Roll No: --------------------------

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES

End Semester Examination, December 2017

Program: B.Tech (Electronics Engg) **Semester – V**
Subject (Course): Antenna & Wave Propagation **Max. Marks : 100**
Course Code :ELEG 361 **Duration : 3 Hrs**
No. of page/s: 02

Part-A

Attempt All questions: **(5x4=20)**

1. Derive Lorentz Gauze condition.

2. Derive Friss transmission formula

3. Prove that R=(4/3)a where a is the actual radius of earth.

4.Calculate the FNBW, HPBW and gain of parabolic reflector antenna with diameter of 5λ operating at 6 GHz.

5. Design a binomial array of 5 elements and find an array factor. Spacing between the elements is λ/2.

Part-B **(4x10=40)**

6. Derive the array factor for n-element linear array with uniform excitation. Deduce the condition for Broad side array, End fire array and main beam to be focused at 30 deg.

7. Explain the following: Critical frequency, maximum usable frequency and skip distance with the support of suitable mathematical expression derivation.

8. Illustrate with neat block diagram how the range and Gain of an antenna are measured. How will you protect the source.

9.. Deduce the directivity and gain for the following pattern by integral method and by approximate method.

$P=P_m \sin^2\theta \sin^3\phi$ (θ & ϕ =0 to π)

Part- C (2x20=40)

9. Derive the field expressions for E-plane sectoral horn.

10a). Design the microstrip patch antenna operating at 10 GHz. Realize the structure with RT-Duriod 5880 substrate(er=2.2, h=0.762mm).

b). Design five turn helical antenna to operate at 300 MHz in axial mode. Find the terminal impedance, axial ratio, circumference of the helix, over all length of the helix and the directivity of the antenna with the spacing between the turns is λ/20.

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Part-A

Attempt All questions: **(5x4=20)**

1. Design the 5-element yagi-uda antenna operating at 450 MHz.

2. Calculate the FNBW, HPBW and gain of parabolic reflector antenna with diameter of 8λ operating at 6 GHz. Calculate the increase in gain if the diameter of the antenna is doubled.

3. Explain multihop propagation and multipath propagation.

4. Derive the expression $D = (4\pi/\lambda^2)\, Ae$

5. Find the array factor and Directivity of 3 element linear array with central element excited with "jEo" and other two elements are excited with' Eo' and '–Eo' respectively. Assume the spacing between the elements is λ/4.

Part-B **(4x10=40)**

6. Prove that $n=\mathrm{sqrt}(1-81N/f^2)$

7. Calculate the power received by receiver antenna having the height of 4 Km from the ground if the transmitter antenna is kept at a height of 4.5 km from the ground. It is expected that system is under LOS and the distance between the txer and rxer is radio horizon. Gain of both antennas is 7dB each and power transmitted is of 1 mw. Frequency of operation is at 5 GHz.. Deduce the expression for radio horizon.

8. Design the microstrip patch antenna operating at 10 GHz. Realize the structure with FR4 substrate(er=4.4, h=1.6mm).

9. Prove that directivity of end fire array is 4nd/λ.

Part- C (2x20=40)

10. Derive the field expression for microstrip patch antenna using cavity model.

11a). Ionic concentration in the layer varies as $N(h) = (20.4h^2+14.6h+4.8)x10^{12}$ electronics/ m^3Find Critical frequency, Maximum usable frequency for the F-layer.

b). Design an Dolph Tchebyschev array of 4 elements with 26 dB down the main lobe maxima with the spacing between the elements of $\lambda/2$. Find the array factor.

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