



WEST BENGAL STATE UNIVERSITY
B.Sc. Honours 5th Semester Examination, 2021-22

ELSADSE02T-ELECTRONICS (DSE1/2)

Time Allotted: 2 Hours

Full Marks: 40

*The figures in the margin indicate full marks.
Candidates should answer in their own words and adhere to the word limit as practicable.
All symbols are of usual significance.*

GROUP-A

1. Answer any *five* questions from the following: 2×5 = 10
- (a) What is meant by distortion-less transmission?
 - (b) What is 'Radiation resistance'?
 - (c) What is displacement current?
 - (d) If the characteristic impedance of an air line is 70Ω and its phase constant 3 rad/m at 100 MHz . Find its resistance and capacitance per metre.
 - (e) How do the Maxwell's equations lead to waveguide theory?
 - (f) What is Brewster's angle?
 - (g) What will be the (i) reflection coefficient and (ii) VSWR if $Z_L = Z_o$ and $Z_L = \infty$?
 - (h) What is the significance of Maxwell's equation $\text{div } \vec{B} = 0$?

GROUP-B

Answer any six questions from the following 5×6 = 30

2. Using equivalent circuit of a transmission line derive expressions for voltage and current at any point on a transmission line of length l . 5
3. (a) Justify the statement — "TEM mode cannot exist in a waveguide". 4+1
(b) Why is a waveguide considered as a high-pass filter?
4. (a) Find an expression for characteristic impedance of a transmission line. 2+3
(b) Show that a finite line terminated in its characteristic impedance is equivalent to an infinite transmission line.
5. (a) A distortionless transmission line has an inductance 1.5 mH/Km and a capacitance of $0.1 \mu\text{F/Km}$. Calculate the characteristic impedance of the line. 3+2
(b) Calculate the radiation resistance of a $\frac{\lambda}{2}$ wire dipole in free space.

6. What is the effective aperture of an antenna? Find a relation of antenna gain and antenna aperture. 2+3
7. Prove that there is no reflection if the transmission line is terminated in its characteristic impedance. 5
8. Prove that Radio Frequency (RF) line is a loss-less line. 5
9. (a) Consider a rectangular wave-guide having broad wall dimension of 2.29 cm and fed by a 10 GHz carrier. Find for TE₁₀ mode – (i) Guide wavelength; (ii) Phase and (iii) group velocity. 4+1
- (b) What is meant by dominant mode in a waveguide?
- 10.(a) Derive relationship between refractive index and dielectric constant of a medium. 2+3
- (b) Explain skin effect in conductors.
11. Show that for a semi-infinite solid conductor, the skin depth δ is given by 5

$$\delta = \sqrt{\frac{2}{\omega\mu\sigma}}$$

N.B. : *Students have to complete submission of their Answer Scripts through E-mail / Whatsapp to their own respective colleges on the same day / date of examination within 1 hour after end of exam. University / College authorities will not be held responsible for wrong submission (at in proper address). Students are strongly advised not to submit multiple copies of the same answer script.*

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