UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, April/May 2018

Programme: B.Tech EE-IOT **Semester – IV**
Course Name: Engineering Electromagnetism **Max. Marks : 100**
Course Code: ELEG 234 **Time : 3 Hrs**

Instructions: All question are compulsory.

SECTION A

S. No.		Marks	CO
Q1	In a loss less medium for which $\eta=60\pi$, $\mu_0= 1$ and H = 0.1 Cos ($\omega t-z$) $\mathbf{a}_x$ +0.5 Sin ($\omega t-z$) $\mathbf{a}_y$. Calculate electric field intensity.	**5**	**CO3**
Q2	What is standing wave ratio?	**5**	**CO2**
Q3	Calculate reflection coefficient having SWR of 1.5.	**5**	**CO2**
Q4	State Maxwell's equation and explain their physical significance.	**5**	**CO1**
	SECTION B		
Q 5	Write both differential and integral form of Maxwell's equations in matter, as well as in free space. Mention clearly the notations used in the equations.	**8**	**CO1**
Q6	Explain the phenomena of reflection and refraction for a uniform wave in conductor with normal incidence.	**8**	**CO3**
Q7	For a distortion less line with propagation constant $\gamma = 0.04 + j1.5$, having characteristics impedance 80 Ω and frequency of operation 500 MHz. Determine the primary constants R, G, L and C.	**8**	**CO2**
Q8	Show that two lines with any characteristic (real) impedances Z_1 [Ω] and Z_2 [Ω] may be matched with a quarter-wavelength line.	**8**	**CO3**
Q9	A line of characteristic impedance 600 Ω is terminated in a load Z_L. The VSWR measured on the line is 1.5 and the first maximum occurs at a distance of 20 cm from the load. The line is open wire and supplied from a generator at 300 MHz. Find the value of the load impedance. Or Why are low frequency waves more suitable than high frequency waves for communication with under water objects?	**8**	**CO4**
	SECTION-C		
Q10	Let us assume that measurements performed on a slotted line of characteristic impedance $Z_0 = 50\Omega$ provided the following data. First, with the short circuit as the termination, voltage minima were found to be 20 cm apart. Next, with one of the minima marked as the reference point and the short circuit replaced by the unknown load, the SWR was found to be 3.0 and a voltage minimum was found to be at 5.80 cm from the reference point on the side toward the load. Calculate the value of the	**20**	**CO4**

	unknown load impedance.		
Q11	A uniform plane wave is traveling inside the earth, which is assumed to be a perfect dielectric infinite in extent. If the relative permittivity of the earth is 9, find, at a frequency of 1 MHz, the: (a) Phase velocity. (b) Wave impedance. (c) Intrinsic impedance. (d) Wavelength of the wave inside the earth. Or A uniform plane wave propagating in a medium with relative permittivity of 4 is incident normally upon a dielectric medium with dielectric constant of 9. Assuming both media are non ferromagnetic and lossless, determine the: (a) Reflection and transmission coefficients. (b) Percentage of incident power density that is reflected and transmitted.	**20**	**CO5**

Name: **Enrolment No:**	UPES

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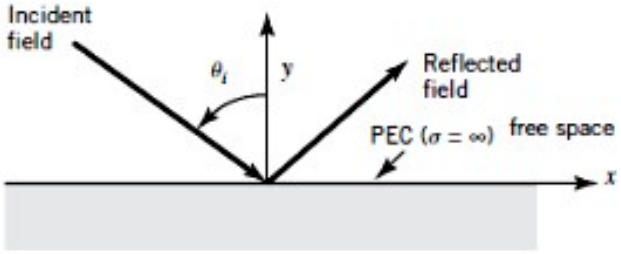
SECTION A

S. No.		Marks	CO
Q1	Define three types of Polarization of electromagnetic waves.	**5**	**CO2**
Q2	Considering a losses having $\mu=2\mu_0$ and $\epsilon=5\epsilon_0$. If **H**=cos(ωt-5y) $\mathbf{a}_x$ mA/m, determine the frequency f and the electric field **E** .	**5**	**CO3**
Q3	State Faraday's law of electromagnetic induction. Show how it leads to the Maxwell equation $\nabla \times E = \frac{-\partial B}{\partial t}$.	**5**	**CO1**
Q4	Given **E**=$E_m$sin(ωt-βz) $\mathbf{a}_y$ in free space, find **D**, **B**, **H**.	**5**	**CO3**
	SECTION B		
Q 5	State Faraday's law in differential form for the general case of the electric field having all three components (x, y, z) each of them depending on all three co-ordinates (x, y & z) in addition to time. Also find B (magnetic field) using Faraday's law for the given **E**= 10cos(6 $\pi 10^8$ t- 2π z)$\mathbf{a}_x$V/ m.	**8**	**CO1**
Q6	Calculate the characteristic impedance Z_0 , propagation constant and the line constants of an open wire loss less line of 50 Km long operating at f = 700 Hz if $Z_{oc}=286\angle -40^0\,\Omega$ $Z_{sc}=1520\angle 16^0\,\Omega$	**8**	**CO4**
Q7	Explain the phenomena of reflection and refraction for a uniform wave in conductor with oblique incidence.	**8**	**CO3**
Q8	A plane electromagnetic wave is incident on the surface of a dielectric at 62^0 from air (free space). Calculate the permittivity of the dielectric if at this angle there is no reflection from the surface. Assume parallel polarization of the wave.	**8**	**CO4**
Q9	Derive the basic transmission line equation. Also, explain the lossless and distortion less transmission lines. Or List different transmission line matching techniques explain one of them in detail.	**8**	**CO5**
	SECTION-C		
Q10	The dielectric constant of water is 81. Calculate the percentage of power density reflected and transmitted when a uniform plane wave traveling in air is incident	**20**	**CO5**

	normally upon a calm lake. Assume that the water in the lake is lossless.		
Q11	A uniform plane wave traveling in a dielectric medium with $\varepsilon_r = 4$ and $\mu_r = 1$ is incident normally upon a free-space medium. If the incident electric field is given by $\mathbf{E}_i = 2 \times 10^{-3} e^{-j\beta z}\, \mathbf{a}_y$ V/m8 write the: (a) Corresponding incident magnetic field. (b) Reflection and transmission coefficients. (c) Reflected and transmitted electric and magnetic fields. (d) Incident, reflected, and transmitted power densities. Or A uniform plane wave traveling in a free space medium is incident at an oblique angle θi upon an infinite and flat perfect electric conductor (PEC, $\sigma = \infty$). The normalized incident and reflected magnetic fields at the surface of the PEC ($y = 0$, on the free space part of the PEC), are given by **H** incident*(*on surface of PEC*)* $= 1/377(-\mathbf{a}_x \cos \theta i + \mathbf{a}_z \sin \theta i)$ **H** reflected*(*on surface of PEC*)* $= 1/377(-\mathbf{a}_x \cos \theta i - \mathbf{a}_z \sin \theta i)$ Find the total electric current density $\mathbf{J}_s$ induced on the surface of the PEC.  	**20**	**CO5**