

2012

PHYSICS (Optional)

100351

भौतिकशास्त्र (वैकल्पिक)

Time : 3 hours

Maximum Marks : 200

Note :

- (i) Answers must be written in English.
- (ii) Question No. 1 is compulsory. Of the remaining questions, attempt any Four selecting one question from each section.
- (iii) Figure to the RIGHT indicates marks of the respective question.
- (iv) Make suitable assumptions, wherever necessary and state the same.
- (v) Number of optional questions upto the prescribed number in the order in which they have been solved will only be assessed. Excess answers will not be assessed.
- (vi) Credit will be given for orderly, concise and effective writing.
- (vii) Candidates should not write roll number, any name (including their own), signature, address or any indication of their identity anywhere inside the answer book otherwise they will be penalised.

1. Answer any four of the following :

- (a) Derive an expression of Moment of Inertia of a solid cylinder about an axis passing through its centre and perpendicular to its own axis. 10
- (b) Define the term interference. In Young's double slit experiment show that bright and dark bands are equally spaced. 10
- (c) What is Doppler effect in sound and obtain an expression for the apparent frequency of the note when the source and the listener are moving away from each other ? 10
- (d) What are Miller indices ? Derive an expression for the interplanar spacing for planes of the (h k l) type in the case of a cubic structure. 10
- (e) What are beats ? Discuss analytically the formation of beats. Calculate the velocity of sound in a gas in which two waves of lengths 1 metre and 1.01 metres produce 10 beats in 3 seconds. 10

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SECTION - A

2. (a) State Bernoulli's theorem and derive Bernoulli's equation. A flat plate of area 10 sq cm is separated from a large plate by a layer of glycerine 1 mm thick. If the viscous coefficient of glycerine is 20 gm per cm per sec, what force is required to keep the plate moving with a velocity of 1 cm per second? 20
- (b) Describe the diesel cycle in detail, using the figure of different strokes in the diesel engine. Draw the P - V diagram and explain the working of diesel engine. Derive the efficiency η for the same. Compare the diesel engine and Otto engine for the value of efficiency and state the advantages of diesel engine. 20
3. (a) With neat ray diagram write the detailed theory of Michelson and Morley's experiment. Discuss its Null result. 20
- (b) What is triple point? Derive Clausius Clapeyron latent heat equation, using the P - V diagram. Calculate the boiling point of water at a pressure of 2.026×10^5 Pa, if boiling point at 1.013×10^5 Pa is 373 K specific volume of steam = 1.671×10^{-3} m³ Latent heat of vaporization L = 540 cal/gm i.e. 2.268×10^6 J/kg. 20

SECTION - B

4. (a) Discuss refraction at a convex surface when the image is virtual. Show that for air medium 10
- $$\frac{\mu}{v} - \frac{1}{u} = \frac{\mu - 1}{R}$$
- (b) Describe the charging of capacitor through series L - C - R circuit, when the battery of e.m.f. 'E' is applied across it. Derive the expression for charge across the capacitor, 'q' at time 't'. Discuss three different cases of over-damping, under damping and critical damping, show it graphically. Calculate the maximum charge on the capacitor of 10 μ F if it is connected in series with a resistance of 10 k Ω and a dc source of 5 V. 20
- (c) State the principle of transformer. Draw the neat diagram of the transformer and explain the working of it. What is turns ratio? Define efficiency of transformer. 10
5. (a) With neat ray diagram explain the theory of Newton's Ring and show that radius of dark ring is directly proportional to square root of natural number. 10
- (b) Write in detail, the Weiss - Molecular field theory and derive the Curie - Weiss Law. 20
- (c) State and derive Biot and Savart's Law. 10

SECTION - C

6. (a) What are X-rays ? How the production of X-rays can be described using the cooledge X-ray tube ? What are the properties of X-rays ? Explain the characteristic line X-ray spectrum and the continuous X-ray spectrum. 20
- (b) Write detailed note on vector atom model with the explanation of spin-orbit interaction for two electron atoms, explain L – S coupling with the help of vector diagram. 20
7. (a) What is De-Broglie hypothesis ? Define De-Broglie wavelength. With neat diagram, describe the Davisson and Germer experiment of reflection of electrons from the Nickel target, which experimentally verified the existence of matter waves. 20
- (b) What is Nuclear Fission ? Explain the concept of chain reaction. Define Nuclear reactor and write its features. What is breedor reactor ? 20

SECTION - D

8. (a) Explain summerfield free electron model and obtain an expression of density of state. 20
- (b) What is operational amplifier ? Explain its application as an integrator. 20
9. (a) What is thermionic emission ? Derive an expression of Richardson T^2 formula. 20
- (b) State Barkhausen criteria of oscillation. Describe phase shift oscillator circuit and its action. State its advantages and disadvantages. 20

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