light of wavelength 550 nm. by means of a grating having 500 lines/mm.?
24. Calculate the thickness of a quarter wave plate. Given  $\mu_E = 1.553$ ,  $\mu_O = 1.544$ , and  $\lambda = 500$  nm.
25. Describe Ramsden's eyepiece.
26. In a common base connection, the current amplification factor is 0.9. If the emitter current is 1 mA, determine the value of the base current.
27. Describe a semi-conductor laser.
28. Calculate the numerical aperture and acceptance angle if the refractive index of the core is 1.52 and that of the cladding is 1.47.

(5 × 2 = 10 weightage)

**Section D (Essay questions)**

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

29. State Fermat's principle. Derive law of reflection and law of refraction using Fermat's principle.
30. Explain with necessary theory, the Fresnel diffraction at a straight edge.
31. Explain the working of an npn transistor. Draw and explain the input and output characteristics of npn transistor in common emitter configuration.

(2 × 4 = 8 weightage)