Birla Institute of Technology & Science, Pilani
First Semester 2023-2024
ECE F314: Electromagnetic Field & Microwave Engineering (Closed Book)
Mid-Semester Test **(Part-A)**

Duration: 30 minutes **Total Marks: 30**

Name: **Student ID:**

Note to Students:
Please circle the correct option and write the final answer with proper units and sign in the space provided. Marks will be deducted for the answers with improper signs and units. There is no negative marking. Please avoid overwriting.

---

1. Which of the following is/are not true for a dielectric-to-dielectric interface?
   a) $Bn_1=Bn_2$ b) $Et_1 = Et_2$ (c) $Dn_1=\rho s$ d) $Ht_1-Ht_2= Js$ **[1]**
2. The following is **true** for an EM wave incident on a dielectric normally **[1]**
   a) Wave is totally reflected back c) Results in a standing wave distribution
   b) Part of the wave is reflected and part of it is transmitted (d) None of the above
3. For a quarter wave transformer, the electrical length **βl** should be equal to …… **[1]**
4. The input impedance of a **λ/8** long open circuited section of a lossless transmission line is …….. (purely resistive/capacitive/inductive) **[1]**
5. In a transmission line, which one is/are correct:
   a) **R=G** **b) R=1/G** **c) R≠1/G** **d) R/G = C/L** **e) L =1/C** **[1]**
6. A family of arcs is obtained in the Smith chart by varying normalized reactance in a range of
   a) **-1 to 0** **b) 0 to 1** **c) 0 to ∞** **d) -∞ to + ∞** **[1]**
7. The electric field in a medium with **$\epsilon = 4\epsilon_0$, $\mu= \mu_0$**, and **σ=0** is given by $\vec{E} = 100\cos(10^8 t + \beta x)\hat{a}_y$ **V/m**. The value of **β** is …… **[2]**
8. If the frequency of the incident wave increases by a factor of **9** then the depth to which an EM wave propagates in a conducting material will be …….. (increases/decreases) by a factor of …….. **[2]**
9. A TE polarized EM wave incident obliquely from air to a medium with dielectric constant **$\epsilon =3\epsilon_0$**. The value of the Brewster angle will be …… **[2]**
10. A **100 m** long lossless transmission line has a total inductance and capacitance of **100μH** and **10nF**, respectively. The value of phase constant at the operating frequency of **100 KHz** is ……**[2]**

11. The range of standing wave ratio **(VSWR)** is from ……to …… **[2]**
12. In an air- air-transmission line, adjacent maxima are found at **12.5 cm** and **37.5 cm**. The operating frequency is …….. **[2]**
13. The ratio of conduction current density and displacement current density is equal to …….. which is known as …… **[2]**
14. When a wave is incident normally from medium 1(perfect dielectric) to medium 2(perfect conductor), the value of the reflection coefficient and transmission coefficients are …… and …… respectively. **[2]**
15. What is the polarization (with orientation) of a wave with an electric field vector $\vec{E} = E_0 e^{(\omega t + \beta z)} \left(\hat{a}_x + \hat{a}_y \right)$? **[2]**
16. In a Smith chart, while moving towards the generator, the observer should move in …… direction, and moving towards the load, the observer should move in ……direction. **[2]**
17. A transmission line has a characteristic impedance of **50 Ω.** It is terminated at a reactance of **j50 Ω**. The input impedance of the section, which is **100 cm** long at a frequency of **150 MHz**, is …….. **[2]**

18. Match the following normalized impedances with points marked on the Smith chart given below:

(i) $\left[\frac{Zin}{Zo} \right]_{\min}$ **(ii)** ***1 + j0*** **(iii)** ***0 + j1*** **(iv)** ***∞ + j∞*** **[2]**