19APC0417T

B.Tech. DEGREE EXAMINATION, FEBRUARY/MARCH 2023.

Seventh Semester

(ECE)

MICROWAVE ENGINEERING AND OPTICAL COMMUNICATION

(RU 19 Regulations)

Time : 3 Hours

Max. Marks : 70

PART — A

Compulsory question.   **(10 × 2 = 20 Marks)**

Answer the following.

1. (a) Calculate the group and phase velocities for an angle of incidence of 33°

   (b) Explain how the excitation of modes is done in rectangular waveguide?

   (c) What is Q Factor?

   (d) Define Coupling Factor of Directional Coupler

   (e) What is the principle of working of Backward Wave Oscillator?

   (f) What is Q of a Cavity Resonator?

   (g) List out applications of Optical Communication

   (h) List the factors that cause intrinsic joint losses in fiber

   (i) What are the Difference Between Laser Diode and an LED

   (j) What are the Receiver error sources .

PART — B

Answer one FULL question from each Unit.   **(5 × 10 = 50 Marks)**

All questions carry equal marks.

UNIT I

2. (a) Discuss the significance and advantage of dominant mode in rectangular waveguide.   (5)

   (b) A rectangular waveguide with a width of 4 cm and a height of 2 cm is used to propagate an electromagnetic wave in the TE10 mode. Determine the wave impedance, phase velocity, and group velocity of the waveguide for the wavelength of 6 cm.   (5)

Or

Turn Over

3. (a) Distinguish between TE and TM modes of the propagation in rectangular waveguide. (5)

(b) A wave of frequency 6GHz is propagated in a parallel plane waveguide separated by 3cm. Calculate

(i) the cut-off wavelength for the dominant mode.

(ii) Wavelength in the waveguide.

(iii) The group and phase velocities.

(iv) Characteristic wave impedance. (5)

UNIT II

4. (a) A 20mV signal is fed to the series arm of a lossless Magic Tee junction. Calculate the power delivered through each port when other ports are terminated with a matched load. (5)

(b) Explain coupling probes and coupling loops. (5)

Or

5. (a) Explain the working of a two-hole directional coupler with a neat diagram and derive the expression for the coupling and directivity of a two-hole directional coupler. (5)

(b) For a directional coupler, the incident power is 550 mW. Calculate the power in the main and auxiliary arm. The coupling factor is 30 dB. (5)

UNIT III

6. (a) Explain Gunn Effect using two-valley theory. (5)

(b) Derive the Hartree anode Voltage equation for linear magnetron. (5)

Or

7. Explain how TWT is increased gain by increasing the bunching of electrons and derive the equation of gain. (10)

UNIT IV

8. (a) Define an optical fiber. Explain in detail different types of optical fibers with neat sketches. (5)

(b) Draw the electromagnetic spectrum, explain different ranges and their wavelengths. Clearly show the range of wavelengths used for optical fiber communication. (5)

Or

9. (a) Explain the material dispersion in optical wave guides. (5)

(b) What are the major problems encountered in the early development of optical communication for the practical use? Explain. (5)

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UNIT V

10. (a) Explain the working principle of avalanche photodiode with a neat diagram. (5)

    (b) Explain output pattern of surface in power launching from source to fiber. (5)

    Or

11. (a) Explain briefly about LED structures. (5)

    (b) Derive the equation of power coupled into step indexed optical fiber from the LED as source. (5)