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 2011
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: (30 x 1 = 30)

I. CHOOSE THE CORRECT ANSWER:

1. According to Fermat's principle the light rays travel along straight line paths in a
   a) Inhomogeneous medium b) homogeneous medium c) Both

2. If the magnification decreases with increasing axial distance, it results in
   a) Barrel shaped distortion b) Pin-cushion distortion c) Astigmatism

3. Cross wires cannot be used in
   a) Huygens eyepiece b) Ramsden's eyepiece c) Both

4. Two lenses of focal lengths 4.5cm and 1.5cm are placed at a certain distance apart. Calculate the distance between the lenses if they form an achromatic combination
   a) 2cm b) 3cm c) 5cm

5. In Fresnel's briprism, 20 bright fringes cross the field of view and the eyepiece moves through a distance L, then the fringe width is
   a) β = L x 20 b) β = 20 / L c) β = L / 20

6. In Michelson's Interferometer, circular fringes are produced when mirrors M_1 and M_2 are
   a) Inclined b) parallel c) Perpendicular

7. The distance between the source and the slit in Fresnel's diffraction is
   a) Finite b) Infinite c) zero

8. The focal length for violet light is more than for red light in a
   a) convex lens b) zone late c) concave lens

9. The expression for the numerical aperture of the objective of a microscope is given as
   a) $2\mu \sin \alpha$ b) $\mu \sin 2\alpha$ c) $\mu \sin\alpha$

10. Calcite crystallises in the form of a
    a) Cuboid b) Rhombohedron c) Tetrahedron

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11. For negative uniaxial crystals,
    a) $\mu_0 > \mu_E$ b) $\mu_0 < \mu_E$ c) $\mu_0 = \mu_E$

12. A half wave plate rotates the azimuth of a beam of plane polarized light by
    a) 60º b) 75 º c) 90º

13. A powerful source of infrared radiation is the
    a) Sun b) Nebulae c) Black holes

14. The spectrum that covers the wavelengths from 4000Aº to 100Aº is called
    a) Infrared spectrum b) Ultraviolet spectrum c) Visible spectrum

15. Radiation scattered with a frequency lower than that of the incident beam gives rise to
    a) Antistoke's lines b) Parent line c) Stoke's lines

II. FILL IN THE BLANKS:

16. The power of a concave lens is _____

17. In the formation of Newton's rings due to transmitted light the central ring is _____

18. The resolving power of a grating is independent of the _____

19. Substances which rotate the plane of vibration to the right are called_____

20. In Raman spectroscopy the rotational quantum number changes by _____ units.

III. STATE WHETHER TRUE OR FALSE:

21. Spherical aberration can be minimized by using a crossed lens.

22. Fresnel's biprism consists of two acute angled prisms placed base to base.

23. Rectilinear propagation of light is not an approximation.

24. When a ray of light travels along the optic axis, the ordinary and extraordinary ray travel along the same direction with same velocity.

25. A single beam ultraviolet – visible spectrophotometer measures the frequency of light passing through the sample.

IV. ANSWER BRIEFLY:

26. Why is Huygen's eyepiece known as a negative eyepiece.

27. What are coherent sources.

28. What is Rayleigh's criterion for just resolution.

29. What is optical activity.

30. State the characteristics of Raman lines.

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TIME : 2½ HOURS MAX. MARKS : 70

SECTION – B

ANSWER ANY FIVE QUESTIONS: (5 X 5 = 25)

1. A convex lens of thickness 4cm has radii of curvature 6cm and 10cm. Find the focal length and the positions of the focal points and the principal points.The refractive index = 1.5.

2. In a Newtons rings arrangement, if a drop of water ($\mu = 4/3$) be placed in between the lens and the plate, the diameter of the 10^{th} ring is found to be 0.6cm.Obtain the radius of curvature of the face of the lens in contact with the plate.The wavelength of light used is 6000A°.

3. A parallel beam of monochromatic light is allowed to be incident normally on a plane transmission grating having 5000 lines / cm and the second order spectral line is found to be diffracted through 30°. Calculate the wavelength of light.

4. Calculate the thickness of (i) a quarter wave plate and (ii) a half wave plate given that, μ_E = 1.553, μ_o = 1.544 and λ = 5000 A°.

5. The object glass of a telescope is an achromat of focal length 90cm. If the magnitude of the dispersive powers of the two lenses are 0.024 and 0.036, calculate their focal lengths.

6. What is spherical aberration? Write any three methods to minimize it.

7. Explain the working of Jamin's refractometer.

SECTION – C

ANSWER ANY THREE QUESTIONS: (3 X 15 = 45)

8. a) Describe the construction and working of Huygens eyepiece.

   b)Indicate the positions of its cardinal points. What are the demerits of this eyepiece.

9. a) Describe the construction and working of Michelson's Interferometer.

   b) How can it be used to find the wavelength of monochromatic light.

10. a) Explain the diffraction phenomena at a straight edge.

    b) Distinguish between Fresnel and Fraunhofer diffraction.

11. a) Define specific rotation. Explain the Laurent's half shade polarimeter to determine the specific rotatory power of an optically active substance.

    b)How will you produce and detect circularly polarized light.

12. a) Describe the working of a single beam ultraviolet- visible spectrophotometer.

    b) Explain Raman effect on the basis of quantum theory.

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