Reg. No. \_\_\_\_\_\_\_\_\_\_\_\_\_



**End Semester Examination – Nov / Dec – 2019**

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| **Code :** | **17PH3012** | **Duration :** | **3hrs** |
| **Sub. Name :** | **SPECTROSCOPY** | **Max. Marks :** | **100** |

**ANSWER ALL QUESTIONS (5 x 20 = 100 Marks)**

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| **Q. No.** | **Sub Div.** | **Questions** | **Course**  **Outcome** | **Marks** |
| 1. | a. | Explain the instrumentation of NMR spectrometer to observe the spectra in continuous wave mode. | CO5 | 15 |
| b. | Calculate the difference in the energies of protons oriented with and against a magnetic field of strength 2T. What is the frequency of radiation that has this energy?  Given: gN = 5.585, µN = 5.051 X 10-27 JT-1. | CO6 | 5 |
| **(OR)** | | | | |
| 2. | a. | Derive the Bloch equations to find the magnetization of the specimen due to interaction of nuclear spin with magnetic field. | CO4 | 15 |
| b. | Depict chemical shift with suitable example. | CO1 | 5 |
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| 3. | a. | Discuss in detail the number of interactions contributing to the total Hamiltonian of the system. | CO4 | 15 |
| b. | At what frequency resonance occurs if the magnetic field is 1.3 T and 0.34 T. Also mention the band it belong to. (μB = 9.274 x 10-24 J/T, g = 2.0026). | CO6 | 5 |
| **(OR)** | | | | |
| 4. | a. | How many hyperfine structure one can observe in (i) ●CH3 (ii) ●C6H6  (iii) ●C10H8? Also represent their transitions in an energy level diagram. | CO2 | 15 |
| b. | Outline the basic requirements of ESR spectrometer. | CO1 | 5 |
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| 5. | a. | Explain the principle of NQR and describe the transition for axially symmetric systems. | CO1 | 15 |
| b. | Distinguish between NMR and NQR based on working and instrumentation. | CO1 | 5 |
| **(OR)** | | | | |
| 6. | a. | Explain the method to detect NQR frequencies having regenerative continuous wave oscillator with a neat block diagram. | CO3 | 15 |
| b. | Expain (i) Nuclear quadrupole moment (ii) Electric field gradient of nucleus. | CO3 | 5 |

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| 7. | a. | Examine the recoilless emission and absorption in Mössbauer spectroscopy. | CO3 | 10 |
| b. | Discuss the importance of source and absorber used to record the transmission of γ rays in Mössbauer spectroscopy. | CO5 | 10 |
| **(OR)** | | | | |
| 8. |  | Describe the types of major hyperfine interactions occur in nucleus under Mösssbauer effect. | CO2 | 20 |
|  | | **Compulsory**: |  |  |
| 9. |  | Elucidate in detail the working process of mass spectrometer which involves production of charged ions, ionic fragmentation and rearrangment of ions according to mass/charge ratio. | CO5 | 20 |