THE MOMBASA POLYTECHNIC UNIVERSITY COLLEGE

(A Constituent College of Jkuat)

Faculty of Engineering and Technology

DEPARTMENT OF ELECTRICAL AND ELECTRONIC ENGINEERING

DIPLOMA IN TECHNOLOGY
TELECOMMUNICATION & INFORMATION ENGINEERING

EET 2310: COMMUNICATION SYSTEMS II

SPECIAL/SUPPLEMENTARY EXAMINATION

SERIES: OCTOBER 2011

TIME: 2 HOURS

Instructions to Candidates:

You should have the following for this examination

- *Answer booklet*
- *A non-programmable scientific calculator*

This paper consists of **FIVE** questions. Answer question **ONE (COMPULSORY)** and any other **TWO** questions

Maximum marks for each part of a question are clearly shown.

This paper consists of **FOUR** printed pages

SECTION A (COMPULSORY)

Question 1

a) (i) Explain any **TWO** factors that influence the distance covered by ground wave

(ii) With the aid of diagrams, describe duct propagation

(iii) A 100m antenna is transmitting at 1.5 MHz by ground wave and has antenna current of 10A rms. Determine the voltage received by a receiving antenna having a height of 3m at a distance of 50km away (12 marks)

b) (i) Explain the meaning of the term end effect as applied in aerials

(ii) Explain why the dipole is folded in the Yagi aerials

(iii) With the aid of a diagram, explain the operation of a three element Yagi array (11 marks)

c) (i) Explain any **THREE** problems associated with mismatched transmission lines

(ii) A high frequency transmission line of negligible loss has a characteristic impedance of 50 Ω and is terminated by a load of impedance 100 +j20.

Calculate:

i. Voltage reflection coefficient

ii. Voltage standing wave ratio on the line (7 marks)

SECTION B (Answer *any TWO questions from this section - 20 marks each*)

Question 2

a) (i) State and explain any **TWO** reasons why waveguides are preferred to coaxial cables at microwave frequencies

(ii) Draw an amplitude vs distance (wavelength λ) diagram to illustrate the formation of Standing waves in a lossless line terminated in a short circuit (6 marks)

b) (i) Define the term **voltage reflection coefficient** as applied to transmission lines

(ii) Show that the voltage reflection coefficient ρ_v is given by;

$$\rho_v = \frac{Z_L - Z_0}{Z_L + Z_0}$$

where Z_L = load impedance

Z_o = characteristic impedance (6 marks)

c) A transmission line of Z_0 = 50 Ω is terminated by a 20-j20 Ω. Use the smith chart to determine:

i. Voltage reflection coefficient
ii. Voltage standing wave ratio
iii. Length and position of a $\frac{\lambda}{4}$ transformer to be connected to provide correct match (8marks)

Question 3

a) Define the following terms:

i. Effective radiated power (EIRP)
ii. Radiation resistance

b) (i) Explain with the aid of a diagram, how electromagnetic waves are radiated from a $\frac{\lambda}{2}$ dipole

(ii) Given that the electric field strength of a current element of dl is given by:

$$\frac{60\prod ldl\sin\theta}{\lambda d}V/m$$

, show that the radiation resistance of such an aerial is given by: $Rr = 80\prod^2\left(\frac{dl}{\lambda}\right)^2$ ohms (12 marks)

c) A monopole aerial is 25m high and it is supplied with current of 100A at 150 kHz. Assuming the current distribution on the aerial to be linear, calculate:

i. The power radiated by the aerial
ii. The field strength produced at ground level at appoint 80km (6 marks)

Question 4

a) Explain the following terms as applied to wave propagation
(i) Sporadic E
(ii) Fading

b) (i) State the **TWO** advantages and any **ONE** disadvantage of propagation of radio swaves as low frequencies

(ii) With the aid of a characteristic curve, explain how the received space signal strength varies with height

(iii) with the aid of diagram, describe tropospheric scatter propagation (13 marks)

c) At a particular time of the day, the E layer has a maximum electron density of 1.8×10^{11} electron/m^3 and it is at virtual height of 140km. Calculate:

i. The critical frequency

ii. Maximum ground range

Take radius of earth = 6400km (3 marks)

Question 5

a) (i) Explain why the F layer exists even at night

(ii) State any **ONE** effects of each of the following ionospheric variations

- Sun spots
- Ionospheric storms

(iii) An aerial is mounted 200m above flat earth. The distance between the transmitting and Receive aerial is 30 km and the frequency is 180MHz. Calculate the minimum height at which the received aerial should be mounted to receive the maximum field strength (10 marks)

b) (i) State any **TWO** differences between resonant and non resonant antennas

(ii) Explain the reasons for using antenna arrays systems

(iii) Draw a diagram to illustrate the following feed arrangements

- Cassegrain
- Offset

(iv) Explain any **TWO** disadvantages of the front feed arrangement (10 marks)