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

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**End Semester Examination – Nov/Dec – 2018**

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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. | Describe the appropriate selection rules for Microwave, IR, Raman, NMR and ESR spectroscopy. | | | CO2 | 10 |
| b. | The force constant of the bond in 12C16O is 1902 N m−1. Calculate thewave number of the transition corresponding to the vibration of CO bond. | | | CO2 | 10 |
| (OR) | | | | | | |
| 2. | a. | The vibration frequency of 1H35Cl is 2990.6 cm-1; without calculating the bond force constant, calculate the vibrational frequencies for 1H37Cl, 2D35Cl and 2D37Cl. | | CO2 | | 10 |
| b. | How many vibrational modes are possible for CO2 and H2O molecule? Sketch and explain. | | CO1 | | 10 |
|  |  |  | |  | |  |
| 3. | a. | Explain the theory, principle and application of IR spectroscopy. | | CO1 | | 10 |
| b. | Differentiate Rayleigh scattering and Raman scattering with illustration. | | CO1 | | 10 |
| (OR) | | | | | | |
| 4. | a. | Explain the factors influencing the vibrational frequencies. | | CO3 | | 10 |
| b. | Derive the vibrational energy equation associated with simple harmonic oscillator. | | CO3 | | 10 |
|  |  |  | |  | |  |
| 5. | a. | What are the factors affecting chemical shift? Explain. | | CO5 | | 10 |
| b. | Draw the energy level diagram for an unpaired electron ( S = 1/2) interacting with two inequivalent spin nuclei (I = ½). | | CO5 | | 10 |
| (OR) | | | | | | |
| 6. | a. | What is the Zeeman effect? Explain. | | CO2 | | 10 |
| b. | Predict the EPR spectrum of the following compounds: (i)Naphthalene radical (ii) •CH-CH2(iii)V4+ (I=7/2) (iv)  CH2-•CH. | | CO5 | | 10 |
|  |  |  | |  | |  |
| 7. | a. | Explain the theory, principle and application of NMR spectroscopy. | | CO2 | | 10 |
| b. | Explain the following   1. Kramer’s degeneracy. 2. Zero field splitting. | |  | | 10 |
| (OR) | | | | | | |
| 8. | a. | Explain the principle and application of Mossbauer spectroscopy. | | CO3 | | 10 |
| b. | Explain the principle and instrumentation of PES. | | CO4 | | 10 |
|  | |  | |  | |  |
|  | | **Compulsory**: | |  | |  |
| 9. | a. | Sketch the Jablonski diagram? Explain various photo processes. | | CO3 | | 10 |
| b. | Describe the FRET process with an example. | | CO3 | | 10 |