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

FINAL
Examination Paper

(COVER PAGE)

Session	:	April 2013
Programme	:	Diploma in Electrical and Electronic Engineering Programme
Course	:	**EEE2109 : Electronic Communication Systems**
Date of Examination	:	30 July 2013
Time	:	5p.m. – 7p.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 : 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: APRIL 2013 SESSION

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

Question 1

(1) (a) Describe the characteristics of different layers of ionosphere and its effect on High Frequency (HF) electromagnetic wave. (10 marks)

(b) A TV broadcast station has an isotropic antenna at height 1600 m above ground, the radiated power is 10 kW. A home viewer installed a 5 elements Yagi-Uda antenna of effective capture area 2 m^2 at the height 16 m above ground. The antenna feed to a 32" TV of 3 dB noise figure. TV's bandwidth is 7 MHz and TV operates at 25°C, located 10 km away from broadcast station.

(i) Calculate the radio horizon of transmitting antenna in meters. (2 marks)
(ii) Calculate the noise power generated in TV in Watt. (3 marks)
(iii) Calculate the signal power received in dBm in a free space. (3 marks)
(iv) Determine the Signal to Noise ratio for TV receiver. (1 mark)
(v) Evaluate the Quality of TV Signal received. (1 mark)
(vi) Sketch the Yagi-Uda antenna and labels radiator, reflector, directors and boom. (5 marks)

Question 2

(a) Describes two types of multiplexing techniques used in telephone communication and illustrate your descriptions with usage examples. (8 marks)

(b) Describes four differences between the resonant antenna and non resonant antenna, refers to antenna structure, radiation pattern, current/voltage distribution and production of standing wave. (8 marks)

(c) A standard rectangular waveguide has a broad base dimension a =3 cm and the signal propagated at 12 GHz at $TM_{1,1}$ mode. Calculate
(i) cut off frequency, (4 marks)
(ii) the guide wavelength, (2 marks)
(iii) the group and phase velocities and the characteristic impedance. (3 marks)

Question 3

(a) With the aid of cross-section 8 resonant cavities of hole-and-slot magnetron, properly labeled the parts and describe its working principles.

(10 marks)

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

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

Question 4 :

(a) Sketch a diagram of microwave varactor diode construction. Label the material used to make contact, package tube body, semiconductor die and wire.

(8 marks)

(b) A policeman uses a Doppler radar of peak pulse power at 500 kW to track the speed of incoming vehicles. The transmit frequency is 5 GHz, the receiver IF bandwidth is 1.5 MHz and a 9 dB 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 20 m^2.

(i) Calculate the minimum receivable signal in a radar receiver. (2 marks)
(ii) Determine the beam width 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 **two (2)** antenna tracking methods. (2 marks)
(vi) Suggest **two (2)** methods to avoid the speed trap by policeman. (2 marks)

(c) Explain how microwave varactor overcomes problems caused by high frequency.

(5 marks)

Question 5

(a) Navy ships use carrier frequency of 50 kHz for ship to ship radio navigation and maritime communication. However, Command center in Colorado and Hawaii uses carrier frequencies of 7 MHz and 5 MHz to broadcast news to the ship.

(i) State the range of frequencies and the appropriate wave propagations used by navy ships and command center. (6 marks)

(ii) Explain why the electromagnetic energy from ships eventually disappears. (2 marks)

(iii) Define the term fading and suggest methods to overcome the fading in news broadcasting. (2 marks)

(b) A common cathode triode amplifier has g_m=4 mA/V and r_p =8 kΩ, the anode series inductance is 1.59 μH and anode to cathode capacitance of 6.28 pF. The anode load is R_L=40 kΩ.

(i) Explain two causes of gain deterioration at microwave frequency. (2 marks)

(ii) Calculate the voltage gain at 5 kHz (2 marks)

(iii) Sketch the equivalent circuit for this triode amplifier at 1 GHz (6 marks)

(iv) Calculate voltage gain and phase shift at 1 GHz (5 marks)

Question 6

(a) Explain the following terms:

(i) Cassegrain feed and Normal horn feed parabolic antenna. (6 marks)

(ii) Shadow mask versus aperture grill in TV display tube (4 marks)

(b) A digital signal from the flying wheel has a maximum signal power at 15 mW and minimum signal at 0.1 mW. The flying wheel is actually spin at a revolution of 100 to 3100 Hz. S/N required for channel is 30 dB. The data is transmitted through the standard telephone channel of 4 kHz.

(i) Calculate the capacity of a standard telephone channel in bps. (3 marks)

(ii) Calculate minimum number of bits and quantization level. (3 marks)

(iii) Determine minimum Signal to Noise in dB required for (ii). (3 marks)

(iv) Sketch the Unipolar NRZ format of 0101_2, with start and stop bit. (3 marks)

(v) Determine the matrix sum code for 111100011011_2. (3 marks)

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