PG – 644

III Semester M.Sc. Degree Examination, December 2016
(2010-11 Scheme) (NS) (Repeaters)
CHEMISTRY
C 302 – PC : Photochemistry

Time : 3 Hours Max. Marks : 80

***Instruction** : Answer question no. **1** and **any five** of the **remaining**.*

1. Answer **any ten** of the following : **(2×10=20)**
   a) State the Grotthus-Draper and Stark-Einstein laws.
   b) Calculate the energy associated in Kilojoules for a photon of wavelength 365 nm.
   c) What is meant by 'inverted multiplet' ? Explain it on the basis of Hund's rules.
   d) Give the electronic configuration of oxygen molecule.
   e) Define the terms photodissociation, predissociation and induced predissociation.
   f) Give the direct product rule for assigning molecular symmetry from orbital symmetry.
   g) Give the molecular orbitals and their approximate energy levels and types of transitions in formaldehyde molecule.
   h) State the Wigner's spin conservation rule.
   i) Write a note on solar energy conversion and storage.
   j) What are time resolved experiments ?
   k) Write a note on two photon absorption spectroscopy.
   l) Give any method of finding the light intensity.

2. a) Derive the term symbols for the two p electrons of a oxygen atom and draw the energy level diagram.
   b) Justify the statement that Eu^{3+} and Tb^{3+} are inverted multiplets. **(8+4=12)**

3. a) Give the pictorial description of bonding and antibonding molecular orbital formation from atomic orbitals for σ and π bonds.
   b) Draw the relative molecular orbital energies of an octahedral complex. **(6+6=12)**

P.T.O.

4. a) Draw the potential energy diagram for molecular oxygen giving the electronic energy states along with absorption spectrum using term symbols of the molecule.

   b) Which reaction parameters can be obtained from the Stern-Volmer plot ?

(8+4=12)

5. a) Give the photophysical pathways for the following process in the Jablonski diagram.

   i) $A'^{*} \rightarrow A^{*} + \text{heat}$

   ii) $A^{*} \rightarrow A + \text{heat}$

   iii) $A^{*} \rightarrow A + h\nu_f$

   iv) $A^{*} \rightarrow {}^3A^{*} + \text{heat}$

   v) ${}^3A^{*} \rightarrow A + h\nu_p$

   vi) ${}^3A^{*} \rightarrow A + \text{heat}.$

   b) Justify the statement 'organic fluorescence usually originates from lowest excited singlet level'. **(8+4=12)**

6. a) Describe the two different methods of finding the excited state acidity constant.

   b) How do you obtain the shapes of the absorption bands based on the Franck Condon principle ? **(6+6=12)**

7. a) Compare the thermal and photochemical reaction pathways for electrocyclic reaction.

   b) Give the Einstein's treatment of absorption and emission. **(8+4=12)**