INTI
International College Penang
LAUREATE INTERNATIONAL UNIVERSITIES

FINAL
Examination Paper

(COVER PAGE)

Session	:	**August 2015**
Programme	:	Diploma In Electrical And Electronic Engineering (DEEI)
Course	:	**EEE2109: Electronic Communication Systems**
Date of Examination	:	8th December 2015 (Tuesday)
Time	:	8:00am – 10:00am
Duration	:	2 Hours Reading Time : Nil
Special Instructions	:	

This paper consists of **SIX (6)** questions. Answer any **FOUR (4)** questions in the answer booklet provided. All questions carry equal marks.

IMPORTANT NOTE : **THIS PAPER SHOULD NOT BE TAKEN OUT OF THE EXAMINATION HALL**

Materials Permitted :
Nil

Materials Provided :
Nil

Examiner(s) : **Mr. Koay Ting Hoo**

Moderator : Dr. Mandeep Singh

This paper consists of 5 printed pages, including the cover page.

INTI INTERNATIONAL COLLEGE PENANG

DIPLOMA IN ELECTRICAL AND ELECTRONIC ENGINEERING PROGRAMME (DEEI)

EEE2109 ELECTRONIC COMMUNICATIONS SYSTEMS
FINAL EXAMINATION: AUG 2015 SESSION

This paper consists of **SIX (6)** questions. Answer any **FOUR (4)** questions in the answer booklet provided. All questions carry equal marks. Answer should be at least in 2 decimals. Boltzmann's constant (k) = 1.38×10^{-23} J/K. Velocity of electromagnetic wave c= 3×10^{8} m/s

Question 1

(1) (a) Explain the following terms ;

(i) Isotropic source. (2 marks)

(ii) Free space. (2 marks)

(iii) Transverse Electromagnetic Wave (2 marks)

(iv) Tropospheric wave propagation and Fading effect (4 marks)

(b) A WIFI router is emitting wave uniformly in all direction and the gain is 20 dBi with the efficiency of 50%. The mobile computer is located at distance that has 10 dB attenuation loss. The environmental loss is 20 dB beside attenuation loss due to distance. The input power to WIFI router is 1 Watt. The WIFI frequency slot used is 5.0 GHz and the bandwidth is 50 MHz.

The mobile computer has noise figure of 3 dB and the patch antenna has gain of 9 dBi. It operates at noise temperature of 17°C. The WIFI signal quality is classified as "poor" if S/N < 28dB, "good" if 28 dB ≤ S/N < 40 and "excellent" if S/N ≥ 40 dB.

(i) Calculate the effective radiated power of WIFI router in dBm. (3 marks)
(ii) Sketch the patch antenna construction and radiation pattern. (3 marks)
(iii) Determine the actual received power by the computer in Watt. (4 marks)
(iv) Calculate the Signal to Noise ratio in dB and determine its signal quality. (5 marks)

Question 2 :

(2) (a) Sketch the construction of magnetron oscillator and describe five (5) differences it has when compared with reflex klystron. (15 marks)

(b) A microwave communication engineer has to use wave guide to transmit the signal of 5.9 GHz over 50 meter distance. He was given a 4 cm diameter circular waveguide.

Table Question 2 : Value of (kr) for the Principal Modes in Circular Waveguides

TE				TM			
MODE	(kr)	MODE	(kr)	MODE	(kr)	MODE	(kr)
$TE_{0,1}$	3.83	$TE_{0,2}$	7.02	$TM_{0,1}$	2.4	$TM_{0,2}$	5.52
$TE_{1,1}$	1.84	$TE_{1,2}$	5.33	$TM_{1,1}$	3.83	$TM_{1,2}$	7.02
$TE_{2,1}$	3.05	$TE_{2,2}$	6.71	$TM_{2,1}$	5.14	$TM_{2,2}$	8.42

(i) Calculate the lowest cutoff frequency, its guide wavelength, propagation speed and its characteristic impedance. (5 marks)

(ii) Beside dominant mode, what other mode(s) the communication engineer can use and the respective bandwidth, characteristic impedance, guide wavelength and propagation speed. (5 marks)

Question 3 :

(3) (a) Sketch the construction of microwave varactor diode with proper labels and explain how it overcomes the effect of microwave frequency. (10 marks)

(b) A Wild life researcher uses 5 elements Yagi Uda antenna with receiver to track the animal movement. This Yagi Uda antenna has 10 dBi gain and 2.4 MHz bandwidth. The horizontal beam width is 30 degree with Front to back ratio of 100.
The collar of animal is a transmitter. The transmitter is an isotropic source that emits signal at 100 MHz. The supply power is 15W. The collar antenna's efficiency is 85%. The battery source is 5V.

(i) Sketch 5 elements Yagi Uda antenna with proper labels of elements (5 marks)
(ii) Calculate the radiation power of transmitting antenna in W (2 marks)
(iii) Explain what is beam width? (1 mark)
(iv) Calculate frequency response of Yagi Uda antenna with proper labels. (2 marks)
(v) Calculate the horizontal polar radiation pattern with proper labels. (2 marks)
(vi) Calculate the coverage distance from animal if the minimum power for receiver attached to Yagi Uda antenna is 10 mW to notice its presence. (3 marks)

Question 4

(4) (a) Describe six (6) differences between Continuous Wave radar and Pulse mode radar that used to measure the speed of moving object.

(12 marks)

(b) An 800 cm fiber optic cable with core of flint glass ($n_1 = 1.5$) and a cladding of crown glass ($n_2 = 1.4$). A laser diode emits 1550nm light is used as an optical source. The numerical aperture for laser diode or pin diode is 0.389. Manufacturer stated the attenuation is 2 dB per meter. There is a mechanical splice at 100 cm, a fusion splice at 200 cm and 500 cm respectively, one macro band at 700 cm. The loss for connection method is as shown in Table Question 4. The light transmitter has maximum power of 0.05 W and the photo receiver has the rise time of 5ps and sensitivity of 0.8 μA/μW and dark current of 2 nA. Assuming semiconductor laser and receiver has design factor of 1.5 dB aging loss each. The S/N ratio required for receiver to function is 40 dB.

Table Question 4

Connection Method	Loss
Mechanical Splice Loss	0.1 dB
Fusion Splice Loss	0.05 dB
Macro Band Loss	4 dB

(i) Calculate the power budget in dB (4 marks)
(ii) Calculate the Fresnel loss, Numerical Aperture loss in dB. (4 marks)
(iii) Evaluate whether the system need a repeater. (5 marks)

Question 5 :

(5) (a) Sketch a simple block diagram for TV transmitter and explain the function of each block.

(10 marks)

(b) The Military fighter plane's radar that can measure speed of moving objects operates at 1.5 GHz with a peak power of 150 kW. The radar's Pulse Repetition Frequency (PRF) is 500 Hz and pulse width is 5.0 μs. A moving enemy plane is detected at 8.0905 radar miles flying toward the fighter plane at 2000 km/h. The fighter plane is travelling at 3000 km/h trying to intercept it.

Calculate the :

(i) Calculate the Doppler frequency detected in the plane. (2 marks)
(ii) Maximum Unambiguous Range for this radar in radar miles. (3 marks)
(iii) Average transmitted power for this radar in dBm. (3 marks)
(iv) Sketch timing diagram in "A" scope for this pulsed radar. (4 marks)
(v) First three blind speed in m/s. (3 marks)

Question 6

(6) (a) Describe the structures and radiation pattern of following types of antenna using a sketch and a written explanation.

(i) Log periodic antenna (6 marks)
(ii) Pyramid horn antenna (6 marks)
(iii) Square loop antenna (6 marks)

(b) A telephone voice channel has 4 kHz. This data is digitized. Each digitized sample uses 8 bits to represent one symbol, pulse width is 0.625 μs. There are many telephone channels to be multiplexed using Time Division Multiplexing (TDM).

(i) Calculate sampling interval in micro seconds. (2 marks)
(ii) Calculate time in micro seconds required to transmit a message (2 marks)
(iii) Determine the maximum number of voice channels per frame. (2 marks)
(iv) Determine the Dynamic Range of voice channel (1 marks)

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