



**Kadi Sarva Vishwavidyalaya**  
**Gandhinagar-382 015**

**B.E Semester: 7**  
**Electronics & Communication Engineering**  
**Subject Name: Microwave Engineering**  
**Subject Code : EC-703**

**A. Course Objective:**

The educational objectives of this course are

- To present a problem oriented introductory knowledge of Microwave Engineering.
- To address the underlying concepts and methods behind Microwave Engineering.

**B Teaching / Examination Scheme**

SUBJECT		Teaching Scheme				Total Credit	Evaluation Scheme					Total Marks
		L	T	P	Total		THEORY	IE	CIA	PR. / VIVO		
CODE	NAME	Hrs	Hrs	Hrs	Hrs		Hrs	Marks	Marks	Marks	Marks	
EC- 703	<b>Microwave Engineering</b>	4	0	2	6	5	3	70	30	20	30	150

**C Syllabus**

1. **Introduction to microwaves:**  
Microwave frequencies, advantages of microwaves, general and Industrial applications of microwaves
2. **Microwave transmission lines and waveguides:**  
Transmission line equations & solutions, reflection and transmission coefficient, standing wave and standing wave ratio, line impedance and admittance, impedance matching, using stub line, application of smith chart in solving transmission line problems Introduction to strip lines, Microstrip lines, parallel strip lines, coplanar strip lines, shielded strip lines, Rectangular waveguides-theory and analysis, principle of circular waveguide
3. **Microwave components & their s-parameters:**  
Wave-guide tees, magic tees, wave-guide corners, bends, twists, directional couples, circulators and isolators. S Matrix and its applications in analyzing microwave components



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4. **Microwave tubes and circuits:**  
Limitations of conventional tubes at UHF & Microwave, Klystrons, velocity modulation, multicavity klystron, reflex klystron, traveling wave tube, Magnetron. (Without derivations).
5. **Semiconductor microwave devices and circuits:**  
Microwave transistors and integrated circuits, varactor diodes, step recovery diodes, parametric amplifiers, tunnel diode and its applications, Gunn diode and its applications IMPATT diode, TRAPATT diode, PIN diode, schottky barrier diodes.
6. **Radar systems:**  
Basic principle, radar range equation: powers and frequencies used in radar, basic pulsed radar system, Factors Influencing maximum range, Effect of noise, Display Methods, Search and Tracking radar systems, Moving target indicator (MTI), CW Doppler Radar, Frequency Modulated CW radar

### D Lesson Planning

Sr. No.	No. of Hrs.	% Weight-age in Exam	Topic
1	03	05	<b>Introduction to microwaves:</b> Microwave frequencies, advantages of microwaves, general and Industrial applications of microwaves
2	20	35	<b>Microwave transmission lines and waveguides:</b> Transmission line equations & solutions, reflection and transmission coefficient, standing wave and standing wave ratio, line impedance and admittance, impedance matching, using stub line, application of smith chart in solving transmission line problems Introduction to strip lines, Microstrip lines, parallel strip lines, coplanar strip lines, shielded strip lines, Rectangular waveguides-theory and analysis, principle of circular waveguide



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3	8	15	<b>Microwave components &amp; their s-parameters:</b> Wave-guide tees, magic tees, wave-guide corners, bends, twists, directional couples, circulators and isolators. S Matrix and its applications in analyzing microwave components
4	10	15	<b>Microwave tubes and circuits:</b> Limitations of conventional tubes at UHF & Microwave, Klystrons, velocity modulation, multicavity klystron, reflex klystron, traveling wave tube, Magnetron. (Without derivations).
5	9	15	<b>Semiconductor microwave devices and circuits:</b> Microwave transistors and integrated circuits, varactor diodes, steprecovery diodes, parametric amplifiers, tunnel diode and its applications, Gunn diode and its applications IMPATT diode, TRAPATT diode, PIN diode, schottky barrier diodes.
6	10	15	<b>Radar systems:</b> Basic principle, radar range equation: powers and frequencies used in radar, basic pulsed radar system, Factors Influencing maximum range, Effect of noise, Display Methods, Search and Tracking radar systems, Moving target indicator (MTI), CW Doppler Radar, Frequency Modulated CW radar
<b>TOTAL</b>	60	<b>100</b>	

### E Instructional Method & Pedagogy

- At the start of course, the course delivery pattern , prerequisite of the subject will be discussed
- Lecture may be conducted with the aid of multi-media projector, black board, OHP etc. & equal weight age should be given to all topics while teaching and conduction of all examinations.



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- Attendance is compulsory in lectures and laboratory, which may carries five marks in overall evaluation.
- One/Two internal exams may be conducted and total/average/best of the same may be converted to equivalent of 30 marks as a part of internal theory evaluation.
- Assignment based on course content will be given to the student for each unit/topic and will be evaluated at regular interval. It may carry an importance of ten marks in the overall internal evaluation.
- Surprise tests/Quizzes/Seminar/Tutorial may be conducted and having share of five marks in the overall internal evaluation.
- Experiments shall be performed in the laboratory related to course contents.

**Suggested list of Experiments**

**Name Of Experiment**

1. To study different types of microwave component.
2. To set the Microwave bench for optimum operation.
3. To study characteristics of the reflex klystron tube and to determine its electronic tuning range.
4. To determine the frequency & wavelength in a rectangular waveguide working in  $TE_{10}$  mode.
5. To determine the standing wave ratio and reflection coefficient.
6. To study magic Tee & measure its various parameters.
7. To study Isolator and Circulator & measure their various parameters.
8. To study the function of multi-hole directional coupler by measuring the following parameters and measure the coupling factor and directivity.
9. To plot the radiation pattern & find out the gain of a waveguide Antenna.
10. To study the V-I characteristics of Gunn Diode.



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11. To study Attenuators.
12. To measure unknown impedance with smith chart.
13. To measure the polar pattern and the gain of a waveguide horn antenna.

**F Students Learning Outcomes**

On successful completion of the course

- The student can identify different areas of microwave engineering and components. Can find the applications of all the areas in day to day life. Can identify the operations, working, construction, material etc. aspects of link budget, losses, fading.

**G Recommended Study Materials**

**Text/ Reference Books:**

1. Microwave Engineering, David M. Pozar, Wiley India 3rd Edition
2. Microwave Devices And Circuits, Samuel Liao, PHI
3. Microwave Engineering, Annapurna Das, Sisirk. Das, TMH 2nd Edition
4. Microwave Engineering, Manojit Mitra, Dhanpatrai & Co.
5. Microwave And Radar Engineering, M Kulkarni, Umesh Publishers
6. Microwave Engineering, Sanjeev Gupta Khanna Pub.