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FAROOK COLLEGE (AUTONOMOUS), KOZHIKODE

First Semester B.Sc Degree Examination, November 2016

PH1B01 – Methodology of science & physics

(2016 Admission onwards)

Max. Time: 3 hours   Max. Marks : 80

PART - A

Answer *all* questions. Each question carries *one* mark

1. What is meant by scientific knowledge?

2. Name the different types of knowledge

3. What is a hypothesis?

4. What is meant by time dilation in relativity?

5. State Wein's radiation law.

6. What is a solenoidal Field?

7. What do you mean by magnitude and direction cosine of a vector?

8. State polygon law of vector addition.

9. Define Gauss's divergence theorem

10. Write down the transformation equation from rectangular Cartesian coordinates to spherical polar coordinates.

11. Define the term conjugate of a matrix.

12. What is a unitary matrix?

(12x1=12 marks)

PART - B

Answer *any seven* questions. Each question carries *two* marks

13. What are auxiliary and ahhoc hypothesis?

14. What is meant by matter waves?

15. What are the basis for scientific laws?

16. What was the discrepancy in Rayleigh Jeans formulae for black body radiation?

17. What are the four empirical methods of scientific enquiry?

18. Prove that curl of a conservative field is zero

19. If the non-parallel vectors A and B are equal in magnitude, show that the vector (A + B) is perpendicular to the vector (A- B).

20. Prove that every diagonal element of a skew hermitian matrix is either zero or a pure imaginary number.

21 Define adjoint of a matrix.   **(7x2=14 marks)**

PART - C
Answer *any* **six** questions. Each question carries *five* marks

22. Show that the matrix $\begin{pmatrix} \frac{1}{\sqrt{2}} & \frac{i}{\sqrt{2}} \\ \frac{-i}{\sqrt{2}} & \frac{-1}{\sqrt{2}} \end{pmatrix}$ is unitary.

23. Find the area of the parallelogram whose sides are A= i + j + k and B= 3i + 2k.

24. Calculate the Laplacian of the following function $\varphi = (x^2 + 2xy + 3z + 4)$.

25. Find the volume of a sphere of radius R using spherical polar coordinates.

26. Show that every square matrix can be expressed as a sum of symmetric and skew symmetric matrices.

27. Determine the value of a, b and c when the matrix $\begin{pmatrix} 0 & 2b & c \\ a & b & -c \\ a & -b & c \end{pmatrix}$ is orthogonal

28. If r is the position vector of a point, deduce the value of $\text{grad}\left(\frac{1}{r}\right)$.

29. Discuss the significance of corroboration and falsification in a hypothesis.

(6 x 5 = 30 marks)

PART - D
Answer *any* **three** questions. Each question carries **eight** marks

30. Inconsistency between theory and experiments give birth to new science concepts. Illustrate with examples.

31. Discuss in detail the development of quantum mechanics.

32. Find the eigen values and eigen vectors of the matrix A = $\begin{pmatrix} 3 & 1 & 4 \\ 0 & 2 & 6 \\ 0 & 0 & 5 \end{pmatrix}$

33. Solve the equations using Cramer's rule.

$2x - y + 2z = 2, \quad x + 10y - 3z = 5, \quad -x + y + z = -3$

34. (i) Explain divergence and curl operations and illustrate its geometrical significance.

(ii) Show that $V = 3y^4z^2i + 4x^3z^2 j - 3x^2y^2 k$ is solenoidal.

(3 x 8 = 24 marks)

FAROOK COLLEGE (AUTONOMOUS), KOZHIKODE

First Semester B.Sc Degree Examination, November 2016

PH1C01 – Properties of matter & thermodynamics

(2016 Admission onwards)

Max. Time: 3 hours   Max. Marks : 64

Section A

(Answer *all* questions. Each carries 1 mark)

1. Explain elastic limit.
2. How Young's modulus is affected with temperature?
3. What is flexural rigidity?
4. Define neutral axis.
5. Write down Stoke's law for viscous force?
6. What is the acceleration of a particle after attaining terminal velocity?
7. Write one example each for isobaric and isochoric processes.
8. How entropy is related to disorder, in a system?
9. Write down the equation of adiabatic process.
10. Which conservation law is obeyed by first law of thermodynamics?

$(10 \times 1=10)$

Section B

(Answer *all seven* questions. Each carries 2 marks)

11. Discuss about the theoretical limiting values of Poisson's ratio.
12. Why a hollow shaft is better than a solid shaft of same mass?
13. Describe briefly the effect of pressure on the viscosity of a gas.
14. Explain how the electrostatic pressure confines the size of the bubble formed.
15. Distinguish between reversible and irreversible processes with examples.
16. State Kelvin-Planck statement of second law of thermodynamics.
17. Explain how the principle of degradation of energy leads into heat death of universe.

$(7 \times 2=14)$

Section C

(Answer *any three* questions. Each carries 4 marks)

18. Derive the relation $w = \frac{1}{2} \times$ stress $\times$ strain, where w is the work done/unit volume in changing the volume of a gas.
19. Describe how coefficient of viscosity of a liquid is determined, using Stoke's method.
20. Discuss the effect of surface tension on evaporation and condensation of a liquid.
21. Explain Carnot's refrigerator and derive the expression for coefficient of performance.
22. Derive C_p-C_v using Maxwell's thermodynamic relations.

$(3 \times 4=12)$

Section D

(Answer *any three* problems. Each problem carries 4 marks)

23. A metallic disc of mass 4 kg and diameter 15 cm is suspended from a wire. If the disc vibrates with a period of 2 seconds, what is the torque for twisting the wire through 0.04 Nm/radian?

24. Find the amount of energy required to break liquid drop of surface tension 0.09 N/m and radius 0.8mm into 27 droplets.

25. Calculate the change in entropy of a chamber containing 2kg of water at 100 °C, which boils at the same temperature. Given latent heat of steam of water is 2.26×10^6 J/kg.

26. A heat engine working between two temperatures converts 20 % of heat into effective work. When the temperature of the source is increased by 120 °C, the efficiency is doubled. Find the temperature of the source and sink.

27. An ideal diatomic gas has an initial pressure of 4 atmospheres and a volume of 2 m^3. It undergoes an adiabatic process. The final pressure and volume of gas are 1.6 atmospheres and 1.8m^3.Calculate the work done by the gas.
    Given 1 atmosphere = 1.013×10^5 N/m^2 and γ of diatomic gas is 1.4.

$$(3 \times 4=12)$$

Section E

(Answer *any two* questions. Each carries 8 marks)

28. Describe three moduli of elasticity and Poisson's ratio. Find the relations among them.

29. Derive Stoke's formula and explain how coefficient of viscosity of a liquid be determined using Stoke's formula

30. Derive an expression for the excess pressure on a curved liquid surface and obtain the excess pressure inside a spherical soap bubble.

31. Explain thermodynamic functions and get thermodynamic relations among them.

$$(2 \times 8=16)$$