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**UNIVERSITI TUN HUSSEIN ONN MALAYSIA**

**FINAL EXAMINATION  
SEMESTER II  
SESSION 2014/2015**

COURSE NAME : BIOMEDICAL OPTIC  
COURSE CODE : BEU41303  
PROGRAMME : BACHELOR OF ELECTRONICS  
ENGINEERING WITH HONOURS  
EXAMINATION DATE : JUNE 2015 / JULY 2015  
DURATION : 2.5 HOURS  
INSTRUCTION : ANSWER **ALL** QUESTIONS

THIS QUESTION PAPER CONSISTS OF **FOUR (4)** PAGES

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- Q1**
- (a) Differentiate light diffraction and interference processes. (4 marks)
  - (b) Light from a laser source of wavelength,  $\lambda=633\text{nm}$  is incident on a glass medium from air at an angle of  $60^\circ$ . Calculate the reflective index of the glass medium if total internal reflection has occurred at this incident angle. (10 marks)
  - (c) A single slit of width  $0.5\text{mm}$  is illuminated with monochromatic light ( $\lambda=630\text{ nm}$ ). A screen is placed  $4.8\text{m}$  from the slit to observe the fringe pattern. Calculate the angle between the second dark fringe ( $m=2$ ) and the central maximum. (11 marks)
- Q2**
- (a) Name **TWO (2)** types of positive lens. (4 marks)
  - (b) List down **FOUR (4)** types of lens aberrations. (4 marks)
  - (c) A real object of height  $20\text{m}$  is at  $10\text{cm}$  from a converging lens with a focal length of  $+5\text{cm}$ . Calculate the position and the size of the image. (10 marks)
  - (d) Lens is made from glass of refractive index  $n$ , with radius of curvatures ( $R_1$  and  $R_2$ ). Estimate the focal length of the lens shown in Figure **Q2(d)** using Lensmaker formula given that  $n = 1.5$ ,  $R_1 = 2\text{cm}$ ,  $R_2 = 10\text{mm}$ . (7 marks)

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- Q3**
- (a) Explain the operating principle of Photomultiplier Tube (PMT). (4 marks)
  - (b) Spectral responsivity of a photosensitive material is the relative efficiency of detection of light as a function of the frequency or wavelength of the signal. Compute the responsivity of a photosensitive material with a quantum efficiency of 5% at 600nm. (4 marks)
  - (c) A P-type intrinsic N-type (PiN) photodiode has quantum efficiency shown in Figure **Q3(c)**. Determine its responsivity at light wavelength of 0.6 $\mu$ m. (9 marks)
  - (d) A detector has a quantum efficiency of 20% at a wavelength of 600nm. At a wavelength of 750nm, the responsivity is twice the responsivity at 600nm. Calculate the quantum efficiency of this detector at 750nm. (8 marks)
- Q4**
- (a) Name **TWO (2)** methods used to produce short laser pulse. (4 marks)
  - (b) List down **ONE (1)** application of laser in medicine and briefly explain its function. (4 marks)
  - (c) One of the keys to the operation of a laser is stimulated emission process in an active medium. Given that in the stimulated emission for a certain helium/neon laser, the energy difference is 1.54eV. Determine the wavelength of light emitted by this laser. (9 marks)
  - (d) Optics is a branch of physics which involves the study of the behaviour and properties of light interacting with matter and the construction of instruments that use or detect it. In your own words and using a simple diagram, summarize the principle of operation of endoscope. (8 marks)

- END OF QUESTION -

FINAL EXAMINATION

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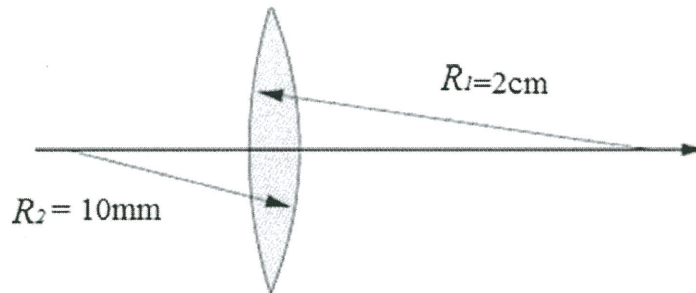


FIGURE Q2(d)

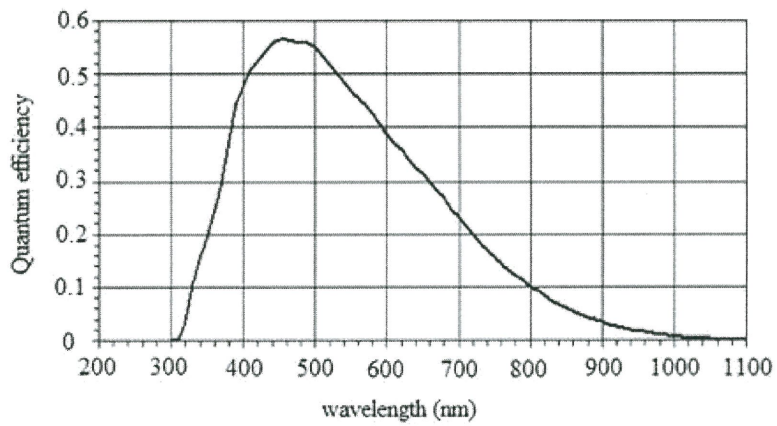


FIGURE Q3(c)