

Reg No.: _____

Name: _____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY
SEVENTH SEMESTER B.TECH DEGREE EXAMINATION(R&S), DECEMBER 2019

Course Code: EC403

Course Name: MICROWAVE & RADAR ENGINEERING

Max. Marks: 100

Duration: 3 Hours

PART A

Answer any two full questions, each carries 15 marks.

Marks

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| 1 | a) Derive the resonant frequency of a rectangular cavity resonator. | (4) |
| | b) Determine the resonant frequency of an air filled rectangular cavity operating in the dominant mode with dimensions as a=4cm, b=5cm and d=6cm. | (3) |
| | c) Assuming pi mode of oscillations explain how a magnetron can sustain its oscillations using the cross field. | (8) |
| 2 | a) With the help of Applegate diagram describe the bunching process in a two cavity klystron amplifier and derive the bunching parameter. | (8) |
| | b) A reflex klystron operates under the following conditions:
$V_0=500V$, $R_{sh}=10K\Omega$, $f_r=8\text{ GHz}$, $L=1\text{ mm}$, $e/m=1.759 \times 10^{11}$ (MKS system)
The tube is oscillating at f_r at the peak of the $n=2$ or $1\frac{3}{4}$ mode. Assume that the transit time through the gap and beam loading to be neglected. Determine:-
1. The value of the repeller voltage V_r .
2. The direct current necessary to give a microwave gap voltage of 200 V.
3. The electronic efficiency under this condition. | (7) |
| 3 | a) Explain the electronic admittance of the gap in the case of reflex klystron. With admittance diagram explain the condition required for oscillation in a reflex Klystron. | (7) |
| | b) Given the parameters of a two cavity klystron amplifier:
Beam Voltage = 1000V,
Beam current = 50mA,
Operating frequency = 10GHz
Gap spacing=1mm,
Spacing between two cavities = 5cm,
$R_o=40K\Omega$, $R_s=30K\Omega$
Determine:
1. Input signal to generate maximum output voltage.
2. Voltage gain.
3. Efficiency. | (8) |

PART B

Answer any two full questions, each carries 15 marks.

- 4 a) With neat diagrams explain any two methods to measure impedance at microwave frequencies. (8)
- b) Explain with figure a two hole directional coupler and derive its S matrix. (7)
- 5 a) With neat diagram explain the operation of a travelling wave tube. (7)
- b) Discuss the constructional features of magic tees and derive its S Matrix. Why are they called so? (8)
- 6 a) Derive the expression of axial electric field of Helix TWT. (8)
- b) With a schematic describe the operation of a four port circulator. Obtain the simplified S matrix of a perfectly matched, lossless four port circulator. (7)

PART C

Answer any two full questions, each carries 20 marks.

- 7 a) What is tunnelling? Explain the operation of a tunnel diode with aid of energy band diagram. (10)
- b) Derive Radar range equation. (5)
- c) A simple MTI delay line canceller is an example of time domain filter. Explain Why? (5)
- 8 a) Discuss the various limitations of microwave transistors. (10)
- b) Explain the more commonly used radar displays. (5)
- c) Explain how the noise figure of a radar receiver is monitored. (5)
- 9 a) Explain with neat diagram, the working of CW radar with non zero IF. (10)
- b) Explain with the help of figures different modes of operation of Gunn diodes. (10)
