<table>
<tr><td>1.</td><td colspan="5">Name of Course</td><td>Electrical Machines</td></tr>
<tr><td>2.</td><td colspan="5">Course Code</td><td>JPMA1103</td></tr>
<tr><td></td><td colspan="6">JPMA = the first alphabet identify the faculty within which the subject is offered., JPMA = the remaining three alphabet identify the course that offers the subject, 1103 = the first digit identify level of study; in this case undergraduate level, 1103= the second and third digits identify subject identity and 1103 = 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 of basic Power Systems and Machine is essential electrical engineering. Moreover, acquiring knowledge in power system enable engineer to design electrical power systems and machines.</td></tr>
<tr><td>5.</td><td colspan="5">Semester and Year offered</td><td>Year 3, Semester 1</td></tr>
<tr><td rowspan="3">6.</td><td colspan="2" rowspan="2">Total Student Learning Time (SLT)</td><td colspan="4">Face to Face</td><td rowspan="2">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></tr>
<tr><td>42</td><td>7</td><td>6</td><td>65</td><td>Total Guided and Independent Learning = 120</td></tr>
<tr><td>7.</td><td colspan="5">Credit Value</td><td>3.0</td></tr>
<tr><td></td><td colspan="6">Lecture: 2 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>None</td></tr>
<tr><td>9.</td><td colspan="6">Course Objectives
1. To equip the students with the knowledge of the Electrical Machines.
Course Learning Outcomes (CLO)
At the end of the semester students should be able to:

CLO1: To differentiate between transformers and other rotating electrical machines;
CLO2: To apply and design three-phase circuits in electrical machines;
CLO3: To analyse characteristics of dc motors and three-phase induction motors.</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;
▪ An ability to take initiative and lead other;
▪ An ability to use software where relevant to the subject.</td></tr>
<tr><td>11.</td><td colspan="6">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.</td></tr>
</table>

	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 electrical engineering. The objective of course is to introduce students to the basic concepts and working principles of electrical machines and basic concepts of the electrical power system and its protection.		
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: To differentiate between transformers and other rotating electrical machines.	**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
CLO2: To apply and design three-phase circuits in electrical machines and power systems;	**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: To analyse characteristics of dc motors and three-phase induction motors;	**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

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

Programme Learning Outcomes (PO) / Programme Objectives (PO)	**PLO1:** Ability to acquire and apply knowledge of science and engineering fundamentals.	**PLO2:** Acquired in-depth technical competence in electrical 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 excellence knowledge and competency in various areas in Civil/Electrical/Mechanical 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 electrical 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: To differentiate between transformers and other rotating electrical machines;	✓			✓		✓	✓				
CLO2: To apply and design three-phase circuits in electrical machines and power systems;	✓			✓		✓	✓				
CLO3: To analyse characteristics of dc motors and three-phase induction motors;	✓			✓		✓	✓				

17.	Content outline of the course/module and the SLT per topic						
	Details		**SLT(Hour)**				
			L	**T**	**P**	**IS**	**Total**
	Topic 1	**Introduction** • Introduction to Machinery Principles • Three-phase Circuits • Transformers • D.C. and A.C. Machines • Introduction to Power System • Basic Protection	3	-	-	10	**13**
	Topic 2	**Introduction to Machinery Principles** • Introduction to electrical machines and transformers. • Rotational motion, • Newton's law and power relationships. • Magnetic field, • Faraday's law, • Induced voltage on a conductor moving in a magnetic field, Production of force on a wire in a magnetic field.	6	1	-	10	**17**
	Topic3	**Three-phase Circuits** • Three-phase systems. • Relation between line and phase quantities. • Analysis of balanced three-phase circuits. • Y-Δ Transformation. • Power, reactive power and complex power calculations	3	-	-	8	**11**
	Topic 4	**Transformers** **Single-phase transformers**: • Construction, principle of operation and equivalent circuit, • Phasor diagram, • Efficiency and regulation. • Short and open circuit tests. • Parallel operation. **Three-phase transformers:** • Construction and connections, Introduction to autotransformers and instrument transformers.	9	2	-	12	**23**

	Topic 5	**D.C. and A.C. Machines** **D.C. Machines** • Principles of operation and construction of DC machines, • Emf equation and principle of commutation. • Types of DC generators. DC motors: • Torque equation, • Characteristics of shunt, • Series and compound motors. • Starting and speed control. • Losses and efficiencies of DC machines. **Induction Machines** • Principles of operation and basic construction of three-phase induction motor. • Slip equation, • Equivalent circuit, • Determination of equivalent circuit parameters by no-Load and blocked-rotor tests. • Torque-speed characteristics.. • Starting methods. • Introduction to single-phase induction motors. **Synchronous Machines** • Principle of operation of Synchronous generators, • Synchronous impedance and simple equivalent circuit • Voltage regulation. • Synchronizing procedures and parallel operation of synchronous machines	12	2	-	13	**27**
	Topic 6	**Introduction to Power System** • Generation of electrical power: • Various types of conventional and non-conventional generation plants Single-line diagram and impedance diagram of power systems. • Per-unit quantities. • Components of a power system: • Generation, • Transmission and Distribution **Basic Protection** • Objective of power system protection. • Basic principles and components of protection including fuses. • Operating principles of over current relays. • Instantaneous and time grading relays. • Safety grounding, • Grounding practice in power systems and electrical installations	9	2	-	12	**23**

	Practical	1. Equivalent circuit determination and load test on single-phase transformer 2. Load test on induction motors	-	-	6	-	**6**
	Total SLT (Hour)		**42**	**7**	**6**	**65**	**120**
18.	**Main references supporting the course** 1. S.J. Chapman, "Electrical Machinery Fundamentals", 5th edition, McGraw Hill Higher Education, 2007						
	Additional references supporting the course 1. B.S. Guru and H.R. Hiziroglu, "Elecgrcial Machinery and Transformers", 5rd edition, Oxford University Press, 2006						
19.	**Other additional information** All materials will be available to the students in the library.						