Name: **Enrolment No:**	UPES

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES

End Semester Examination, May 2021

Programme Name: B Tech ECE **Semester : IV**
Course Name : Electromagnetic Waves **Time : 03 hrs**
Course Code : ECEG 2035 **Max. Marks : 100**
Nos. of page(s) : 02
Instructions:

- Attempt all questions.

SECTION-A (30 Marks)

Q1	Determine cutoff freq, guided wavelength, group velocity, phase constant ,wave impedance of TM_2 mode passing through the parallel plate waveguide having the dimension of a=2 cm filled with dielectric material of permittivity 4.6. Signal frequency is 10 GHz.	**5**	**CO5**
Q2	In spherical coordinates V=-25 volts on a conductor at r=2 cm and V=150 volts at r=35 cm. Space between the conductors is filled with dielectric of ϵr=3.12. Find surface charge densities on the conductor.	**5**	**CO1**
Q3	Derive the wave equation in conducting media.	**5**	**CO2**
Q4	Derive the continuity equation and calculate the relaxation time for silver with σ= 61.7MS/m and relative dielectric permittivity is 0.79.	**5**	**CO1**
Q5	Derive the expression for line impedance of transmission line of length 'l', having characteristic impedance	**5**	**CO4**
Q6	In a material for which σ=5 S/m and ϵr =1, electric field intensity is given by E = 250 $\sin 10^{10}t$ (V/m). find the conduction current density, displacement current density and the frequency at which they have equal magnitudes.	**5**	**CO1**

SECTION-B (50 Marks)

Q7	Explain the wave propagation of EM waves in good conductors.	**10**	**CO2**
Q8	Derive the field expressions of TE waves in parallel plate waveguide placed in xz plane where the waveguide has finite dimensions along x-axis and infinite in length in z-direction.	**10**	**CO5**
Q9	Derive Maxwell's equation and explain the physical interpretation.	**10**	**CO1**
Q10	Region1 for which $\mu r1$=3 is defined by x<0, region 2 x>0 has $\mu r2$=5. Given $\mathbf{H_1 = 4a_x + 3a_y - 6a_z}$**. Show that θ_2=19.7 deg and H_2=7.12 A/m.**	**10**	**CO1**

Q11	A travelling H field in free space of amplitude 1 A/m at a frequency of 200 MHz strikes the silver sheet of thickness 5 μm with σ=61.7 MS/m. Find transmitted field beyond the sheet.	**10**	**CO2**
SECTION-C (20 Marks)			
Q12	a) Design stub matching network for the transmission line of characteristic impedance of 100 ohms is terminated with load of 150-j150 ohms. Find the SWR and Zmax and Zmin. b) Synthesize the microstrip line (Z_0=50 ohms) realized with copper strip having σ=5.7e7S/m is desired to operate at 5 GHz, in dielectric substrate having the following parameters:ϵ_r=2.2, h=0.762 mm, tanδ =0.01. Find W, L, ereff at 10 GHz, conductor and dielectric losses.	**20**	**CO4**