M.E. (ETCE) 1st YEAR EXAMINATION, 2017
( 1st Semester )

ANTENNA ANALYSIS AND SYNTHESIS

Time: Three hours                                                                                         Full Marks 100

| No. of questions | | Marks |
|---|---|---|
| | Answer *question no. 1* and any *four* from the rest. | |
| 1. | In each case, choose the correct/best alternative. | |
| (i) | At very large distances from the source, a spherical wave may be treated<br>(a) as a plane wave<br>(b) as a cylindrical wave<br>(c) either as a plane wave or as a cylindrical wave<br>(d) neither as a plane wave nor as a cylindrical wave | |
| (ii) | Left circularly polarized radiation can be received by<br>(a) a vertically polarized antenna<br>(b) a horizontally polarized antenna<br>(c) a left circularly polarized antenna<br>(d) all of the above | |
| (iii) | A current sheet may exist<br>(a) on a dielectric-dielectric interface<br>(b) on a dielectric-conductor interface<br>(c) on a conductor-conductor interface<br>(d) on no cases cited above | |
| (iv) | As frequency increases, displacement current<br>(a) increases<br>(b) deceases<br>(c) remains constant<br>(d) changes unpredictably | |
| (v) | On a short dipole, the current distribution may be assumed to be<br>(a) sinusoidal<br>(b) constant<br>(c) triangular<br>(d) parabolic | |
| (vi) | An array with no sidelobes is<br>(a) Chebyshev array<br>(b) Taylor array<br>(c) Binomial array<br>(d) None of the above | 2X6 |
| 2.(a)<br>(b)<br>(c) | Discuss the inconsistency of Ampere's law and how it was removed by Maxwell.<br>Write the resulting Maxwell Heaviside equations both in integral and differential forms.<br>Derive the wave equations for both electric and magnetic fields therefrom. | 8<br>8<br>6 |

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| 3.(a) | In unbounded free space, show that electromagnetic fields are essentially of wave nature. | 10 |
| (b) | Hence prove that the mode of propagation there is TEM. | 12 |
| | | |
| 4 (a) | In context of antennas, define Radiation Pattern, Gain, Directivity and Effective Aperture. | 8 |
| (b) | Elaborate how the problem of radiation from a time varying current source is solved. | 10 |
| (c) | Explain why no other gauge condition except Lorentz gauge condition is accepted in this process. | 4 |
| | | |
| 5.(a) | Define polarization. | 2 |
| (b) | Establish that elliptical is the most general form of polarization. | 10 |
| (c) | State and prove Poynting theorem. | 6 |
| (d) | Logically establish that only field components varying inversely with distance can contribute to outward power flow. | 4 |
| | | |
| 6.(a) | State the three theorems of Schelkunoff on linear arrays. | 6 |
| (b) | Show that for a uniform linear array, the side lobe level cannot be improved beyond a certain limit. | 10 |
| (c) | Which performance figure can be increased monotonically by increasing the length of a uniform linear array? | 2 |
| (d) | Justify your answer to the last question. | 4 |
| | | |
| 7.(a) | Explain principle of pattern multiplication in linear arrays with a suitable example. | 6 |
| (b) | Prove that the beam width for a uniform broadside array is less than that for a uniform endfire array. | 8 |
| (c) | Discuss the principle of duality in electromagnetics. | 8 |