BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(END SEMESTER EXAMINATION)

CLASS: BE **SEMESTER : V**
BRANCH: ECE **SESSION : MO/18**

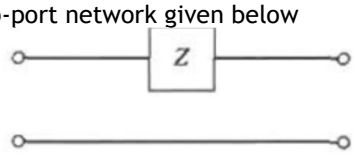
SUBJECT: EC5203 MICROWAVE ENGINEERING

TIME: **FULL MARKS: 60**

INSTRUCTIONS:
1. The question paper contains 7 questions each of 12 marks and total 84 marks.
2. Candidates may attempt any 5 questions maximum of 60 marks.
3. The missing data, if any, may be assumed suitably.
***4*. Before attempting the question paper, be sure that you have got the correct question paper.**
5. Tables/Data hand book/Graph paper etc. to be supplied to the candidates in the examination hall.

Q.1(a) Discuss the advantages of microwave frequencies compared to low frequency waves. [2]
Q.1(b) What is electromagnetic Shielding? Why is this needed? [4]
Q.1(c) Discuss MMIC with its advantages and disadvantages. [6]

Q.2(a) Derive the condition/s on S matrix for reciprocal network. [2]
Q.2(b) Find the ABCD parameters of a two-port network given below [4]

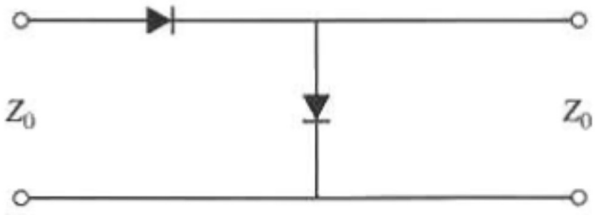


Q.2(c) Consider two two-port networks with individual scattering matrices, [S^A] and [S^B]. Show that the overall S_{21} parameter of the cascade of these networks is given by [6]

$$S_{21} = \frac{S_{21}^A S_{21}^B}{1 - S_{22}^A S_{11}^B}$$

Q.3(a) Define quantities used to characterize a directional coupler. [2]
Q.3(b) Derive the Scattering matrix for a Magic TEE. [4]
Q.3(c) Calculate the amplitudes of emerging waves at each port of the branch- line hybrid. [6]

Q.4(a) Explain the transit time domain mode of a Gunn diode. [2]
Q.4(b) Using suitable sketches explain how oscillations are sustained in the cavity magnetron for pi mode operation. [4]
Q.4(c) A single-pole, single-throw switch is constructed using two identical PIN diodes in the arrangement shown below. In the ON state, the series diode is forward biased and the shunt diode is reversed biased and vice versa for the OFF state. If f= 6 GHz, Z_o=50 Ω, C_j=0.1 pF, R_r = 0.5 Ω, R_f = 0.3 Ω, and L_i=0.4 nH. Determine the insertion losses for the ON and OFF states. [6]



Q.5(a) What are the basic properties of ferrite materials? [2]
Q.5(b) Explain the working of four port circulator using faraday rotation. [4]
Q.5(c) Derive the tensor permeability for a magnetized material. [6]

Q.6(a) Draw the electric and magnetic fields for strip line. [2]
Q.6(b) A 50 Ω copper stripline conductor, with the ground plane separation = 0.32 cm and ε_r = 2.20. If the dielectric loss tangent is 0.001 and the operating frequency is 10 GHz, calculate the dielectricattenuation in dB/λ. Assume a conductor thickness is 0.01 mm. [4]
Q.6(c) Discuss the losses which occur in a microstrip line. [6]

Q.7(a) Explain the slotted line method to measure the frequency. [2]
Q.7(b) Explain vector spectrum analyzer with the help of block diagram. [4]
Q.7(c) Write a short notes on radiation pattern. What kind of radiation pattern a microstrip antenna and horn antenna exhibit? [6]

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