(vi) In a slotted line, measurement probes are placed at half-power points to measure
(a) load impedance (b) guided wavelength
(c) high VSWR (d) low VSWR

(vii) Tangents to the resistance and reactance circles in a Smith chart intersect at an angle
(a) 135^0 (b) 180^0 (c) 45^0 (d) 90^0

(viii) In a mixer the local oscillator frequency is 1200 MHz. If a signal frequency is 700 MHz what will be its image frequency?
(a) 2000 MHz (b) 1700 MHz
(c) 1500 MHz (d) 1000 MHz

(ix) A cavity wavemeter measures microwave frequencies because the cavity
(a) offers high impedance to microwave
(b) offers resistive load
(c) has more volume for microwave to interact
(d) has resonance with one frequency of microwave signal

(x) Spectrum analyzer is a broadband
(a) homodyne receiver (b) superheterodyne receiver
(c) digital signal processor (d) FFT analyzer

Group – B

2. (a) What are the advantages of double bridge over single bridge in power meter bridge circuit.

(b) Discuss the working principle of microwave sensor, based on practical application.

6 + 6 = 12

3. (a) Give a list of frequency bands , subbands, their designations and applications in the following frequency regions
(i) RF
(ii) Microwave
(iii) Infrared and visible light

(b) Outline the constructional features and temperature characteristics of Thermistors and Barretters. Classify the range of values of low and high microwave power.

6 + 6 = 12

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Group – C

4. (a) Define VSWR. Describe the methods of measuring high and low VSWRs.

(b) A 75 Ω transmission line is connected to a load impedance Z_L =45+j12 Ω. Find the position and length of a short-circuited stub required to match the line using Smith Chart.

5 + 7 = 12

5. (a) Briefly describe the principal features of construction of Smith chart.

(b) A transmission line of 100 meter length and a characteristic impedance of 100 Ω is terminated by a load Z_L= 100 - j200 Ω. Using the Smith chart determine the line impedance and admittance at 25 meter from the load end at a frequency of 10 MHz.

5 + 7 = 12

Group – D

6. (a) What is a microwave cavity ? On what theoretical principle does it work? Define quality factor Q of a cavity. Explain the meaning of loaded Q (Q_l), unloaded Q (Q_u) and external Q (Q_e). Mention a typical value of Q.

(b) Q_l and Q_e of a microwave cavity are 1000 and 1500 respectively. Find the value of Q_e. Derive the relation you would use.

6 + 6 = 12

7. (a) Explain the waveguide method for dielectric constant measurement of a solid.

(b) By the help of schematic diagram explain the measurement of cavity Q using Network Analyzer.

6 + 6 = 12

Group – E

8. (a) Briefly explain the working principle of spectrum analyser.

(b) For a two port network, show the schematic for measuring S-parameters using network analyser.

6 + 6 = 12

9. (a) What is Bolometer? Give some applications of Bolometer.

   (b) What is reflectometer? How can it be used to measure return loss?

5 + 7 = 12

2016

MICROWAVE MEASUREMENT AND INSTRUMENTATION
(ECEN 5234)

Time Allotted : 3 hrs **Full Marks : 70**

Figures out of the right margin indicate full marks.

Candidates are required to answer Group A and any 5 (five) from Group B to E, taking at least one from each group.

Candidates are required to give answer in their own words as far as practicable.

Group – A
(Multiple Choice Type Questions)

1. Choose the correct alternatives for the following: **10 × 1=10**

   (i) The difference between spectrum analyser (SA) and CRO is
   (a) CRO and SA both measure time domain signal
   (b) CRO and SA both measure frequency domain signal
   (c) CRO measures time domain signal and SA measures frequency domain
   (d) CRO measures frequency domain signal and SA measures time domain

   (ii) Microwave Power meter contains
   (a) Chebyshev filter
   (b) Butterworth filter
   (c) Wheatstone Bridge circuit
   (d) Magic Tee junction for its operation

   (iii) Dominant transverse electric mode in a circular waveguide is
   (a) TE_{11} (b) TE_{22} (c) TE_{10} (d) TE_{20}

   (iv) Main application of TDR is
   (a) location discontinuity (b) evaluating cable loss
   (c) analyzing reflection (d) all of them

   (v) How can SWR be minimized?
   (a) Using filters (b) Using limiter
   (c) Using Smith Chart (d) Using stubs