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| Name: | |  | |
| Enrolment No: | | | |
| UPES End Semester Examination, December 2024 | | | |
| Course: ELECTROMAGNETIC THEORY II Program: INT. B.Sc-M.Sc (PHYSICS) Course Code: PHYS 4002 | | Semester : VII Time : 03 hrs. Max. Marks: 100 | |
| Instructions: All questions are compulsory (Q6 in section B has an internal choice & Q11 in section C has an internal choice) No. of pages: 2 | | | |
| SECTION A (5Qx4M=20Marks) | | | |
| S. No. | | Marks | CO |
| Q 1 | State the Poynting's (work-energy) theorem. | 4 | CO1 |
| Q 2 | Describe briefly the Coulomb gauge. | 4 | CO1 |
| Q 3 | Describe briefly the concept of retarded time in electromagnetism. | 4 | CO1 |
| Q 4 | What is Debye shielding in plasmas? | 4 | CO1 |
| Q 5 | Give expressions for potential and field due to an electric monopole. | 4 | CO1 |
| SECTION B (4Qx10M= 40 Marks) | | | |
| Q 6 | Give the first uniqueness theorem. Appraise the significance of boundary conditions as brought out by this theorem. <p style="text-align: center;">OR</p> What are gauge transformations in electrodynamics? Evaluate the Coulomb gauge in detail. | 10 | CO3 |
| Q 7 | Analyze the propagation of electromagnetic waves in conductors. Highlight the significant inferences that can be drawn from this analysis. | 10 | CO4 |
| Q 8 | On her 21 st birthday, one twin gets on a moving sidewalk, which carries her out to star X at speed $4/5c$; her twin stays home. When the travelling twin gets to star X, she immediately jumps onto the returning moving sidewalk and comes back home to earth, again at speed $4/5c$. Kindly note that she returns on her 39 th birthday (as determined by her watch). | 4+4+2 | CO2 |

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| | <p>A. How old is her twin brother who stayed back home? B. How far away is star X (in light years)? C. Any significance of jumping on and off the sidewalk?</p> <p>where the symbols have their usual meaning.</p> | | |
| Q 9 | Qualify the adage “Magnetism is a relativistic phenomenon” in your own words. | 10 | CO3 |
| SECTION-C (2Qx20M=40 Marks) | | | |
| Q 10 | <p>Evaluate the concept of retarded potentials. Begin with writing the expression for retarded potentials from the general expression for “V” and “A”, and obtain the expression for Lienard-Wiechert potentials. Apprise the concept of <i>advanced potentials</i>.</p> <p>where the symbols have their usual meaning.</p> | 15+5 | CO4 |
| Q 11 | <p>Plasma is often referred to as the fourth state of matter. State and elaborate on the conditions needed to be satisfied to qualify a mixture as plasma. Describe the different types of plasma confinement in detail.</p> <p style="text-align: center;">OR</p> <p>Write short notes on:</p> <ol style="list-style-type: none"> a. Plasma instabilities b. Low temperature plasma | 10+10 | CO3 |