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

FINAL
Examination Paper

(COVER PAGE)

Session	:	JANUARY 2012
Programme	:	DIPLOMA IN ELECTRICAL AND ELECTRONIC ENGINEERING
Course	:	**EEE 2109: ELECTRONIC COMMUNICATIONS SYSTEMS**
Date of Examination	:	17 April 2012
Time	:	11a.m. – 1p.m. 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	:	NON-PROGRAMMABLE SCIENTIFIC CALCULATOR Nil
Materials provided	:	Nil
Examiner(s)	:	**Koay Ying Hoo**
Moderator	:	**V.Meenakshi**

This paper consists of 5 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: JAN 2012 SESSION

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

Question 1

(1) (a) (i) Describe **two** recently developed means of beyond the horizon wave propagation for microwave communication.

(6 marks)

(ii) With the aid of the circuit diagram of a simple color matrix, show how the *I, Q* and *Y* signals are generated in a color TV transmitter. Calculate typical values for resistors used in the Y and I components on your matrix.

(7 marks)

(iii) Explain the scanning process of TV that make television capable of displaying complete moving pictures.

(4 marks)

(b) A TV broadcast station has an isotropic antenna at height 1600m above ground, the radiated power is 10kW. A home viewer installed a Yagi-Uda antenna of effective capture area $2m^2$ at the height 16m above ground. The antenna feed to a 32" TV of 3db noise figure. TV's bandwidth is 7MHz and TV operates at 25°C, located 10km away from broadcast station.
Note : (Boltzmann constant = $1.38x10^{-23}$J/K)

(i) Calculate the radio horizon of transmitting antenna in meter.
(ii) Calculate the noise power generated in TV in watt.
(iii) Calculate the signal power received in dbm assuming in a free space.
(iv) Sketch the Yagi-Uda antenna and properly label radiator, reflector, director and boom.

(8 marks)

Question 2

(a) Describes two types of multiplexing schemes used in telephone communication system and illustrate your descriptions with usage examples.

(8 marks)

(b) Using illustration an example of each, explain the differences between the resonant antenna and non resonant antenna

(8 marks)

(c) A standard rectangular waveguide has a broad base dimension a =3 cm, calculate its cut off frequency, the guide wavelength, the group and phase velocities and the characteristic impedance for the $TM_{1,1}$ mode. The signal propagated at 12GHz.

(9 marks)

Question 3

(a) Describe five differences of the two-cavity klystron amplifier and a traveling tube amplifier in terms of principle of operation and construction, with the aid of a schematic diagram which shows the essential components of the klystron.

(10 marks)

(b) List out five types of lasers source and its common characteristics.

(5 marks)

(c) An optic fiber system OC-3 (155Mbps) consists of a laser, a 2.5km fiber optic and a photodiode. There are two installation splices (Splice loss is 0.5db for each splice) and three connectors (Connector loss is 1db each). The laser has rise time of 2ns and a capacitance of 3pF. The core of fiber optic is flint glass (n_1=1.61) and a cladding of crown glass (n_2=1.52). The light transmitted is 1550nm, the core diameter is 1.5μm and attenuation of 1.2 db/km. The photodiode responsivity is 0.5A/W. The launching power is from 0.1mW to 1mW and the receiver functions from 0.5μA to 0.25mA. No aging and dispersion margins are required.

(i) Calculate bandwidth for laser and evaluate its suitability for OC-3.
(ii) Calculate the maximum and minimum launching power in dbm.
(iii) Calculate the maximum and minimum receiver sensitivity in dbm.
(iv) Determine the total loss in the optical fiber system in db.
(v) Calculate the critical angle and cone of acceptance for the optical fiber.

(10 marks)

Question 4 :

(a) (i) Discuss the capabilities and applications of varactor and snap-recovery diode frequency amplifier.

(6 marks)

(ii) Describe operation and construction of a 2.5GHz SAW resonator. Calculate the acoustic wavelength. Illustrates answer with sketches of labeled components.

(7 marks)

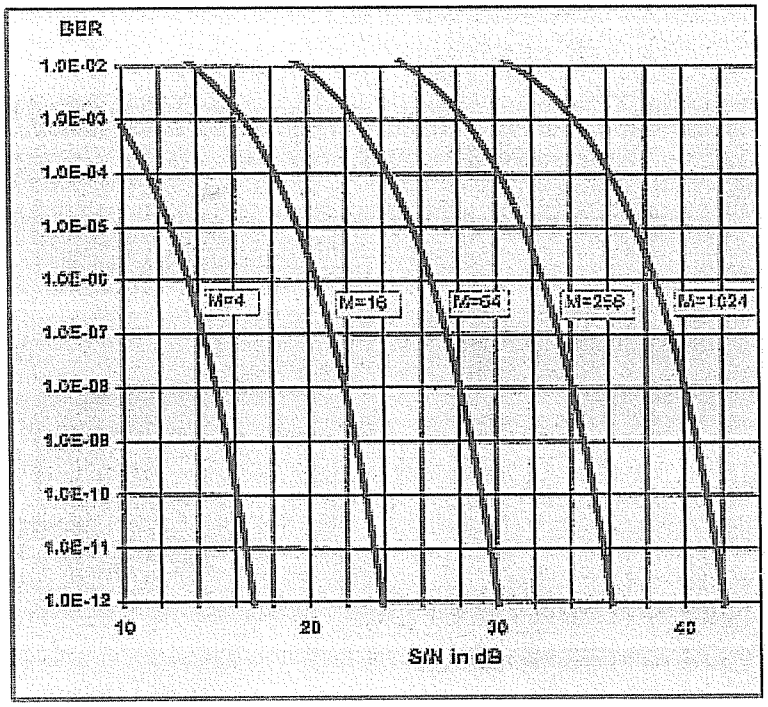
(b) A policeman uses a Doppler radar of peak pulse power at 500kW to track the speed of incoming vehicles. The transmit frequency is 5GHz, the receiver IF bandwidth is 1.5MHz and a 9db noise figure. The antenna is parabolic disc of A_P=600. It is operating at 17°C. The effective cross-section area of a normal car is $20m^2$

(i) Calculate the minimum receivable signal in a radar receiver. (2 marks)
(ii) Determine the beamwidth between nulls of the antenna. (2 marks)
(iii) Calculate the maximum range in km of the radar system. (2 marks)
(iv) Calculate the Doppler frequency for car traveling at 50km/h. (2 marks)
(v) Explain briefly <u>two (2)</u> antenna tracking methods. (2 marks)
(vi) Suggest <u>two (2)</u> methods to avoid the speed trap by policeman. (2 marks)

Question 5

(a) Discuss two fundamental differences between propagation in waveguides and propagation in a free space. (4 marks)

(b) A radio telemetry system is connected to four temperature sensors. First two sensors (Channel 1 and 2) measurement changes at one every 10 microseconds. Second two sensors (Channel 3 and 4) measurement changes at 1KHz rate. The measurements are digitalized, multiplexed and modulated using PCM/AM system. It is transmitted and received in a free space through Marconi antenna at 1.9 GHz. Each sample has 8bits. The pulse width is 1μs and a sync bit added for each frame.



(i) Draw the block schematic and explain the above PCM/AM telemetry system. (10 marks)

(ii) Calculate the minimum sampling rate required for channel 1and 3. (2 marks)

(iii) Calculate antenna's length and sketch its radiation pattern. (2 marks)

(iv) Determine the minimum bandwidth for this PCM/AM system. (2 marks)

(v) The minimum and maximum temperature is -15°C to 35°C and the required resolution is 0.1°C. Evaluate the suitability of 8 bits linear ADC. (2 marks)

(vi) If radiated power is 100mW, determine suitability of receiver (Noise Figure = 3db, Bandwidth= 2MHz, temperature =17°C) to ensure Bit error rate (BER) of less than 1 per 1000 bits at 1km. Antenna gain = 5 dbi. (3 marks)

Question 6

(a) Explain the following terms:

(i) Error Correction and Error Detection in Digital Data Communication.
(ii) Frequency Pulling and Frequency Pushing in Microwave tube.
(iii) Grounded antennas and ungrounded antenna.
(iv) Cassegrain feed and Normal horn feed parabolic antenna.
(v) Shadow mask versus aperture grill (tension mask) in TV display tube

(10 marks)

(b) A tunnel diode of r_s=6Ω, L_s=0.1nH, C_j=0.6pF and R=-75Ω is used as a tunnel diode amplifier with circulator to receive signal from an isotropic source. The efficiency of antenna is 99%. When current feed is 200mA, it radiated 2 Watt.

(i) Draw the tunnel diode equivalent circuit. (2 marks)
(ii) Calculate the cutoff frequency of tunnel diode. (1 mark)
(iii) Determine the antenna radiation resistance and antenna resistance. (2 marks)
(iv) Draw schematic of a tunnel diode amplifier and explain. (8 marks)
(v) Calculate the power gain in db for a perfectly matched load. (2 marks)

--THE END--

EEE2109 THKOAY Jan 2012