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

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

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| **Code :** | **14PH2012** | **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. | Discuss classification of crystal systems. | CO1 | 4 |
| b. | [Explain the Debye-Scherrer method](http://physics.usask.ca/~bzulkosk/modphyslab/phys381manual/xray_diffraction_2004.pdf) of X-ray diffraction in determining crystal structure of a material. | CO1 | 16 |
| (OR) | | | | |
| 2. | a. | Compare and contrast Zeeman and Stark effects. | CO1 | 4 |
| b. | Explain in detail the working principle of X-ray photoelectron spectroscopy and its application in materials characterization. | CO1 | 16 |
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| 3. | a. | Briefly describe the theory involved in UV-Visible Spectrometer. | CO1 | 4 |
| b. | Analyse UV-Vis absorption and emission spectrum with an example. | CO1 | 16 |
| (OR) | | | | |
| 4. |  | Explain the basic working principle of FTIR spectroscopy. Discuss the instrumentation part of FTIR in identifying chemical compounds. | CO1 | 20 |
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| 5. | a. | When the photons of wavelength 6368 Å is incident on a molecule, it gives Raman lines at 4447 Å. Find out the Raman Shift in cm-1. | CO1 | 4 |
| b. | Analyse the vibrational spectrum of carbon monoxide and discuss its energy level calculations. | CO1 | 16 |
| (OR) | | | | |
| 6. | a. | Define the terms Stokes line and Anti-stokes line. | CO1 | 4 |
| b. | Discuss the theory and instrumentation of IR spectrophotometer in detail. | CO1 | 16 |
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| 7. | a. | Explain Raman shift in detail. | CO1 | 4 |
| b. | Differentiate Rayleigh and Raman Scattering. Also, compare Fluorescence and Raman Spectroscopy for material analysis. | CO1 | 16 |
| (OR) | | | | |
| 8. | a. | Compare and contrast different types of optical polarization. | CO1 | 4 |
| b. | Discuss the principle behind Laser Raman spectroscopy and its advantages. | CO1 | 16 |
|  | |  |  |  |
|  | | **Compulsory**: |  |  |
| 9. |  | Discuss the instrumentation of laser Raman in detail and explain how it is useful in determining molecular vibrational modes. | CO1 | 20 |