This question paper contains 3 printed pages.

3350 *Your Roll No.* .....

B. Tech. (EC) / IV **J**

Paper— MICROWAVE ENGINEERING

(EEC–402)

Time : 3 hours *Maximum Marks* : 70

(Write your Roll No. on the top immediately on receipt of this question paper.)

Question No. 1 is compulsory and attempt any four out of remaining six questions. Make suitable assumption, if required. Put all subparts of a question together.

1. (*a*) Why is S-matrix used in microwave analysis? 2

(*b*) What are hull cut-off conditions in magnetron? 2

(*c*) State the differences between TWT and Klystron. 2

(*d*) Explain tunnel diode characteristics with energy band diagram. 2

(*e*) Explain the different types of microstrip lines and give a brief note on their characteristics. 2

(*f*) What do you mean by O-type tubes? Explain difference between M-type and O-type tubes. 2

(*g*) State the advantages and limitations of Microwave Communication. 2

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2. (*a*) What is Transferred Electron Effect? What are the various modes of transferred electron oscillations? 4

(*b*) Explain the operation of TRAPP and IMPATT diodes. 6

(*c*) An IMPATT diode has drift length of 2 μm. Determine the operating frequency of IMPATT diode if drift velocity is 100 cm/sec. 4

3. (*a*) What is negative resistance in Gunn diode? 4

(*b*) Using RWH theory, explain two valley model of GUNN diode. 6

(*c*) Explain the several mode formation in GUNN diode. 4

4. (*a*) What is a parametric amplifier? How is it different from a normal amplifier? 4

(*b*) Derive and explain Manley Rowe equations/ relations. 6

(*c*) Use the above relations to find the power gain of an up and down converter. 4

5. (*a*) With neat circuit diagrams and relevant equations, explain the velocity modulation process and bunching in a Klystron amplifier. 6

(*b*) Derive expression for the distance between cavities of Klystron for maximum bunching. 4

(*c*) A reflex klystron has following parameters:

V_r=300 V, V_o =500 V, mode (n)=1, f=10 GHz, e/m= 1·76 $\times 10^{11}$ (MKS), and ΔV_r=5% then find variation in frequency. 4

6. (*a*) Explain operation, construction and applications of varactor diode. 5

   (*b*) With the help of neat diagram, explain working of isolator. 5

   (*c*) Derive S-matrix of H-Tee and E-Tee. 4

7. (*a*) Draw the schematic diagram of a helix TWT and explain its working with slow wave structure. 6

   (*b*) Write formula of propagation constants and ourput power gain of TWT. 3

   (*c*) For a helix TWT, V_o=400 V, P (pitch of helix)= 0·2 mm, d (diameter of helix)= 1 mm, L (length of helix)=1 cm, C (Gain parameter of TWT)=0·2 and f=10 GHz then find values of propagation constants and power gain. 5

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