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

SUBJECT CODE : 15PH/MC/PA14

B.Sc. DEGREE EXAMINATION NOVEMBER 2015
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. The work done per unit volume in stretching the wire is equal to
   a) stress X strain
   b) (½) stress X strain
   c) stress/strain
   d) strain/stress

2. Which of the following possess the highest elasticity?
   a) Rubber
   b) Glass
   c) Steel
   d) Copper

3. A rod is supported on two edges of the knife and loaded in the middle. The depression at the center is noted. The knife edges are shifted slightly outwards. The depression will
   a) Increase
   b) decrease
   c) remain the same
   d) divide the original value

4. A liquid does not wet the surface of a solid surface if angle of contact is
   ` a) Zero
   b) an acute angle
   c) 45^{o}
   d) an obtuse angle

5. Excess pressures inside a bubble of radius ‘ r’ formed from a liquid of surface tension T is
   a) T/r
   b) 4T/r
   c) 2T/r
   d) 3T/r

6. Energy needed in breaking a drop of radius 'R' into 'n' drops of radius is 'r'is
   a) $(4\pi r^2 n - 4\pi R^2)$
   b) $(\frac{4}{3}\pi r^2 n - \frac{4}{3}\pi R^2)$
   c) $(4\pi R^2 - 4\pi r^2)$ nT
   d) $(4\pi R^2 - 4\pi r^2 n)$ T

7. Viscosity of water in comparison to mercury is
   a) Lower
   b) higher
   c) same
   d) unpredictable

8. Streamline motion is that motion in which there is
   a) only radial velocity gradient.
   b) only longitudinal velocity gradient
   c) Both longitudinal and radial velocity gradient
   d) Neither longitudinal nor radial velocity gradient

9. Poise is the unit of
   a) Surface tension
   b) Capillarity
   c) Shearing stress in fluids
   d) Viscosity

10. X rays will not show the phenomenon of
    a) Diffraction
    b) Polarization
    c) Deflection by electric field
    d) Interferance

11. The photo electric effect is based upon the conservation of
    a) Momentum
    b) Mass
    c) Energy
    d) Angular momentum

12. The penetration power of X- rays increases with the
    a) Increase in its velocity
    b) Increase in its frequency
    c) Increase in its intensity
    d) Decrease in its velocity

13. Zeeman shift of wave length $d\lambda$ is
    a) $d\lambda = \pm Be/ 4\pi m$
    b) $d\lambda = \pm Be\lambda/ 4\pi mc$
    c) $d\lambda = \pm Be\lambda^2/ 4\pi mc$
    d) $d\lambda = \pm Be\lambda^2/ 4\pi mc^2$

14. Spin quantum number of an electron can have:
    a) Only half integral value
    b) Only integral values
    c) Integral and half integral values
    d) Only one constant value

15. Stern –Gerlach Experiment demonstrates directly the existence of
    a) Space quantization
    b) Electron spin
    c) Both space Quantization and electron spin
    d) Neither space quantization nor electron spin

II STATE WHETHER TRUE OR FALSE:

16. The twisting couple per unit angular twist of the wire or cylinder is called its torsional rigidity.
17. Surface tension of the liquid increase with increase in temperature.
18. Above critical velocity the turbulent flow changes to streamline flow.
19. The valve of Zeeman shift is inversely proportional to strength of magnetic field.
20. Magnetic orbital quantum number takes $(2l+1)$ different value.

III FILL IN THE BLANKS:

21. The dimension formula for Young's modulus is ____________________.
22. Potential energy per unit area of the surface film is called its ___________________.
23. The viscosity of liquids ________________with temperature.
24. Rate of change to mass of an electron is called __________________.
25. The penetrating power of X- rays _____________with increase in its velocity.

IV ANSWER BRIEFLY:

26. Calculate the work done in twisting a wire.

27. What do you understand by angle of contact in the case of a liquid?

28. Explain the term coefficient of viscosity.

29. State Bragg's law.

30. What is Stark Effect

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TIME : 2 ½ HOURS MAX. MARKS : 70

SECTION – B

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

1. Determine Young's Modulus of the material of a rod if it is bent uniformly over two knife edges separated by a distance of 0.6 m and loads of 2.5 kg are hung at 0.18m away from the knife edge. The breadth and thickness of the rod are 0.025 m and 0.005 m respectively. The elevation at the middle of rod is 0.007 m.

2. Calculate the excess pressure inside a soap bubble of radius $3x10^{-3}$ m. The surface tension of soap solution is $20x10^{-3}$ Nm^{-1}. Also calculate the surface area.

3. Calculate the mass of water flowing in 10 minutes through a tube 0.1 cm in diameter, 40 cm long if there is constant pressure head of 20 cm of water. The coefficient of viscosity of water 0.00089 Nsm^{-2}.

4. X rays of wavelength of 0.71A° are reflected from the (110) plane of a rock salt crystal (a=2.82 A°). Calculate the glancing angle corresponding to second order reflection.

5. Describe Stern-Gerlach experiment. Describe how it verifies the concept of space quantization and electron spin.

6. One of the most prominent spectral lines of calcium is one with λ = 4226.73 A°. Calcium atom exhibits normal Zeeman patterns when placed in uniform magnetic field of 4 weber/m^2. Calculate the wavelength of the three components of normal Zeeman pattern and the separation between them.

7. Obtain an expression for bending moment of a beam.

SECTION – C

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

8. Describe with relevant theory, an experiment to determine the Young's Modulus of a material of a beam using non- uniform bending.

9. Describe Quincke's method for determination of surface tension. Derive the formula employed.

10. With a neat diagram, explain how viscosities of two liquids compared using Ostwald's Viscometer.

11. Give the theory of Compton Effect and briefly explain its experimental verification.

12. What is Zeeman Effect? Describe the experimental arrangement for studying Zeeman Effect. Show that the Zeeman shift $d\lambda = \pm\, Be\lambda^2 / 4\pi mc$.

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