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

FINAL
Examination Paper

(COVER PAGE)

Session	:	JANUARY 2014
Programme	:	**DIPLOMA IN ELECTRICAL AND ELECTRONIC ENGINEERING**
Course	:	**EEE 2109 : ELECTRONIC COMMUNICATION SYSTEMS**
Date of Examination	:	13 March 2014
Time	:	11.00am – 1.00pm 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.

Materials permitted :

Nil

Materials provided :

Nil

Examiner(s)	:	**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 (DEEI)

EEE2109 ELECTRONIC COMMUNICATIONS SYSTEMS
FINAL EXAMINATION: JAN 2014 SESSION

This paper consists of **SIX (6)** questions. Answer any **FOUR (4)** questions in the answer booklet provided. All questions carry equal marks. Boltzmann constant = 1.38×10^{-23} J/K)

Question 1

(1) (a) A cell phone transceiver has an isotropic antenna broadcast a 3G cellular signal at 1.8 GHz. A smart phone received the signal has a microstrip antenna with directivity of 10 dBi. The smart phone receiver has a noise figure (NF) of 2. The isotropic antenna has radiation resistance of 50 Ω and antenna resistance of 2.5 Ω. The signal power at broadcast station is 5 Watt. The noise temperature is 17°C. Determine the:

(i) capture area of smart phone receiver. (4 marks)
(ii) effective radiated power of broadcast antenna in dBm. (7 marks)
(iii) main differences between the cellular and land line phone system. (4 marks)
(iv) S/N in dB of reception if bandwidth is 1.25 Mega Hertz at 2000 m from the broadcast station in free space. (8 marks)
(v) quality of image and sound received in the smart phone (2 marks)

Question 2

(2) (a) Compare the three major differences between a reflex klystron oscillator and a magnetron oscillator by an appropriate drawing. (10 marks)

(b) A microwave oven uses a waveguide to transmit 2.45 GHz electromagnetic wave to heat the food. The waveguide must be installed in a limited space of 10 cm x 10 cm (100 cm^2). Determine the:

(i) propagation modes that can be transmitted if a circular waveguide is used and the maximum number of modes that can be used. [Use table 10.2] (5 marks)
(ii) propagation modes that can be transmitted if a rectangular waveguide is used and the maximum number of modes that can be used. (7 marks)
(iii) type of waveguide that can allow more propagation modes (1 mark)
(iv) two reasons for rectangular waveguide not used (2 marks)

TABLE 10-2 Values 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	$TM_{0,1}$	2.40	$TM_{0,2}$	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

Question 3

(3) (a) Compare the five differences between Time Division Multiplexing (TDM) and Frequency Division Multiplexing (FDM) used in telecommunication.

(10 marks)

(b) An MTI radar operates at 5.5 GHz, with peak pulse power at 1 kW and pulse repetition frequency (PRF) of 2000 pps. The pulse width is 5 microseconds. An enemy plane (target) is travelling at 300 km/h horizontally in the sky. The plane is at 50 km, 45° from the mounted MTI radar at time of scan as shown in Fig 1.0.

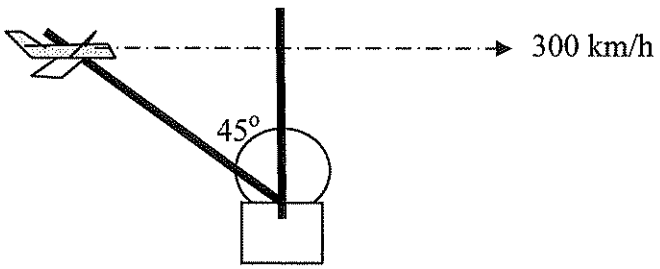

Fig 1.0 – MTI radar

Calculate the :

(i) minimum range in yards. (2 marks)
(ii) average power for this radar and its target time (4 marks)
(iii) doppler frequency (4 marks)
(iv) lowest two blind speeds of the radar (2 marks)
(v) Illustrate graphically how MTI radar displays moving target. (3 marks)

Question 4 :

(4) (a) Sketch a typical outdoor fiber optic cable and label the layer.

(5 marks)

(b) A fiber optical system is using graded-index 85/125μm MMF for 1550 nm light transmission. The refractive index of core is 1.5 and cladding is 1.45. The fiber cable is 20 km long and cable loss is 0.4 dB/km. There are two fiber patch panel, one near the transmission and one near the reception. The APD photodiode used has R = 70A/W and dark current is 5 nA. The laser and APD diode has 100μm diameter and NA = 0.3 and connected to fiber directly. Fiber patch panel has losses of 2.0 dB per patch panel.

(i) Calculate the minimum signal power in dBm to meet S/N > 40 dB for ideal fiber optical system (i.e. lossless system) (4 marks)
(ii) Calculate the critical angle of the fiber and cone of acceptance. (3 marks)
(iii) Determine the power budget in dB if laser source has 10W. (2 marks)
(iv) Describe the three possible losses when light is coupled to fiber. (3 marks)
(v) Calculate the total losses in the above fiber optical system. (6 marks)
(vi) Sketch the fiber propagation mode of this fiber. (2 marks)

Question 5

(5) (a) There are 10 analog inputs been converted into digital data and multiplexed into a single pulse coded modulation (PCM) frame before amplitude modulated and transmitted. Each analog input is produced by motor tachometer that registered variation as high as 10,000 revolutions per second. The tachometer has output from -5 V to 5 V with required resolution of 0.01V. Each PCM frame is identified by a sync bit. Determine the :

(i) Minimum sampling rate for Analog to Digital A/D (3 marks)
(ii) Dynamic range of analog signal. (3 marks)
(iii) Quantization Signal to Noise in dB. (3 marks)
(iv) Minimum transmission speed of the PCM channel and whether 5 MHz cable is suitable to transmit it. (3 marks)
(v) Maximum pulse width. (3 marks)
(vi) Encoded data bit for '10111011' into Hamming code. (10 marks)

Question 6

(6) (a) Compare one major difference of the following:
(i) Hertzian antenna versus half wave dipole antenna
(ii) Microstrip and stripline device
(iii) Luminance versus chrominance
(iv) Shadow mask versus aperture mask
(v) Packet switching versus circuit switching

(10 marks)

(b) An isotropic transmitter is transmitting signal of 10 GHz and the average power is 10mW. A horn antenna receiver has antenna gain of 20 dB and at 5 meter from the transmitter. The noise temperature for the receiver is 290 Kelvin and noise figure (NF) is 3dB. The bandwidth of information is 20 MHz. The horn antenna is connected using a rectangular waveguide (2 cm x 1 cm) of 25 cm using TE(1,0) to receiver.

(i) Determine the effective capture area of horn antenna. (2 marks)
(ii) Determine the power received at horn antenna. (2 marks)
(iii) Sketch and name three basic types of horn antenna. (6 marks)
(iv) Determine the power attenuation for 1 GHz signal at waveguide. (2 marks)
(v) Evaluate the S/N in the receiver for good image reception. (3 marks)