



**University of Tehran**  
**School of Electrical and Computer Engineering**

<b>Course:</b>	<b>Electrical Machines 3</b>									
<b>Course type:</b>	EE*						CE*			Credit: 3
	Com	E	P	B	Con	D	SW	HW	IT	
	Required	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
	Elective	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
<b>Level:</b>	Undergraduate <input checked="" type="checkbox"/> Graduate <input type="checkbox"/>									
<b>Co-requisite(s):</b>	None.									
<b>Prerequisite(s):</b>	Electrical machines 2									
<b>Prerequisite by topic:</b>	Knowing single phase transformer and being introduced to 3 phase transformers, Understanding 3-phase induction machines principles									
<b>Textbook(s):</b>	<ol style="list-style-type: none"> <li>1. P. S. Bimbhra, Generalized Theory of Electrical Machines, Khanna Publishers, India, 2007.</li> <li>2. J. Nagrath, D. P. Kothari, Electrical Machines, McGraw Hill, 2006</li> <li>3. P. C. Sen, Principles of Electric Machines and Power Electronics, John Wiley &amp; Sons, 2013</li> <li>4. Matsch, L.W. and Morgan, J.D., Electromagnetic and electromechanical Machines. 3<sup>rd</sup> ed. NY: Harper &amp; Row, 1986.</li> </ol>									
<b>Coordinator:</b>	Mohammad Taghi Nabavi Razavi, School of ECE.									
<b>Goals:</b>	Teaching the principles of synchronus machines Teaching the principles of 3-phase transformers									
<b>Outcome:</b>	Upon successful completion of the course, students will: <ol style="list-style-type: none"> <li>1. Analyze the synchronous machines in whether linear or nonlinear performance and in motor or generator operating</li> <li>2. Evaluate the active and reactive power of synchronous generator</li> <li>3. Understand parallel operation of synchronous generators and load distribution among them.</li> <li>4. Determine the synchronous motor as a inductively dynamic compensator</li> <li>5. Use three similar single-phase transformer to build a three-phase transformer with different connections</li> <li>6. Determine phase-angle indicator of three-phase transformer and apply it to connect transformers in parallel</li> <li>7. Analyze the impact of harmonic and single-phase loads on 3-phase transformer with different conventional connections</li> </ol>									
<b>Topics:</b>	<ol style="list-style-type: none"> <li>1. Introduction to construction of cylindrical synchronous machines</li> <li>2. Analysis of no-load and under-load performance of synchronous</li> </ol>									

	<p>machine</p> <ol style="list-style-type: none"> <li>3. Circuit model of synchronous machine</li> <li>4. Synchronizing a no-load synchronous generator to infinite bus-bar</li> <li>5. Power flow equations</li> <li>6. To Analyze all above mentioned topics for salient synchronous machine</li> <li>7. The impact of non-linear behavior of magnetic materials on the performance of the synchronous machine</li> <li>8. Synchronous motors for power factor correction</li> <li>9. Determining the phase-angle indicator of three-phase transformers with different connections</li> <li>10. The impact of harmonics generated by saturated magnetic core on three-phase transformers with different connections</li> <li>11. The ability of different connections of three-phase transformers in providing single-phase loads</li> </ol>								
<b>Computer usage:</b>	<p>Analyze of odd harmonics generated in transformers assuming non-linear magnetic characteristic using PSPICE.</p> <p>Analyze of performance of different types of synchronous machines using appropriate software</p> <p>Analyze of synchronous machine assuming non-linear magnetic characteristic using appropriate software</p>								
<b>Assignments:</b>	4 assignments about 3-phase transformers, synchronous motor and generators are uploaded								
<b>Projects:</b>									
<b>Grading:</b>	<table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 70%;">Assignments</td> <td style="text-align: right;">10 %</td> </tr> <tr> <td>Quiz</td> <td style="text-align: right;">10%</td> </tr> <tr> <td>Midterm exam:</td> <td style="text-align: right;">30 %</td> </tr> <tr> <td>Final exam:</td> <td style="text-align: right;">50 %</td> </tr> </table>	Assignments	10 %	Quiz	10%	Midterm exam:	30 %	Final exam:	50 %
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<b>Further readings:</b>									
<b>Prepared by:</b>	Mohammad Taghi Nabavi Razavi, School of ECE								
<b>Date:</b>	November 22. 2017								

*EE: Electrical Engineering		CE: Computer Engineering	
Com	Communications	SW	Software
E	Electronics	HW	Hardware
P	Power	IT	Information Technology
B	Bioelectronics		
Con	Control		
D	Digital System		