

STELLA MARIS COLLEGE (AUTONOMOUS) CHENNAI – 600 086.  
(For candidates admitted during the academic year 2004-05 & thereafter)

SUBJECT CODE : **PH/MC/OS44**

**B.Sc. DEGREE EXAMINATION APRIL 2009**  
BRANCH III - PHYSICS  
FOURTH SEMESTER

REG. No. \_\_\_\_\_

COURSE : **MAJOR – CORE**  
PAPER : **OPTICS AND SPECTROSCOPY**  
TIME : **30 MINS.** MAX. MARKS : 30

TO BE ANSWERED IN THE QUESTION PAPER ITSELF

**SECTION – A**

ANSWER ALL QUESTIONS: (30 x 1 = 30)

I CHOOSE THE CORRECT ANSWER:

- For a thin lens the nodal points coincide with  
a) Optic axis b) Optic Centre c) Nodal Planes
- If half of the body of a lens is covered with black paper, the image produced by the lens will  
a) disappear b) have its intensity reduced to half c) have its size reduced to half.
- Spherical aberration of a lens may be reduced by designing the lens so that the deviation of rays is  
a) equal at both the surfaces b) minimum c) maximum
- When white light is used in biprism experiment, centre of fringe system is  
a) dark b) bright c) achromatic
- Colours of thin films result from  
a) interference of light b) absorption of light c) dispersion of light
- Interference of two light waves can be observed with the help of a  
a) spectrometer b) Michelson's interferometer c) photometer
- Interference and diffraction of light support the  
a) wave nature of light b) quantum nature of light c) transverse nature of light
- A diffraction pattern is obtained using a beam of red light. Now red light is replaced by the blue light, then  
a) bands will disappear b) no change c) bands will become narrower and crowded
- The useful magnifying power of a telescope should be  
a) about 200 b) 20 c) 10

10. Polarisation of light waves afford a convincing evidence of
  - a) Transverse nature
  - b) quantum nature
  - c) dual nature.
11. Light transmitted by a single Nicol crystal is
  - a) plane polarised
  - b) un polarised
  - c) circularly polarised
12. The property of certain substances by virtue of which they rotate the plane of polarisation of a plane polarised light is known as
  - a) optical activity
  - b) specific gravity
  - c) Malus law
13. Ultra-violet radiation mercury lamps are made of quartz, so that the lamp may
  - a) become robust
  - b) look beautiful
  - c) not become very hot
14. Fraunhofer lines are found in the spectrum of the sun, their characteristic being
  - a) dark lines
  - b) bright lines
  - c) dark bands
15. In Raman scattering when an incident photon is absorbed by a molecule which is already in the excited state, then on de-excitement of the said molecule, the wavelength of the emitted photon will be ----- the wavelength of the incident photon.
  - a) greater than
  - b) less than
  - c) same

## II STATE WHETHER TRUE OR FALSE:

16. The focal length of a convex lens placed in water remains same as in air.
17. In Young's double slit experiment, if the width of the slits is gradually increased then fringes get blurred.
18. The thickness of diffraction fringes in a given pattern is always same.
19. According to Brewster's law  $\mu = \tan i_p$ .
20. The heating effect of these radiations is used in measuring the wavelength of the Infrared radiations.

## III FILL IN THE BLANKS:

21. A convex lens of focal length 40cm is in contact with a concave lens of focal length 25 cm. the power of combination is -----
22. In Fresnel's biprism experiments, the number of fringes obtained with white light compared to monochromatic light source is -----
23. The total length of a zone plate in terms of radii  $r_n$ , order of zone n and wavelength of light  $\lambda$  is given by -----
24. Light is incident on a surface at a polarizing angle of  $40^\circ$ . The angle of incidence is -----

25. ----- was awarded Nobel Prize for Raman effect.

IV ANSWER BRIEFLY:

26. Define chromatic aberration.

27. Define Interference.

28. Define resolving power of grating.

29. Specific rotation of sugar is  $66^\circ$ . 20 % of impure sugar solution is taken in a sample tube of length 20 cm and the optical rotation is found to be  $23.5^\circ$ . What is the percentage of purity sugar?

30. The danger signals are red while the eye is more sensitive to yellow. Why?

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**SECTION – B**

Answers any **five** of the following: (5 x 5 = 25)

1. The focal length of a lens in air is 10 cm. What will be its focal length if air is replaced by water?
2. A soap film of refractive index 1.33 is illuminated with light of different wavelength at an angle of  $45^\circ$ . There is complete destructive interference for  $\lambda = 5890 \text{ \AA}$ . Find the thickness of the film.
3. Two coherent sources of monochromatic light of wavelength  $6000 \text{ \AA}$  produce an interference pattern on a screen kept at a distance of 1 m from them. The distance between two consecutive bright fringes on the screen is 0.5 mm. Find the distance between the two coherent sources.
4. A single slit of width 0.14 mm is illuminated normally by monochromatic light and diffraction bands are observed on a screen 2 m away. If the centre of the second dark band is 1.6 cm from the middle of the central bright band, deduce the wavelength of light used.
5. Light is incident normally on a grating of total ruled width  $5 \times 10^{-3} \text{ m}$  with 2500 lines in all. Calculate the angular separation of the two sodium lines in the first order spectrum can they be seen distinctly?
6. Calculate the specific rotation if the plane of polarisation is turned through  $26.4^\circ$  traversing 20 cm length of 20 % sugar solution.
7. Nuclear Magnetic resonance in water is due to the protons of hydrogen. Find the field necessary to produce NMR at 69 MHz.

**SECTION – C**

Answer any **Three** of the following: (3 x 15 = 45)

1. a) Explain the construction and working of a Huygen's eyepiece; find its cardinal points.  
b) Compare it with Huygen's eyepiece.

2. a) Give the theory of Newton's rings.  
b) Describe an experiment to determine wavelength of light using Newton's rings.
3. a) What is zone plate and how is it made? Explain how a zone plate acts like a convergent lens having multiple foci. Derive an expression for its focal length.  
b) explain the difference between zone plate and a convex lens.
4. a) How can elliptically and circularly polarized light be produce.  
b) How can elliptically and circularly polarized light be detected.
5. a) Explain the concept of resonance.  
b) Discuss in detail the Electron Spin Resonance spectroscopy and give any one of the application.

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