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



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

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| **Code :** | **17CH3006** | **Duration :** | **3hrs** |
| **Sub. Name :** | **MOLECULAR 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 suitable selection rules for IR, Raman, NMR and ESR spectroscopy. | CO1 | 10 |
| b. | HCl molecule has a rotational constant B value of 1059.3 m-1 and a centrifugal constant D of 5.3 x 10-2 m-1. Estimate the vibrational y frequency and force constant of the molecule. | CO1 | 10 |
| **(OR)** | | | | |
| 2. | a. | Explain the number of modes of vibration for linear and non-liner molecules. | CO2 | 10 |
|  | b. | The force constant of the bond in 12C16O is 1902 N m-1. Calculate the wave number of the transition corresponding to the vibration of CO bond. | CO2 | 10 |
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| 3. | a. | Discuss the factors influencing the vibrational frequencies. | CO3 | 10 |
| b. | Write short note the following.  (i) Overtone (ii) Combination bands  (iii) Fermi resonance (iv) Franck-Condon Principle | CO3 | 10 |
| **(OR)** | | | | |
| 4. | a. | Explore the the vibrational frequency associated with Morse oscillator. | CO4 | 10 |
|  | b. | Explain the Rayleigh scattering and Raman scattering with illustration. | CO4 | 10 |
|  |  |  |  |  |
| 5. | a. | Predict the EPR spectrum of the following compounds: (i)Naphthalene radical (ii) •C2H5 (iii)V4+ (I=7/2) (iv)  Benzene radical. | CO4 | 10 |
| b. | (i) What would be the chemical shift of a peak that occurs 655.2 Hz downfield of TMS on a spectrum recorded using a 90 MHz spectrometer?  (ii) 1H NMR spectroscopic data for an organic compound C8H6O2 is δ 8.6 (4H) 10.5 (2H). Identfy the compound. | CO4 | 10 |
| **(OR)** | | | | |
| 6. | a. | What is mutual exclusion principle? Explain the factors influencing the chemical shift. | CO5 | 10 |
|  | b. | Explain the following.  (i) Kramer’s degeneracy (ii) Zero field splitting (iii) Zeeman effect | CO5 | 10 |
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| 7. | a. | Explain the theory and principle of Mossbauer spectroscopy. | CO5 | 10 |
| b. | Explain the theory and principle of XPS. | CO5 | 10 |
| **(OR)** | | | | |
| 8. | a. | Explain the following.  (i) Isomer shift (ii) Hyperfine splitting (iii) Quadrupole effects  (iv) Stokes Shift | CO6 | 10 |
| b. | How will you obtain a photoelectron spectrum? Find binding energy of an electron. | CO6 | 10 |
|  | | **Compulsory:** |  |  |
| 9. | a. | Explain the quantum yield and fluorescence life time. | CO6 | 10 |
| b. | List the factors that affect the fluorescence characteristics of a molecule. | CO6 | 10 |