

MODEL EXAMINATION 2011- 2012

PHYSICS

HSE II

Time: 2¼ hrs

All questions are compulsory

Marks: 60

Cool off time: 15 minutes

1. Match the following:

Electric charge and flux	Bohr	Electric field evaluation
Colours on soap bubble	Coulomb	Dispersion
Line spectrum	Huygen	Interference
	Gauss	Polarisation

(3)

2. A box encloses an electric dipole consisting of charge 5 mc and -5 mc and of length 5 cm . What is the total electric flux through the box? **(1)**

3. The super imposing of light wave is known as interference

(a) Write the relation between path difference and phase difference. **(1)**

(b) Derive an expression for bandwidth of interference pattern in young's double slit experiment. **(2)**

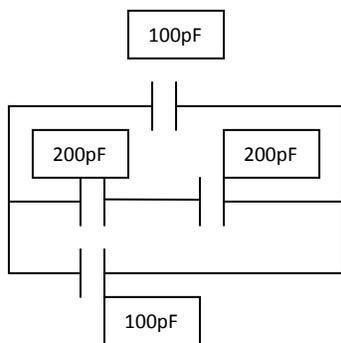
(c) Write the difference between interference and diffraction. **(2)**

4. Microscope is to obtain large image of an object.

(a) Draw the figure which shows the image formation in a compound microscope. **(2)**

(b) Derive the expression for magnifying power of compound microscope. **(2)**

5.



(a) Obtain the equivalent capacitance

(b) Determine the charge and voltage across each capacitor **(3)**

6. The electromagnetic induction was discovered by Faraday

(a) State the laws of electromagnetic induction (2)

(b) The magnetic flux through a coil perpendicular to its plane is varying according to the relation $Q = (4t^3 + 5t^2 + 8t + 5)$ Wb. Calculate the induced current through the coil at time $t = 2s$, if the resistance of the coil is 8.1Ω (2)

7. If the wavelength ' λ ' of spectral lines emitted by hydrogen atom is generally expressed as

$$\frac{1}{\lambda} = R \left[\frac{1}{m^2} - \frac{1}{n^2} \right]$$

(a) Write down the expression for Balmer series of spectral lines. (1)

(b) Find out the shortest wave length of spectral line emitted in Balmer series. (2)

8. According to de Broglie matter exhibits particle s well as wave nature.

(a) What will be the de Broglie wave length of a moving particle and that of a photon? (1.5)

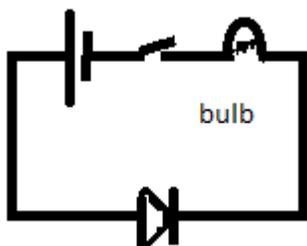
(b) Name the experiment which proves the wave length of electrons. Illustrate the experiment with a suitable diagram. (3.5)

9. As you know diodes are inevitable components of electronic circuits to meet specific requirements of our daily life.

(a) Name the diode which regulates the output of an unregulated supply. (1)

(b) Draw its circuit symbol and general shape of its volt-ampere characteristics (2)

10. A bulb is made to glow using the circuit arrangement given in fig. (I)



(a) If the polarity of the diode is reversed, will there be any change in the glow of the bulb.

Explain ? (2)

11. (a) Which are the rules used for determining the direction of magnetic field produced by a current carrying conductor? (1)

(b) A flexible wire loop of irregular shape, carrying current is located in an external B. Will there be any change in the geometry of the wire. Comment? (2)

(c) An infinite long straight conductor XY carrying a current of 10 A. An electron is moving with a speed of 10^5 m/s parallel to the conductor in air from point A to B. The \perp r distance b/w the electron & the conductor is 20 cm. Calculate the force experienced by the electron? (2)

12. Ramu peddles a stationary bicycle, the pedals of which are attached to a 100 turn coil of area 0.10 sq.m. The coil rotates at half a revolution in one second & it is placed in a uniform B of 0.01 T \perp r to the axis of rotation of the coil. What is the maximum voltage generated in the coil? (2)
13. (a) Graphically represent the variation of stopping potential with frequency of incident radiation on a metal plate. How can the value of Planck's constant be determined from this graph? (2)
- (b) X-rays of wave length λ fall on a photo sensitive surface emitting electrons. Assuming that the work function of the surface can be neglected, Prove that the de-broglie wavelength of electrons emitted will be $\sqrt{[h \lambda / 2 mc]}$ (2)
- (c) Mention some applications of photo-electric effect? (1)
14. (a) Define half-life period of a radioactive substance. Establish its relation with the decay constant? (1)
- (b) Deduce an expression for energy of an electron in an atom on the basis of Bohr atom model? (3)
- (c) Graphically represent the variation of Binding energy / Mass number with Mass number? (1)
15. Considering the electromagnetic spectrum, name the electromagnetic wave which
- (a) Is used to detect fracture in bones.
- (b) Is absorbed by ozone layer of our atmosphere.
- (c) Is produced in nuclear reactions.
- (d) Arrange the above three waves in increase in order of wavelength. (2)
16. Communication is the process of sending information from one place to another by electric signals.
- (a) Name the two types of electric signal. (1)
- (b) Differentiate these signals, giving one example each. (2)
17. One can determine the direction of electric field around a stationary charge with the help of electric field lines.
- (a) What do you know understand by the term 'electric flux'? Give its SI unit. (1)
- (b) State Gauss's theorem in electrostatics and express it in mathematical form. (1)
- (c) Consider a spherical shell of radius 'R' is uniformly charged with charge 'q'. By using Gauss's theorem, find the electric field intensity at a point 'p'.
- (i) Outside this spherical shell
- (ii) Inside this spherical shell (3)