Total number of printed pages–3

**53 (EC 501) EMWV**

## 2019

# ELECTROMAGNETIC WAVES

Paper : EC 501

*Full Marks : 100*

Time : Three hours

***The figures in the margin indicate
full marks for the questions.***

Answer **any five** questions.          5×20=100

1. Given point $P(-2, 6, 3)$ and a vector
   $A = ya_x + (x + z)a_y$, express $P$ and $A$ in
   cylindrical and spherical co-ordinates.
   Evaluate $A$ at $P$ in the Cartesian and Sperical
   systems.                                    20

2. *(a)* What is meant by the uniform plane
   wave ? Derive the wave equation in
   terms of electric and magnetic fields.

*Contd.*

(b) Derive Poynting theorem and explain clearly every term. Calculate power flow for a plane wave. $(3+7)+(6+4)$

3. (a) Derive an expression for the input impedance $Z_{in}$ of a lossless transmission line, in terms of relevant parameters, when the line is terminated into impedance $Z_L$.

(b) Show that for a lossless transmission line, the input impedance of a line repeats over every $\lambda/2$ distance.

(c) At a frequency of 80MHz, a lossless transmission line has a characteristic impedance of $300\Omega$ and a wavelength of 2.5m. Find the value of $L$ and $C$. $8+5+7$

4. (a) What does a lossless and distortionless line mean?

(b) Derive the necessary conditions for a transmission line to become distortionless line.

(c) Prove that a distortionless line is not necessarily a lossless line but a lossless line is a distortionless line.

(d) An airline has characteristic impedance of $70\Omega$ and a phase constant $3\,rad/m$ at 100MHz. Calculate the inductance per meter and the capacitance per meter of the line. $4+8+3+5$

5. (a) Define characteristic impedance of a transmission line. Explain the formation of standing wave pattern on transmission line.

(b) Deduce the relation between reflection co-efficient and VSWR.

(c) A transmission line of characteristic impedance $50\Omega$ is terminated by resistor of $100\Omega$. What will be the VSWR in the line? Calculate impedance at the voltages minimum and maximum positions. $(3+4)+6+7$

6. Write short notes on : *(any four)*  $4\times5=20$

(i) Skin depth

(ii) Ampere's Circuit law

(iii) Smith Chart

(iv) Poynting theorem

(v) Conduction and Convection Current

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