Semester- IV
Professional Core Theory Courses

Walchand College of Engineering, Sangli

(Government Aided Autonomous Institute)

AY 2024-25

Course Information

Programme	B. Tech. Electrical Engineering
Class, Semester	Second Year B. Tech., Sem IV
Course Code	7EL221
Course Name	AC Machines
Desired Requisites:	Fundamentals of Electrical Engineering, DC Machines and Transformer

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	3 Hrs/week	**MSE**	**ISE**	**ESE**	**Total**
Tutorial	-	30	20	50	100
		Credits: 3			

Course Objectives

1	This course intends to provide basic concepts of operation and performance of asynchronous and synchronous machines.
2	It intends to develop implicational skill to operate asynchronous and synchronous machines.
3	It intends to develop skill to determine performance asynchronous and synchronous machines.
4	Applications which will be utilized in the electrical machines with its performance and theory of operation.

Course Outcomes (CO) with Bloom's Taxonomy Level

At the end of the course, the students will be able to,

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Description**
CO1	Explain the working principle, construction and operation of asynchronous and synchronous machines	II	Understanding
CO2	Solve numerical on asynchronous and synchronous machines.	III	Applying
CO3	Analyze the performance of synchronous and asynchronous machines.	IV	Analyzing
CO4	Assess machines as per performance analysis requirement.	V	Evaluating

Module	**Module Contents**	**Hours**
I	**Synchronous Generator** Construction, Principle of operation, distribution factor, pitch factor, Three Phase Winding (Single layer, double layer), Elimination of harmonics voltage, EMF equation, leakage reactance, armature reaction, armature resistance and reactance, field excitation system, damper winding	8
II	**Performance of Synchronous Generator** Calculation of voltage regulation by synchronous Impedance method, zero power factor method, MMF method, experimental setup for above method, rating, efficiency and losses, method of synchronizing, synchronizing power, hunting, damping operation single and Infinite bus, power angle equation, short circuit ratio and its significance. Two Reaction Theory: Phasor diagram, slip test, power angle equation, saliency power.	6
III	**Synchronous Motor** Method of starting, phasor diagram, torque and torque angle equation, V curves and experimental setup, hunting and damping, synchronous condenser.	5

IV	**Three Phase Induction Motor** a. Construction, Principle of operation: Phasor diagram, equivalent circuit, analysis based on approximate equivalent circuit, Torque equation, speed equation, speed torque curve, b. Slip ring Induction Motor: Effect of increase in rotor resistance, starting, speed control of motor. c. Speed control of Induction Motor: Change of supply frequency, pole changing, cascading, Injection of EMF in secondary. d. Application and Testing: Testing as per I.S.S., Industrial applications of induction motor	8
V	**Computations and Classification of Three Phase Induction Motor** a. Computations: No load test, Blocked rotor test, and circle diagram, starting and types of starter, ratio of starting torque to full load torque. b. Double Cage Induction Motor (D.C.I.M.): Construction, Characteristics and Equivalent circuit. c. Synchronous Induction Motor: Construction, Circle diagram, Phasor diagram.	8
VI	**Single Phase Induction Motor and, Three Phase Motor Winding** Single Phase Induction Motor: Types, Construction, Double revolving field theory, Principle of operation, phasor diagram, equivalent circuit, Experimental determination of parameter, application.	4

Textbooks	
1	M. G. Say. "Performance Design of AC Machines", CBS Publishers, 4thEdition, 1976.
2	O. E. Taylor, "Performance Design of AC Commutator Motors", Wheeler Publisher, 15th Reprint.
References	
1	J. Chapman, "Electrical Machine", McGraw Hill, 5th Edition, 2009.
2	P S Bimbhra, "Electrical Machinery", KHANNA PUBLISHERS, Seventh edition, 2021
3	J. B. Gupta, "Electrical Machines", SK Kataria and Sons, 3rd edition, 2011.
4	Fitzerald and Kingsley,"Electric Machine", Tata McGraw Hill, 2nd Edition, 2000.
Useful Links	
1	Electrical Machines 2 NPTEL: https://archive.nptel.ac.in/courses/108/105/108105131/

CO-PO Mapping

	Programme Outcomes (PO)												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3													
CO2		3												3
CO3				2										3
CO4	3	2												

The strength of mapping is to be written as 1: Low, 2: Medium, 3: High
Each CO of the course must map to at least one PO.

Assessment

The assessment is based on MSE, ISE and ESE.
MSE shall be typically on modules 1 to 3.
ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO.
ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6.
For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

Syllabus Prepared By	Mr. S. S. Medhekar
Syllabus Checked By	Mrs. S. L. Shaikh

Walchand College of Engineering, Sangli

(Government Aided Autonomous Institute)

AY 2024-25

Course Information	
Programme	B. Tech. Electrical Engineering
Class, Semester	Second Year B. Tech., Sem. IV
Course Code	7EL222
Course Name	Electrical Transmission and Distribution
Desired Requisites:	Electrical Circuit Analysis, D.C. Machine and Transformers

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	3 Hrs/week	**MSE**	**ISE**	**ESE**	**Total**
Tutorial	-	30	20	50	100
		Credits: 3			

Course Objectives	
1	To introduce the students to the general structure of the network for transferring power from generating stations to the consumers
2	This course will introduce the students about the structure and performance analysis of power systems
3	To expose the students to the different electrical & mechanical aspects of the power network along with its environmental and safety constraints.
4	This course will develop analytical skills in the students for investigating issues related to power systems.

Course Outcomes (CO) with Bloom's Taxonomy Level

At the end of the course, the students will be able to,

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Description**
CO1	Understand the basic concepts of electrical power supply related to transmission and distribution.	II	Understanding
CO2	Calculate the transmission line parameters, sag of an overhead transmission line and string efficiency of insulators.	III	Applying
CO3	Analyze the performance of various types of transmission lines and distribution system topologies.	IV	Analyzing
CO4	Scrutinize voltage and power factor control methods for improving performance of transmission and distribution systems.	IV	Analyzing

Module	**Module Contents**	**Hours**
I	**Structure of Power Systems** Generation, transmission, distribution and utilization of electrical power, A.C. and D.C. Transmission, Advantage and limitation of high transmission voltage, Types of lines, Types of conductors, Voltage levels.	5
II	**Mechanical aspects of transmission lines** Support structures, Electrical clearances, Safety norms, Sag calculations, Effect of wind and ice covering of sag, Types of insulators, String efficiency of insulators.	6
III	**Transmission line representation and performance calculation** Resistance of transmission line, Skin effect, Inductance of transmission line, Concept of self GMD and mutual GMD, Capacitance of transmission line, Single Line Diagram (SLD), PU quantities, short, medium and long line models, performance calculations, ABCD constants.	8
IV	**Distribution Systems and Underground Cables** Types of feeders, distributors, AC and DC distribution systems, Sub-stations, UG cables for LT and HT systems.	6

V	**Voltage control and Power factor improvement** Methods of voltage control, AVRs, Tap changing transformers, Causes of low p.f., Effects of low p.f., Shunt capacitors, Calculation of reactive power injection and p.f. correction.	8
VI	**Economic operation of power systems** Basics of Economic load sharing, Incremental fuel cost, Economic dispatch neglecting transmissions losses, Penalty factor, General Loss Formula, optimum load dispatch considering transmissions losses.	6

Textbooks	
1	Ashfaq Husain, "*Electrical Power Systems*", CBS, 5th Edition, 2007.
2	D Das, "*Electrical Power Systems*", New Age International, 2016.
3	V.K. Mehta and Rohit Mehta, "Principles of Power System", S. Chand, 2005
References	
1	Nagrath, Kothari, Modern, "*Power System Analysis*", TMH, 2nd Edition, 2015.
2	HadiSaadat, "*Power System Analysis*", TMH, 1st Edition, 2002.
3	S. Sivanagaraju and S. Satyanarayana, "Electrical Power Transmission and Distribution",Pearson, 2009
Useful Links	
1	https://nptel.ac.in/courses/108/105/108105104/

CO-PO Mapping

	Programme Outcomes (PO)												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2												2	
CO2	3												2	
CO3		3											2	
CO4			3										2	

The strength of mapping is to be written as 1: Low, 2: Medium, 3: High
Each CO of the course must map to at least one PO.

Assessment

The assessment is based on MSE, ISE and ESE.
MSE shall be typically on modules 1 to 3.
ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO.
ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6.
For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

Syllabus Prepared By	Mr. N.V. Patel
Syllabus Checked By	Dr. V.P. Mohale

Walchand College of Engineering, Sangli

(Government Aided Autonomous Institute)

AY 2024-25

Course Information

Programme	B. Tech. Electrical Engineering
Class, Semester	Second Year B. Tech., Sem. IV
Course Code	7EL223
Course Name	Power Electronics
Desired Requisites:	Analog and Digital Circuits

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	3 Hrs/week	**MSE**	**ISE**	**ESE**	**Total**
Tutorial	-	30	20	50	100
		Credits: 3			

Course Objectives

1	To provide basic knowledge of different power electronic devices, rectifiers, converters, inverters and choppers.
2	To impart skills of analysis for different types of converters such as rectifiers, controlled converters, inverters and choppers.
3	To make the students acquainted with design of different types of converters such as rectifiers, controlled converters, inverters, choppers and their associated control circuit.
4	To provide foundation for advances in power electronic circuits and systems.

Course Outcomes (CO) with Bloom's Taxonomy Level

At the end of the course, the students will be able to,

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Description**
CO1	Describe the basics of semiconductor switches, rectifier, control converter, inverter, choppers, and cyclo-converter and matrix converter circuits.	II	Understanding
CO2	Calculate the performance of semiconductor switches, rectifier, converter, inverter, choppers, and cyclo-converter and matrix converter circuits.	III	Applying
CO3	Analyze the Power Electronic Circuits such as rectifier, converter, inverter, choppers, and cyclo-converter and matrix converter circuits.	IV	Analyzing
CO4	Evaluate the performance of power electronic circuits such as rectifier, converter, inverter, choppers, and cyclo-converter and matrix converter circuits.	V	Evaluating

Module	**Module Contents**	**Hours**
I	**Power Semiconductor Switches:** Characteristics of ideal switch, V-I Characteristics, Rating, protection and cooling of power semiconductor devices such as power diodes, transistor, MOSFET, IGBT and GTO, Study of the driver circuits for thyristor, GTO and IGBT, Introduction to smart power modules, Comparative study of MOSFET, thyristor, GTO, BJT and IGBT.	6
II	**Single Phase and Three Phase AC to DC rectifiers** Single phase half wave and single-phase full wave diode bridge. Three phase half wave and three phase full wave diode bridge, Transformer power rating for above configurations. Source current and output voltage analysis.	6

III	**Phase Controlled AC to DC Converters** Classification of converters, Single phase half controlled and fully controlled thyristor converters, three pulse and six pulse controlled converters, operation of converter with freewheeling diode. Effect of source inductance on the performance of the converter, overlap – angle. Performance factors for the converter such as displacement factor, distortion factor, total harmonic distortion, ripple factor and transformer utilization factor. Introduction to 12 pulse converter, single phase and three phase dual converter, firing scheme for 1 phase and three phase converter, Brief introduction to commutation methods. Introduction to PWM converters.	8
IV	**DC to DC Converters** Control of DC-to-DC converters, step down (buck) converter, Analysis of buck converter with RLE load, step up converter, buck – boost converter, full bridge DC to DC converter, concept of multiphase choppers, cuk converter.	6
V	**Switch Mode DC – AC Inverters** Basic concepts of switch mode inverters, types: VSI and CSI, single phase half bridge and full bridge inverter, three phase six step inverter, 1200 mode of conduction, 1800 mode of conduction, three phase PWM Inverter, sinusoidal PWM and selective harmonics elimination methods of PWM. Effect of blanking time on output voltage in PWM inverters, auto sequentially commutated CSI, Solar Inverters, Introduction to multilevel inverters.	7
VI	**Cycloconverters and Matrix Converter** Introduction to Single phase and three phase cycloconverters. Working and topologies of Matrix converter, control methods, performance analysis of matrix converter.	6

Textbooks	
1	M. H. Rashid "Power Electronics, Circuits, Devices and Applications", Pearson Education Inc., 4th Edition, November 2017.
2	P. S. Bhimra, "Power Electronics",3rd Edition, Khanna Publishers, 2002.
References	
1	B.K. Bose, "Modern Power Electronics and A.C. Drives", Prentice Hall of India Pvt. Ltd. Publication, 2002.
2	Mohan, Undeland Robins, "Power Electronics, Converter Applications and Design", John Wiley and sons (Asia) Pvt. Ltd., 3rd Edition, 2010.
3	G. K. Dubey and Others "Thyristorised Power Controller", New Edge International Publishers, 1st Edition Reprint, 2005.
Useful Links	
1	https://nptel.ac.in/courses/108105066
2	https://archive.nptel.ac.in/courses/108/102/108102145/

CO-PO Mapping

	Programme Outcomes (PO)												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3													
CO2		3												
CO3		3												
CO4		2	2											

The strength of mapping is to be written as 1: Low, 2: Medium, 3: High
Each CO of the course must map to at least one PO.

Assessment

The assessment is based on MSE, ISE and ESE. MSE shall be typically on modules 1 to 3. ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO. ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6. For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

Syllabus Prepared By	Dr. D. S. More
Syllabus Checked By	Dr. Mrs. A. S. Karvekar

Professional Core Laboratory Courses

Walchand College of Engineering, Sangli

(Government Aided Autonomous Institute)

AY 2024-25

Course Information

Programme	B. Tech. Electrical Engineering
Class, Semester	Second Year B. Tech., Sem. IV
Course Code	7EL271
Course Name	AC Machines Lab
Desired Requisites:	Fundamentals of Electrical Engineering, DC Machines and Transformers

Teaching Scheme		**Examination Scheme (Marks)**			
Practical	2 Hrs/ Week	**LA1**	**LA2**	**Lab ESE**	**Total**
Interaction	-	30	30	40	100
		Credits: 1			

Course Objectives

1	This course intends to demonstrate performance operation of synchronous and asynchronous machines.
2	It intends to develop skills to analyse operation and performance of asynchronous and synchronous machines.
3	To understand the equivalent circuit of a synchronous and asynchronous machines.
4	To obtain the characteristics of Synchronous and Asynchronous machines by performing suitable test.

Course Outcomes (CO) with Bloom's Taxonomy Level

At the end of the course, the students will be able to,

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Description**
CO1	Demonstrate experiment to verify electrical characteristics and performance of induction and synchronous machines	III	Applying
CO2	Analyse performance of induction motors and synchronous machines.	IV	Analysing
CO3	Estimate appropriate ratings and develop circuit connections for an experiment as a group activity.	IV	Analysing
CO4	Design winding diagrams as per given specification	VI	Creating

List of Experiments / Lab Activities/Topics

List of Lab Activities:

1. No load and Blocked rotor test on induction motor and performance of 3 phase I.M. from circle diagram.
2. Study of A.C. Machines parts.
3. Study of Induction motor starters.
4. Speed control of Induction Motor
5. Parameter calculation of single phase induction motor from No load and Blocked rotor test.
6. Determination of voltage regulation of alternator using Synchronous Impedance method.
7. Determination of voltage regulation of alternator using MMF method.
8. Determination of voltage regulation of alternator using Zero power factor method.
9. Synchronization of alternator with bus bar.
10. V-Curves of Synchronous motor.
11. Study of starting method of synchronous motor.
12. No load and Blocked rotor test on induction motor and performance of 1 phase I.M.
13. Design of 3 phase armature winding for synchronous and asynchronous machines.

Textbooks

1	M. G. Say. "Performance Design of AC Machines", CBS Publishers, 4thEdition, 1976.
2	O. E. Taylor, "Performance Design of AC Commutator Motors", Wheeler Publisher, 15th Reprint.

References	
1	J. Chapman, “Electrical Machine”, McGraw Hill, 5th Edition, 2009.
2	P S Bimbhra, “Electrical Machinery”, KHANNA PUBLISHERS, Seventh edition, 2021
3	J. B. Gupta, “Electrical Machines”, SK Kataria and Sons, 3rd edition, 2011.
4	Fitzerald and Kingsley,“Electric Machine”, Tata McGraw Hill, 2nd Edition, 2000.
Useful Links	
1	Electrical Machines 2 NPTEL: https://archive.nptel.ac.in/courses/108/105/108105131/

CO-PO Mapping

	Programme Outcomes (PO)												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3													
CO2		3												
CO3			2											1
CO4	3			2										

The strength of mapping is to be written as 1,2,3; where, 1: Low, 2: Medium, 3: High
Each CO of the course must map to at least one PO, and preferably to only one PO.

Assessment

There are three components of lab assessment, LA1, LA2 and Lab ESE.
IMP: Lab ESE is a separate head of passing.(min 40 %), LA1+LA2 should be min 40%

Assessment	Based on	Conducted by	Typical Schedule	Marks
LA1	Lab activities, attendance, journal	Lab Course Faculty	During Week 1 to Week 8 Marks Submission at the end of Week 8	30
LA2	Lab activities, attendance, journal	Lab Course Faculty	During Week 9 to Week 16 Marks Submission at the end of Week 16	30
Lab ESE	Lab activities, journal/ performance	Lab Course Faculty and External Examiner as applicable	During Week 18 to Week 19 Marks Submission at the end of Week 19	40

Week 1 indicates starting week of a semester. Lab activities/Lab performance shall include performing experiments, mini-project, presentations, drawings, programming, and other suitable activities, as per the nature and requirement of the lab course. The experimental lab shall have typically 8-10 experiments and related activities if any.

Syllabus Prepared By	Mr. S. S. Medhekar
Syllabus Checked By	Mrs. S. L. Shaikh

Walchand College of Engineering, Sangli

(Government Aided Autonomous Institute)

AY 2024-25

Course Information	
Programme	B. Tech. Electrical Engineering
Class, Semester	Second Year B. Tech., Sem. IV
Course Code	7EL272
Course Name	Power Electronics Lab
Desired Requisites:	Analog and Digital Circuits Lab

Teaching Scheme		**Examination Scheme (Marks)**			
Practical	2 Hrs/ Week	**LA1**	**LA2**	**Lab ESE**	**Total**
Interaction	-	30	30	40	100
		Credits: 1			

Course Objectives

1	To provide the practical knowledge of different power electronics devices.
2	To impart skills of working of different power electronic converter through simulation and experimentation.
3	To make the students acquainted with simulation, analysis and design of power electronic converters.
4	To provide foundation for advances in power electronic circuits and systems.

Course Outcomes (CO) with Bloom's Taxonomy Level

At the end of the course, the students will be able to,

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Description**
CO1	Demonstrate experiments on basics of converters such as rectifier, inverter, and Chopper etc.	III	Applying
CO2	Construct different types of converters such as rectifier, inverter and Chopper with their control techniques using simulation.	III	Applying
CO3	Measure the performance of converters such as rectifier, inverter, and Chopper.	IV	Analysing
CO4	Design and Analyze power converter circuits and select suitable power electronics devices by assessing the requirements of application fields.	V	Evaluate

List of Experiments / Lab Activities/Topics

List of Lab Activities:

1. Verify the Voltage and current relationship in 3 phase full wave diode bridge rectifier and evaluate the input current harmonic spectrum.
2. Evaluate the load side performance of single-phase full wave half control converter.
3. Evaluate the load side performance of single-phase full wave full control converter.
4. Evaluate the load side performance of three phase full wave half-controlled converter.
5. Evaluate the load side performance of three phase full wave full controlled converter.
6. Develop the firing angle control scheme for single phase full wave, half controlled and full controlled converters.
7. Develop the firing angle control scheme for three phase full wave half-controlled converter.
8. Develop the firing angle control scheme for three phase full wave full controlled converter.
9. Evaluate the performance of MOSFET based buck converter.
10. Evaluate the performance of MOSFET based boost converter.
11. Develop the control circuit for single phase PWM Inverter.
12. Develop the control circuit for three phase square wave Inverter.

Textbooks

1	M.H.Rashid "Power Electronics, Circuits, Devices and Applications", Pearson Education Inc., 4th Edition, November 2017.
2	P. S. Bhimra, "Power Electronics", 3rd Edition, Khanna Publishers, 2002.

References	
1	B.K. Bose, “Modern Power Electronics and A.C. Drives”, Prentice Hall of India Pvt. Ltd. Publication, 2002.
2	Mohan, Undeland and Robins, “Power Electronics, Converter Applications and Design”, John Wiley and sons (Asia) Pvt. Ltd., 3rd Edition, 2010.
3	G. K. Dubey and Others “Thyristorised Power Controller”, New Edge International Publishers, 1st Edition Reprint, 2005.
Useful Links	
1	

CO-PO Mapping														
	Programme Outcomes (PO)												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1				3					2					
CO2					3									
CO3				3					2					
CO4			3		2				2					
The strength of mapping is to be written as 1,2,3; where, 1: Low, 2: Medium, 3: High Each CO of the course must map to at least one PO, and preferably to only one PO.														

Assessment				
There are three components of lab assessment, LA1, LA2 and Lab ESE. IMP: Lab ESE is a separate head of passing.(min 40 %), LA1+LA2 should be min 40%				
Assessment	**Based on**	**Conducted by**	**Typical Schedule**	**Marks**
LA1	Lab activities, attendance, journal	Lab Course Faculty	During Week 1 to Week 8 Marks Submission at the end of Week 8	30
LA2	Lab activities, attendance, journal	Lab Course Faculty	During Week 9 to Week 16 Marks Submission at the end of Week 16	30
Lab ESE	Lab activities, journal/ performance	Lab Course Faculty and External Examiner as applicable	During Week 18 to Week 19 Marks Submission at the end of Week 19	40
Week 1 indicates starting week of a semester. Lab activities/Lab performance shall include performing experiments, mini-project, presentations, drawings, programming, and other suitable activities, as per the nature and requirement of the lab course. The experimental lab shall have typically 8-10 experiments and related activities if any.				

Syllabus Prepared By	Dr. D. S. More
Syllabus Checked By	Dr. Mrs. A. S. Karvekar

Multidisciplinary Minor

Walchand College of Engineering, Sangli

(Government Aided Autonomous Institute)

AY 2023-24

Course Information

Programme	B.Tech. (Electrical Engineering)
Class, Semester	Second Year B. Tech., Sem IV
Course Code	7MDEL221
Course Name	Multi-Disciplinary Minor I : Electrical Machines
Desired Requisites:	Fundamentals of Electrical Engineering

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	3 Hrs/week	**MSE**	**ISE**	**ESE**	**Total**
Tutorial	-	30	20	50	100
		Credits: 3			

Course Objectives

1	To make students understand operation and performance of ac and dc machines.
2	To make students learn characteristics of ac and dc machines.
3	To develop skills to choose ratings of ac and dc machines for various applications.

Course Outcomes (CO) with Bloom's Taxonomy Level

At the end of the course, the students will be able to,

CO1	Explain the construction and working principle of A.C. and D.C. Machines.	Understand
CO2	Examine the various characteristics of A.C. and D.C. machines.	Apply
CO3	Analyze the performance of A.C. and D.C. machines for various applications.	Analyze
CO4	Evaluate the efficiency and regulation of transformers and machines for optimal design.	Evaluate

Module	**Module Contents**	**Hours**
I	**DC Motors** Review of Construction, Working and Types, Back emf, Speed equation, Armature Reaction, Torque equation, Speed torque characteristics, Applications, Power losses in d.c. motors. Need of starter speed control of D.C. shunt and series motor, Thyristor based speed control for D.C. motor. Reversal of rotation, Electric braking of shunt and series motor.	6
II	**Single Phase Transformer** Construction and type, EMF equation phasor diagram, equivalent circuit, efficiency, losses, regulation, Experimental determination of equivalent circuit parameters and calculation of efficiency and regulation, Introductionto three Phase Transformer, Connection of three Phase Transformer, Applications of Transformers	6
III	**Single-Phase Induction Motor** Double revolving field theory and principle of operation. Construction and operation of split-phase, capacitor start, capacitor run, and shaded pole motors. Comparison of single-phase motors and applications.	6
IV	**Three Phase Induction Motor** Construction, Types, Working, Speed equation, Torque equation, Starting torque, Concept of full load torque, torque speed characteristics, Power stages in motor, Induction Generator.	7

V	**Synchronous Machines** Alternator, Construction of Alternator, Synchronous Motor, Equivalent Circuit, Motor on load, Pull-Out Torque, Motor Phasor Diagram, Mechanical Power Developed by Motor, Power Factor of Synchronous Motor, Application of Synchronous Motor, Comparison of Synchronous Motor with Induction Motor.	7
VI	**Special-Purpose Electric Machines** Stepper motor-Variable-Reluctance Motor, Permanent Magnet Motor, Hybrid Stepper Motor, Servomechanism, D.C. Servomotors, A.C. Servomotors, Switched Reluctance Motor, Permanent Magnet D.C. Motor, Brushless D.C. Motor. Selection and Sizing of Motors based on applications.	7

Text Books	
1	S. J. Chapman, "Electric Machinery Fundamentals", Tata Mc Graw Hill publication, 4th Edition, 2011, ISBN: 9780071070522
2	M. G. Say. "Performance Design of AC Machines", CBS Publishers, 3rd Edition, 2017, ISBN: 9788123910277

References	
1	SK Bhattacharya, "Electrical Machines", Tata Mc Graw Hill, 3rd Edition, 2010, ISBN: 9789332902855
2	J. B. Gupta, "Electrical Machines", SK Kataria and Sons, 2013, ISBN: 9789350140550

Useful Links	
1	https://nptel.ac.in/courses/108/102/108102146/
2	https://nptel.ac.in/courses/108/105/108105155/
3	https://nptel.ac.in/courses/108/105/108105131/

CO-PO Mapping

	Programme Outcomes (PO)												**PSO**		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3														
CO2		2													
CO3		2													
CO4			2												

The strength of mapping is to be written as 1,2,3; Where, 1:Low, 2:Medium, 3:High
Each CO of the course must map to at least one PO.

Assessment

The assessment is based on MSE, ISE and ESE.
MSE shall be typically on modules 1 to 3.
ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO.
ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6.
For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

Syllabus Prepared By	Mr. A. N. Inamdar
Syllabus Checked By	

Mandatory Courses

Walchand College of Engineering, Sangli

(Government Aided Autonomous Institute)

AY 2024-25

Course Information

Programme	B. Tech. Electrical Engineering
Class, Semester	Second Year B. Tech., Sem. IV
Course Code	7ESEL201
Course Name	Signals and Systems
Desired Requisites:	Engineering Mathematics III

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	3 Hrs./week	**MSE**	**ISE**	**ESE**	**Total**
Tutorial	--	30	20	50	100
		Credits: 3			

Course Objectives

1	This course intends to develop an understanding of the basic concepts of signals and systems.
2	It will make students to learn signal and system operations and analysis techniques such as convolution for continuous and discrete time.
3	It will make students to study and analyze the continuous time signals and systems in laplace and fourier domain.
4	It will make students to study and analyze the discrete time signals and systems in z-domain and discrete time fourier domain.

Course Outcomes (CO) with Bloom's Taxonomy Level

At the end of the course, the students will be able to,

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Description**
CO1	Explain the mathematical principles of continuous time, discrete time systems and applications of signal processing techniques.	II	Understanding
CO2	Use mathematical concepts for signal and system response like convolution.	III	Applying
CO3	Calculate the response of linear systems in continuous time domain using tools laplace transform and fourier transform.	IV	Analyzing
CO4	Calculate the response of linear systems in discrete time domain using tools z- transform and discrete time fourier transforms.	IV	Analyzing

Module	**Module Contents**	**Hours**
I	**Introduction to Signals and Systems** Continuous and Discrete time signals , standard signals, signal representation, classification of signals, systems – Introduction ,representation, classification, Linear, Time invariant, causal, BIBO stable, Static, dynamic.	8
II	**Time Domain Analysis of Continuous and Discrete Time Systems** Zero state and Zero input response, Impulse response, Convolution integral and convolution sum, graphical representation of convolution.	6
III	**Fourier Domain Analysis of Continuous Time Signals and Systems** Fourier series, Exponential form, Dirichlet Conditions, Frequency domain representation of periodic signals, Fourier Transform representation of aperiodic signals, Properties of CTFT, Convolution – time and frequency domain, system response using CTFT.	6
IV	**Laplace Transform Analysis of Signals and System** Definition, Properties, magnitude and phase, Solution of differential equation. Transfer function, Poles and Zeroes, Initial conditions, System analysis using laplace transform with and without initial conditions, Stability in s-domain.	7
V	**Fourier Domain Analysis of Discrete Time Signal and Systems** Representation of CT signals using Samples, Nyquist Sampling Theorem Discrete time Fourier Transform, Representation of aperiodic sequence, Properties of DTFT: time reversal, Convolution. System response using DTFT	6

VI	**Z Transform Analysis of Discrete Time Signals and Systems** Definition, Properties, Solution of difference equation. Transfer function, Poles and Zeroes, System analysis using Z-Transform with and without initial conditions, Stability analysis using z-plane.	6
Textbooks		
1	A.V. Oppenheim, A.S. Willsky, S.H. Nawab, "*Signals and Systems"*, Prentice Hall, 1997.	
2	B. P. Lathi, "*Linear systems and signals"*, Oxford University press, 2005.	
References		
1	Simon Haykin, Barry Van Veen, "*Signals and systems"*, Wiley, 2003.	
2	M. J. Roberts, "*Signals and systems"*, Tata McGraw Hill, 2005.	
Useful Links		
1		

CO-PO Mapping														
	Programme Outcomes (PO)												**PSO**	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3													
CO2	3													
CO3		3												
CO4		3												
The strength of mapping is to be written as 1: Low, 2: Medium, 3: High Each CO of the course must map to at least one PO.														

Assessment
The assessment is based on MSE, ISE and ESE. MSE shall be typically on modules 1 to 3. ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO. ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6. For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

Syllabus Prepared By	Mr. A.B. Patil
Syllabus Checked By	Mrs. S.P. Diwan

Walchand College of Engineering, Sangli

(Government Aided Autonomous Institute)

AY 2024-25

Course Information

Programme	B.Tech. (All branches)
Class, Semester	Second Year B.Tech., Sem - II
Course Code	7AE201
Course Name	Employability Skills Development (ESD)
Desired Requisites:	--

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	4Hrs/week	**ISE**	**MSE**	**ESE**	**Total**
Tutorial	-	20	30	50	100
Practical	-				
Interaction	-	**Credits: 2**			

Course Objectives

1	To improve the problem-solving skills of students
2	To understand the approach towards problem solving
3	Understanding the sectional cut-offs for different companies

Course Outcomes

CO1	Ability to improve the accuracy percentage	
CO2	Understand the current changing recruitment trends	
CO3	Understanding the differential marking scheme in papers	
CO4	Performance improvement in competitive exams like CAT, GATE	

Module	**Module Contents**	**Hours**
I	**Arithmetic I** Ratio, Proportion, Mark Up & Discount, Averages, Mixtures & Alligations, Simple & Compound Interest	6

II	**Arithmetic II** Percentages, Profit & Loss, Time & Work, Time, Speed & Distance, Boat & Streams, Linear Races s	8
II	**Numbers** Cyclicity, Remainders, Cyclicity of Remainders, Indices, Factors, LCM, HCF	4
III	**Permutation, Combination, Probability** Fundamental principal of counting, Arrangements, Selection, Grouping, Distribution, Independent Events, Conditional Probability, Binomial Distribution	6
IV	**Logical Reasoning** Clocks, Calendars, Games & Tournaments, Analytical Puzzles, Binary Logic, Blood relations, Directions, Coding, Decoding, Seating Arrangement (Linear, Circular & Rectangular)	6
V	**Verbal Ability I** Vocabulary - Synonyms, Antonyms, Analogies Reading Comprehension, Para Jumbles	6
VI	**Verbal Ability II** Parts of Speech, Tenses, Subject Verb Agreement	4
	Text Books	
1	Quantitative Aptitude - Abhijit Guha	
2	Quantitative Aptitude - Sarvesh Agarwal	
	References	
1	Quicker Maths - M. Tyra	
2	Quantitative Aptitude - Chandresh Agarwal	
3	Puzzles to puzzle you - Shakuntala Devi	
	Useful Links	
1	www.campusgate.co.in	
2	www. Lofoya.com	
3	www.brainbashers.com	

CO-PO Mapping															
	Programme Outcomes (PO)												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1											3				
CO2							2								
CO3									3						
CO4										3					
The strength of mapping is to be written as 1,2,3; Where, 1: Low, 2: Medium, 3: High Each CO of the course must map to at least one PO.															

Assessment
The assessment is based on the MCQ test which will be conducted online through the platform and it will be a proctored test. No negative marking will be there in the test. Test will be of 60 minutes with 20 questions each on Quantitative Aptitude, Logical Reasoning & Verbal Ability

Walchand College of Engineering, Sangli

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AY 2024-25

Course Information	
Programme	B.Tech. (All Branches)
Class, Semester	Second Year B. Tech., Sem III & IV
Course Code	7IK201
Course Name	Introduction to Ancient Indian Technology
Desired Requisites:	General curiosity, maturity expected from adult student.

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	02 Hrs/week	MSE	ISE	ESE	Total
Tutorial	0 Hrs/week	30	20	50	100
		Credits: 2			

Course Objectives	
1	The course is designed for undergraduate students, interested in learning about the ancient Indian technology which is the hallmark of glorious Indian civilization.
2	The objective is to emphasize on nature centric aspects of ancient Indian technologies that can be adopted in modern time.
3	The course is to expose the students to ancient science and technologies which can be adopted for modern technological development.

Course Outcomes (CO) with Bloom's Taxonomy Level

At the end of the course, the students will be able to,

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Descriptor**
CO1	Name the ancient Indian technological achivments	1	Remenbering
CO2	Comprehend the concept of Indian traditional knowledge and its relevance	2	Understanding
CO3	Explain the Indian contribution to the world at large	2	Understanding
CO4	Judge the ancient Indian technology.	5	Evaluating

Module	**Module Contents**	**Hours**
I	Introduction: Why are ancient Indian science and technology relevant today? What is science? How is it different from technology? .	4
II	Philosophy of ancient Indian technology, how is different from modern technology? Ancient Indian Scientific methods. Glimpses of ancient Indian science and technology?.	4
III	Material technology in ancient India : Mining, Metals and Metallurgy, Iron Making and craftsmanship, Wootz Steel Technology	5
IV	Extraction of Zinc in ancient India, Glass making, Bead making Techniques, Ceramic Technology.	4
V	Water Harvesting Technology, Irrigation Systems. Town planning, Building construction, Sanitation from ancient India period.	5
VI	Agriculture and Textile Technology in context of ancient India i.e Bharat.	4

	Textbooks	
	1	Transcript of the NPTEL course available at https://archive.nptel.ac.in/courses/101/104/101104065/. Title of the course "Introduction To Ancient Indian Technology" by Prof. D.P. Mishra Department of Aerospace Engineering, IIT Kanpur
	References	
	1	The NPTEL course available at https://archive.nptel.ac.in/courses/101/104/101104065/. Title of the course "Introduction To Ancient Indian Technology" by Prof. D.P. Mishra Department of Aerospace Engineering, IIT Kanpur
	Useful Links	
	1	https://archive.nptel.ac.in/courses/101/104/101104065/

CO-PO Mapping

	Programme Outcomes (PO)												**PSO**	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2					1								
CO2	1					2						1		
CO3	1					2			1					

The strength of mapping is to be written as 1: Low, 2: Medium, 3: High
Each CO of the course must map to at least one PO.

Assessment

The assessment is based on MSE, ISE and ESE.
MSE shall be typically on modules 1 to 3.
ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be Tests, assignments, oral, seminar etc. and is expected to map at least one higher order PO.
ESE shall be on all modules with around 30 - 40% weightage on modules 1 to 3 and 60 - 70% weightage on modules 4 to 6.
For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

Walchand College of Engineering, Sangli

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AY 2024-25

Course Information

Programme	B. Tech. Electrical Engineering
Class, Semester	Second Year B. Tech., Sem IV
Course Code	7VSEL271
Course Name	Advance Simulation Lab
Desired Requisites:	NIL

Teaching Scheme		**Examination Scheme (Marks)**			
Practical	2 Hrs/ Week	**LA1**	**LA2**	**Lab ESE**	**Total**
Lecture	1	30	30	40	100
		Credits: 2			

Course Objectives

1	This course intends to provide advance knowledge of MATLAB, PSIM and ETAP software for developing modelling and programming techniques.
2	It intends to impart skills to implement different tool boxes of MATLAB Simulink, PSIM and ETAP for electrical engineering application
3	To solve complex electrical engineering problems with different tool boxes of MATLAB Simulink, PSIM and ETAP for electrical engineering application.
4	To design complex electrical systems with MATLAB Simulink, PSIM and ETAP software's.

Course Outcomes (CO) with Bloom's Taxonomy Level

At the end of the course, the students will be able to,

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Description**
CO1	Grasp the aspects of MATLAB simulation, PSIM, ETAP and OPAL-RT simulation tools.	II	Understanding
CO2	Solve complex mathematical equations using MATLAB.	III	Applying
CO3	Construct MATLAB, PSIM, ETAP and OPAL-RT software-based projects.	IV	Analysing
CO4	Design complex electrical systems using MATLAB, PSIM, ETAP and OPAL-RT.	VI	Creating

List of Experiments / Lab Activities/Topics

List of Lab Activities:

1. Modelling of complex electrical systems with MATLAB.
2. Modelling and analysis of power systems with MATLAB.
3. Study of fault analysis using MATLAB.
4. Study of built-in library examples of electrical engineering with ETAP.
5. Modelling of electrical systems with ETAP and simulation tools.
6. Modelling and analysis of power systems with ETAP.
7. Modelling and simulation of power flow diagram in ETAP.
8. Study of interface and built-in library of PSIM.
9. Modelling of electrical systems with PSIM.
10. Introduction to OPAL-RT (real time digital simulator).
11. Modelling of electrical systems with MATLAB and OPAL-RT (software in loop).

Textbooks

1	"Modelling and simulation using MATLAB Simulink", Wiley Publication, Dr. Shailendra Jain ,Reprint :2013

References

1	“Matlab programming for Engineers”, Stephen Chapman, Thomson Learning publication, 3rd Edition.
2	“Power System Transient Analysis”, Theory and Practice using simulation programs, Power System, Eiichi Haginomori Junichi Arai, WILEY Publication.
3	User manual of ETAP, PSIM and OPAL-RT.
Useful Links	
1	MATLAB Programming for Numerical Computation: https://nptel.ac.in/courses/103106118

CO-PO Mapping														
	Programme Outcomes (PO)												**PSO**	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2				1									
CO2	1	2												
CO3			3		2									2
CO4	3	3	2											
The strength of mapping is to be written as 1,2,3; where, 1: Low, 2: Medium, 3: High Each CO of the course must map to at least one PO, and preferably to only one PO.														

Assessment				
There are three components of lab assessment, LA1, LA2 and Lab ESE. IMP: Lab ESE is a separate head of passing.(min 40 %), LA1+LA2 should be min 40%				
Assessment	**Based on**	**Conducted by**	**Typical Schedule**	**Marks**
LA1	Lab activities, attendance, journal	Lab Course Faculty	During Week 1 to Week 8 Marks Submission at the end of Week 8	30
LA2	Lab activities, attendance, journal	Lab Course Faculty	During Week 9 to Week 16 Marks Submission at the end of Week 16	30
Lab ESE	Lab activities, journal/ performance	Lab Course Faculty and External Examiner as applicable	During Week 18 to Week 19 Marks Submission at the end of Week 19	40
Week 1 indicates starting week of a semester. Lab activities/Lab performance shall include performing experiments, mini-project, presentations, drawings, programming, and other suitable activities, as per the nature and requirement of the lab course. The experimental lab shall have typically 8-10 experiments and related activities if any.				

Syllabus Prepared By	Mr. S. S. Medhekar
Syllabus Checked By	Dr. R. P. Hasabe