

STELLA MARIS COLLEGE (AUTONOMOUS) CHENNAI – 600 086.  
(For candidates admitted during the academic year 2015-16 Y & thereafter)

SUBJECT CODE : 15PH/MC/PA14

**B.Sc. DEGREE EXAMINATION NOVEMBER 2016**  
**BRANCH III - PHYSICS**  
**FIRST SEMESTER**

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

**COURSE : MAJOR – CORE**

**PAPER : PROPERTIES OF MATTER AND ATOMIC PHYSICS**

**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 ANSWERS:**

- The S.I units of stress is given by  
a)  $\text{Nm}^{-2}$                       b)  $\text{Nm}^{-1}$                       c)  $\text{Nm}^{-3}$                       d) N
- The layers, which remains unaltered during bending is called as  
a) Parallel axis    b) Neutral axis    c) Perpendicular axis    d) Principle axis
- The young's modulus of the material is inversely proportional to  
a)  $bd^3$                       b)  $bd^3y$                       c)  $bd^2y$                       d)  $l^3$
- The dimensional formula for surface tension is  
a)  $\text{MLT}^{-2}$                       b)  $\text{MT}^{-2}$                       c)  $\text{ML}^{-1}\text{T}^{-1}$                       d)  $\text{ML}^{-2}\text{T}^{-1}$
- If the free surface of the liquid is plane, the resultant force due to surface tension on a molecule on the surface is  
a) Maximum    b) zero    c)  $\leq 0$     d) Negative
- The excess pressure inside a drop or a bubble is  
a)  $p \propto r$                       b)  $p \propto 1/r$                       c)  $p \propto 1/r^2$                       d)  $p = 0$
- The dimensional formula for viscosity is  
a)  $\text{ML}^{-1}\text{T}^{-1}$                       b)  $\text{ML}^{-1}\text{T}^{-2}$                       c)  $\text{ML}^{-2}\text{T}^{-2}$                       d)  $\text{MT}^{-1}$
- The pressure difference between the ends of the capillary tube is  
a)  $h\rho g$                       b)  $hg$                       c)  $\rho g$                       d)  $h\rho^2g$
- The variation of viscosity of a liquid with temperature is given by  
a)  $\eta_t = \eta_0/1+at+bt^3$                       b)  $\eta_0 = \eta_t/1+at+bt^3$   
c)  $\eta_t = \eta_0/1+at^2+bt^3$                       d)  $\eta_t = \eta_0/1+at^2+bt^2$
- The velocities of positive rays range from  
a)  $10^3$  to  $10^4$  m/s<sup>2</sup>                      b)  $10^5$  to  $10^6$  m/s<sup>2</sup>                      c)  $10^2$  to  $10^3$  m/s<sup>2</sup>                      d)  $10^7$  to  $10^8$  m/s<sup>2</sup>

11. The charge and mass ratio of photoelectron is given by  
 a)  $2V/B^2R^2$                       b)  $2V/BR$                       c)  $2V/BR^2$                       d)  $2V/B^2R$
12. The minimum wavelength produced by an X-ray tube  
 a)  $\lambda_{\min} = h e/cv$                       b)  $\lambda_{\min} = h c^2/e v^2$                       c)  $\lambda_{\min} = h c/e v^2$                       d)  $\lambda_{\min} = h c/e v$
13. According to wave mechanics, the orbital angular momentum of the electron is given by  
 a)  $P_l = [l l + 1]^{1/2} \hbar^2$                       b)  $P_l = [l l + 1]^{1/3} \hbar$   
 c)  $P_l = [l l + 1]^{1/2} \hbar$                       d)  $P_l = [l l + 1]^{1/2} \hbar^3$
14. In Stern and Gerlach experiment the atomic magnet experiences a translatory force whose value is given by  
 a)  $\frac{dB}{dx} \mu_l \sin\theta$                       b)  $\frac{dB}{dx} \mu_l \cos^2\theta$                       c)  $\frac{dB}{dx} \mu_l \cos\theta$                       d)  $\frac{dB}{dx} \mu_l \sin^2\theta$
15. The expression for Zeeman shift is given by  
 a)  $\pm Be\lambda^2/4\pi mc$                       b)  $\pm Be\lambda^3/4\pi mc$                       c)  $\pm B\lambda^2/4\pi mc$                       d)  $\pm Be\lambda^2/4\pi mc^2$

## II      FILL IN THE BLANKS:

16. The maximum load to which the wire is subjected divided by its original cross-sectional area is called \_\_\_\_\_.
17. If the free surface of the liquid is concave, then the resultant force due to S.T on a molecule on the surface acts \_\_\_\_\_.
18. The coefficient of viscosity is defined as \_\_\_\_\_ per unit area required to maintain a unit velocity gradient.
19. The kinetic energy of emitted photo-electron at threshold frequency is \_\_\_\_\_.
20. The splitting of a spectral line into more than three components in ordinary weak magnetic fields is called \_\_\_\_\_.

## III      STATE WHETHER TRUE OR FALSE:

21. When the beam is in equilibrium, the external bending moment = internal bending moment.
22. The molecules in the surface film have smaller potential energy than the molecules inside the liquid.
23. In a capillary tube the velocity of the liquid is zero along the axis and is maximum at the walls.
24. Positive rays are deflected by both electric and magnetic fields.
25. An atom radiates energy only when an electron jumps from a stationary orbit of lower energy to one of higher energy.

**IV ANSWER BRIEFLY:**

26. Write an expression for the period of oscillation of a torsion pendulum.

27. Define surface energy.

28. Give the poiseuille's formula for the rate of flow of liquid through a capillary tube.

29. What is "soft X rays"?

30. Write the two distinct features of the vector atom model.

XXXXXXXXXX

STELLA MARIS COLLEGE (AUTONOMOUS) CHENNAI – 600 086.  
(For candidates admitted during the academic year 2015-16 Y & thereafter)

SUBJECT CODE : 15PH/MC/PA14

**B.Sc. DEGREE EXAMINATION NOVEMBER 2016**  
**BRANCH III - PHYSICS**  
**FIRST SEMESTER**

**COURSE : MAJOR – CORE**  
**PAPER : PROPERTIES OF MATTER AND ATOMIC PHYSICS**  
**TIME : 2 ½ HOURS** **MAX. MARKS : 70**

**SECTION – B**

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

1. Calculate the depression at the free end of a rectangular cantilever of length 0.6m loaded with 0.2kg; breadth=0.02m; thickness=0.02m;  $d=0.02\text{m}$ ; Young's modulus of material of the beam= $1 \times 10^{10} \text{ Nm}^{-2}$ .
2. The pressure of air in a soap bubble of  $7 \times 10^{-3} \text{ m}$  diameter is  $8 \times 10^{-3} \text{ m}$  of water above the atmosphere pressure. Calculate the S.T. of the soap solution.
3. Calculate the mass of water flowing in 10 minutes through a tube 0.001m diameter and 0.4m long if there is a constant pressure head of 0.2m of water. The coefficient of viscosity of water is  $0.00082 \text{ Nsm}^{-2}$ .
4. The spacing between principal planes of NaCl crystal is  $2082 \text{ \AA}$ . It is found that first order Bragg reflection occurs at an angle of  $10^\circ$ . What is the wavelength of X-rays?
5. Calculate the wavelength separation between the two component lines which are observed in the normal Zeeman Effect. The magnetic field used is  $0.4 \text{ weber/m}^2$ ; the specific charge= $1.76 \times 10^{11} \text{ Ckg}^{-1}$  and  $\lambda = 6000 \text{ \AA}$ .
6. Explain the surface tension on the basis of Kinetic theory.
7. Derive an expression for the internal bending moment of a bar.

**SECTION – C**

**ANSWER ANY THREE QUESTIONS: ( 3 x 15 = 45 )**

8. (i) Derive an expression for the period of oscillation of a cantilever.  
(ii) Describe, with necessary theory, the oscillation method to determine Young's modulus for the material of a cantilever.
9. Obtain an expression for the excess of pressure inside (i) a spherical soap bubble and (ii) a spherical liquid drop,

10. Derive Poiseuille's formula for the rate of flow of a liquid through capillary tube. Describe a laboratory method for determining the coefficient of viscosity of a liquid at room temperature.
11. What is a mass spectrograph? Describe the construction of Aston's mass spectrograph with necessary theory and show how it can be used in detection of isotopes. State the limitations of Aston's mass spectrograph.
12. Describe the vector model of the atom and explain the different quantum numbers associated with.

XXXXXXXXXX