WIN2122UGFCAT1_VL2021220505598_BPHY101L_MAR22_ANURADHA C (#37388)

Total Marks: 30

Total Duration: 60 minutes

Instructions

Basic Instructions

1. You can freely navigate between different questions forward and backward using **Next** and **Previous** buttons
2. **Finish** button will be enabled only towards the end of the exam.

Instructions for DESCRIPTIVE questions requiring SCAN & UPLOAD

1. Make sure to upload your **scans immediately after you answer** every question. Do NOT wait till the end to **avoid panic at the end**.
2. The exam time is inclusive of time for scanning & uploading answers.
3. If using **laptop + mobile** for the exam, click on **Open Test** on laptop and click on **Scan & Upload** on mobile.
4. If using **laptop + mobile** for the exam, when scanning and uploading from mobile, ensure that the correct question is open on the laptop.
5. When clicking on Camera button on a smart phone for scanning and uploading, you have 2 camera applications available to scan the answer: your phone's **native camera** and an alternative Low Memory Camera. Click on the **Low Memory Camera** in case your browser shows an error due to low memory.

Section: Module 1

Marks per question: 10
1 question(s) out of the 3 question(s) in this section will be shown to examinee
Examinee should answer all 1 question(s) in this section

Q1 Difficulty Level: Easy

Knowledge Level: K1 **Course Outcomes: CO1**

Consider a transverse wave encountering a change in impedance of a medium in which it is travelling. Discuss its travel by deducing the reflection and transmission coefficients.

Q2 Difficulty Level: Easy

Knowledge Level: K1 **Course Outcomes: CO1**

Describe the standing wave pattern in a fixed length string. Obtain the frequency of first four harmonics with necessary diagram.

Q3 Difficulty Level: Easy

Knowledge Level: K1 **Course Outcomes: CO1**

Define normal and anomalous dispersion. Relate the phase velocity with group velocity in both cases.

Section: Question 2 (5+5mark)

Marks per question: 10
1 question(s) out of the 3 question(s) in this section will be shown to examinee
Examinee should answer all 1 question(s) in this section

Q1 Difficulty Level: Hard

Knowledge Level: K1 **Course Outcomes: CO1**

Apply Fourier series to explain the superposition of waves.

The displacement of a particle of a string carrying a traveling wave is given by y = 3sin6.28(0.50x-50t), where x is in cm and t in sec. Find a)the amplitude, b)the wavelength, c) the frequency and the d) speed of the wave.

Q2 Difficulty Level: Hard

Knowledge Level: K1 **Course Outcomes: CO1**

Identify the characteristics of a wave motion.

The equation for a wave traveling in x direction on a string is y = 3cm sin[(3.14/cm)x – (314/s)t] . Find out the maximum velocity of a particle of the string. Also calculate the acceleration of a particle at x=6 cm and time t=0.11 s.

Q3 Difficulty Level: Hard

Knowledge Level: K1 **Course Outcomes: CO1**

With sufficient examples and diagrams, relate longitudinal and transverse waves.

A 'wave-like' function is written as $y = A(x) \cos(100t)$, where the 'amplitude' is a function of position. Deduce the condition it should satisfy in order to be qualified as a wave.

Section: Question 3 (5+5mark)

Marks per question: 10
1 question(s) out of the 3 question(s) in this section will be shown to examinee
Examinee should answer all 1 question(s) in this section

Q1 Difficulty Level: Medium

Knowledge Level: K1 **Course Outcomes:** CO2

Explain divergence of a vector field. Infer the condition of positive, negative and zero divergence.

Find the volume charge density associated with a field using its displacement given by $D = (xy^2)\mathbf{i} + (yx^2)j + zk$ C/m^2.

Q2 Difficulty Level: Medium

Knowledge Level: K1 **Course Outcomes:** CO2

Summarize Maxwell's equations in differential form.

Find the magnetic field B of electromagnetic waves in free space if the components of electric field are $E_x = E_y = 0$ and $E_z = E_0 \cos kx \sin wt$.

Q3 **Difficulty Level: Medium**

Knowledge Level: K1 **Course Outcomes:** CO2

Discuss irrotational field. Show that it can be regarded as a field of gradient of a scalar.

Find displacement current density for the magnetic field given by $H_x=0$, $H_y=0$ and $H_z=H_0\sin(wt-\beta x)$. Assume the conduction current density to be zero.