

**Q.P. Code – 50721**

**Second Year B.Sc. Degree Examination**

**OCTOBER/NOVEMBER 2014**

**(Directorate of Distance Education)**

**Physics**

**(DSB 210) Paper II – SOUND, OPTICS, ELECTRICITY AND  
ELECTROMAGNETISM**

*Time : 3 Hours]*

*[Max. Marks : 75/85*

**Instructions to Candidates :**

- 1) *Students who have attended **25** marks **I-A** scheme will have to answer for a total of **75** marks.*
- 2) *Students who have attended **15** marks **I-A** scheme will have to answer for a total of **85** marks.*
- 3) *Section-**E** is **compulsory** for **85** marks scheme **only**.*

SECTION – A

I. Answer **ALL** questions :

**10 × 1 = 10**

1. What are forced vibrations?
2. Define intensity of a wave motion.
3. What are progressive waves?
4. Define wave front.
5. What is a thin film?
6. What is Quarter wave plate?
7. What is the significance of quality factor?
8. State Gauss-Divergence theorem.
9. What is the average power dissipated in a LC circuit.
10. What is Bleeder Resistor?

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### SECTION – B

II. Answer any **FIVE** questions : **5 × 3 = 15**

11. Write the uses of Lissajous Figures.
12. Prove that velocity of sound in air increases by  $0.61 \text{ ms}^{-1}$  for each degree Celsius rise in temperature. (Given velocity of sound at  $0^\circ\text{C}$  is  $332 \text{ ms}^{-1}$ )
13. Huygen's Eye-piece is called as a negative eye-piece. Explain.
14. Obtain the relation between phase velocity and group velocity. Group velocity is always less than wave velocity, explain.
15. Distinguish between circularly and elliptically polarised lights.
16. What are band pass and band stop filters? Write any two applications of them.
17. A personal computer draws  $2.7 \text{ A}$  from a  $220 \text{ V}$ ,  $50 \text{ Hz}$  line. For this computer what are (a) The average current (b) The average of the square of the currents (c) The current amplitude.

### SECTION – C

III. Answer any **FIVE** questions : **5 × 6 = 30**

18. Obtain an expression for velocity of sound in a rod.
19. Explain the different methods of obtaining coherent sources of light. Describe an experiment to determine the wave length of sodium light by setting Newton's rings.
20. Distinguish between the phenomenon of Interference and Diffraction.
21. Give Fresnel's theory of optical rotation.
22. (a) Define divergence of a vector field. Explain its physical significance.  
(b) Let  $\phi = 9x^2 + 18xy^2 - 2xyz$  be a scalar point function. Find  $\text{grad}\phi$  at the point  $(1, 1, -2)$ .

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23. Derive an expression for the amplitude and phase of the current in a series LCR resonant circuit using  $j$ -operator, when an alternating emf is applied. Show how the impedance and current varies with frequency.
24. (a) What do you mean by Time-Base circuit?  
(b) Describe the procedure for (i) Measurement of frequency and (ii) Measurement of phase difference by using CRO.

### SECTION – D

IV. Answer any **TWO** questions : **2 × 10 = 20**

25. (a) Deduce Maxwell's Electromagnetic field equations for a material medium. **7**  
(b) Explain the production of Electromagnetic waves by using oscillating dipole. **3**
26. (a) Derive Newton's formula for velocity of sound and hence discuss Laplace's correction for it. **7**  
(b) Calculate the frequency of the fundamental note of a string 1 metre long and weighing 2 grams, when stretched by a weight of 400 kg. **3**
27. (a) Derive the condition for achromatization of two thin lenses placed in contact. **6**  
(b) Two glasses have dispersive powers in the ratio 1 : 2. These glasses are used in the manufacture of an achromatic objective of focal length 0.25 m. What are the focal lengths of the two lenses of the objective? **4**
28. (a) Derive an expression for the velocity of electromagnetic waves in an isotropic medium. **4**  
(b) State Poynting theorem. Write the significance of Poynting vector. **3**  
(c) The Electron circulates around the nucleus in a path of radius  $5.1 \times 10^{-11}$  m at a frequency of  $6.8 \times 10^{15}$  revolutions/second. Calculate magnetic field 'B' at the centre and the magnetic dipole moment. **3**

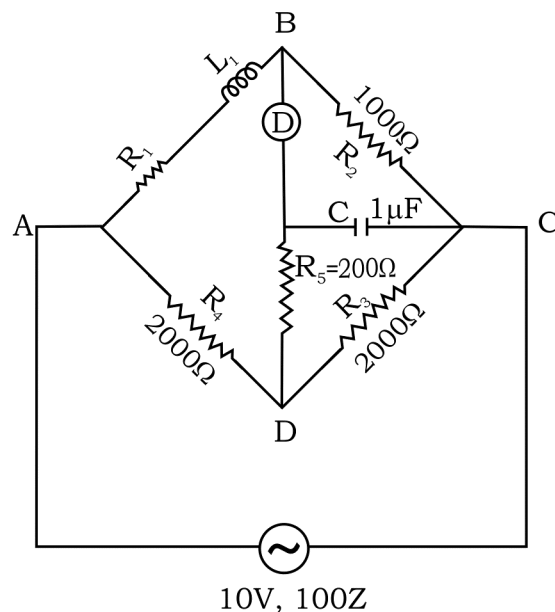
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SECTION – E

V. Answer any **ONE** of the following question : **1 × 10 = 10**

**(Compulsory question for 85 marks scheme only)**

29. (a) Give the theory of BG. Obtain the relation between charge sensitivity and current sensitivity. **6**
- (b) The circuit connection of Anderson's bridge for measuring the inductance  $L_1$  and resistance  $R_1$  of a coil as shown in Fig.



Find  $R_1$  and  $L_1$ , if balance is obtained when  $R_3 = R_4 = 2000 \Omega$ ,  $R_2 = 1000 \Omega$  and  $R_5 = 200 \Omega$ ,  $C = 1 \mu F$ . **4**

30. (a) Explain the procedure for the detection of linearly, circularly and elliptically polarized light. **6**
- (b) Plane polarized light passes through a quartz plate with its optic axis parallel to the faces. Calculate the least thickness of the plate for which the emergent beam (i) will be plane polarized and (ii) will be circularly polarized. Given,  $n_e = 1.553$ ,  $n_o = 1.544$  and  $\lambda = 5000 \text{ \AA}$ . **4**