UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, May 2019

Course: Microwave Engineering   Semester: VI
Program: B.Tech(Electronics Engineering) & B.Tech (EE-BCT)   Time : 03 hrs.
Course Code: ELEG 415   Max. Marks: 100

Instructions:

SECTION A

S. No.		Marks	CO
Q 1	Explain the principle of operation of Tunnel diode with the help of energy band diagram	5	CO5
Q2	Explain the various methods of excitation of modes in rectangular waveguide . What are dominant modes, evanescent and degenerate modes in waveguide.	5	CO1
Q3	Deduce the Relation between [S] and [Z].	5	CO2
Q4	How will you measure the return loss. Explain the procedure with the help of neat sketch of block diagram.	5	CO4

SECTION B

Q 5	Derive the expression for Hull cutoff voltage and Hull cutoff magnetic flux density in Cylindrical Magnetron.	10	CO3
Q6	Derive the field expressions for TE modes in Rectangular wave guide.	10	CO1
Q7	Deduce the S matrix of directional coupler.	10	CO2
Q8.	Explain the Working of IMPATT diode.	10	CO5

SECTION-C

Q 9	a). A two cavity klystron amplifier is tuned at 3 GHz. The drift space length is 2 cm, beam current 25 mA. The catcher voltage is 0.3 times the bean voltage. It is assumed that the gap length of the cavity is very less than the drift space, so that the input and output voltages are in phase(β=1). Compute (i) power output and efficiency for N= $5\frac{1}{4}$ (ii) beam voltage, input voltage, output voltage and efficiency for maximum power output for N= $5\frac{1}{4}$ mode.	10	CO3
	b). Design Power divider realizable using microstrip on FR4 dielectric substrate with	5	CO2

	power division ratio of P3/P2 =2/3		
	c). A rectangular waveguide is terminated with an unknown load impedance. SWR is found to be 2 by using the slotted line and distance between 2 consecutive minima is 1.5 cm. when the load is replaced by short, the shift in the minima is observed to be 0.3 cm towards the generator. Find the normalized value of the load.	5	CO4
Q10	Derive the attenuation factor for TE101 mode of cavity resonator.	20	CO1

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SECTION A			
S. No.		Marks	CO
Q 1	Derive the velocity modulation equation	5	CO3
Q2	Explain the working of realization of four port circulator using two magic TEE's and 180 deg phase shifter.	5	CO2
Q3	Rectangular wave guide is said to support dominant mode with cutoff frequency of 2 GHz. Find the dimensions of the waveguide. Also determine guided wavelength, phase velocity, phase constant and guided impedance if the operating frequency is 1.5fc.	5	CO1
Q4	Explain with the help of neat sketch of block diagram, how will you measure SWR.	5	CO4
SECTION B			
Q 5	Derive the hull cutoff voltage and magnetic flux density for linear magnetron.	10	CO3
Q6	Derive the field expressions for TM modes in cylindrical wave guide.	10	CO1
Q7	Explain with neat sketch the working of Network analyzer and how it is used to measure the attenuation constant, Insertion loss and return loss.	10	CO4
Q8	Explain the working of Rotary Vane Attenuator	10	CO2
SECTION-C			
Q 9	a)Design Branch line coupler and 60 deg phase shifter with BLC using the microstrip (w/h =1.5) on RT Duriod 5880 substrate. The phase shifter should be symmetric with respect to output ports.	10	CO2
	b). Explain RWH theory and two valley model.	5	CO5
	c). n-type GaAs gunn diode has the following parameters operating at f =10 GHz. Threshold field : 2800 V/cm	5	CO5

	Applied Field :3200 V/cm Device length : 10 micro meter Doping concentration (n0): $2x10^{14}$ cm^{-3} Compute electron drift velocity, current density and electron mobility.		
Q10	a) Deduce S parameters of an isolator with SWR of 1.5 at both input and output ports and with an insertion loss of 2 dB.	5	CO2
	b) Calculate the power delivered to port 2 and 3 of E-plane TEE with input power of 1 mW is fed to port 1 and SWR at all ports of 1.5.	5	CO2
	c).An air filled rectangular waveguide is to be operated at 6 GHz and is said to have the dimensions such that fc=0.8f for the dominant mode. Calculate the guided wavelength, phase velocity, guided impedance, guided velocity.	10	CO1