B. Sc. DEGREE END SEMESTER EXAMINATION OCT. 2020: JANUARY 2021
SEMESTER –5: PHYSICS (CORE COURSE)
COURSE: 15U5CRPHY06: PHYSICAL OPTICS AND PHOTONICS
(Common for Regular 2018 admission & Improvement 2017/Supplementary 2017/ 2016 /2015 admissions)

Time: Three Hours   Max. Marks: 60

PART A (Very short answer questions)
Answer all questions, each question carries 1 Mark

1. What is meant by localized fringes?
2. Oil that is spread on water surface appears coloured in sunlight, why?
3. Explain why gratings with larger number of lines are preferred?
4. Write down the equation for n^{th} dark band from center in the diffraction pattern due to a straight edge.
5. What is a quarter wave plate?
6. What is meant by metastable state?
7. What is stimulated emission?
8. Explain Optic axis in a crystal.
9. What feature of the light source used in holography determines the size of the objects that can be holographed?
10. What is the practical unit in which optical fiber attenuation is expressed?   (1 x 10 = 10)

PART B (Short answer questions)
Answer any Seven questions, each question carries 2 Marks

11. What are the conditions for sustained interference?
12. Mention four salient features of interference pattern due to a wedge shaped film.
13. Distinguish between interference and diffraction.
14. State and explain Brewster's law.
15. Explain spiking in ruby laser.
16. What Einstein's A and B coefficients? What is the equation connecting the two?
17. What are the advantages of hologram compared to a photograph?
18. Define mode volume in optical fiber.
19. What is the reason for pulse dispersion in optical fibers?   (2 x 7 = 14)

PART C (Problem/Derivations)
Answer any Four question, each question carries 4 Marks

20. When the movable mirror of Michelson interferometer is shifted by 0.0589 mm, a shift of 200 fringes is observed.   What is the wavelength of light?

21. What is the radius of the first half period zone in a zone plate behaving like a convex lens of focal length 80 cm for a light of wavelength 550 nm?

22. Unpolarised light falls on two polarizing sheets placed one on top of the other. The intensity of the transmitted light is 30% that of the incident light.   What must be the angle between the v directions of the sheets?

23. The ratio of population $N2/N1$ in a laser system is 10^{-30}. Find the wavelength of light emitted at 320K.

24. The length of a laser tube is 130 mm and its gain factor is 0.0005/cm. If one of the cavity mirrors reflects 100 %, what is the required reflectance of the other mirror?

25. What is the numerical aperture of a cable whose critical angle is 26.1 degree?   (4 x 4 = 16)

PART D (Long answer questions)
Answer any Two question, each question carries 10 Marks

26. Outline the theory of formation of Newton's rings. Prove that the rings are not evenly spaced.

27. Discuss the theory of Fraunhoffer diffraction pattern at double slit. Distinguish between single and double slit diffraction patterns.

28. Define double refraction. Give an account of Huygens' explanation of double refraction. Describe positive and negative crystals.

29. Describe the construction and working of He-Ne laser. This is a four level laser system- justify.

(10 x 2 = 20)

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