 PG/IIIS/CHEM/301/22(CCAE)

M.Sc. 3rd Semester Examination, 2022

CHEMISTRY

PAPER – CEM-301(CCAE)

Full Marks : 40

Time : 2 hours

The figures in the right hand margin indicate marks

Candidates are required to give their answers in their own words as far as practicable

GROUP – A

Answer any **four** questions of the following : 2×4

1. What do you mean by exciplex emission ? Give one example.

2. What is E-type delayed emission ? Give example.

3. Inversion of population is one of the essential criteria for any system to show lasing activity.

4. What do you mean by "adiabatic ionization energy" ?

5. Calculate the *g* value of an unknown radical shows ESR line at 1.258 T in a spectrometer operating at 40 GHz. (Given $\beta = 9.27 \times 10^{-24}\ JT^{-1}$).

6. The interaction of an unpaired electron with ^{14}N causes a splitting of three lines while with ^{55}Mn it gives six lines. Why ?

GROUP – B

Answer any **four** questions of the following : 4×4

7. Write down the steps and the rate of each step for a bimolecular photophysical process. Deduce Stern-Volmer equation.

8. Write down the characteristics of exciplex emission. Explain the effect of solvent polarity on exciplex emission.

9. Show that, Einstein coefficient of induced absorption and induced emission are equal for a two level system.

10. Showing all possible transitions predict the intensity distribution in the hyperfine lines of the ESR spectrum of $^{\bullet}NH_2$ radical.

11. The ESR spectrum of $[(NH_3)_5Co\text{-}O_2\text{-}Co(NH_3)_5]^{5+}$ shows fifteen lines. Explain.

12. Draw and interpret the ESR spectrum of bis-salicylaldimine Cu(II) complex.

GROUP – C

Answer any two questions of the following : 8×2

13. What is meant by static and dynamic quenching of a fluorophore ? How do you determine the rate constant of both static and dynamic quenching constant when both the quenching take place simultaneously. 8

14. "Inversion of population cannot be achieved for a two level system" Justify or criticize the statement. 8

15. (*a*) Considering zero-filed splitting predict the ESR spectrum of Cr(III) octahedral complex. 5

(*b*) From photoelectron spectral data explain $\sigma_g(1s)^2$ electrons of H_2 molecule are more stable than the $1s^1$ electron of H atom. 3

16. (*a*) Using photoelectron spectral data explain the nature of different molecular orbitals of N_2 molecule. 5

(*b*) Explain the appearance of two lines in the ESR spectrum of hydrogen atom. 3
