INTI
INTERNATIONAL COLLEGE PENANG (507232-U)
LAUREATE INTERNATIONAL UNIVERSITIES

FINAL
Examination Paper

(COVER PAGE)

Session	:	**AUGUST 2014**
Programme	:	DIPLOMA IN ELECTRICAL AND ELECTRONIC ENGINEERING
Course	:	**EEE2109: ELECTRONIC COMMUNICATION SYSTEMS**
Date of Examination	:	December 10, 2014 (Wednesday)
Time	:	5.00pm – 7.00pm Reading Time : Nil
Duration	:	2 Hours
Special Instructions	:	

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

Students are not allowed to remove the question papers from the examination venue.

Materials permitted :

NON-PROGRAMMABLE SCIENTIFIC CALCULATOR

Materials provided :

Nil

Examiner(s) : **Mr. Koay Ting Hoo**
Moderator : **Dr. Mandeep Singh**

This paper consists of 4 printed pages, including the cover page.

INTI INTERNATIONAL COLLEGE PENANG

DIPLOMA IN ELECTRICAL AND ELECTRONIC ENGINEERING PROGRAMME (DEE/I)

EEE2109 ELECTRONIC COMMUNICATIONS SYSTEMS
FINAL EXAMINATION: AUG 2014 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 in 2 decimals. Boltzmann's constant (k) = 1.38×10^{-23} J/K

Question 1

(1) (a) Compare and contrast five differences between space wave and sky wave.

(10 marks)

(b) A high-gain receiving antenna of G_P = 40 dBi situated on earth station has a noise figure of F = 3 dB, the receiver operates at 17 °C noise temperature. A communication satellite transmits signal to earth station at 10 GHz. The signal's bandwidth is 6 MHz. The transmitter's power to a parabolic antenna is 500 W. The diameter of a parabolic antenna is 60 cm and its efficiency is 95%. The signal encountered connection loss of 3 dB from transmitter to antenna. The satellite is situated at about 35,888 km from the earth. Calculate the :-

(i) Effective radiated power (EIRP) of satellite in dBm (7 marks)
(ii) Received power at the receiver in dBm and signal to noise ratio in decibel (dB).

(8 marks)

Question 2

(2) (a) State/Give five differences between klystron microwave amplifier and tunnel diode microwave amplifier.

(10 marks)

(b) A microwave link connects a rectangular wave guide (5 cm x 2.5 cm) of 50 meter long between a transmitting horn antenna and a transmitter. The connector loss is 3 dB in addition to attenuation loss which is specified by the manufacturer as 0.03 dB per meter under normal operating frequency. The signal carrier frequency is 7 GHz. Determine :-

(i) The lowest cutoff frequency in Giga Hertz and link loss in dB.

(3 marks)

(ii) All possible modes of transmission and their respective characteristic impedance.

(10 marks)

Question 3 :

(3) (a) Describe the differences in the operation of pulsed radar and CW (Continuous Wave) Doppler radar by using a simple sketch of pulsed radar and CW Doppler radar.

(10 marks)

(b) The analog voice sensor can detect the largest sound pressure level (SPL) from 0 to 100 mPa while the smallest recognizable change of SPL is 0.2 mPa. The voice voltage v(t) is shown in equation below:

$v(t) = 1.5 \sin(50t) + 3 \sin(400t) + 0.5 \sin(1600t)$ where $0 < v(t) < 5V$

This signal is sampled, quantized and encoded for digital communication.

(i) Sketch v(t) in frequency spectrum. (3 marks)
(ii) Determine Nyquist frequency for v(t). (1 mark)
(iii) Determine minimum number of bits for linear PCM (Pulse Code Modulation) (1 mark)
(iv) Develop a two-level matrix sum FEC code for 40 mPa SPL. (10 marks)

Question 4

(4) (a) State/Give four differences between the Telemetry, Telegraph and Telephone Communication.

(12 marks)

(b) A 50 meter fiber optic with core of flint glass (n1 = 1.48) and a cladding of crown glass (n2 = 1.42) connects two stations for one way communication. The light is transmitted at 1550 nm with power of 5 W. A laser diode and photo diode are used as an optical source and a receiver. The numerical aperture for laser diode and pin diode are 0.389.

At transmitting side, a 2 to 1 Optical multiplexer is installed for broadcasting stations. At receiving side, a 1 to 5 Optical de multiplexer is installed for receiving stations.

Manufacturer stated the loss of fiber is 0.01 dB per meter. There is one splice loss (0.2 dB) at 25 meter.

(i) Sketch the fiber optical system of above with proper labels. (6 marks)
(ii) Calculate critical angle and cone of acceptance for the fiber. (3 marks)
(iii) Determine the optical power in Watt at one of receiving station. (4 marks)

Question 5 :

(5) (a) Describe the construction of optical cable using a sketch with a proper label for each layer and explain the purpose of each layer.

(10 marks)

(5) (b) The guided-missile tracking radar operates at 5 GHz, with a peak pulse power of 400 kW, a PRF of 1000 pulses per second and the pulse width is 0.8 μs. If the antenna diameter is 3.0 meter, and the radar receiver has an IF (Intermediate Frequency) bandwidth of 3.0 MHz and a 9 dB noise figure operating at noise temperature of 17 ^{o}C. A target of S (radar cross section) = 1 m^2 is detected at 1,000 meter.

Determine the :

(i) Maximum unambiguous range (MUR) in miles. (3 marks)
(ii) Minimum distance in yards. (3 marks)
(iii) Average transmitted power for this radar in dBm. (3 marks)
(iv) Timing diagram showing position of first pulse, echo pulse, second pulse. (3 marks)
(v) Minimum received power to overcome noise effect in dBm. (3 marks)

Question 6

(6) (a) Illustrates three main differences between the following antennas, the answer should include the sketch of structures, voltage/current distribution and radiation pattern.

(i) Rhombic antenna (6 marks)
(ii) Marconi antenna (6 marks)

(b) NTV 7 broadcasts signals using Channel 37 with carrier frequency at 599.25 MHz. A household is using a 1080i High Definition Television to watch NTV 7 program.

(i) Calculate the color carrier, picture carrier and sound carrier for NTV 7. (3 marks)

(ii) Determine bandwidth for video and sound of NTV 7 signal. (2 marks)

(iii) Sketch radio frequency response of PAL TV in frequency spectrum. (3 marks)

(iv) Explain the meaning of 1080i and its scanning method. (2 marks)

(v) Calculate resolution in pixels 1080i TV. (1 mark)

(vi) Determine the formula that represent color chrominance if red is represented by R, green by G and blue by B. (2 marks)

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