Reg. No…….. Name…… **19U438**

B. Sc. DEGREE END SEMESTER EXAMINATION - MARCH/APRIL 2019

SEMESTER – 4: PHYSICS (COMPLEMENTARY COURSE FOR MATHEMATICS)

COURSE: 15U4CPPHY7, PHYSICAL OPTICS, LASER PHYSICS AND ASTROPHYSICS

(Common for Regular 2017 admission and improvement 2016/ supplementary 2016/2015/2014 admission)

Time: Three Hours Max. Marks: 60

PART A (Very Short Answer Questions.)

*Answer **all**. Each question carries **1** mark*

1. Why does the superposition of two incoherent waves not produce interference pattern?
2. State principle of superposition of light waves.
3. What are the parameters that influence the conditions of interference in plane parallel thin film?
4. If θ is the angular separation of two spectral lines in first order grating spectrum, what will be the angular separation for the same spectral lines in the second order spectrum?
5. State Brewster's Law.
6. What is meant by plane polarisation of light?
7. Which are the basic components of a LASER
8. What is the main source of energy in stars? (1 × 8 = 8)

PART B (Brief Answer Questions.)

*Answer **any six** questions. Each question carries **2** marks*

9. Explain the experimental arrangement (with the help of a figure) for observing Newton's rings.
10. What are the main differences between interference and diffraction?
11. Explain resolving power of a grating?
12. Differentiate between Fresnel and Fraunhoffer diffraction.
13. If circularly polarised light is passed through a quarter wave plate, what will be the state of polarisation of the emerging light? Justify your answer.
14. Enlist applications of lasers.
15. Define Schwarzschild radius. What is its significance?
16. What is Chandrasekhar limit? Explain its significance? (2 × 6 = 12)

PART C (Problems/Derivations)

*Answer **any four** questions. Each question carries **4** marks*

17. Suppose in Young's double-slit arrangement, *d* (slit separation) =0.150mm, *D* (distance between screen and slits) = 120cm, λ (wavelength) =833nm and x (distance from the centre to the point P on the screen) = 2.00 cm
    a) What is the path difference δ for the rays from the two slits arriving at point P?
    b) Express this path difference in terms of λ .
    c) Does point P correspond to a maximum, a minimum, or an intermediate condition?

18. Consider an oil film (thickness *d, n* = 1.5) on top of water (*n* = 1.3). Light of λ= 600 nm is normally incident. Which value of *d* corresponds to destructive interference?
19. What are the advantages of four level pumping scheme compared to three level pumping scheme for laser action.
20. Describe the formation of a Neutron star.
21. Unpolarized light with an intensity of I_o = 16 W/m^2 is incident on a pair of polarizers. The first polarizer has its transmission axis aligned at 50^o from the vertical. The second polarizer has its transmission axis aligned at 20^o from the vertical. What is the intensity of the light when it emerges from the second polarizer?
22. At what temperature are the rates of spontaneous and stimulated emission equal? Assume λ = 5000 A^O. (4 × 4 = 16)

PART D (Long Answer Questions.)

*Answer **any two** questions. Each question carries **12** marks*

23. Describe how plain transmission grating at normal incidence is used to determine the wavelength of light.
24. What are Newton's rings? Describe an experiment to determine wavelength of light by setting up Newton's rings.
25. Describe how quarter wave and half wave plates are made? Explain their uses in the study of different types of polarized light.
26. Explain the formation and features of black holes. (12 × 2 = 24)

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