



Name: ..... Roll No.: .....

Branch: ..... Signature of Invigilator: .....

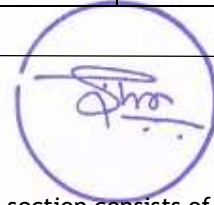
Semester: IVth

Date: 02/05/2022 (MORNING)

Subject with Code: EC257 ELECTROMAGNETIC FIELDS AND WAVES

Marks Obtained	Section A (30)	Section B (20)	Total Marks (50)

INSTRUCTION TO CANDIDATE



1. The booklet (question paper cum answer sheet) consists of two sections. First section consists of MCQs of 30 marks. Candidates may mark the correct answer in the space provided / may also write answers in the answer sheet provided. The Second section of question paper consists of subjective questions of 20 marks. The candidates may write the answers for these questions in the answer sheets provided with the question booklet.
2. The booklet will be distributed to the candidates before 05 minutes of the examination. Candidates should write their roll no. in each page of the booklet.
3. Place the Student ID card, Registration Slip and No Dues Clearance (if applicable) on your desk. All the entries on the cover page must be filled at the specified space.
4. Carrying or using of mobile phone / any electronic gadgets (except regular scientific calculator)/chits are strictly prohibited inside the examination hall as it comes under the category of unfair means.
5. No candidate should be allowed to enter the examination hall later than 10 minutes after the commencement of examination. Candidates are not allowed to go out of the examination hall/room during the first 30 minutes and last 10 minutes of the examination.
6. Write on both side of the leaf and use pens with same ink.
7. The medium of examination is English. Answer book written in language other than English is liable to be rejected.
8. All attached sheets such as graph papers, drawing sheets etc. should be properly folded to the size of the answer book and tagged with the answer book by the candidate at least 05 minutes before the end of examination.
9. The door of examination hall will be closed 10 minutes before the end of examination. Do not leave the examination hall until the invigilators instruct you to do so.
10. Always maintain the highest level of integrity. Remember you are a BITian.
11. Candidates need to submit the question paper cum answer sheets before leaving the examination hall.

**BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI  
(END SEMESTER EXAMINATION)**

CLASS:BE  
BRANCH: ECE

SEMESTER :IV  
SESSION: SP/22

SUBJECT:EC257 ELECTROMAGNETIC FIELD AND WAVES SET A

TIME:2Hrs

FULL MARKS: 50

**INSTRUCTIONS:**

1. The question paper contains two sections sec A and B of total 50 marks.
2. All questions are compulsory.
3. Section A has 30 multiple choice questions of 30 marks.
3. Section B has 9 short questions of 20 marks.
4. The missing data, if any, may be assumed suitably.
5. Before attempting the question paper, be sure that you have got the correct question paper.
6. Tables/Data hand book/Graph paper etc. to be supplied to the candidates in the examination hall.

Section A

- Q.1 Identify the correct relation between Electric Flux Density-  $D$ , Electric Field Intensity -  $E$ , Magnetic Field -  $H$  and Magnetic Flux density,  $B$ . [1]
- a.  $D = \epsilon E$  and  $B = \mu H$
  - b.  $D = \epsilon H$  and  $B = \mu E$
  - c.  $D = \epsilon E$  and  $B = \sigma H$
  - d.  $D = \sigma H$  and  $B = \sigma H$
- Q.2 The divergence of curl of a magnetic field is [1]
- a. Zero
  - b. Infinity
  - c. Finite
  - d. Vector
- Q.3 Identify which of the following expressions are not Maxwell's equations for time varying fields: [1]
- a.  $\nabla \cdot J + \frac{\partial \rho_v}{\partial t} = 0$
  - b.  $\nabla \cdot D = \rho_v$
  - c.  $\nabla \times E = -\frac{\partial B}{\partial t}$
  - d.  $\oint_L H \cdot dl = \int_s \left( \sigma E + \epsilon \frac{\partial E}{\partial t} \right) \cdot dS$
  - e.  $\oint_s B \cdot dS = 0$
- Q.4 What is not true about a phasor? [1]
- a. It may be a scalar or a vector.
  - b. It is a time dependent quantity.
  - c. It is represented as  $V_0 \angle \theta$  or  $V_0 e^{j\omega}$  where  $V_0 = |V_s|$
  - d. It is a complex quantity.
- Q.5 Which component of the electric field is always continuous at the boundary? [1]
- a. Normal
  - b. Horizontal
  - c. Vertical
  - d. Tangential
- Q.6 The electric field just above a conductor is always [1]
- a. Tangential to source
  - b. Normal to the surface
  - c. Zero

d.  $\infty$

- Q.7 The intrinsic impedance of the medium whose  $\sigma = 0, \epsilon_r = 9, \mu_r = 1$  is [1]  
 a.  $40\pi \Omega$   
 b.  $9\pi \Omega$   
 c.  $120\pi \Omega$   
 d.  $60\pi \Omega$
- Q.8) Skin depth is dependent on which of the following parameter(s)? [1]  
 a. Attenuation constant  
 b. Phase constant  
 c. Frequency  
 d. All of the above
- Q.9 If  $E = \cos(9 \times 10^7 t - \beta z) a_x$ ,  $\beta$  is \_\_\_\_\_. [1]  
 a. 0.5 rad/m  
 b. 0.2 rad/m  
 c. 0.3 rad/m  
 d. 5 rad/m
- Q.10 Which of the following is/are true for Brewster angle? [1]  
 a. It is the angle of incidence  
 b. It is also referred as the polarization angle  
 c. It is the angle of reflection  
 d. It is the angle of transmission
- Q.11 Brewster's angle is given by [1]  
 a.  $\cos^{-1} \sqrt{\frac{1}{\epsilon_1 \epsilon_2}}$   
 b.  $\tan^{-1} \sqrt{\frac{\mu_2}{\mu_1}}$   
 c.  $\tan^{-1} \sqrt{\frac{\epsilon_2}{\epsilon_1}}$   
 d.  $\sin^{-1} \frac{\epsilon_2}{\epsilon_1}$
- Q.12 The Poynting vector physically denotes the power density leaving or entering a given volume in a time varying field. [1]  
 a. True  
 b. False
- Q.13 If a transmission line is terminated with load equal to the characteristic impedance of the line, then the reflection coefficient is [1]  
 a. 0  
 b. 1  
 c. -1  
 d. Infinity
- Q.14 In the context of Smith's chart, what is the position of reflection coefficient value for a unity circle with unit radius? [1]  
 a. Outside the circle  
 b. On or inside the circle  
 c. Both a and b  
 d. None of the above

- Q.15 The R,L,C parameters in the transmission line are [1]  
a. Lumped  
b. Series  
c. Distributed  
d. parallel
- Q.16 Which is the best stub for the transmission line? [1]  
a. Short circuited stub in series  
b. Short circuited stub in parallel  
c. Open ended stub in series  
d. Open ended stub in parallel
- Q.17 To get an admittance chart from an impedance chart in a smith chart: [1]  
a. Smith chart has to be rotated by  $90^\circ$   
b. Smith chart has to be rotated by  $180^\circ$   
c. Admittance chart cannot be obtained from the impedance chart anyway.  
d. None of the mentioned
- Q.18 The condition for a quarter-wave transformer is [1]  
a.  $Z_0 = Z_{in}$   
b.  $Z_L^2 = Z_{in}Z_0$   
c.  $Z_0^2 = Z_{in}Z_L$   
d.  $Z_0^2 = Z_{in}Z_L$
- Q.19 The cut-off frequency of a metallic waveguide depends on which of the following factors [1]  
a. Dimension  
b. Dielectric material filled in the guide  
c. Both the above  
d. None of the above
- Q.20 An evanescent mode occurs when [1]  
a. the wave is attenuated rather than propagated.  
b. the propagation constant is purely imaginary.  
c.  $m = 0 = n$  so that all field components vanish.  
d. the wave frequency is the same as the cut-off frequency.
- Q.21 Dominant mode is defined as [1]  
a. Any TEM mode is called dominant mode.  
b. Mode with lowest cutoff frequency.  
c. Mode with highest cutoff frequency.  
d. None of the mentioned.
- Q.22 Which of the following modes cannot be sustained in a rectangular waveguide. (0.5 marks) [1]  
a. TEM  
b. TM  
c. TE  
d. HEM
- Q.23 Degenerate modes in a waveguide have (0.5 marks) [1]  
a. Same cut-off frequency  
b. Same transverse mode of operation  
c. different cut off frequency  
d. same attenuation

- Q.24 Waveguides act as \_\_\_\_\_. [1]  
a. low-pass filter  
b. bandpass filter  
c. high-pass filter  
d. band-stop filter
- Q.25 Which of the following can be classified as a Hertzian Dipole? [1]  
a.  $\lambda/2$  dipole  
b.  $\lambda/4$  dipole  
c.  $\lambda/100$  dipole  
d. All of the above
- Q.26 Far-field consists of [1]  
a.  $\frac{1}{r}$  term  
b.  $\frac{1}{r^2}$  term  
c.  $\frac{1}{r^3}$  term  
d.  $r$  term
- Q.27 Radiation from a dipole is [1]  
a. Omnidirectional  
b. Isotropic  
c. Directional  
d. All of the above
- Q.28 Which of the following statement(s) are true with regard to directivity of an antenna [1]  
a. It is dimensionless  
b. It's unit is dB  
c. It is defined as the maximum directive gain  
d. It is defined as the maximum beamwidth
- Q.29 Sidelobes in an antenna radiation are desirable [1]  
a. True  
b. False
- Q.30 Which among the following defines the angular distance between two points on each side of major lobe especially when the radiation drops to zero? [1]  
a. Half power beam width (HPBW)  
b. First null beam width (FNBW)  
c. Side lobe level (SLL)  
d. Front to back ratio (FBR)

### Section B

- Q.31 State Maxwell's equations in their integral form and give their brief interpretation. [4]
- Q.32 State the boundary condition for tangential component of electric field E and magnetic field H and normal component of magnetic flux density B and electric flux density D. [2]
- Q.33 Calculate the induced voltage when the magnetic field cuts across 200 turns at the rate of 3 Wb/s. [2]

Q.34 Define propagation constant, attenuation constant and phase constant. What is the relation between the three? [2]

Q.35 An electric field in free space is given by [2]

$$E = 30\cos(2X10^{8t} + \beta x)a_y V/m$$

- a. Find the direction of wave propagation.
- b. Calculate phase constant  $\beta$ .

Q.36 Define Poynting vector. State the Poynting's theorem. What is its physical interpretation? [2]

Q.37 A transmission line of characteristic impedance  $Z_0$  terminated in a load of  $Z_r$ , such that  $Z_r = Z_0/4$ . Find the reflection coefficient  $|\Gamma|$ . [2]

Q.38 Draw the field distribution in a dominant mode in a rectangular waveguide. [2]

Q.39 What is Hertzian dipole? How is it different from practical dipole? [2]

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