Total Pages—7

M.Sc.—Phy-IIIS (CEC 306/ CEC 307)

2019

(January)

Time : 3 hours

Full Marks : 80

Answer all questions from any one Group according to your specialisation

The figures in the right-hand margin indicate marks

Candidates are required to answer in their own words as far as practicable

GROUP— I

(FIBER OPTICS AND OPTOELECTRONICS)

SECTION— A

1. Answer any *four* of the following : 4 × 4

   (*a*) Explain different modes in step index optical fiber.

   (*b*) Explain power flow in step index fiber.

(*c*) Explain signal distortion in single mode fibers.

(*d*) Explain splicing technique in optical fibers.

(*e*) Explain the noise sources in optical fibers.

(*f*) Obtain an expression for noise figure.

Or

2. Answer *all* the questions from the following : 2 × 8

(*a*) Distinguish between step index and graded index fibers.

(*b*) Write about modal concept in optical fibers.

(*c*) Define attenuation and absorption in optical fiber.

(*d*) Define material distortion.

(*e*) Explain about Fusion splice.

(*f*) Write a note on optical fiber couplers.

(*g*) Explain the principle of optical sources.

(*h*) What is Threshold condition in optical fibers ?

SECTION– B

Answer all questions : **16 × 4**

3. (*a*) Describe the transmission of light through cylindrical waveguide by using electro-magnetic theory in optical fibers.

Or

(*b*) Give the elementary idea on fiber materials and describe the double crucible method in the fabrication of optical fibers.

4. (*a*) Describe in detail the bending, scattering and core cladding losses in optical fibers.

Or

(*b*) Explain modal dispersion in single mode fibers and discuss the design of optimization of single mode fibers.

5. (*a*) Explain in detail the losses during coupling between source fibers and fiber to fiber.

Or

(*b*) Discuss the Lensing scheme for coupling improvement in optical fibers and write a brief note on connectors.

6. (*a*) Explain the integral and external quantum efficiency of LED and write about Edge emitting LED.

Or

(*b*) Describe the principle, instrumentation and working of semiconductor optical amplifier (SOA) with a neat diagram.

GROUP– II

(ATOMIC AND MOLECULAR SPECTRA)

SECTION– A

1. Answer any *four* of the following : 4 × 4

(*a*) Briefly explain the revision of hydrogen atom.

(*b*) Explain the spectrum of Helium.

(*c*) State and explain Landi's interval rule.

(*d*) Explain Stark effect in hydrogen.

(*e*) What information is obtained from rotational analysis of electronic spectra.

(*f*) Write a note on isotope effect.

Or

2. Answer *all* questions from the following : 2 × 8

(*a*) Define magnetic dipole moment.

(*b*) Explain Spin orbits interaction.

(*c*) What are selection rules for multiatoms.

(*d*) Define Zeeman effect.

(*e*) Explain why bond dissociation energy of N_2^+ is smaller than N_2.

(*f*) Define the importance of molecular quantum numbers in molecular spectroscopy.

(*g*) Explain how molecule on a rigid rotator.

(*h*) What do you mean by pure rotational spectra ? Explain.

SECTION– B

Answer **all** questions : 16 × 4

3. (*a*) Describe the Bohr-Summarfield theory and explain the relation between the magnetic dipole moment and spin angular momentum of an orbiting electron.

Or

(*b*) Discuss the quantum theory of hydrogen atom and explain the fine structure of hydrogen.

4. (*a*) Describe the Hartree's central field approximation in Multi electron atom and explain Hund's rule.

Or

(*b*) Explain the normal and inverted multiplets and obtain the selection rule for L-S and J-J coupling schemes.

5. (*a*) State and explain Paschen-Back effect and explain the different mechanisms in explaining the width of the spectral lines.

Or

(*b*) With necessary theory explain the normal Stark effect and discuss the hyperfine structure of hydrogen.

6. (*a*) Describe the theory of a diatomic molecule as a rigid rotator and explain how the energy spectrum of non-rigid rotator differs from that of rigid rotator.

Or

(*b*) Discuss the vibrational analysis of electronic bard spectra in the evaluation of vibrational constants and derive an expression for vibrational energy of a diatomic molecule.
