Con. 5103-06.   (REVISED COURSE)   YM- 7082

(3 Hours)   [Total Marks : 100

N. B. : (1) Question No. **1** is **compulsory**.
        (2) Attempt any **four** questions from the remaining **six** questions.
        (3) Figures to the **right** indicate **full** marks.

1. (a) List at least four advantages of fiber optic communication over other systems of communication.   **20**
   (b) State and explain the symmetry property of S-matrix.
   (c) What do you mean by VSWR ? What is its significance ?
   (d) Explain why TEM waves cannot propagate in waveguides.

2. (a) Obtain an expression for the modulated velocity of the electron beam in klystron amplifier in terms   **12**
        of the beam coupling coefficient B_i and the average transit angle θg.
   (b) A two - cavity klystron amplifier has the following parameters :   **8**
            $V_o = 800$ V, $I_o = 20$ mA,   f = 5 GHz,
        Gap spacing in either cavity d = 1mm. Spacing between the two cavities L = 4 cm Find :—
            (i)   The electron velocity just leaving the cathode
            (ii) The gap transit angle
            (iii) The beam coupling coefficient
            (iv) The dc transit angle between the cavities.

3. (a) Describe the operating principles of Tunnel diode, Gunn diode and LSA diode.   **10**
   (b) Describe the operation of IMPATT diode. Compare it with TRAPATT diode.   **10**

4. (a) Explain the microwave circulators with S matrix.   **12**
   (b) An air filled rectangular waveguide of inside dimensions 7 x 3.5 cm operates in the dominant   **8**
        TE_{10} mode. Find the cut-off frequency. What is the change in the cut-off frequency if the waveguide
        is now filled with a dielectric material with $\epsilon r = 2.5$.

5. (a) A step index fiber with a large core diameter has an acceptable angle in air of 22° and a relative **10**
        refractive index difference of 3%. Estimate the numerical aperture and the critical angle at the
        core cladding interface for the fiber.
   (b) An optical fiber is made of glass core of radius 50 μm with a refractive index of 1.55 and a cladding **10**
        with a refractive index of 1.51. If the launching of the light ray takes place from air, find the following
        for the fiber;
            (i)   Numerical Aperture
            (ii) Normalized Frequency V at 0.8 mm
            (iii) The number of modes that fiber can support at 0.8 um.

6. (a) Explain material dispension.   **8**
   (b) A continuous 12 km long optical fiber link has a loss of 1.5 dB/km.   **12**
            (i)   What is the minimum optical power that must be launched into the fiber to maintain an
                  optical power level of 0.3 mW at the receiving end.
            (ii) What is the required input power if the fiber has a loss of 2.5 dB/km.

7. (a) What are the advantages and drawbacks of LEDS in comparison with the injection lasers for   **6**
        use as a source in optical fiber communication.
   (b) Define quantum efficiency and responsivity of a photo detector. Derive an expression for the   **10**
        responsivity of an intrinsic photo detector in terms of the quantum efficiency of the device and
        the wavelength of the incident radiation.
   (c) What is a heterojunction structure ? How is it different from a homojunction?   **4**