UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, May 2023

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	At an airport, the traffic controller unit has installed a radar system to monitor the movement of objects in the nearby areas. Draw the block diagram of the suitable radar system for this purpose.	4	CO2
Q 2	Draw a 4-port circulator using the phase shifter. Show with suitable explanation what will be the output at all ports, when a signal is fed into port 2.	4	CO3
Q 3	A Gunn diode is made to operate with the following parameters: Threshold field = 3 kV/cm, Input voltage = 59 V Electronic drift velocity = 2.2×10^5 m/sec. Compute the operating frequency and electron mobility of the specified diode.	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 3.3 V and 4.5 V respectively. Calculate the values of the reflection loss and return loss of the network.	4	CO1
Q 5	A terrestrial microwave link is established between 2 stations to carry digital telephone line. How many telephone lines can be supported if the link is fully operated in C band.	4	CO2

SECTION B
(4Qx10M= 40 Marks)

| Q 6 | Derive the equations of the field components within a rectangular waveguide using the wave propagation equation and show that in a rectangular waveguide TEM wave doesn't exist. | 10 | CO3 |

Q 7	(a) Compare Magnetron and Cavity Klystron in terms of their operation, key specifications, and applications. (b) Compare Gunn diode and Impatt diode in terms of their operation, key specifications, and applications.	5+5	CO1
Q 8	Derive the S parameter of a Magic tee and show its operation as a power combiner.	10	CO2
Q 9	A rectangular waveguide has dimensions of 2.5 cm and 2 cm. A signal of frequency is 3 GHz is fed into it. Compute the following for the TE10, TE01, TM12 and TM31 modes. (i) Cut off frequency. (ii) Wavelength in the waveguide. (iii) Phase velocity in the waveguide.	10	CO2
	SECTION-C **(2Qx20M=40 Marks)**		
Q 10	Describe, with a neat sketch, the construction, and features of a two cavity Klystron microwave tube. Explain its working with the help of demonstrating the bunching process.	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