 **ST.ANNE’S**

**COLLEGE OF ENGINEERING AND TECHNOLOGY**

(An ISO 9001:2015 Certified Institution)

Anguchettypalayam, Panruti – 607106.

**QUESTION BANK**

**PERIOD:** JULY - NOV 2018 **BATCH**: 2015 – 2019

**BRANCH:** ECE **YEAR/SEM:** IV/VIII

**SUB CODE/NAME: EC6701 - RF AND MICROWAVE ENGINEERING**

**UNIT I -TWO PORT NETWORK THEORY**

**PART – A**

1. Write the frequency range for IEEE microwave bands?**[D]** **(April/May 2017)**
2. L band
3. S band
4. C band
5. X band
6. Give the relation between S and ABCD parameter.**[I.D] (April/May 2017, Nov/Dec 2012)**
7. List the radio frequency bands available in microwave and radio frequency ranges**.[D] (Nov/Dec 2016)**
8. Define S parameters**.[D] (Nov/Dec 2016)**
9. State the principle advantage of microwave frequency over lower frequency**.[D](May/June 2009)**
10. Define reciprocal and symmetrical network**.[D]** **(May/June 2013)**
11. Mention the limitation in measuring Z, Y and ABCD parameters at microwave frequencies**.[I.D] (Nov/Dec 2011)**
12. State the significance of scattering matrix representation**.[D] (Nov/Dec 2012)**
13. Name the properties of S parameters**.[I.D] (Nov/Dec 2012)**
14. Draw the equivalent circuit of a practical capacitor**.[D] (Nov/Dec 2012)**
15. Draw the equivalent circuit of inductor at radio frequency**.[D](May/June 2013)**
16. Give the relationship between s and z**.[D] (May/June 2014**)
17. What are the advantages of S parameters**?[D] (May/June 2012)**
18. Mention any 4 difference between low frequency and high frequency microwave circuits**.[D] (April/May 2015)\**
19. Draw the high frequency equivalent circuit of resistor and inductor**.[D] (April/May 2015)**
20. Define 2 port network**.[D]**
21. Define a junction. **(QB)[D]**
22. Why S matrix are used in microwave. **[D](Nov/Dec 2011)**
23. State reciprocity theorem**.[D] (QB)**
24. Define quality factor of a capacitor**.[D] (QB)**
25. Write about the skin effect in a wire**.[D] (QB)**
26. Name the types of resistors**.[D] (QB)**
27. Write the applications of inductors**.[D] (QB)**
28. State zero property**.[D]**
29. State few disadvantages of microwave**.[D]**
30. What are the .Properties of s-matrix? **[D]**
31. Define one port circuit.Give two examples**.[D]**
32. What are the two types of terminations. **[D]**
33. What are power dividers? **[D]**
34. Give the applications of directional coupler**.[D]**

**PART – B**

**[First Half]**

**[Low frequency parameters]**

1. Write a detailed note on ABCD parameter. (8**)[D] (May/June 2013)**
2. Discuss the importance of low frequency and high frequency parameters of RF two port networks**.[D] (Nov/Dec 2014)**
3. Derive the overall network parameters for cascade connection of 2 port network. Discuss about short circuit, open circuit, H and ABCD low frequency parameters. **[D](16) (April/May 2017)**

**(OR)**

Explain in detail about low frequency parameters.

**[Formulation of S parameters]**

1. Formulate S parameter for n port network. Compute ABCD for a T network. (16**)[I.D] (May/June 2013, Nov/Dec 2012)**
2. Derive Z and Y matrix formulation of multi port network. (8) **[I.D](April/May 2015)**
3. Explain about the different types of interconnection of 2 port network. **[D](QB)**
4. Explain the scattering matrix for a lossless junction. (16) **[D](April/May 2015)**

**(OR)**

Explain the formulation of S matrix**.[D] (April/May 2015)**

**[Properties of S parameters]**

1. State and prove the properties of S matrix. (8**)[D] (April/May 2017)**

**(OR)**

List and explain the properties of S matrix. (8**)[D] (Nov/Dec 2011)**

**(OR)**

State and prove the properties of S matrix. (16) **[D] (May/June 2009)**

**(OR)**

With the help of S matrix concept prove the S matrix properties. **[D](May/June 2014)**

1. Symmetry
2. Unity
3. Zero
4. Phase shift

**[Second Half]**

**[Reciprocal network]**

1. Explain the symmetry property in reciprocal network. (8) **[D] (April/May 2017, Nov/Dec 2011, April/May 2015)**
2. Explain and analyze any reciprocal lossless network with derivation. (10**)[D] (Nov/Dec 2016)** 2016)

**[Transmission matrix]**

1. Explain the transmission matrix for 2 port network.**[D]** (8) **(Nov/Dec 2011)**

**(OR)**

Why do you prefer transmission matrix? Obtain ABCD matrix of a transformer with the turns ratio of N:1**. [I.D] (May/June 2014)**

**(OR)**

What is T matrix? Obtain and explain its relationship with [S] and vice versa. (8) **[I.D] (Nov/Dec 2016)**

**[RF behavior of Resistors, Capacitors and Inductors]**

1. Write in detail about types of resistors. (8) **[D] (Nov/Dec 2011)**
2. Discuss on the application of RF and microwave area. (6) **[D] (Nov/Dec 2016)**

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**UNIT II - RF AMPLIFIERS AND MATCHING NETWORKS**

**PART A**

1. Define transducer power gain**.[D](Nov/Dec 2013)**
2. Define unilateral power gain**.[D] (Nov/Dec 2014)**
3. Write the function of matching network? Or What is the need of matching network? **[D] (Nov/Dec 2011, Nov/Dec 2014, April/May 2015)**
4. Write notes on feedback of RF circuits**.[D] (QB)**
5. Define unconditional stability. **[D] (QB)**
6. Define noise figure**.[D] (Nov/Dec 2011)**
7. Mention the importance of matching network**.[I.D] (Nov/Dec 2012)**
8. What are the approaches used to a matching network**?[I.D]**
9. Define loaded quality factor**.[D] (Rejinpaul)**
10. Define nodal quality factor**.[D]**
11. What are the advantage of T and Pi matching network**? [D] (Nov/Dec 2016)**
12. Why we go for double stub matching network**?[I.D] (QB)**
13. Name the factors used for selecting a matching network**.[D] (QB)**
14. Mention the advantage of smith chart. **(Rejinpaul)**
15. Draw the typical output stability circle and input stability circle**.[D] (May/June 2013)**
16. Why impedance matching is required. What are the other constraints**?[I.D] (May/June 2013)**
17. Define stability**.[D] (May/June 2014)**
18. State the significance of microstrip matching networks. **[D] (Nov/Dec 2014)**
19. Give the expression that relates nodal quality factor with loaded quality factor**.[D] (Nov/Dec 2013)**
20. What the need of load matching in 2 port network**.[I.D] (April/May2017)**
21. What is transducer power gain.**[D]** **(April/May2017)**
22. Distinguish between conditional and unconditional stability**.[D] (May/June 2012)**
23. Define power gain of an amplifier in terms of S parameters and reflection coefficients**.[D] (Nov/Dec 2012)**
24. Define available power gain**.[D]**
25. Give the expressions for noise figure of an amplifier**.[I.D] (Nov/Dec 2012)**
26. What are the key parameters used to evaluate the performance of an amplifier**?[D] (Rejinpaul)**
27. Write the voltage matrix for an N-port microwave circuits.
28. Define nodal quality factor**.[D]**
29. Define unconditional stability. **[D] (QB)**
30. Write the function of matching network? **April/May 2015)**

**PART B**

**[First Half]**

**Amplifier power relations**

1. A microwave amplifier is characterized by its S-parameters. Derive equations for power, gain, available gain and transducer gain. **[I.D](16) (April/May 2015, April/May 2012)**

**(OR)**

Discuss various aspects of amplifier-power relation for RF transistor amplifier design**.[I.D]**

**(OR)**

Derive the amplifier power relations for 2 port amplifier**[D]**

1. Discuss gain considerations for RF amplifier**.[D]**
2. Write the mathematical analysis of amplifier stability. (8**)[D] (April/may 2015)**
3. Design a microwave amplifier for transducer power gain. (8) **[D] (April/May 2015)**

**Stability considerations**

1. With reference to RF transistor amplifier, discuss the considerations for stability and gain.(16**)[I.D] (Nov/Dec 2011) (Nov/Dec 2014)**
2. Explain input and output stability circles with different conditions**[D](8)**

**Stabilization Methods**

1. Discuss various stabilization methods and stability considerations for RF transistor, amplifier gain. (16) **[D](Nov/Dec 2011)**
2. Explain various stabilization methods. **(16)[D]**

**Noise Figure & VSWR**

1. Explain noise figure circles and VSWR circles in detail. (16)**[D]**

**(OR)**

1. Analyze noise figure circles and VSWR circles and derive the expressions. (16) **[D]**
2. Describe the process of visualizing the noise performance of a transistor by plotting noise circles on the S plane. (16) **(May/June 2012) [I.D]**

**High power and Multistage Amplifiers**

1. Write detailed note on Broadband, High power and Multistage Amplifiers. (16**) [D]**

**[Second Half]**

**T and Pi Matching Networks**

1. Explain the concept of T and micro strip matching network? (10) **(Nov/Dec 2014) [D]**
2. Describe the smith chart. How can it be used to determine an unknown impedance?(6**)[D] (Nov/Dec 2014)**
3. Discuss the design procedure for T and pi matching network. (16**) (Nov/Dec 2013) [D]**

**(OR)**

1. Explain the design procedure for T and π matching network. (16) **[D] (Nov/Dec 2013, April/May 2017)**
2. What are T and π matching network. Explain in detail. Also state its functions **[D]**
3. Explain different types of matching networks **(16) [D] (Nov/Dec 2011)**
4. Explain 2 component matching network. (8**)[D]**

**Microstrip Line Matching Networks**

1. Explain the different types of micro strip lines and give a brief note of their characteristics. (16) **(April/May 2017) [D]**

**(OR)**

Explain in detail about micro strip line matching network with a neat diagram**.[D]**

1. Explain the following: (a) Impedance matching networks. (b) Microstripline matching networks(16**)[D] (Nov/Dec 2011)**

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**UNIT 3 – PASSIVE AND ACTIVE MICROWAVE DEVICES**

**PART A**

1. Name the any two microwave passive devices which make use of Faraday rotation. **[D](AU A/M 2015)**
2. What are the properties of S matrix**?[D] (AU A/M 2015)**
3. Draw the equivalent circuit of Varactor diode**.[D] (AU A/M 2015)**
4. Compare PIN and PN diode**.[D] (AU N/D 2016)**
5. What is isolator? And why isolators are called uniline? **[D](AU N/D 2016)**
6. Mention the application of Gyrator and Isolator. **[D] (AU N/D 2014)**
7. Write the necessary conditions for Gunn Effect. **[D] (AU N/D 2014)**
8. What are the factors that reduce the efficiency of IMPATT diode? **[D](AU M/J 2014)**
9. What is negative resistance in Gunn diode? **[D](AU M/J 2014)**
10. What are matched terminators? **[D](AU M/J 2014)**
11. What are ferrites? Why is its need in circulators? **[D](AU M/J 2014)**
12. What are power dividers**?[D]**
13. What is the S-matrix of 3 port circulators? **[D]**
14. Give the differences between Isolator and Circulator**.[D]**
15. What is the S-matrix for 4 port circulators?**[D]**
16. Which has lesser coupling in the following? **[D]**

i) 3 dB coupler ii) 6 dB coupler iii) 10 dB coupler.

1. What are ferrites and write its properties. Give some examples of ferrite devices.**[D]**
2. Give the S-matrix of series Tee.**[D]**
3. Give the S-matrix of shunt Tee.**[D]**
4. Give the S-matrix of hybrid Tee. **[D]**
5. Give the S- Matrix of directional coupler. **[D]**
6. Give an example for a two port MW device. **[D]**
7. Give the applications of directional coupler**[D]**
8. What is Faraday’s rotation law? **[D]**
9. What is the principle of Microwave phase shifter? **[D]**
10. What are junctions? Give some examples**[D]**
11. What is Tee junction? Give two examples**[D]**
12. What is hybrid ring? **[D]**
13. Name some wave guide components used to change the direction of the guide through an arbitrary angle**[I.D]**
14. What are the different types of Directional coupler? **[D]**
15. What are nonreciprocal devices? Give two examples**[I.D]**
16. Why isolators are called uniline? **[D]**
17. Give some coupling parameters of directional coupler? **[D]**
18. A directional coupler is having coupling factor of 20 db and directivity of 40 db.if the incident power is 900mW, what is the coupled power? **[D]**

**PART B**

**[First Half]**

**Attenuators, Phase shifters**

1. With neat diagram explain the various types of attenuators and phase shifters (8) **[D]**

**Directional couplers**

1. With neat diagram explain the operation and types of the directional coupler. (16) **(AU A/M 2015) [D]**
2. What do you mean by S parameters? Why do we require S parameters? Draw the diagram of a

Directional coupler and explain the working. Derive S matrix of a directional coupler. (16) **[D]**

**Hybrid Junctions**

1. Describe Magic Tee with neat sketch. (6)[D]
2. Discuss the properties of scattering matrix. Determine the Scattering matrix representation

of E plane Tee Junction. (10) **(AU N/D 2016) [D]**

1. Derive scattering matrix of H – plane tee using S – parameter theory. (8) **[D]**

**(OR)**

Derive scattering matrix of shunt tee using S – parameter theory **[I.D]**

1. Derive scattering matrix of E – plane tee using S – parameter theory. (8) **[D]**

**(OR)**

Derive scattering matrix of Series tee using S – parameter theory. (8) **[I.D]**

**Circulator, Isolator**

1. Explain the operating principle of a microwave, circulator with neat schematic diagram. (8)

**(AU N/D 2014) [D]**

1. What is circulator? With neat diagram, explain the working principle, Construction, operation of Four -port circulator using magic -tees. Verify the Circulator theory with necessary

S -parameter equations. **(AU N/D 2016)[I.D]**

1. Explain the construction working and application of isolator based on Faraday rotation? **[D]**
2. Discuss the structure and principle of operation of **[D]**
   * 1. Isolator (8)
     2. Circulator (8)

**(OR)**

Explain about Circulator and Isolator with its working principle (10) **[D]**

**[Second Half]**

**Crystal and Schottkey diode detector**

1. Conclude the operating principles of schottkey Barrier diode and step recovery diodes. (8) **[D]**
2. Explain the operating principle of varactor and schottkey diodes**. (AU M/J 2014) [D]**

**Gunn diode oscillator**

1. Explain the working principle of Gunn diode with two valley model and Plot its characteristics. **(AU A/M 2015) [D]**

**(OR)**

1. Explain Ridley-Watkins –Hilsum (RHW) theory with the help of two-valley modal. **[I.D]**
2. With neat diagram, explain the construction and characteristics of Gunn diode. **(AU N/D 2014)**

**(OR)**

Explain the operating principle of a Gunn diode. Describe its domain formation and various

Modes of operation? **(AU M/J 2014)** **[D]**

**(OR)**

1. Recall the working principle of Gunn diode (8)
2. What are the various modes of operations of the Gunn diode (4)
3. Plot Gunn Diode characteristics. (4)

**IMPATT diode oscillator**

1. What are avalanche transit time devices? Explain the operation and construction of IMPATT diode. (**AU A/M 2015)** **[D]**
2. Give the comparison between Gunn, IMPATT, TRAPATT and Baritt. **.(A/M 2017) [D]**

**Varactor diode**

1. Discuss briefly about working principle, operation, characteristics and application of varactor diode. (16) **(AU A/M 2015) [D]**

**UNIT 4 – MICROWAVE GENERATION**

**PART A**

1. What is magnetron? **[D] (N/D 2016)**
2. Write the classification of microwave tubes and explain the difference between them. **[D](A/M 2017)**
3. What are slow wave structures? Give examples. **(A/M 2017) ?[I.D]**
4. What is the purpose of slow wave structures used in TWT amplifiers? **[D] (N/D 2017)**
5. What do you mean by O type tube ? Name some O type tubes. **(N/D 2017)**
6. What is Tetrodes and Pentodes? **[D] (N/D 2016)**
7. A Si Mw transistor has a maximum electric field intensity Em of 3 x 105 %m and its carrier has a drift velocity of 4 x 106 on/s . The emitter collector length is 4, um, find maximum possible transit time cut off frequency. **[D]**
8. Compare two cavity klystron and traveling wave tube**[D]**
9. What are the limitations of conventional vacuum devices? **[D]**
10. Mention the major differences between the TWT and Klystron. **(A/M 2015) [D]**
11. State any four limitations of conventional tubes at high frequencies. **[D]**
12. What are the high frequency effects in conventional tubes? **[D]**
13. What are the assumptions for calculation of RF power in Reflex Klystron? **[D]**
14. Give the drawbacks of klystron amplifiers**[D]**
15. What are the applications of reflex klystron? **[D]**
16. What is the purpose of slow wave structures used in TWT amplifiers? **[D]**
17. State the applications of TWT. **[D]**
18. What do you mean by O-type tubes? Name some O-type tube?**[I.D]**
19. What is the effect of transit time? **[D]**
20. Explain Hull cutoff condition? **[I.D]**
21. Why magnetron is called as Cross field Devices? **[D]**
22. How would you explain BWO? State the applications of BWO. **[D]**
23. Why magnetron is called as Cross field Devices? **[D]**
24. How the klystron amplifier can act as klystron oscillator? What are the applications of klystron amplifier?**[I.D]**
25. Compare TWTA Klystron amplifier. **(A/M 2015) [D]**
26. Give the performance Specification of Reflex klystron? **[D]**
27. What are the assumptions for calculation of RF power in Reflex Klystron? **[D]**
28. What is the condition for oscillation in Reflex klystron ? **[D]**
29. Give the drawbacks of klystron amplifiers. **[D]**
30. What are the applications of reflex klystron ? **[D]**

**PART B**

**[First Half]**

**Two cavity Klystron Amplifier**

1. With neat diagram explain the operation of two cavity klystron amplifier and derive the equations for velocity modulation process. (16)**.(A/M 2017) [D]**

**(OR)**

Explain in detail about 2-cavity klystron amplifier.(16) **[D]**

1. What are the launching process of a two cavity klystron (8) **[I.D]**

**Reflex Klystron oscillator**

1. Explain the operation of reflex klystron oscillator with neat diagram. Write the performance characteristics and applications of the reflex Klystron **(N/D 2017) [D]**

**(OR)**

Discuss the working principle of reflex klystron oscillator with necessary diagrams. (8)

**(OR)**

Explain briefly the working principle of the reflex klystron oscillator (6)

**(OR)**

Show the working principle of reflex klystron oscillator with necessary diagram (10)

1. Derive velocity modulation, transit time of reflex klystron oscillator.(8) **[D]**
2. Explain the working principle and operation of multi -cavity Klystron amplifier and derive the expressions for its output power. (16) **(N/D 2016) [D]**

**[Second Half]**

**Traveling wave tube amplifier**

1. Explain the operation of travelling wave tube and write its characteristics. **.(A/M 2017) [D]**

**(OR)**

Illustrate with interaction region diagram the mechanism of operation of TWT amplifier, its

Applications and the expression for the gain of a TWT **[D]**

1. A travelling wave tube (TWT) operates under the following parameters : **(N/D 2016) [D]**

Beam Voltage Vo = 3 kV

Beam Current 10 = 30 mA

Characteristic impedance of helix = Zo =10 Q

Circuit length = N = 50 m

Frequency f = 10 GHz

Determine

* + - 1. Gain parameters C.
      2. Output power gain Ap in decibels.
      3. All four propagation constants. (16)

**Magnetron oscillator using Cylindrical, Linear, Coaxial Voltage tunable Magnetrons**

1. Write a detailed notes on the following **[D]**

Travelling wave tube amplifier. ii) Cylindrical magnetron(8) **(N/D 2017)**

1. With neat diagrams and relevant equations, explain about cylindrical and coaxial magnetron. (16) **[D]**
2. Discuss in detail about tunable magnetron and also explain in brief regarding Ricke diagram. (16)**[I.D]**
3. Explain coaxial voltage tunable magnetrons with necessary diagrams **[D]**
4. Explain the π mode of operation of magnetron. Mention few high Frequency limitations.**[D]**

**(OR)**

1. How would you describe the π mode of oscillations of Magnetron, what is meant by strapping in Magnetron and why it is done**?[AU M/J 2015][D]**

14.

**Backward wave crossed field amplifier and oscillator**

1. Explain about (i) Backward wave Crossed field amplifier (8) (ii) Backward wave oscillator.

**(OR)**

1. Explain the construction, operation, characteristics and applications of BWO.**[D]**
2. Define optimum bunching distance Lopt. And derive the expression for it. **[I.D]**
3. Derive the equation of velocity modulated wave and discuss the concept of bunching effect in two cavity klystron. With neat diagrams and relevant equations, explain about helix traveling wave tube.(16)**[I.D]**

19. Explain the π mode of operation of magnetron

* 1. Show the High frequency effects in vacuum tubes.
  2. Explain the impact of frequency effects in real time vacuum tube applications.
  3. An X band pulsed cylindrical magnetron has the following
     1. Operating parameters:
     2. Anode voltage Vo = 26 kV
     3. Beam current Io = 27 A
     4. Magnetic flux density Bo = 0.336 Wb/m2
     5. Radius of cathode cylinder a = 5 cm
     6. Radius of vane edge to center b = 10 cm.
  4. Determine cyclotron angular frequency, cut off voltage for a fixed Bo and cut off magnetic flux density for a fixed Vo. (10)
  5. A travelling wave tube (TWT) operates under the following parameters :
  6. Beam Voltage Vo = 3 kV
  7. Beam Current 10 = 30 mA
  8. Characteristic impedance of helix = Zo =10 Q
  9. Circuit length = N = 50 m
  10. Frequency f = 10 GHz
  11. Determine Gain parameters C and Output power gain Ap in decibels and All four propagation constants

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**UNIT 5 – MICROWAVE MEASUREMENTS**

**PART A**

1. What is network analyzer? **[D](N/D 2016)**
2. Classify microwave powers with its range ? **[D]** (N/D 2016)
3. What is the significance of VSWR measurement? **[D]**
4. Differentiate barretter and thermistor. **[D]**
5. Demonstrate the errors possible in VSWR measurements. **[I.D]**
6. Explain how to measure dielectric measurement of a solid? **[D]**
7. Give some application of spectrum analyzer. **[D]**
8. How will you determine the VSWR and return loss in reflectometer method. **[D]**
9. What is bolometer? Discuss the different types of Impedance measurement method? **[D]**
10. What is calorimeter? **[D]**
11. What are tunable detectors? **[D]**
12. What is calorimetric direct heating method? **[D]**
13. What is the principle by which high power measurements could be done by calorimetric method? **[D]**
14. Name the scales used in VSWR meter. **[D]**
15. Why direct microwave measuring instruments are not used in laboratory?**[I.D]**
16. Define reflection coefficient? **[D]**
17. Define guide wavelength**.(A/M 2017) [D]**
18. Define return loss and insertion loss in RF networks. **(N/D 2017) [D]**
19. What are the uses of network analyzer? What are the types of network analyzer? (N/D2017) **[D]**
20. How do you measure microwave frequency? **[D]**
21. What is a wavemeter? **[D]**
22. Define dielectric constant? **[D]**
23. How the S-parameter of a microwave circuit measured? **[D]**
24. List the methods for measuring dielectric constants? **[D]**
25. What is spectrum analyzer? **[D]**
26. List the types of spectrum analyzer**[D]**
27. List some application of spectrum analyzer. **[D]**
28. How will you determine the vswr and return loss in reflecto meter method? **[D]**
29. List the different types of Impedence measurement methods? **[D]**
30. How do you measure microwave frequency? **[D]**

**PART B**

**[First Half]**

**Measuring Instruments- VSWR meter**

1. Explain in detail the measurement of VSWR through return loss measurements.(16) **[D]**
2. Explain the measurement of high VSWR with the help of block diagram**[D]**
3. Explain how low VSWR can be measured using a microwave bench. . **[D] (N/D 2017)**
4. Explain the principle of operation of VSWR meter. **[D] (N/D 2017)**

**Power meter**

1. Explain the operation of microwave power meter with neat sketches. **[D]**

**Spectrum analyzer, Network analyzer**

1. Explain Spectrum analyzer and Network analyzer with suitable diagrams. **[D]**
2. Explain the operation of network analyzer with neat sketches. **[D]**

**[Second Half]**

**Measurement of Impedance, Frequency, Power, VSWR**

1. Write notes on power sensors used for microwave power measurements **[D]** (8)
2. Identify how high power measurements are done using calorimetric method. **[D](8)**
3. Discuss the measurement of power at microwave frequency in detail. **[D] (N/D2017) (8)**
4. Discuss in detail the power measurement using microwave devices. (16) . **[D] (A/M 2017)**
5. Describe how the power of a microwave generator can be measured using bolometer**[D](8)**
6. Describe how the frequency of a given microwave source can be measured? **[D](8)**
7. Discuss in detail the impedance measurement using microwave devices.(16) **[D]**
8. Explain the impedance measurement technique using slotted line and Reflectometer.(16) **[D]**

**(OR)**

1. Explain the procedure to measure the impedance of a load using slotted line method?(12) **[D] (N/D2017)**
2. Discuss the impedance, wavelength and frequency measurement using

Slotted line method.(16) **[D] (A/M 2017)**

1. Describe the measurement of Q by slotted line method with neat sketch. **[D](8)**

**Dielectric constant**

1. Explain in detail about the dielectric constant measurement of a solid using waveguide. **[D]** (16)