Name:

Enrolment No:

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, May 2024

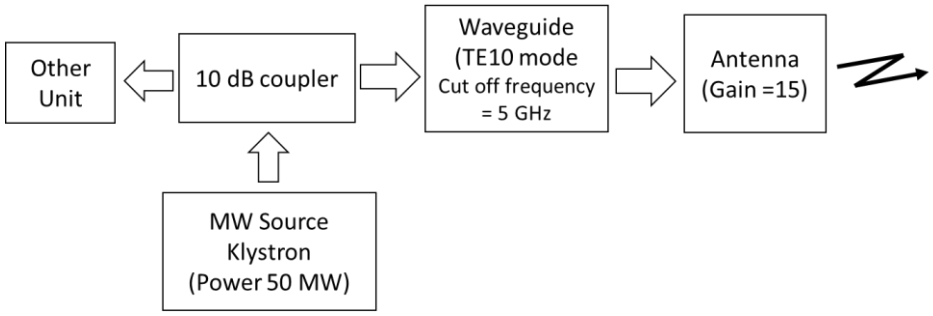
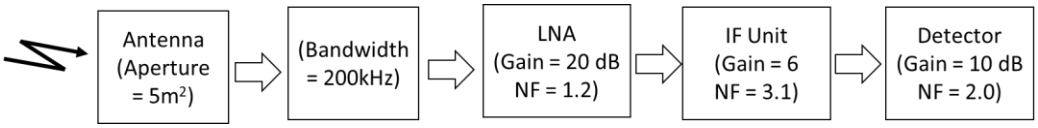
Course: Microwave Engineering **Semester: VI**
Program: B. Tech ECE **Time 03 hrs.**
Course Code: ECEG 3050 **Max. Marks: 100**

Instructions: Answer all questions.
Diagrams must be neat and clean

SECTION A
(5Qx4M=20Marks)

S. No.		Marks	CO
Q 1	On an expressway, traffic police have installed a radar system to check the over speeding of passing by vehicles. Draw the block diagram of the suitable radar system.	**4**	**CO2**
Q 2	Analyze whether the following design is possible or not. Justify with the help of schematic diagram. (a) 4- port circulator using 3- port circulator, (b) 8- port circulator using 4- port circulator, (c) 8- port circulator using 3- port circulator.	**4**	**CO1**
Q 3	Calculate the maximum range of Radar for the following specifications − Peak power transmitted by the Radar, Pt=250 kW Gain of transmitting Antenna, G = 30 dB Effective aperture of the receiving Antenna, Ae = $4m^2$ Radar cross section of the target, σ = $25m^2$ Power of minimum detectable signal, Smin = 10^{-12}W	**4**	**CO1**
Q 4	In a 2-port network, a signal of amplitude 10 V is energized into port-1, the signal measured at the output of port-1 and port-2 are 2.3 V and 5.5 V respectively. Calculate the values of the insertion loss and transmission loss of the network.	**4**	**CO2**
Q 5	In a 2-port network, a signal of amplitude 10 V is energized into port-1, the signal measured at the output of port-1 and port-2 are 3.3 V and 4.5 V respectively. Calculate the values of the reflection loss and return loss of the network.	**4**	**CO2**

SECTION B
(4Qx10M= 40 Marks)

Q 6	Derive the S- S-parameter of a Magic tee and show its operation as a power divider	**10**	**CO2**
Q 7	Demonstrate why TEM waves are absent in a rectangular waveguide by deriving the field component (H_x, H_y, E_x and E_y) equations within the waveguide using the wave propagation equation.	**10**	**CO3**
Q 8	(a) Compare the two microwave solid state sources that work on transferred electron device principle and transit time principles, in terms of their operation, key specifications, and applications. (b) Compare Cavity Klystron and Reflex Klystron in terms of their operation, key specifications, and applications.	**10**	**CO1**
Q 9	A rectangular wave guide has dimensions of 7 cm × 3.5 cm. Determine the following for the first two mode configuration of TE and TM wave. (i) Cut off frequency. (ii) Group velocity in the waveguide at a frequency of 5 GHz. (iii) Guided wavelength at 2 GHz.	**10**	**CO2**
	SECTION-C (2Qx20M=40 Marks)		
Q 10	Satellite on board used a high power microwave esource, Describe, with a neat sketch, the construction, and features of that specific microwave device. Explain how amplification is realized in it with the help of electron and RF interaction diagram.	**10+10**	**CO2**
Q 11	A microwave station is installed, with 50 m high tower as per the following parameters of its transmitter (shown below)  A receiving station, whose antenna is mounted on 10 m high tower, is in line of sight of it having its specifications as given in figure below.  Analyze the link and determine (i) Distance between two stations. (ii) Effective Isotropic Radiated Power of the transmitter. (iii) Noise figure of the receiver. (iv) C/N of the received signal. (take Boltzmann constant = - 228 dB, and Radius of Earth = 6400 km).	**20**	**CO4**