(3 Hours) **Max Marks: 80**

N:B : 1. Question no. 1 is compulsory.
2. Out of remaining questions, attempt any three questions.
3. Assume suitable additional data if required.
4. Figures on the right hand side indicate full marks.

Q.1 (a) Explain Doppler shift and its role in pulsed and CW radar. **[5]**
(b) How does a slow–wave structure operate? **[5]**
(c) What are the advantages of more than two cavities in a Klystron? **[5]**
(d) Name four categories of transmission lines. What restricts the use of two-wire line in the microwave region? **[5]**

Q.2 (a) What are the relationships of the signal, pump and idler frequencies for a parametric amplifier with an idler circuit operated as a degenerate amplifier? **[10]**
(b) Derive equation for phase velocity, cutoff frequency, cutoff wavelength and field equations for rectangular waveguide. **[10]**

Q.3 (a) Explain the working of TWT. A helix travelling wave tube operates at 4GHz under a beam voltage 10KV and beam current of 500 mA. If the helix impedance is 25 ohms and the interaction length is 20 cm. Find the output power gain in decibels. **[10]**
(b) With the help of suitable diagram explain mechanism of operation of Magnetron. What is mode jumping in Magnetron? How are various modes separated? **[10]**

Q.4 (a) Explain how avalanche devices operate. Name three devices that use the avalanche mode for their operation. **[10]**
(b) Antenna with impedance 40+j30 ohms is to be matched to 100 ohms lossless line with a shorted stub. Determine: i) Required stub admittance **[10]**
ii) Distance between stub and antenna
iii) Stub length
iv) Standing wave ratio between stub and load, stub and source, along the stub. (use smith chart).

Q.5 (a) Derive the Radar range equation as governed by minimum detectable signal to noise ratio. **[10]**
(b) With a suitable block diagram explain the working of a conical scan tracking radar **[10]**

Q.6 Write short note on:
i) Modes in Gunn diode **[07]**
ii) High electron mobility transistors **[07]**
iii) Instrument landing system **[06]**
