5/10/19

VCD S.Y.B.Sc SEM-IV ATKT PHYSICS-I 2019-20 100 MARKS 3 HRS

Note: (1) All questions are compulsory.

(2) Figures to the right indicate maximum marks.

(3) Use of non-programmable calculators is permitted.

(4) Symbols used have their usual meaning.

Q.1. (A) Choose correct alternative in each of the following: (12)

(i) To note diffraction, the size of the obstacle / slit:

a) Should be much larger than the wavelength.

b) Has no relation to wavelength.

c) Should be of the order of wavelength.

d) Should be $\lambda/2$, where λ is the wavelength.

(ii) Diffraction effect can be observe in

a) Only sound waves b) only light waves c) only ultrasonic waves d) sound and light waves both

(iii) The angle between pass axis of polarizer and analyzer is 45^0. The percentage of polarized light passing through analyzer is

a) 75% b) 25% c) 50% d) 100%

(iv) An optically active compound

a) Rotates the plane of polarized light.
b) Changes the direction of polarized light.
c) Does not allow plane polarized light to pass through.
d) None of these.

(v) The 2's complement form of $(22)_{10}$ is

a) 11110001 b) 01101010 c) 11101010 d) 00010110

(vi) Flip-flop can be used to store

a) one byte data b) one bit data c) two bit data d) two byte data

Q.1. (B) Answer in one statement: (03)

(i) Define wavelength.
(ii) What is meant by polarization of light?
(iii) Define flip-flop.

Q.1. (C) Fill in the blanks: (05)

(i) To observe fraunhoffer diffraction, wavefront should be_____.

(ii) Transverse nature of light was confirmed by the phenomenon of_____ of light.

(iii) The number of nibbles, which make up one byte _____ .

(iv) A flip-flop can be built by using_____ .

(v) Minimum _____ number of flip-flops is required for MOD-5 counter.

Q.2. (A) Attempt any one: (08)

(i) Give the mathematical treatment of intensity distribution in the illuminated region for Fresnel's diffraction phenomenon due to straight edge. Draw necessary diagram.

(ii) Describe the interference phenomenon occurring in Fraunhofer double slit set up. Prove that angular separation for two consecutive minima or two consecutive maxima is equal to $\lambda / (a+b)$.

Q.2. (B) Attempt any one: (08)

(i) Give the theory of plane transmission grating. Draw the diagram of intensity distribution on the screen clearly indicating the positions of secondary maxima and secondary minima.

(ii) What are half-period zones? Show that the radii of half period zones are proportional to the square roots of natural numbers and the area of each half period zone is $\pi b\lambda$.

Q.2. (C) Attempt any one: (04)

(i) a single slit diffraction produces a central maximum of width 0.5cm on a screen placed at 40cm from the lens. Calculate the distance between the first dark and the next bright fringe on the screen. Wavelength of light used is 5890 A^0.

(ii) Light of wavelength 5896 A^0 was allowed to fall normally on a plane diffraction grating having 15000 lines per inch. Calculate the difference in the angles of diffraction in first and second order.

Q.3. (A) Attempt any one: (08)

(i) Discuss theoretically the superposition of two linearly polarized light wave propogating in the same direction having same frequency when the optical vectors are mutually perpendicular to each other for phase difference of odd and even multiple of $\pi/2$.

(ii) Give the properties of calcite crystal. What is optic axis? Explain the double refraction in calcite crystal.

Q.3. (B) Attempt any one: (08)

(i) Describe in brief a) polarization by scattering and b) polarization by selective absorption for producing plane polarized light.

(ii) What are a retarders or wave plates? Explain construction of quarter wave plate. Obtain the equation of the thickness of the quarter wave plates for a given 'λ'.

Q.3. (C) Attempt any one: (04)

(i) For calcite crystal $\mu_0 = 1.55$, and $\mu_E = 1.45$. Find the thickness of a half wave plate for light of wave length 5000 A^0.

(ii) Two Nicols are so oriented that the maximum of light is transmitted. Find to what fraction of its maximum value is the intensity of transmitted light reduces when the analyzer is rotated through 30^0.

Q.4. (A) Attempt any one: (08)

(i) With the help of diagram and truth table explain the working of RS flip flop using NAND gates. Draw the logic symbol of RS flip flop and show how it is converted into D flip flop. Write the truth table for D flips flop.

(ii) Describe three bit binary ripple counter with the help of relevant circuit diagram. Write truth table. Draw also the waveforms.

Q.4. (B) Attempt any one: (08)

(i) What is shift register? Explain each of its type briefly using block symbol.

(ii) Explain a decade counter counting binary sequence. Give its truth table and draw necessary waveforms. Why it is referred to as 8421 decade counter?

Q.4. (C) Attempt any one: (04)

(i) Explain the concept of toggle in negative edge triggered JK flip flop? What are the required values of J and K inputs for the output to toggle in JK flip flop?

(ii) Convert hexadecimal number 7F3F into binary and decimal.

Q.5. Attempt any four: (20)

(i) Distinguish between interference and diffraction.
(ii) Derive an expression for the width of central maximum in case of single slit Fraunhofer diffraction.
(iii) State five application of polarized light.
(iv) State and explain the law of Malus.
(v) Convert decimal number 166.80 into hexadecimal system. Convert hexadecimal number 34D into binary system.
(vi) Using 2's complement arithmetic, find (-A+B) and (-A-B). Given: A=010101 and B= 001010.