<table>
<tr><td>1.</td><td colspan="5">Name of Course</td><td>Microwave Engineering</td></tr>
<tr><td>2.</td><td colspan="5">Course Code</td><td>JMIE2052</td></tr>
<tr><td></td><td colspan="6">JMIE = the first alphabet identify the faculty within which the subject is offered., JMIE = the remaining three alphabets identify the course that offers the subject, 2052= the first digit identify level of study; in this case undergraduate level, 2052 = the second and third digits identify subject identity and 2052 = the fourth digit identify credit value or credit hours</td></tr>
<tr><td>3.</td><td colspan="5">Name(s) of academic staff</td><td>To be Assigned</td></tr>
<tr><td>4.</td><td colspan="5">Rationale for the inclusion of the course/module in the programme</td><td>Knowledge Microwave Engineering is essential in electrical and electronic engineering. Moreover, acquiring knowledge in Microwave Engineering enable engineer to design system and appropriate dielectric system.</td></tr>
<tr><td>5.</td><td colspan="5">Semester and Year offered</td><td>Year 4, Semester 2</td></tr>
<tr><td rowspan="3">6.</td><td>Total Student Learning Time (SLT)</td><td colspan="4">Face to Face</td><td>Total Guided and Independent Learning</td></tr>
<tr><td rowspan="2">L = Lecture T = Tutorial
P = Practical
IS= Independent Study</td><td>L</td><td>T</td><td>P</td><td>IS</td><td rowspan="2">Total Guided and Independent Learning = 120</td></tr>
<tr><td>42</td><td>7</td><td>6</td><td>65</td></tr>
<tr><td>7.</td><td colspan="5">Credit Value</td><td>3.0</td></tr>
<tr><td></td><td colspan="6">Lecture: 3 hours per week x 14 weeks
Tutorial: 1 hour per week x 7 weeks
Practical: 2 hours x 3 weeks</td></tr>
<tr><td>8.</td><td colspan="5">Prerequisite (if any)</td><td></td></tr>
<tr><td>9.</td><td colspan="6">Course Objectives
1. This course introduces Microwave Devices and Components and application in Electrical engineering.

Course Learning Outcomes (CLO)
At the end of the semester students should be able to:

CLO1: Identify the characteristics of waveguides and planar transmission line structures such as stripline, microstrip line and coupled line structures
CLO2: Calculate the network parameters of microwave networks using microwave network analysis
CLO3: Design and analyse impedance matching networks for a given set of specifications
CLO4: Design and Analyse passive microwave component s such as power dividers, hybrids, couples and filters for a given set of specifications
CLO5: Design microwave amplifiers for a given set of specifications.</td></tr>
<tr><td>10.</td><td colspan="6">Transferable Skills:
This course is expected the development of the following transferable skills:
▪ An ability to manage time and task
▪ An ability to learn both independently and co—operatively;
▪ An ability to take responsibility and carry out laboratory test;</td></tr>
</table>

	▪ An ability to take initiative and lead other; ▪ An ability to use software where relevant to the subject.
11.	**Teaching-learning and assessment strategy** A variety of learning strategies are used throughout the course, including the following • Classroom Lesson, Lecturer and power point presentation • Tutorial session • Student- lecturer Discussion • Collaborative and co-operative learn; • Independent Study. **Assessment:** **Course works** **40%** Assignment 5% Tutorial 5% Quizzes 5% Laboratory works 10% Test 15% **Final Examination** **60%** **Total** **100%**
12.	**Synopsis:** This course is very important course in the field of electronics engineering. The objective of course is to expose students to engineering system development process and to enhance students' skill and capability in understanding microwaves components.
13.	**Mode of Delivery:** Lectures; Tutorials; Laboratory works

14. **Assessment Methods and Types:**
Performance Criteria :

CLO-PLO	Assessment Tool	1	2	3	4	5
Marks		**0-39**	**40-49**	**50-59**	**60-74**	**75-100**
Grade		**(F)**	**(D,D+)**	**(C-,C,C+)**	**(B-,B,B+)**	**(A-,A,A+)**
CLO1: Identify the characteristics of waveguides and planar transmission line structures such as stripline, microstrip line and coupled line structures	**Assignment** **Tutorials** **Quizzes** **Lab works** **Test** **Examination**	**Fail To:** - learn both independently and cooperatively - take responsibility and carry out laboratory test	**Poor To**: - learn both independently and cooperatively - take responsibility and carry out laboratory test	**Satisfactory To**: - learn both independently and cooperatively - take responsibility and carry out laboratory test	**Good To**: - learn both independently and cooperatively - take responsibility and carry out laboratory test	**Excellent To:** - learn both independently and cooperatively - take responsibility and carry out laboratory test
CLO2: Calculate the network parameters of microwave networks using microwave network analysis	**Assignment** **Tutorials** **Quizzes** **Lab works** **Test** **Examination**	**Fail To:** - manage time and task - learn both independently and cooperatively - take responsibility and carry out laboratory test	**Poor To**: - manage time and task - learn both independently and cooperatively - take responsibility and carry out laboratory test	**Satisfactory To**: - manage time and task - learn both independently and cooperatively - take responsibility and carry out laboratory test	**Good To:** - manage time and task - learn both independently and cooperatively - take responsibility and carry out laboratory test	**Excellent To:** - manage time and task - learn both independently and cooperatively - take responsibility and carry out laboratory test
CLO3: Design and analyse impedance matching networks for a given set of specifications	**Assignment** **Tutorials** **Quizzes** **Lab works** **Test** **Examination**	**Fail To:** - manage time and task - learn both independently and cooperatively - take responsibility and carry out laboratory test - take responsibility and carry out laboratory test	**Poor To**: - manage time and task - learn both independently and cooperatively - take responsibility and carry out laboratory test - take responsibility and carry out laboratory test	**Satisfactory To**: - manage time and task - learn both independently and cooperatively - take responsibility and carry out laboratory test - take responsibility and carry out laboratory test	**Good To**: - manage time and task - learn both independently and cooperatively - take responsibility and carry out laboratory test - take responsibility and carry out laboratory test	**Excellent To:** - manage time and task - learn both independently and cooperatively - take responsibility and carry out laboratory test - take responsibility and carry out laboratory test

	CLO4: Design and Analyse passive microwave component s such as power dividers, hybrids, couples and filters for a given set of specifications	**Assignment** **Tutorials** **Quizzes** **Lab works** **Test** **Examination**	**Fail To:** - manage time and task - learn both independently and cooperatively - take responsibility and carry out laboratory test - take responsibility and carry out laboratory test	**Poor To**: - manage time and task - learn both independently and cooperatively - take responsibility and carry out laboratory test - take responsibility and carry out laboratory test	**Satisfactory To**: - manage time and task - learn both independently and cooperatively - take responsibility and carry out laboratory test - take responsibility and carry out laboratory test	**Good To**: - manage time and task - learn both independently and cooperatively - take responsibility and carry out laboratory test - take responsibility and carry out laboratory test	**Excellent To:** - manage time and task - learn both independently and cooperatively - take responsibility and carry out laboratory test - take responsibility and carry out laboratory test
	CLO5: Design microwave amplifiers for a given set of specifications.	**Assignment** **Tutorials** **Quizzes** **Lab works** **Test** **Examination**	**Fail To:** - manage time and task - learn both independently and cooperatively - take responsibility and carry out laboratory test - take responsibility and carry out laboratory test	**Poor To**: - manage time and task - learn both independently and cooperatively - take responsibility and carry out laboratory test - take responsibility and carry out laboratory test	**Satisfactory To**: - manage time and task - learn both independently and cooperatively - take responsibility and carry out laboratory test - take responsibility and carry out laboratory test	**Good To**: - manage time and task - learn both independently and cooperatively - take responsibility and carry out laboratory test - take responsibility and carry out laboratory test	**Excellent To:** - manage time and task - learn both independently and cooperatively - take responsibility and carry out laboratory test - take responsibility and carry out laboratory test

15. **Mapping of the Programme Objectives to the Programme Learning Outcomes**

Programme Learning Outcomes (PLO) / Programme Objectives (PO)	**PLO1:** Ability to acquire and apply knowledge of science and engineering fundamentals.	**PLO2:** Acquired in-depth technical competence in electronics engineering discipline.	**PLO3:** Ability to undertake problem identification, formulation and solution;	**PLO4:** Ability to utilise systems approach to design and evaluate operational performance.	**PLO5:** Understanding of the principles of design for sustainable development;	**PLO6:** Understanding of professional and ethical responsibilities and commitment to them.	**PLO7:** Ability to communicate effectively, not only with engineers but also with the community at large.	**PLO8:** Ability to function effectively as an individual and in a group with the capacity to be a leader or manager;	**PLO9:** Understanding of the social, cultural, global and environmental responsibilities of a professional engineer	**PLO10:** Recognising the need to undertake lifelong learning, and possessing/acquiring the capacity to do so	**PLO11**: Ability become entrepreneur
PEO1: To produce graduates with excellent knowledge and competency in Electrical and Electronic Engineering;	✓	✓		✓		✓					
PEO2: To produce graduates with professional, generic attributes to meet the present and future global demands.											
PEO3: To produce graduates with Islamic humanistic values and reinvention skills to meet the requirement of a dynamic environment. These skills include Civil Intelligence, Moral Intelligence, Self-Reliance and Communication Skills**.**											

16. **Mapping of the course Learning Outcome to the Programme Outcome**

Programme Learning Outcomes (PLO) / Course Learning Outcome (CLO)	**PLO1:** Ability to acquire and apply knowledge of science and engineering fundamentals.	**PLO2:** Acquired in-depth technical competence in electronics engineering discipline.	**PLO3:** Ability to undertake problem identification, formulation and solution;	**PLO4:** Ability to utilise systems approach to design and evaluate operational performance.	**PLO5:** Understanding of the principles of design for sustainable development;	**PLO6:** Understanding of professional and ethical responsibilities and commitment to them.	**PLO7:** Ability to communicate effectively, not only with engineers but also with the community at large.	**PLO8:** Ability to function effectively as an individual and in a group with the capacity to be a leader or manager;	**PLO9:** Understanding of the social, cultural, global and environmental responsibilities of a professional engineer	**PLO10:** Recognising the need to undertake lifelong learning, and possessing/acquiring the capacity to do so	**PLO11**: Ability become entrepreneur
CLO1: Identify the characteristics of waveguides and planar transmission line structures such as stripline, microstrip line and coupled line structures	✓	✓		✓		✓					
CLO2: Calculate the network parameters of microwave networks using microwave network analysis	✓	✓		✓		✓					
CLO3: Design and analyse impedance matching networks for a given set of specifications	✓	✓		✓		✓					
CLO4: Design and Analyse passive microwave component s such as power dividers, hybrids, couples and filters for a given set of specifications	✓	✓		✓		✓					
CLO5: Design microwave amplifiers for a given set of specifications.	✓	✓		✓		✓					

17.	Content outline of the course/module and the SLT per topic						
	Details		**SLT (Hour)**				
			L	**T**	**P**	**IS**	**Total**
	Topic 1	**Review of Electromagnetic Theory** • Introduction to Microwave Engineering • Maxwell's Equations • Fields in Media and Boundary Conditions • The Wave Equations and Basic Plane Wave Solutions • General Plane Wave Solutions • Energy and Power • Plane Wave Reflection from a Media • Oblique Incidence at a Dielectric Interface • Useful Theorems	6	1	-	10	**17**
	Topic 2	**Transmission Line Theory** • The Lumped-Element Circuit Model for a Transmission line • Field analysis of Transmission Lines • The Terminated Lossless Transmission line • The Smith Chart • The Quarter- Wave Transformer • Generator and Load Mismatches • Lossy Transmission Lines	9	2	-	12	**23**
	Topic 3	**Transmission Lines and Waveguides** • General Solutions for TEM, and TM Waves • Parallel Plate Waveguide. TEM Modes • Rectangular Waveguide • Coaxial Line • Surface Waves on a Grounded Dielectric Slab • Stripline and Microstrip	6	1	-	10	**17**
	Topic 4	**Microwave Network Analysis** • Impedance and Equivalent Voltages and Currents • Impedance and Admittance Matrices • The Scattering Matrix • The Transmission (ABCD) Matrix • Signal Flow Graphs • Discontinuities and Model Analysis • Excitations of Waveguides-Electric and Magnetic Currents	6	1	-	10	**17**

	Topic 5	**Impedance Matching and Tuning** • Matching with Lumped Element (L Networks). • Single-Stub Tunging and Double –Stub Tuning • The Quarter-wave Transformer • The Theory of small Reflections • Binominal Multisection Matching Transformers • Tapered Lines	3	1	-	6	**10**
	Topic 6	**Microwave Resonators** • Series and Parallel Resonant Circuits • Transmission line Resonators • Rectangular and circular Waveguide Cavities • Dielectric Resonators • Excitations of Resonators	3	-	-	6	**9**
	Topic 7	**Power Dividers and Directional** • Basic Properties of Divides and Couplers • The T-junction Power Divider. • The Wilkinson Power Divider. • Waveguide Directional Couplers. • The Quadrature (90.) Hybrid. • Coupled line Directional Couplers. • The Lange Coupler. • The 180. Hybrid.	6	1	-	8	**15**
	Topic 8	**MICROWAVE FILTERS.** • Periodic Structures. • Filter Design by the Image Parameter Method. • Filter Design by the Insertion Loss Method. • Filter Transformations. • Filter Implementations. • Stepped-Impedance Low-Pass Filters.	3	-	-	3	**6**
	practical	1. Passive microwave circuit design 2. Microwave amplifier design	-	-	6	-	**6**
	Total SLT (Hour)		**42**	**7**	**6**	**65**	**120**
18.	**Main references supporting the course** 1. David M. Pozar, " Microwave Engineering", 3rd Edition, John Wiley, 2005						
	Additional references supporting the course						
19.	**Other additional information** All materials will be available to the students in the library.						