UTHM
Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER I
SESSION 2019/2020

COURSE NAME   : OPTOELECTRONICS

COURSE CODE   : BWC 40603

PROGRAMME CODE   : BWC

EXAMINATION DATE   : DECEMBER 2019 / JANUARY 2020

DURATION   : 2 HOUR 30 MINUTES

INSTRUCTION   : ANSWER **ALL** QUESTIONS

TERBUKA

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

Q1   (a)   (i)   Sketch a simple diagram of total internal reflection (TIR) of light.

(4 marks)

(ii)   Based on the sketched diagram in **Q1(a)(i)**, explain systematically the TIR phenomena.

(4 marks)

(b)   (i)   List **FOUR (4)** types of optical components.

(4 marks)

(ii)   Based on your answer in **Q1(b)(i)**, explain the function of each components.

(8 marks)

Q2   (a)   (i)   Discuss the similarity of Pockels and Kerr effects.

(2 marks)

(ii)   Explain the differences between Pockels and Kerr effects.

(4 marks)

(iii)   Suggest a suitable optical modulator to generate Q-switch pulse for Nd:YAG laser. Justify your answer.

(4 marks)

(b)   Discuss the differences between single mode and multimode fibre?

(4 marks)

(c)   A step index fibre has a core diameter of 100 μm and refractive index of 1.4800. The cladding has a refractive index of 1.4600. The source wavelength is 850 nm. Calculate the

(i)   numerical aperture of the fibre,
(ii)   acceptance angle from air,
(iii)   V-number.

(6 marks)

Q3   (a)   (i)   Sketch a simple diagram of the process of stimulated emission of photon.

(3 marks)

(ii)   Based on the sketched diagram as in **Q3(a)(i)**, explain the process of stimulated emission of photon.

(7 marks)

(b)   Discuss the differences between laser lights and conventional lights.

(6 marks)

(c)   Propose an equipment used to measure laser pulse energy. Justify your answer.

(4 marks)

Q4   (a)   Explain the photoluminescence, cathodoluminescence and electroluminescence.

(6 marks)

(b)   Suggest an optical luminescence based measurement technique used to determine the crystalline properties of a material. Justify your answer.

(4 marks)

(c)   (i)   List **FOUR (4)** advantages of a semiconductor light emitting diode (LED). Explain for each of them.

(8 marks)

(ii)   Suggest **TWO (2)** methods to produce white light LED.

(2 marks)

Q5   (a)   By sketching a simple diagram, explain the working principle of solar cells.

(6 marks)

(b)   Discuss the advantages of a Schottky photodiode.

(4 marks)

(c)   (i)   Explain the analog communication.

(4 marks)

(ii)   Discuss the advantages and disadvantages of amplitude modulation (AM) and frequency modulation (FM) signals.

(6 marks)

- **END OF QUESTIONS** –

3

CONFIDENTIAL

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LIST OF EQUATIONS

$m = \dfrac{Y'}{Y} = \dfrac{-F}{s-F}$	$s' = -ms$
$NA = (n_1^2 - n_2^2)^{1/2}$	$\sin \alpha_{max} = \dfrac{NA}{n_0}$
$V = \left(\dfrac{2\pi a}{\lambda}\right) NA$	$M \approx \dfrac{V^2}{2}$