Please check that this question paper contains 09 questions and 02 printed pages within first ten minutes.

EVENING

[Total No. of Questions: 09] [Total No. of Pages: 02]

Uni. Roll No. ..... 29 JUN 2022

Program: B.Tech. (Scheme 2018 onward)

Semester: 6th

Name of Subject: Microwave & Radar Engineering

Subject Code: PCEC-116

Paper ID: 17178

Time Allowed: 03 Hours **Max. Marks: 60**

NOTE:

1) Parts A and B are compulsory
2) Part-C has Two Questions Q8 and Q9. Both are compulsory, but with internal choice
3) Any missing data may be assumed appropriately

Part – A **[Marks: 02 each]**

Q1.

a) Explain the 'magic' in Magic Tee.
b) Draw the Applegate diagram with gap voltage for a Reflex Klystron.
c) List four main applications of IMPATT diode.
d) State the frequency range for following bands: (a) S-band (b) C-band (c) K-band (d) Ku-band.
e) Distinguish between stationary target and moving target.
f) Write the typical usage of RADAR beacon.

Part – B **[Marks: 04 each]**

Q2. Explain with neat sketch the working principle of Gyrator.

Q3. Discuss RWH theory with reference to the Gunn Diode operation.

Q4. A tunnel diode can be realized as a negative resistance amplifier. Justify your answer.

Q5. Describe the working principle of MTI RADAR.

Q6. Explain the working mechanism of device used for measurement of incident power and SWR.

P.T.O.

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Q7. A 2-cavity klystron operates at 5 GHz with a dc voltage of 10 kV and a 2 mm cavity gap. For a given RF voltage the magnitude of gap voltage is 100 volts Calculate (a) Transit angle (b) Velocity of electron leaving the gap.

Part – C **[Marks: 12 each]**

Q8. For a two-port network, discuss the properties of S-parameter matrix. Using those properties, derive the s-parameter matrix for E-plane Tee.

OR

Draw the structure of 8-cavity Magnetron and explain its bunching process.

Q9. (a) Evaluate the maximum range of Radar for the following specifications:

- Peak power transmitted by the Radar, P_t=250KW
- Gain of transmitting Antenna, G=4000
- Effective aperture of the receiving Antenna, $A_e=4m^2$
- Radar cross section of the target, $\sigma=25m^2$
- Power of minimum detectable signal, $S_{min}=10^{-12}W$

(b) A civilian RADAR has a maximum range of 30kms. Determine the maximum rage with an equivalent echoing area of 50 times and the effect of doubling the transmitter power on the range.

OR

(a) A guided missile tracking radar has the following specifications:

Transmitted power: 400 kW
Pulse repetition frequency: 1500 pps
Pulse width: 0.8 μsec
Determine (a) Unambiguous range (b) Duty Cycle (c) Average Power (d) Suitable bandwidth of RADAR

(b) A radar sends a short pulse of microwave electromagnetic energy directed towards the moon. Some of the energy scatters off of the moon's surface and returns to the radar. Compute the round trip time? If the target was an aircraft 150 nmi. distant, then evaluate its round trip time?

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