Sixth Semester B.E. Degree Examination, Dec.2019/Jan.2020
Antennas and Propagation

Time: 3 hrs.

Max. Marks:100

Note: *Answer any FIVE full questions, selecting
at least TWO questions from each part.*

PART – A

1   a. Derive an expression for the maximum effective aperture and directivity. **(08 Marks)**
    b. State and prove FRISS transmission formula for radio communication link. **(08 Marks)**
    c. A radio link has a 26 Watts transmitter connected to an antenna of $1.8 \ m^2$ effective aperture at 5 GHz. The receiving antenna has an effective aperture of $0.7 \ m^2$ and is located at 10 km. Find the power delivered to the receiver. **(04 Marks)**

2   a. Derive an expression and draw the field pattern for 2 isotropic point sources of the same amplitude and same phase. **(10 Marks)**
    b. Show that the directivity for unidirectional operation is $2(n + 1)$ for an intensity variation of $U = U_m \cos^n \theta$. Also verify the expression for n = 3 and compare with the exact directivity. **(07 Marks)**
    c. State and prove power theorem. **(03 Marks)**

3   a. Derive the expression for the far field pattern of thin linear antenna. **(10 Marks)**
    b. Derive the radiation resistance of $\lambda/2$ dipole. **(10 Marks)**

4   a. Explain Babinet's principle with illustrations. **(05 Marks)**
    b. Write a note on patch antenna. **(05 Marks)**
    c. Derive the expression for radiation resistance of loop antenna and also find directivity of small loop and large loop. **(10 Marks)**

PART – B

5   a. With neat sketch, explain the design criteria of horn antenna. **(06 Marks)**
    b. Calculate directivity of rectangular horn antenna whose height of 78 cm and width of the mouth 8 cm. It operates at 9.6 GHz. Take Aperture efficiency η as 68%. **(04 Marks)**
    c. Explain the design of log periodic antenna and analyze the three regions of log periodic antenna. **(10 Marks)**

6   a. Explain a Yagi-Uda antenna structure with a neat diagram. **(06 Marks)**
    b. Design a 3 element Yagi-Uda antenna to operate at a frequency of 225 MHz. **(04 Marks)**
    c. Write a note on turnstile antenna and antennas for Ground Penetrating Radars. **(10 Marks)**

7   a. With a neat sketch, explain and derive an expression for skip distance in terms of critical frequency and the maximum useable frequency f_{MUF}. **(10 Marks)**
    b. Define critical frequency and virtual height with sketches. **(06 Marks)**
    c. Calculate the critical frequency for reflection at vertical incidence if the maximum electron density is $1.52 \times 10^6/cm^3$. **(04 Marks)**

8   a. Draw and explain the characteristics of different ionized layers. **(10 Marks)**
    b. Derive an expression for the refractive index of ionosphere. **(06 Marks)**
    c. A HF radio link is established for a range of 2500 km. If the reflection region of the ionosphere is at a height of 250 km and has a critical frequency of 7 MHz. Calculate maximum useable frequency f_{MUF}. **(04 Marks)**

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24 JAN 2020