

STELLA MARIS COLLEGE (AUTONOMOUS) CHENNAI – 600 086.  
(For candidates admitted during the academic year 2008-09&thereafter)  
SUBJECT CODE : PH/MC/OS54

B.Sc. DEGREE EXAMINATION NOVEMBER 2012  
BRANCH III - PHYSICS  
FIFTH SEMESTER

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

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

MAX. MARKS : 30

SECTION – A

TO BE ANSWERED IN THE QUESTION PAPER ITSELF

ANSWER ALL QUESTIONS:

(30x1=30)

I. CHOOSE THE CORRECT ANSWER:

1. If  $\mu_{\text{water}} = 1.33$  and  $\mu_{\text{liquid}} = 1.8$ , then total internal reflection at the interface occurs:  
a) Whenever the light goes from liquid to water  
b) whenever the light goes from water to liquid  
c) may occur when the light goes from liquid to water  
d) can never occur at this interface
2. When light travels from medium 1 to medium 2:  
a) both the speed and the frequency change  
b) both the speed and the wavelength change  
c) both the wavelength and the frequency remain unchanged  
d) both speed and frequency remain unchanged
3. As light goes from one medium to another, it is bent away from the normal. Then what can be said about the speed of the light?  
a) increased      b) decreased      c) no change      d) nothing can be said
4. Of the following, human eyes are most sensitive to:  
a) red light    b) violet light    c) green light    d) equally sensitive to all colors
5. The time taken for ruby laser light to travel to the Moon and back to earth, a one-way distance of about  $3.75 \times 10^8$  m  
a) 2.5 s      b) 3.0 s      c) 5.5 s      d) none of the above
6. When light wave is reflected at a denser medium, the change of phase is  
a) No change    b)  $\pi$  radian    c)  $\pi/2$  radian    d) 90 degrees
7. Which one of the following colours travels at the greatest speed in vacuum?  
a) Red      b) Blue      c) Green      d) all travel at the same speed
8. Coherent waves are defined as waves with same  
a) frequency    b) wavelength    c) speed      d) phase
9. Intensity of light is directly proportional to the square of  
a) frequency    b) wavelength    c) amplitude    d) phase

10. The image you see when you stand in front of a plane mirror is  
 a) virtual, erect, laterally inverted and the same size as you  
 b) real, erect, no inversion and same size  
 c) virtual, upside down, laterally inverted  
 d) none of the above
11. What is the order of the frequency of the visible light?  
 a)  $10^{16}$  Hz                      b)  $10^{12}$  Hz                      c)  $10^{14}$  Hz                      d)  $10^9$  Hz
12. The evidence provided by Polarization experiments is that light is a  
 a) transverse wave              b) longitudinal wave              c) both              d) none of the above
13. A clear sheet of polaroid is placed on top of a similar sheet so that their polarizing axes make an angle of  $30^\circ$  with each other. The ratio of the intensity of emerging light to that of the incident unpolarized light is  
 a) 1: 1                      b) 1: 2                      c) 1: 4                      d) 3: 4
14. The state of polarisation of the visible part of light from the sun is  
 a) unpolarized                      b) plane polarized  
 c) circularly polarized              d) elliptically polarized
15. Paraxial ray approximation is valid when light rays travel  
 a) perpendicular to principal axis                      b) at large angles with principal axis  
 c) parallel to principal axis                      d) at small angles with principal axis

**II. FILL IN THE BLANKS:**

16. The number of cardinal pins of a lens equals \_\_\_\_\_
17. During rainy days, oil droplets floating on water appear coloured due to \_\_\_\_\_
18. The waves from adjacent Fresnel zones in a wave front differ in path length by \_\_\_\_\_
19. \_\_\_\_\_ wave plate is used to convert linear polarization to circular one
20. Anti-Stokes lines in Raman spectrum have frequency \_\_\_\_\_ than the unmodified line.

**III. STATE WHETHER TRUE OR FALSE:**

21. Chromatic aberration is due to light of different colours travelling with different speeds in glass
22. There is only one achromatic fringe in the interference pattern with white light
23. Fresnel biprism experiment is used to demonstrate interference of light by division of amplitude

- 24. In Fraunhofer diffraction, only a spherical waves are used
- 25. Scattering of unpolarised light produces linear polarization

**IV. ANSWER BRIEFLY:**

- 26. State the laws of refraction.
  
  
  
  
  
  
  
  
  
  
- 27. What are Haidinger's fringes?
  
  
  
  
  
  
  
  
  
  
- 28. State the Rayleigh's criterion for resolution.
  
  
  
  
  
  
  
  
  
  
- 29. State Brewster's law.
  
  
  
  
  
  
  
  
  
  
- 30. Write down a general atomic state using the 'spectral term'

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**BRANCH III - PHYSICS**  
**FIFTH SEMESTER**

**COURSE : MAJOR – CORE**  
**PAPER : OPTICS AND SPECTROSCOPY**  
**TIME : 2½ HOURS** **MAX. MARKS : 70**

**SECTION – B**

**ANSWER ANY FIVE QUESTIONS: (5X5=25)**

1. A 10 cm diameter glass sphere of refractive index 1.50 is used for imaging an object. Determine the focal length and the location of its principal points
2. The distance from the source to the screen in a Fresnel biprism set up is 90 cm and the distance from the prism to the screen is 65 cm. If the refractive index of the prism is 1.53 and the fringe separation in light of wavelength 632.8 nm is 0.31 mm, find the refracting angles of the prism in minutes
3. Light of wavelength 589.3 nm falls normally on a thin wedge shaped film of refractive index 1.35, forming fringes that are 2 mm apart. Find the angle of the wedge in rad. Determine the fringe separation for the same set up with air as medium
4. In a Newton's rings experiment using planoconvex lens of refractive index 1.53 the diameter of 10<sup>th</sup> dark ring is 3.56 mm for red cadmium light of wavelength 643.8 nm. What is the focal length of the lens?
5. If a grating has 600 rulings per mm, find how many orders of diffraction images can be obtained for Na light (589.3 nm). Also find the angular width of the central maximum, if the width of the grating is 2 cm
6. Describe the Fresnel's diffraction at a straight edge
7. Give Fresnel's explanation of optical activity

**SECTION – C**

**ANSWER ANY THREE QUESTIONS: (3X15 = 45)**

8. a) Obtain the condition for achromatism when two lenses are  
i) in contact and ii) out of contact  
b) Describe the construction and working of Huygen's eyepiece

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9. With a neat diagram, explain how Jamin's interferometer can be used to measure the refractive index of a gas at different pressures.
10. a) Give the theory of plane diffraction grating at  
i) normal incidence and  
ii) oblique incidence  
b) apply Rayleigh's criterion to determine the chromatic resolving power of a grating
11. Give a detailed account of i) production and  
ii) detection of various types of polarized light
12. a) Define the terms: (i) absorption spectrum (ii) band spectrum  
b) what is IR spectroscopy? How does absorption of an IR line take place in a molecule?  
c) Using a block diagram explain the various parts of an IR spectrometer

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