

15

Name of the Program: B.Sc. in EEE
Semester: 5th

Date: 6 October, 2023
Time: 10:30 am – 12:00 pm

ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)
ORGANISATION OF ISLAMIC COOPERATION (OIC)
DEPARTMENT OF ELECTRICAL AND ELECTRONIC ENGINEERING

Mid-Semester Examination
Course No.: EEE 4541
Course Title: Wireless Communication

Winter Semester, A. Y. 2022-2023
Time: 90 Minutes
Full Marks: 75

There are 3 (three) questions. Answer all 3 (three) questions. The symbols have their usual meanings. Programmable calculators are not allowed. Marks of each question and corresponding COs and POs are written in the brackets.

1. a) Assume that IUT wants to set up a new network with 10 Gbps capacity throughout the campus, which often requires around 300 ft long connections. Recommend a particular type of cable for the network considering cost and effectiveness. 4
(CO1, PO1)
- b) Explain how the waveguide can carry a signal despite its single-sided closed cross-section. 5
(CO1, PO1)
- c) The gain of antenna A is higher than that of antenna B. Determine which of these parameters are higher for antenna A and which are higher for antenna B: physical size, directivity, HPBW, and effective aperture. 6
(CO1, PO1)
- d) A plane EM wave is propagating through a waveguide, which is filled in with material A. The relative permeability of A is 1. The EM wave is propagating at velocity 1.5×10^8 m/sec. The magnetic field intensity of the EM wave is 0.04 amp/cm. The cross-sectional area of the waveguide is 15 cm^2 . Determine how much power is flowing through the waveguide. 10
(CO2, PO2)
2. a) Formulate an expression for received power in the case of two-ray model for a large distance between the transmitter and the receiver. 12
(CO1, PO1)
- b) A base station transmits signal and a phone receives it. There is a knife-edge blockage between the base station and the phone. The 38 m high blockage is 3 km away from the base station and 2 km away from the phone. In addition, the phone is inside a building (located next to the outer wall) and the building has a building penetration loss (BPL) of 5 dB. The transmitting antenna is located at a height of 40 m on the base station. The phone is located at a height of 20 m from the ground. The gain of the transmitting antenna is 13 dB. The effective aperture of the receiving antenna is 4 cm^2 . The minimum required power at the phone is -85 dBm . The frequency of the signal is 6 GHz. Determine the minimum required transmitted power. 13
(CO2, PO2)

$$[G \text{ (dB)} = 20 \log \left(0.4 - \sqrt{0.1184 - (0.38 - 0.1v)^2} \right) \quad 1 < v < 2.4$$

$$G \text{ (dB)} = 20 \log \left(\frac{0.225}{v} \right) \quad v > 2.4]$$

3. a) "The Doppler shift f_d increases if the frequency of the transmitted signal increases" – find out its reason. 6
(CO1, PO1)
- b) A voice call uses a spreading factor (SF) of 128 in UMTS. Determine its data rate. 7
(CO2, PO2)
- c) The power delay profile for a multipath environment is shown in Figure 1. The coherence time is 5 microseconds. Determine whether the multipath environment is underspread or overspread. 12
(CO2, PO2)

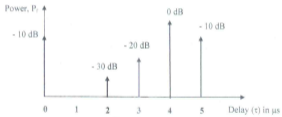


Figure 1