**STELLA MARIS COLLEGE (AUTONOMOUS) CHENNAI – 600 086.**
**(For candidates admitted during the academic year 2011-12 & thereafter)**

**SUBJECT CODE : 11PH/MC/PA14**

**B.Sc. DEGREE EXAMINATION NOVEMBER 2014**
**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:**

1. Which of the following is not having the same dimensions as stress?
   a) pressure b) force c) elastic limit d) modulus of elasticity

2. The elevation at the centre of a beam subjected to uniform bending is given by
   a) $\frac{mgal^2}{4E\,Ak^2}$ b) $\frac{3mgal^2}{8\,E\,Ak^2}$ c) $\frac{mgal^2}{8\,E\,Ak^2}$ d) $\frac{3mgal^2}{4\,E\,Ak^2}$

3. The time period of torsional oscillations of a body of moment of inertia I is directly proportional to
   a) I b) $\sqrt{I}$ c) $I^2$ d) I + 1

4. The ratio of the respective excess of pressure inside a liquid drop and a bubble of the same radius is
   a) 1: 1 b) 1: 2 c) 2: 1 d) 4:1

5. If the cohesive force inside a liquid is greater than the force of adhesion between the liquid and the contact surface, then the angle of contact is
   a) 90º b) 0º c) acute d) obtuse

6. One of the important advantage of Jaeger's method is that
   a) it measures the surface tension accurately
   b) the angle of contact need not be measured.
   c) it captures the bubble radius accurately
   d) it deals with the dynamics of formation of bubble.

7. Ostwald's viscometer is not used to
   a) study the variation of viscosity with temperature
   b) compare the viscosities of two liquids
   c) find the viscosities of a liquid with a standard
   d) turbulent speed of a liquid.

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8. The correction made to the length of the tube in the Poiseuille's equation is
   a) 1.64 times the bore radius b) 0.64 times the bore radius
   c) 1.8 times the bore radius d) 0.8 times the bore radius.

9. The force acting on a steel ball dropped in a highly viscous liquid becomes zero implies that
   a) it travels with increasing velocity. b) it travels with increasing velocity.
   c) it has come to rest. d) it is not accelerated.

10. In a magnetic field, positive rays are deflected
    a) more than an electron b) more than a proton
    c) less than cathode rays d) more than an electron, cathode rays and a proton

11. The strength of the photo current after it starts flowing increases along with the
    a) frequency of the incident photon b) intensity of the incident photon
    c) time interval after the start d) all of the above

12. In Dempster's mass spectrograph, under constant electric and magnetic fields, e/m is proportional to
    a) r b) $r^2$ c) $\frac{1}{r}$ d) $\frac{1}{r^2}$

13. The maximum number of electrons in a 3 d subshell is
    a) 10 b) 14 c) 18 d) 8

14. 1 Bohr magneton $\mu_B =$
    a) $\frac{eh}{2m}$ b) $\frac{eh}{2\pi m}$ c) $\frac{eh}{4\pi m}$ d) $\frac{eh}{4m}$

15. 2 $P_{3/2}$ in spectral notation indicates that the quantum numbers are
    a) $l = 2$ and s = 3/2 b) $l = 2$ and j = 3/2
    c) $l = 1$ and s = 3/2 d) $l = 1$ and j = 3 /2

## II STATE WHETHER TRUE OR FALSE:

16. Poisson's ratio of a flint glass is 1.
17. The excess of pressure inside a synclastic and anti-clastic surface of similar radii are the same.
18. The viscosity of liquids is independent of temperature.
19. The shift in the Compton wavelength is independent of the energy of the incident photons.
20. Vector atom model could not explain Zeeman effect.

**III FILL IN THE BLANKS:**

21. When the beam is in equilibrium, the moment of the elastic couple in it is equal to _____.
22. The shape of a liquid drop depends on its surface tension and _____.
23. The flow of a fluid is said to be turbulent if its velocity is greater than its _____.
24. The selection rule on L for an electronic transition in atom is _____.
25. Bragg's law is mathematically expressed as _____.

**IV ANSWER BRIEFLY:**

26. What is a cantilever?

27. Define sphere of influence.

28. Write the Euler's equation of flow of a liquid.

29. State Moseley's law.

30. What is Paschen – back effect?

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**TIME : 2 ½ HOURS MAX. MARKS : 70**

**SECTION – B**

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

1. A wire 2.5 m long with a cross- sectional area of 5 sq. mm stretches by 1.25 mm when a mass of 50 kg is suspended from it. Assuming g = 10 $ms^{-2}$, find the stress, the resulting strain on the wire and the value of Young's modulus of the material of the wire.

2. Calculate the amount of workdone in blowing a soap bubble of radius from 10 cm to 15 cm S.T of a soap bubble = 0.035 N/m.

3. Define Ionisation and Excitation potential. Calculate the excitation potential when an electron goes from $1^{st}$ to $2^{nd}$ level, $1^{st}$ to $3^{rd}$ level, $1^{st}$ to $4^{th}$ level and $2^{nd}$ to $4^{th}$ level.

4. a) With necessary theory of photo-electric effect, obtain the Einstein's equation. (3)
   b) Find the longest wavelength that can produce photo-electrons from Sodium plate with a work function of 2.3eV (Given that h = 6.63 x $10^{-34}$ J s). (2)

5. Describe the experimental arrangement of Stern and Gerlach in confirming the vector atom model.

6. Find the expression for the torque per unit twist of a cylindrical body.

7. What couple must be applied to a wire one metre long, 1 mm diameter in order to twist one end of it, through $90^{o}$, the other end remaining fixed? Rigidity modulus of the material of the wire is 2.8 $\times$ $10^{10}$ $N/m^2$.

**SECTION – C**

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

8. a) Derive relations between the modulii of elasticity of a material. (10)
   b) Obtain an expression for the depression at the end of a cantilever when it is loaded. Deduce it for a rectangular beam. (5)

9. Describe the Jaeger's method of determining the surface tension of a liquid at different temperatures with necessary diagrams.

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10. a) Describe a McLeod gauge with a simple diagram and its principle of action.(10)
    b) Obtain an expression for the terminal velocity of a steel falling in a viscous liquid. (5)

11. With neat diagrams, describe the construction and theory of Aston's mass spectrograph.

12. Discuss the experiment of determining the normal Zeeman shift with adequate theory and diagrams

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