UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, April/May 2018

Programme: B.Tech EE **Semester – VI**
Course Name: Microwave Engineering **Max. Marks: 100**
Course Code: ELEG415 **Time : 3 Hrs**

Instructions: All questions are compulsory.

SECTION A

S. No.		Marks	CO
Q1	Explain Gunn effect.	**5**	**CO3**
Q2	State and prove kurodas fourth identity.	**5**	**CO2**
Q3	Explain the working of realization of four port circulator using two magic TEE's and 180 deg phase shifter.	**5**	**CO2**
Q4	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**
	SECTION B		
Q 5	Discuss the working of two cavity klystron amplifier and derive expression for the efficiency of above amplifier starting from basic principles.	**8**	**CO1**
Q6	Derive the field expressions for TM modes in cylindrical wave guide.	**8**	**CO3**
Q7	Explain with neat sketch the working of Network analyzer and how it is used to measure the attenuation constant and return loss.	**8**	**CO2**
Q8	With neat energy band diagram, explain Ridley-Watkins-Hilsum (RWH) theory in GUNN diode.	**8**	**CO3**
Q9	A TWT operates under the following parameters: Beam Voltage Vo=3KV, Beam current Io=30mA, characteristic impedance of helix Zo=10Ω, circuit length N=50, Operating Frequency=10GHz. Determine (i) The gain parameter C. (ii) The output power gain Ap in dB. Or A rectangular waveguide has inner dimensions of 4 cm x 6 cm. When the waveguide is terminated in unknown load impedance, the distance measured between a node and next antinode is found to be 4.55 cm, for the dominant mode. Find the frequency of the transmitted wave signal.	**8**	**CO4** **CO1**
	SECTION-C		
Q10	(a) Design stepped impedance LPF with maximally flat response response with N=6. Center frequency is 2.5 GHz, highest practical line impedance is 120 ohms	**20**	**CO4**

	and the lowest line impedance is 20 ohms. Realize the filter with RT-Duriod 5880 substrate. (g1 =g6 =0.517, g2=g5 =1.414, g3=g4 =1.932) (15) (b) An isolator having the return loss of -35dB and isolation of -60dB, find the S-Parameter.(5)		
Q11	A Reflex klystron operates under the following conditions: V_o=600 V, L= 1mm, R_{sh}=15KΩ f = 9 GHz, e/m=1.759x10^{11}. The tube is operating at f_r at the peak of the n = 2 mode or $3\frac{1}{4}$mode. The transit time through the gap and beam loading can be neglected. (i) Find the value of repeller voltage V_r. (ii) Find the direct current necessary to give a microwave gap voltage of 200V. (iii) What is the electronic efficiency Or An X band pulsed cylindrical magnetron has the following operating parameters. Anode voltage V_o = 26 K volts, Beam current I_o = 27 A, Magnetic flux density B_o = 0.336 wb/m^2. Radius of cathode cylinder a = 5 cms, Radius of vane edge to center = b = 10 cms, compute the (i) cyclotron angular fr (ii) Cut off voltage for a fixed B_o (iii) The cut off magnetic flux density	**20**	**CO5**

	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.		
Q11	(a) Design Power divider realizable using microstrip on FR4 dielectric substrate with power division ratio of P3/P2 =2/3. (b) Design microwave bandpass filter having 0.5 dB equal ripple response with N=3. Center frequency is 2 GHz, bandwidth of 15% and port impedance is 50 ohms. (g1=g3 =1.5963, g2 =1.0967) Or Dominant TE_{101} mode is propagated through a rectangular cavity resonator of heigth 10 cm operating at 2.5GHz frequency. Find (i) Cutoff wavelength (ii) Phase velocity (iii) Group velocity (iv) Guide wavelength (v) Wave impedance (vi) Dimensions	**20**	**CO3**