**GOVERNMENT POLYTECHNIC**

**CHHAPRA**



COURSE FILE (Lecture Plan)

OF

**MICTROWAVE ENGINEERING (1621605E)**

Faculty Name:

Prof. SAURAV KUMAR

Lecturer

**DEPARTMENT OF ELECTRONICS ENGINEERING**

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| **STATE BOARD OF TECHNICAL EDUCATION** |
| Bihar, PatnaSS.JPG&CC.JPG |

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Department of Electronics Engineering

**Vision**

To be a centre of excellence in the field of Electronics Engineering offering value based world class education and research producing well qualified engineers, who can contribute favorably to the technological and socio-economic development of the nation.

**Mission**

1. To ensure sufficient modern technological exposure to the students in order to create skilled professionals.

2. To frequently update the labs keeping in view the requirement of the current industry scenario.

3. To extend counseling and career guidance facility to the students to help them to achieve their goal.

4. To encourage faculties and staffs to pursue higher education and to do the research work.

5. To encourage faculties and staffs to participate in various seminars, conferences and workshops to keep themselves updated of the state-of-the-art technology.

**Course Description:-**

Microwave engineering pertains to the study and design of microwave circuits, components, and systems. Fundamental principles are applied to analysis, design and measurement techniques in this field. The short wavelengths involved distinguish this discipline from electronic engineering. Microwave frequency usage is significant for the design of shipboard radar because it makes possible the detection of smaller targets. Microwave frequencies present special problems in transmission, generation, and circuit design that are not encountered at lower frequencies.

**Course Objectives:-**

The aim of this course is to help the students to attain the following industry identified competency through various teaching learning experiences:

Microwave Engineering introduces the student to RF/microwave analysis methods and design techniques. Scattering parameters are defined and used to characterize devices and system behavior. Passive and active devices commonly utilized in microwave subsystems are analyzed and studied.

**Course Syllabus**

**ELECTIVE - (ANY ONE) - (v) MICTROWAVE ENGINEERING (ELECTRONICS ENGINEERING GROUP)**

|  |  |  |  |
| --- | --- | --- | --- |
| **Subject Code 1621605E** | **Theory** | **No of Period in one session :** | **Credits** |
| **No. of Periods Per Week** | **Full Marks** | **:** | **100** | **03** |
| **L** | **T** | **P/S** | **ESE** | **:** | **70** |
| **03** | **—** | **—** | **TA** | **:** | **10** |
|  |  |  | **CT** | **:** | **20** |

|  |  |  |
| --- | --- | --- |
| **Contents :Theory** | **Hrs/week** | **Marks** |
| **UNIT-1** | **MICROWAVE TUBES:** |  |  |
| 01.01 | Introduction. |
| 01.02 | Microwave frequency band spectrum. |
| 01.03 | Klystron. |
| 01.04 | Reflex Klystron. |
| 01.05 | Travelling Wave tubes. (TWT) |
| 01.06 | Magnetron. |
| **UNIT-2** |  **MICROWAVE SEMI CONDUCTOR DEVICES:** |  |  |
| 02.01 | Microwave Diodes. |
| 02.01.01 | Varactor Diodes. |
| 02.01.02 | Tunnel Diodes. |
| 02.01.03 | Gunn Diodes. |
| 02.01.04 | Avalanche effect diodes. |
| 02.02 | M A S E R. |
| **UNIT-3** | **MICROWAVE COMPONENTS AND ANTENNAS:** |  |  |
| 03.01 | Coaxial Lines. |
| 03.02 | Wave guides. |
| 03.02.01 | Rectangular. |
| 03.02.02 | Circular. |
| 03.03 | Wave guide corners and Tees. |
| 03.04 | Directional couplers. |
| 03.05 | Attenualtors. |
| 03.06 | Antennas. |
| 03.07.01 | Parabolic. |
| 03.08.02 | Horn. |
| 03.09.03 | Slot. |

**Course Objectives:** Microwave Engineering introduces the student to RF/microwave analysis methods and design techniques. Scattering parameters are defined and used to characterize devices and system behavior. Passive and active devices commonly utilized in microwave subsystems are analyzed and studied:

|  |  |  |  |
| --- | --- | --- | --- |
| **UNIT-4** | **MICROWAVE TRANSMISSION:** |  |  |
| 04.01 | Maxwells equations. |
| 04.02 | Modes of propagation in rectangular and circular wave guides. |
| 04.03 | Transmission through rectangular wave guide. |
| 04.04 | Cut off frequency and guide wave length. |
| 04.05 | Phase and group velocity, and relation between them. |
| **UNIT-5** | **DETECTORS:** |  |  |
| 05.01 | Measurement of impedance. |
| 05.02 | Measurement of frequency. |
| 05.03 | Voltage standing wave ratio. (VSWR) and its measurement. |
| **Total** |  |  |

**Books Recommended:**

* Microwave Communication. - Angelkos & Everhar.
* Foundation of Microwave Communication. - Collins.
* Microwaves. - Sanjeev Gupta & others.
* Electromagnetic Waves & Radiating Systems - Jordan.
* Microwave Theory & Measurement - Heylward Packard

**Course outcomes:**

The aim of the course is to provide a through coverage of fundamental principles of microwave engineering with focus on wireless communication system and high- speed data transmission. Besides enhancing general radio frequency circuit theory covered in previous courses, it introduces the fundamental of microwave circuit analysis and design, from electromagnetic theory to radar systems. Starting with a concise presentation of the electromagnetic theory, the course leads to passive and active microwave circuit design supported by complex Electronic Design Automation (EDA) software for high-frequency systems. After passing the course the student should know: Maxwell's and Helmholtz's equations, wave solutions, TEM, TE and TM wave propagation modes, and account for the relevant propagation modes for transmission lines Describe the concept of plane waves in different transmission media, polarized plane waves and plane wave reflection in mathematical form Compare the electromagnetic theory with transmission line theory in order to describe transmission lines from the point of view of either field theory or the circuit model Calculate the characteristic parameters of a rectangular waveguide Use Smith Chart to design matching networks Understand different concepts of impedance matching, i.e., narrow- and broadband impedance matching Describe, analyse and design basic passive and active microwave circuits such as couplers, amplifiers, mixers, oscillators Describe, analyse on system level different radarsystem, e.g., Doppler radar. Use radar equation, understand radar parameters and describe different modern radar applications. Carry out the design of microwave circuits using advanced simulation tools, including electromagnetic simulations

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<https://www.gpchhapra.org.in/2022/07/13/class-routine-notice/>

**TIME TABLE**

**FACULTY:-** Prof.Saurav Kumar (Electronics Engineering Department)

**GOVERNMENT POLYTECHNIC CHAPRA**

**CLASS ROUTINE FOR DIPLOMA 6th SEMESTER EC- Electronics Engineering**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | 1st10:00-11:00 | 2nd1:00-12:00 | 3rd12:00-1:00 |  | 4th2:00-3:00 | 5th3:00-4:00 | 6th4:00-5:00 |
| MON |  |  |  | LUNCH | **Elective- Microwave Engineering 1621605(Saurav Kumar)** |  |  |
| TUE |  |  |  | **Elective- Microwave Engineering 1621605(Saurav Kumar)** |  |  |
| WED |  |  |  |  |  |  |
| THU |  |  |  |  |  |  |
| FRI |  |  |  |  |  |  |
| SAT | **Elective- Microwave Engineering 1621605(Saurav Kumar)** |  |  |  |  |  |

**Student list**

**Electronics Engineering.**

|  |  |
| --- | --- |
| **Roll Number** | **Name Of the Student** |
| 401/EC/20 | RAVI RANJAN KUMAR |
| 402/EC/20 | MEGHNATH KR. KUSHWAHA |
| 403/EC/20 | DEEPAK KR. YADAV |
| 404/EC/20 | DILIP KUMAR PANDIT |
| 405/EC/20 | MUKESH KUMAR |
| 601/EC/20 | JULEE KUMARI |
| 602/EC/20 | SUDHIR KUMAR |
| 603/EC/20 | ABHIMANYU SINGH |
| 604/EC/20 | NIDHI KUMARI |
| 605/EC/20 | MD. IRFAN |
| 606/EC/20 | RAHUL KR. MAHTO |
| 607/EC/20 | RAHUL KUMAR |
| 608/EC/20 | VBINIT KUMAR |

**LECTURE PLAN**

|  |  |
| --- | --- |
| **Topics** | **Lecture Number** |
| **MICROWAVE TUBES:** | **01-12** |
| Introduction | 1-2 |
| Microwave frequency band spectrum | 3-4 |
| Klystron | 5 |
| Reflex Klystron | 6-7 |
| Travelling Wave tubes. (TWT) | 8-10 |
| Magnetron | 11-12 |
| **MICROWAVE SEMI CONDUCTOR DEVICES:** | **13-24** |
| Microwave Diodes | 13-14 |
| Varactor Diodes | 15-16 |
| Tunnel Diodes | 17-18 |
| Gunn Diodes | 19-20 |
| Avalanche effect diodes | 21-22 |
| M A S E R | 23-24 |
| **MICROWAVE COMPONENTS AND ANTENNAS:** | **25-44** |
| Coaxial Lines | 25-26 |
| Wave guides | 27-28 |
| Rectangular | 29-30 |
| Circular | 31-32 |
| Wave guide corners and Tees | 33-34 |
| Directional couplers | 35-36 |
| Attenualtors | 37-38 |
| Antennas | 39-40 |
| Parabolic,  | 41-42 |
| Horn, slot | 43-44 |
| **MICROWAVE TRANSMISSION:** | **45-54** |
| Maxwells equations | 45-46 |
| Modes of propagation in rectangular and circular wave guides | 47-48 |
| Transmission through rectangular wave guide | 49-50 |
| -Cut off frequency and guide wave length | 51-52 |
| Phase and group velocity, and relation between them | 53-54 |
| **DETECTORS:** | **55-60** |
| Measurement of impedance | 55-56 |
| Measurement of frequency | 57-58 |
| Voltage standing wave ratio. (VSWR) and its measurement | 59-60 |

**This document is approved by**

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| --- | --- | --- |
| **Designation** | **Name** | **Signature** |
| Course Coordinator | Prof. Saurav Kumar |  |
| HoD | Prof. Om Prakash Aditya |  |
| Principal | Dr. Anil Kumar Singh |  |
| Date |  |  |