**UPES**

**UNIVERSITY OF PETROLEUM AND ENERGY STUDIES**
**End Semester Examination, Dec, 2017**

Program Name: B.Tech AVE                     Semester – V
Course Name : EM WAVES & ANTENNAS            Max. Marks  : 100
Course Code  :ELEG 391                       Duration    : 3 Hrs
No. of page/s:

**DRAW THE DIAGRAMS WHEREVER NECESSARY WITH PENCIL**
**Section-A**
**Answer all the questions**                    4x5=20

1.  a) Write about Gain and Directivity b)Determine the directivity of an antenna $\Phi_{HPBW}=30^0$ ; $\theta_{HPBW} = 60^0$ .

2.  Define polarization and explain the three types of polarizations with help of neat sketches.

3.  Define effective length and physical length; Self impedance and mutual impedance.

4.  Determine the fine virtual height with the help of neat sketch and write the expression for the same.

**Section-B**

**Answer all the questions**                    5X8=40

5.  An antenna has a radiation resistance of 73 ohms and a lossy resistance of 7 ohms. If the power gain is 20, calculate the directivity and the efficiency of the antenna.

6.  Determine the Electric field strength of the antenna array having two dipole antenna elements   spaced distance  'd' and fed by equal currents  'I' and with zero phase.

7.  Determine the power of half wave dipole Write the relation between aperture and directivity. Calculate the maximum effective aperture of an antenna which has a directivity of 1000 at a working frequency of 10 GHz.                    .[2+6]

8. Determine the electric field component of the current carrying conductor which has the current direction in +z and distribution cosωt. Draw a neat sketch of the fields radiated from the conductor.

9. Describe the different types of feeds with reflector antennas. Explain the aperture blockage.

<div align="center">(or)</div>

Distinguish between broad-side array and end-fire array with respect to antenna spacing between the elements.

10. What is pattern multiplication? Determine the resultant pattern of the antenna array if it contains 16 elements and the distance between the antenna elements is $\lambda/2$ and obtain the group pattern and unit pattern.

<div align="center">

**Section –C**
**Note: Answer any two**         **2x20=40.**

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11. a) Determine the far field component of Electric field strength for the dipole has current 15 m A and the length of 10cm .The field is observed at the distance of 10m and the dipole is excited by 20 wavelengths for an angle $30^0$ .

   b)Determine the radiation resistance of current element when the length is 100cm and the frequency of excitation is 10kHz and carries the current 10 A. Determine the power radiated.        [10+10]

12. A radio link is to be established via ionosphere. Take maximum virtual height to be 1000km at the mid point of the path. Assume critical frequency to be $2 \times 10^6$ Hz and distance between stations to be 600 km. determine the optimum working frequency and the angle with which the beam is to be transmitted.

13. Design an antenna which has driven element folded dipole with single turn and reflector and directors. Reflector and driven element are spaced with $0.25\lambda$ and others are spaced with $0.31\lambda$. Evaluate the designed antenna if the directivity is to be improved, what are the features to be incorporated.

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**DRAW THE DIAGRAMS WHEREVER NECESSARY WITH PENCIL**
**Section-A**
**Answer all the questions** 4x5=20

1. Define effective length and physical length; Self impedance and mutual impedance.

2. Define virtual height with the help of neat sketch and write the expression for the same.

3. The radiation intensity of the major lobe is defined by $U=B_o \cos \theta$. The radiation exists along $(0 \leq \theta \leq \pi/2)$ and $(0 \leq \Phi \leq 2\pi)$. Determine the beam solid angle.

4. Draw the diagram of measurement set up of antenna gain.

**Section-B**

**Answer all the questions** 5X8=40

5. Design an antenna which has antenna elements connected the (a)If the directivity of an antenna is 40. Determine the beam solid angle for the same antenna. Give relationship for tangential angle and azimuth angle. [6+4]

6. (b)Determine the input impedance resistance of Folded Dipole? Determine its input resistance when the number turn s of the antenna are 4. [6+2]

7. Determine the total Electric field strength of the two element antenna array fed with equal currents and same phase with the help of phase diagram.

8. Determine the pattern factor of the corner reflector antenna with sheets of infinite length. Draw the images of reflector antenna with apex angle $60^0$.

9. Discuss the antenna useful in Radio direction finding and describe the same in detail.

10. Determine the horn antenna HPBW flare required to work 6 MHz range and explain design considerations. Determine Directivity and Power Gain.

## Section-C

**Answer any two questions**                                          **5X8=40**

11. (a)Determine the maximum effective aperture of the antenna which is working in 300 MHz and  has    directivity 40.

    (b)Design an antenna with eight element which has no minor lobes and determine the pattern for eight element array which was fed with equal current I and with zero phase between the antenna elements                                          [10+10]

12. A radio link is to be established via ionosphere. Take maximum virtual height to be 1000km at the mid point of the path. Assume critical frequency to be $2.4 \times 10^6$ Hz and distance between stations to be 500 km. determine the optimum working frequency and the angle with which the beam is to be transmitted.                 [20]

13. (a)Design a reconfigurable antenna with the frequency reconfiguration, which switches itself from mobile frequency range (of 1.8GHz) to 2.4GHz.

    (b)Design a frequency independent antenna which has conical spiral  structure for in UHF and L bands.                                          [10+10]