



Printed Pages : 4

TEC-604

(Following Paper ID and Roll No. to be filled in your Answer Book)

PAPER ID : 3094

Roll No.

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## B. Tech.

### (SEM. VI) EXAMINATION, 2007-08 MICROWAVE AND RADAR ENGG.

Time : 3 Hours]

[Total Marks : 100

Note : Answer all questions.

1 Attempt any four of the following : 5×4=20

- (a) Derive the field component present in  $TE_{10}$  mode of propagation in rectangular wave guide and draw its field pattern.
- (b) A rectangular wave guide is to be operated in the frequency range 7.5 to 10 GHz. Calculate the inside dimensions so that the following design criteria are satisfied (i) there is only one mode of propagation (ii) lowest usable frequency is 10% above the cut-off and (iii) highest usable frequency is 5% below the frequency where next higher mode can propagate.
- (c) A circular cylindrical cavity resonates at 3 GHz in  $TM_{010}$  mode. If  $X_{01} = 2.405$  and resonator is filled with dielectric material of dielectric constant 2.56. Calculate the new resonance frequency.
- (d) Explain various losses present in waveguides. How cut-off Attenuators work ?



- (e) Derive the S matrix of E-plane Tee when power is fed from auxillary port. Consider other ports in the matched condition.
- (f) Explain the working of multi-hole directional coupler and compute its various parameters.

2 Attempt any **four** of the following : **5×4=20**

- (a) Explain the operating principle of isolator and discuss its working with relevant diagram.
- (b) With block diagram explain the procedure to measure the impedance of an unknown impedance using slotted wave section.
- (c) Explain the operating principle and working of crystal detector.
- (d) What are the limitations of conventional active devices at microwave frequencies.
- (e) Explain the relevance of dominant mode in rectangular wave guide and why TEM wave can not exist in wave guides ?
- (f) Explain the working of PIN diode and Tunnel diode.



3 Attempt any **two** of the following :

**10×2=20**

(a) A two cavity klystron has beam voltage  $V_0 = 900$  V and beam current  $I_0 = 30$  mA with operating frequency of 8 GHz. If gap spacing in either cavity is  $(d) = 1$  mm, spacing between centers of cavity  $(L) = 4$  cm, effective shunt impedance  $R_{sn} = 40$  K  $\Omega$ . Find :

- (i) The electron velocity
- (ii) DC electron transit time
- (iii) Input voltage for maximum output voltage
- (iv) Voltage gain
- (v) Why we put Repeller negative with respect to Beam voltage in Reflex Klystron ?

(b) With relevant figure, explain the working of 8 cavity cylindrical magnetron. What is the role of slow wave structure in travelling wavetube ?

- (c) (i) Discuss the working of TRAPATT.
- (ii) What is the relevance of different modes of operation in Gunn diode ?



4 Attempt any **two** of the following : **10×2=20**

- (a) With relevant diagram explain the working of Reflex Klystron.
- (b) Discuss principle of operation characteristics and application of Gunn diode.
- (c) Derive Radar Range Equation. What is doppler effect and how it is useful in long distance communication ?

5 Attempt any **two** of the following : **10×2=20**

- (a) Pulse Radar.
  - (b) Radar receiver for continuous wave radar.
  - (c) Radar displays.
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