Walchand College of Engineering, Sangli

(Government Aided Autonomous Institute)

AY 2021-22

Course Information

Programme	M. Tech. (Power System Engineering)
Class, Semester	Second Year M. Tech., Sem III
Course Code	5PS601
Course Name	Legal, Financial aspects of industrial project
Desired Requisites:	

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	2 Hrs/Week	**T1**	**T2**	**ESE**	**Total**
Tutorial	-	20	20	60	100
Practical	-				
Interaction	-	**Credits: 2**			

Course Objectives

1	To identify and analyse the relevant legal issues involved in Industrial Project and criminal matters affecting business.
2	To understand theories of value, risk and return, capital investment decisions, wages and working hours, insurance schemes, labour laws
3	

Course Outcomes (CO) with Bloom's Taxonomy Level

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

CO1	To understand the terms involved and laws applicable for an Industrial Project	Understand
CO2	To get acquainted with investments, taxes and employee schemes	Apply
CO3	To be familiar with Cyber laws applicable for cyber crimes	Apply

Course Content

Module No.	Content	Hrs
1	**Economic Decision Making** Introduction, Mathematics of Time Value of Money: Compound Interest, Cash Flow Diagram, Uniform Annual Series, Irregular Cash Flows, Cost Comparison: Present Worth Analysis, Annual Cost Analysis, Capitalized Cost Analysis	4
2	**Taxes and Profitability** Taxes, Profitability of Investments: Rate of Return, Payback Period, Net Present Worth, Internal Rate of Return, Inflation, Sensitivity and Break-Even Analysis, Uncertainty in Economic Analysis	4

3	**Factories Act, 1948:** Health, Safety, Provisions relating to Hazardous Processes, Welfare, Working Hours of Adults, Employment of young persons, Annual Leave with wages. The Employees Provident Fund and Miscellaneous Provisions Act, 1952 (10 of 1952). Employees Provident Fund Schemes, Central Board, Employees' Pension Scheme, Employees Deposit Linked Insurance Scheme, Contributions.	4
4	**Constitution and Labour Laws:** labour laws, Equality before law and its application in Labour Laws, Equal pay for equal work; and Article-16 and reservation policies, Articles 19, 21, 23 and 24 and its implications.	4
5	**Intellectual Property in Cyber Space** Computer Software and Copyright Law, Software Licences, Computer Databases and the law, Domain Names and the law, Trademark issues in cyberspace	4
6	**Cyber Crimes and Cyber Laws** Cyber Crimes, Malware, Computer Source Code, Digital Signature, Information Technology Laws, IT ACT & how to prevent yourself from being a victim of Cyber Crime	5

Text Books	
1	P.L. Mehta, Managerial Economics Analysis, Problems and cases, S. Chand & Co. Ltd., 2001
2	Dieter G.E., Engineering Design, McGraw-Hill Education 5th edition, 2012.
3	N. Godbole, S. Belapure, Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives, Wiley India Pvt. Ltd.

References	
1	Peterson and Lewis: Managerial Economics, 4th Ed., Prentice Hall, 2004
2	R. Drefuss, J. Pila; The Oxford Handbook of Intellectual Property Law, Oxford University Press, 2018.
3	Adv. P. Mali, Cyber Law & Cyber Crimes Simplified, Cyber Infomedia, 2017.

Useful Links	
1	Video on 'Intellectual Property Rights in Cyber Space': Link
2	Video on Cybersquatting and Internet Domain Names in 2016- by WIPO: Link
3	Video on Cyber Laws in India - I: Link
4	Video on Cyber Crimes - Cyber Law: Link

CO-PO Mapping						
	Programme Outcomes (PO)					
	1	**2**	**3**	**4**	**5**	**6**
CO1				2		
CO2		2			1	
CO3				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 (for Theory Course)						
The assessment is based on 2 in-semester examinations in the form of T1 (Test-1) and T2 (Test-2) of 20 marks each. Also there shall be 1 End-Sem examination (ESE) of 60 marks. T1 shall be typically on modules 1 and 2, T2 based typically on modules 3, 4 and ESE shall be on all modules with nearly 50% weightage on modules 1 to 4 and 50% weightage on modules 5, 6.						

Assessment Plan based on Bloom's Taxonomy Level (Marks) For Theory Course					
Bloom's Taxonomy Level		**T1**	**T2**	**ESE**	**Total**
1	Remember				
2	Understand				
3	Apply				
4	Analyze	5	5	20	30
5	Evaluate	5	5	20	30
6	Create	10	10	20	40
Total		**20**	**20**	**60**	**100**

Walchand College of Engineering, Sangli

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AY 2021-22

Course Information

Programme	M. Tech. (Power System Engineering)
Class, Semester	Second Year M. Tech., Sem III
Course Code	5PS690
Course Name	Dissertation Phase I
Desired Requisites:	Concept knowledge of research methodology, project management, Electrical Engineering

Teaching Scheme (Hrs)		**Examination Scheme (Marks)**			
Lecture	-	**LA1**	**LA2**	**ESE**	**Total**
Tutorial	-	30	30	40	100
Practical	20				
Interaction	-	**Credits: 10**			

Course Objectives

1	To develop the student to apply the knowledge gained to identify problems for research and provide the solutions by self-study and interaction with stakeholders.
2	Acquire knowledge to tackle real world problems of societal concerns
3	Impart flexibility to the student to have increased control over his/ her learning
4	Teachers would serve as mentor/facilitator of inquiry and reflection rather than as an instructor
5	Enhance a students' learning through increased interaction with peers and colleagues.

Course Outcomes (CO) with Bloom's Taxonomy Level

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

CO1	**Defend** the objectives of the dissertation by grasping and **analyzing** through an extensive literature review in the area of study.	Understand Analyze
CO2	**Formulate** the methodology and **Execute** the study through conduct of analytical/Experimental work to achieve the objectives.	Apply Create
CO3	**Analyze, interpret and critique** the findings of the study.	Apply Analyze Evaluate
CO4	**Defend** the outcomes of the dissertation through self-learning and **justify** the project work as per appropriate standards of documentation and presentation.	Evaluate

Course Content

The third semester is completely devoted to dissertation work which is defined based on the interest of the students to specialize in a particular area.

Student is expected to carry out independent research work on the chosen topic. In this semester it is expected that the student has carried out substantial research work including exhaustive literature survey, formulation of the research problem, development/fabrication of experimental set-up (if any/required) and testing, and analysis of initial results thus obtained. In fourth semester, the student continues his/her dissertation work. It is expected that the student has completed most of the experimental/computation works and analyzed the results so obtained as proposed in the synopsis. The work should be completed in all respects in this semester. The student is required to submit the dissertation work in the form of report as per the institute rule.

Text Books	
1	As per the research topic
References	
1	National and International Journals
Useful Links	
1	

CO-PO Mapping

	Programme Outcomes (PO)					
	1	**2**	**3**	**4**	**5**	**6**
CO1	3	2			2	
CO2	2		3	3		
CO3				2	1	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.

Assessment

There are three components of lab assessment, LA1, LA2 and Lab ESE.
IMP: Lab ESE is a separate head of passing. LA1, LA2 together is treated as In-Semester Evaluation.

Assessment	Based on	Conducted by	Typical Schedule (for 26-week Sem)	Marks
LA1	Lab activities, attendance, journal	Lab Course Faculty	During Week 1 to Week 6 Marks Submission at the end of Week 6	30
LA2	Lab activities, attendance, journal	Lab Course Faculty	During Week 7 to Week 12 Marks Submission at the end of Week 12	30
Lab ESE	Lab activities, attendance, journal	Lab Course Faculty	During Week 15 to Week 18 Marks Submission at the end of Week 18	40

Week 1 indicates starting week of a semester. The typical schedule of lab assessments is shown, considering a 26-week semester. The actual schedule shall be as per academic calendar. 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.

Assessment Plan based on Bloom's Taxonomy Level (Marks) (For lab Courses)

Bloom's Taxonomy Level	LA1	LA2	Lab ESE	Total
Remember				
Understand	5	5		**10**
Apply	5	5		**10**
Analyze	5	5	10	**20**
Evaluate	5	5	10	**20**
Create	10	10	20	**40**
Total Marks	**30**	**30**	**40**	**100**

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Course Information

Programme	M. Tech. (Power System Engineering)
Class, Semester	Second Year M. Tech., Sem III
Course Code	5PS602
Course Name	Industry Orientation Course
Desired Requisites:	

Teaching Scheme (Hrs)		**Examination Scheme (Marks)**			
Lecture	-	**LA1**	**LA2**	**ESE**	**Total**
Tutorial	-	30	30	40	100
Practical	-				
Interaction	1	**Credits: 1**			

Course Objectives

1	To provide a hands on experience of software in solving complex electrical engineering problems.
2	To enhance the employability of electrical control engineering student.

Course Outcomes (CO) with Bloom's Taxonomy Level

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

CO1	**Use** of the software related to design of electrical system effectively.	Evaluate
CO2	**Develop** the solution for electrical engineering problem using software.	Create
CO3	**Explain** the working of research and development department.	Understand

Course Content

This course is based on computers as a tool to design and analyse the electrical system. In the modern day work environment, Electrical Engineer should be able to simulate and solve complex problems on computers. Electrical Engineer must be highly computer literate. The engineer with strong fundamentals in Control Engineering and computer software proficiency is highly in demand from industry. Employability of the student can be enhanced by providing software training of Analysis and simulation software in electrical engineering.

Text Books

1	Suitable books based on the software selected.

References

1	Suitable books based on the contents of software selected

Useful Links

1	As per the need of the software training

CO-PO Mapping						
	Programme Outcomes (PO)					
	1	**2**	**3**	**4**	**5**	**6**
CO1		1				
CO2			2			2
CO3				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				
There are three components of lab assessment, LA1, LA2 and Lab ESE. IMP: Lab ESE is a separate head of passing. LA1, LA2 together is treated as In-Semester Evaluation.				
Assessment	**Based on**	**Conducted by**	**Typical Schedule (for 26-week Sem)**	**Marks**
LA1	Lab activities, attendance, journal	Lab Course Faculty	During Week 1 to Week 6 Marks Submission at the end of Week 6	30
LA2	Lab activities, attendance, journal	Lab Course Faculty	During Week 7 to Week 12 Marks Submission at the end of Week 12	30
Lab ESE	Lab activities, attendance, journal	Lab Course Faculty	During Week 15 to Week 18 Marks Submission at the end of Week 18	40
Week 1 indicates starting week of a semester. The typical schedule of lab assessments is shown, considering a 26-week semester. The actual schedule shall be as per academic calendar. 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.				

Assessment Plan based on Bloom's Taxonomy Level (Marks) (For lab Courses)				
Bloom's Taxonomy Level	**LA1**	**LA2**	**Lab ESE**	**Total**
Remember				
Understand	10	10	10	**30**
Apply				
Analyze				
Evaluate	10	10	15	**35**
Create	10	10	15	**35**
Total Marks	**30**	**30**	**40**	**100**

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Course Information	
Programme	M. Tech. (Power System Engineering)
Class, Semester	Second Year M. Tech., Sem III
Course Code	5PS611
Course Name	Professional Elective 5: Modern Power Electronics
Desired Requisites:	Power Electronics

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	2 Hrs/week	**T1**	**T2**	**ESE**	**Total**
Tutorial	-	20	20	60	100
Practical	-				
Interaction	-	**Credits: 2**			

Course Objectives	
1	It is aimed to impart skills of analysis for different types of advanced converters and shunt active power filters.
2	Make the students acquainted with control strategies of different types of advanced converters and shunt active power filters.
3	To make aware of research avenues in the field of power electronics.

Course Outcomes (CO) with Bloom's Taxonomy Level		
At the end of the course, the students will be able to,		
CO1	**Interpret** configuration and working of various Power Electronic converters.	Apply
CO2	**Analyze** various Power Electronic converters and systems.	Analyze
CO3	**Evaluate** various power electronic systems using power electronic converters.	Evaluate

Module	**Module Contents**	**Hours**
I	**PWM rectifiers** Advantages & disadvantages of three phase thyristor converter, Single phase and three phase VSI PWM converters working, types, Control of PWM rectifiers, analysis and application. Three phase CSI PWM converter, control and applications.	5
II	**Multilevel inverters** Three phase two level Voltage source inverter, various PWM methods, Multilevel Voltage source inverter, Types: Diode clamp multilevel inverter, flying capacitor multilevel inverter, cascaded multilevel inverter, applications of multilevel inverters, comparison of multilevel inverter. Control method: Multiple carrier PWM for MLI	5

III	**Resonant pulse inverters** Series resonant inverter with unidirectional and bi-directional switches, parallel resonant inverters, voltage control of resonant inverters, zero current and zero voltage switching resonant converters, two-quadrant ZVS resonant converters, resonant DC link inverters and control technique.	5
IV	**Photovoltaic Inverters** Photovoltaic Inverters structures derived from H bridge topology such as H5 inverter, Heric inverter, REFU inverter, full bridge inverter with DC bypass, inverter structures derived from NPC topology such as neutral point clamped half bridge inverter, conergy NPC inverter, three phase PV inverter.	5
V	**Matrix Converters and Z source inverters** Topology, working and control methods of Matrix converters, Various circuit topologies and control of Z source inverter, Application of Z source in induction motor control.	4
VI	**Active power filters** Power Quality Issues due to power Electronics, Introduction to active power filter, types of active power filters overall control of shunt active power filter, control of shunt active filter based on SRF theory. Control of shunt active filter based on instantaneous power theory. harmonic compensation & reactive power compensation.	4

Text Books	
1	M. H. Rashid, "*Power Electronics: circuits devices and applications*", Pearson Education, Third edition.
References	
1	B. K. Bose, "*Modern Power Electronics and AC drives*", PHIPL, New Delhi.
2	M. B. Patil, V. Ramayanan and V. T. Ranganathan, "*Simulation of Power Electronics circuits*", Narosa publication.
3	Remus Teodorescu, Marco Liserre and Pedro Rodrigues, "*Grid- Converters for Photovoltaic and Wind Power Converters*", A john Wiley and sons Ltd., first edition 2011.
4	IEEE Transaction papers.
Useful Links	
1	NPTEL lectures on Advanced Power Electronics

CO-PO Mapping						
	Programme Outcomes (PO)					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1			1			
CO2				1		
CO3				2		1

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 (for Theory Course)
The assessment is based on 2 in-semester examinations in the form of T1 (Test-1) and T2 (Test-2) of 20 marks each. Also there shall be 1 End-Sem examination (ESE) of 60 marks. T1 shall be typically on modules 1 and 2, T2 based typically on modules 3, 4 and ESE shall be on all modules with nearly 50% weightage on modules 1 to 4 and 50% weightage on modules 5, 6.

Assessment Plan based on Bloom's Taxonomy Level (Marks) For Theory Course					
Bloom's Taxonomy Level		**T1**	**T2**	**ESE**	**Total**
1	Remember				
2	Understand				
3	Apply		10	20	**30**
4	Analyze	10		20	**30**
5	Evaluate	10	10	20	**40**
6	Create				
Total		**20**	**20**	**60**	**100**

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Course Information	
Programme	M. Tech. (Power System Engineering)
Class, Semester	Second Year M. Tech., Sem III
Course Code	5PS612
Course Name	Professional Elective 5: HVDC Transmission
Desired Requisites:	Power Electronics , Power System Engineering

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	2 Hrs/week	**T1**	**T2**	**ESE**	**Total**
Tutorial	-	20	20	60	100
Practical	-				
Interaction	-	**Credits: 2**			

Course Objectives	
1	It is aimed to provide detailed knowledge of controlled converters for HVDC transmission system.
2	It demonstrates use of different control and protection methods in HVDC transmission system.
3	It provides recent trends in HVDC transmission system.

Course Outcomes (CO) with Bloom's Taxonomy Level		
At the end of the course, the students will be able to,		
CO1	**Investigate** appropriate control and protection schemes for HVDC transmission system.	Apply
CO2	**Interpret** performance of converter for HVDC transmission systems.	Analyse
CO3	**Appraise** recent trends in HVDC transmission systems.	Evaluate

Module	**Module Contents**	**Hours**
I	**Introduction to HVDC Transmission Technology** Comparison of EHVAC and HVDC Transmission, types of HVDC transmission systems, components of HVDC transmission system	6
II	**Analysis of HVDC converter** Different modes of valve operation, o/p voltage waveforms and D C voltage in rectification, and inverter operation, valve voltages, equivalent electrical circuit, converter charts.	6
III	**HVDCTS control features** Control modes, control schemes and their comparisons, energization and de-energization of bridges, starting and stopping of D C link.	6
IV	**Faults and over-voltages** Converter mal-operations, commutation failure, over-voltages in HVDCTS, protection of converters, D C reactor and damper circuits.	6

V	**Harmonics and their suppression in HVDCTS** Harmonic analysis, filter design, minimum cost tuned A C filters, reactive power requirements.	6
VI	**Multi terminal HVDCTS** Series and parallel MTDCTS, their control, introduction to HVDC light, recent trends in HVDCTS.	6

Text Books	
1	E.W. Kimbark, *"Direct Current Transmission",* Win publisher.
2	K.R. Padiyar*, "H.V.D.C. Power Transmission",* Wiley Eastern New Delhi.
References	
1	J. Arrillaga, *"H.V.D.C. Transmission",* Peter limited.
2	S.Rao, *"E.H.V.A.C. & H.V.D.C. Transmission",* Khanna Publishers.
Useful Links	
1	

CO-PO Mapping						
	Programme Outcomes (PO)					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1				3		
CO2			3			
CO3						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 (for Theory Course)
The assessment is based on 2 in-semester examinations in the form of T1 (Test-1) and T2 (Test-2) of 20 marks each. Also there shall be 1 End-Sem examination (ESE) of 60 marks. T1 shall be typically on modules 1 and 2, T2 based typically on modules 3, 4 and ESE shall be on all modules with nearly 50% weightage on modules 1 to 4 and 50% weightage on modules 5, 6.

Assessment Plan based on Bloom's Taxonomy Level (Marks) For Theory Course					
Bloom's Taxonomy Level		**T1**	**T2**	**ESE**	**Total**
1	Remember				
2	Understand				
3	Apply	10		20	**30**

4	Analyze	10	10	20	**30**
5	Evaluate		10	20	**40**
6	Create				
Total		**20**	**20**	**60**	**100**

Walchand College of Engineering, Sangli

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Course Information

Programme	M. Tech. (Power System Engineering)
Class, Semester	Second Year M. Tech., Sem III
Course Code	5PS651
Course Name	Activity based elective lab 2: Modern Power Electronics Lab
Desired Requisites:	Power Electronics

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

Course Objectives

1	It is aimed to impart skills of analysis for different types of advanced converters and shunt active power filters.
2	Make the students acquainted with control strategies of different types of advanced converters and shunt active power filters.
3	To make aware of research avenues in the field of power electronics.

Course Outcomes (CO) with Bloom's Taxonomy Level

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

CO1	**Interpret** configuration and working of various Power Electronic converters.	Apply
CO2	**Analyze** various Power Electronic converters and systems.	Analyze
CO3	**Evaluate** various power electronic systems using power electronic converters.	Evaluate

List of Experiments / Lab Activities

Lab activities/performance shall include mini project, presentations, drawings, case study, report writing, site visit, lab experiment, tutorials, assignments, group discussion, programming, and other suitable activities as per nature and requirement of lab course.

Text Books

1	M. H. Rashid, "*Power Electronics: circuits devices and applications*", Pearson Education, Third edition.

References

1	B. K. Bose, "*Modern Power Electronics and AC drives*", PHIPL, New Delhi.
2	M. B. Patil, V. Ramayanan and V. T. Ranganathan, "*Simulation of Power Electronics circuits*", Narosa publication.
3	Remus Teodorescu, Marco Liserre and Pedro Rodrigues, "*Grid- Converters for Photovoltaic and Wind Power Converters*", A john wiley and sons Ltd., first edition 2011.
4	IEEE Transaction papers.

Useful Links

1	NPTEL lectures on Advanced Power Electronics

CO-PO Mapping						
	Programme Outcomes (PO)					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1			1			
CO2				1		
CO3				2		1
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				
There are three components of lab assessment, LA1, LA2 and Lab ESE. IMP: Lab ESE is a separate head of passing. LA1, LA2 together is treated as In-Semester Evaluation.				
Assessment	**Based on**	**Conducted by**	**Typical Schedule (for 26-week Sem)**	**Marks**
LA1	Lab activities, attendance	Lab Course Faculty	During Week 1 to Week 6 Marks Submission at the end of Week 6	30
LA2	Lab activities, attendance	Lab Course Faculty	During Week 7 to Week 12 Marks Submission at the end of Week 12	30
Lab ESE	Lab activities, attendance	Lab Course Faculty	During Week 15 to Week 18 Marks Submission at the end of Week 18	40
Week 1 indicates starting week of a semester. The typical schedule of lab assessments is shown, considering a 26-week semester. The actual schedule shall be as per academic calendar. 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.				

Assessment Plan based on Bloom's Taxonomy Level (Marks) (For lab Courses)				
Bloom's Taxonomy Level	**LA1**	**LA2**	**Lab ESE**	**Total**
Remember				
Understand				
Apply	10	10	10	**30**
Analyze	10	10	20	**40**
Evaluate	10	10	10	**30**
Create				
Total Marks	**30**	**30**	**40**	**100**

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Course Information	
Programme	M. Tech. (Power System Engineering)
Class, Semester	Second Year M. Tech., Sem III
Course Code	5PS652
Course Name	Activity based elective lab 2: HVDC Transmission Lab
Desired Requisites:	Power Electronics

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

Course Objectives	
1	It makes the students to analyse concept of HVDC transmission system.
2	It provides the knowledge of appropriate control systems in HVDC transmission systems.
3	It gives the overview of protection systems in HVDC transmission systems.

Course Outcomes (CO) with Bloom's Taxonomy Level		
At the end of the course, the students will be able to,		
CO1	Implement various control and protection schemes for HVDC transmission system.	Apply
CO2	Analyse HVDC systems	Analyse

List of Experiments / Lab Activities

Lab activities/performance shall include mini project, presentations, drawings, case study, report writing, site visit, lab experiment, tutorials, assignments, group discussion, programming, and other suitable activities as per nature and requirement of lab course.

Text Books	
1	E.W. Kimbark, *"Direct Current Transmission",* Win publisher.
2	K.R. Padiyar, *"H.V.D.C. Power Transmission",* Wiley Eastern New Delhi.

References	
1	J. Arrillaga, *"H.V.D.C. Transmission",* Peter limited.
2	S.Rao, *"E.H.V.A.C. & H.V.D.C. Transmission",* Khanna Publishers.

Useful Links	
1	

CO-PO Mapping						
	Programme Outcomes (PO)					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**

CO1			2			
CO2				2	1	
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				
There are three components of lab assessment, LA1, LA2 and Lab ESE. IMP: Lab ESE is a separate head of passing. LA1, LA2 together is treated as In-Semester Evaluation.				
Assessment	**Based on**	**Conducted by**	**Typical Schedule (for 26-week Sem)**	**Marks**
LA1	Lab activities, attendance	Lab Course Faculty	During Week 1 to Week 6 Marks Submission at the end of Week 6	30
LA2	Lab activities, attendance	Lab Course Faculty	During Week 7 to Week 12 Marks Submission at the end of Week 12	30
Lab ESE	Lab activities, attendance	Lab Course Faculty	During Week 15 to Week 18 Marks Submission at the end of Week 18	40
Week 1 indicates starting week of a semester. The typical schedule of lab assessments is shown, considering a 26-week semester. The actual schedule shall be as per academic calendar. 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.				

Assessment Plan based on Bloom's Taxonomy Level (Marks) (For lab Courses)				
Bloom's Taxonomy Level	**LA1**	**LA2**	**Lab ESE**	**Total**
Remember				
Understand				
Apply	10	10	10	**30**
Analyze	10	10	20	**40**
Evaluate	10	10	10	**30**
Create				
Total Marks	**30**	**30**	**40**	**100**

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Course Information

Programme	M. Tech. (Power System Engineering)
Class, Semester	Second Year M. Tech., Sem IV
Course Code	5PS691
Course Name	Dissertation Phase I I
Desired Requisites:	Concept knowledge of research methodology, project management, Electrical Engineering

Teaching Scheme (Hrs)		**Examination Scheme (Marks)**			
Lecture	-	**LA1**	**LA2**	**ESE**	**Total**
Tutorial	-	30	30	40	100
Practical	24				
Interaction	-	**Credits: 12**			

Course Objectives

1	To develop the student to apply the knowledge gained to identify problems for research and provide the solutions by self-study and interaction with stakeholders.
2	Acquire knowledge to tackle real world problems of societal concerns
3	Impart flexibility to the student to have increased control over his/ her learning
4	Teachers would serve as mentor/facilitator of inquiry and reflection rather than as an instructor
5	Enhance a students' learning through increased interaction with peers and colleagues.

Course Outcomes (CO) with Bloom's Taxonomy Level

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

CO1	**Defend** the objectives of the dissertation by grasping and **analyzing** through an extensive literature review in the area of study.	Understand Analyze
CO2	**Formulate** the methodology and **Execute** the study through conduct of analytical/Experimental work to achieve the objectives.	Apply Create
CO3	**Analyze, interpret and critique** the findings of the study.	Apply Analyze Evaluate
CO4	**Defend** the outcomes of the dissertation through self-learning and **justify** the project work as per appropriate standards of documentation and presentation.	Evaluate

Course Content

The third semester is completely devoted to dissertation work which is defined based on the interest of the students to specialize in a particular area.

Student is expected to carry out independent research work on the chosen topic. In this semester it is expected that the student has carried out substantial research work including exhaustive literature survey, formulation of the research problem, development/fabrication of experimental set-up (if any/required) and testing, and analysis of initial results thus obtained. In fourth semester, the student continues his/her dissertation work. It is expected that the student has completed most of the experimental/computation works and analyzed the results so obtained as proposed in the synopsis. The work should be completed in all respects in this semester. The student is required to submit the dissertation work in the form of report as per the institute rule.

Text Books	
1	As per the research topic
References	
1	National and International Journals
Useful Links	
1	

CO-PO Mapping

	Programme Outcomes (PO)					
	1	**2**	**3**	**4**	**5**	**6**
CO1	3	2			2	
CO2	2		3	3		
CO3				2	1	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.

Assessment

There are three components of lab assessment, LA1, LA2 and Lab ESE.
IMP: Lab ESE is a separate head of passing. LA1, LA2 together is treated as In-Semester Evaluation.

Assessment	Based on	Conducted by	Typical Schedule (for 26-week Sem)	Marks
LA1	Lab activities, attendance, journal	Lab Course Faculty	During Week 1 to Week 6 Marks Submission at the end of Week 6	30
LA2	Lab activities, attendance, journal	Lab Course Faculty	During Week 7 to Week 12 Marks Submission at the end of Week 12	30
Lab ESE	Lab activities, attendance, journal	Lab Course Faculty	During Week 15 to Week 18 Marks Submission at the end of Week 18	40

Week 1 indicates starting week of a semester. The typical schedule of lab assessments is shown, considering a 26-week semester. The actual schedule shall be as per academic calendar. 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.

Assessment Plan based on Bloom's Taxonomy Level (Marks) (For lab Courses)

Bloom's Taxonomy Level	LA1	LA2	Lab ESE	Total
Remember				
Understand	5	5		
Apply	5	5		
Analyze	5	5	10	**30**
Evaluate	5	5	10	**30**
Create	10	10	20	**40**
Total Marks	**30**	**30**	**40**	**100**

Walchand College of Engineering, Sangli

(Government Aided Autonomous Institute)

AY 2021-22

Course Information

Programme	M. Tech. (Power System Engineering)
Class, Semester	Second Year M. Tech., Sem IV
Course Code	5PS671
Course Name	Techno-Socio Activity
Desired Requisites:	

Teaching Scheme (Hrs)		**Examination Scheme (Marks)**			
Lecture	-	**LA1**	**LA2**	**ESE**	**Total**
Tutorial	-	30	30	40	100
Practical	-				
Interaction	1	**Credits: 1**			

Course Objectives

1	To record student performance in co-curricular and extra-curricular activities over two years will be considered.
2	To encourage the students to participate in activities that help develop leadership skills, team integrity, coordination skills, Time management, Communications skills, Interviewing skills etc.
3	To highlight importance of social responsibility.

Course Outcomes (CO) with Bloom's Taxonomy Level

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

CO1	**Notice** an improvement in his/her understanding and presentation skills.	Apply
CO2	**Understand** and value the importance of working in a diversified team.	Analyze
CO3	**Demonstrate** the soft skills like presentation skills, technical report writing etc.	Evaluate

Course Contents

The guide will be mentoring a given student batch for the duration of two years. The students shall submit proof of their achievements in various extra and co-curricular activities related to technical, cultural and social causes from first year to second year. The faculty will evaluate the students' performance at the end of 4thsemester, based on the rubrics provided by the department from time to time.

Text Books

1	Not applicable

References

1	Not applicable

Useful Links

1	Not applicable

CO-PO Mapping

	Programme Outcomes (PO)					
	1	**2**	**3**	**4**	**5**	**6**
CO1	2				3	
CO2		1			2	
CO3			2		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				
There are three components of lab assessment, LA1, LA2 and Lab ESE. IMP: Lab ESE is a separate head of passing. LA1, LA2 together is treated as In-Semester Evaluation.				
Assessment	**Based on**	**Conducted by**	**Typical Schedule (for 26-week Sem)**	**Marks**
LA1	Lab activities, attendance, journal	Lab Course Faculty	During Week 1 to Week 6 Marks Submission at the end of Week 6	30
LA2	Lab activities, attendance, journal	Lab Course Faculty	During Week 7 to Week 12 Marks Submission at the end of Week 12	30
Lab ESE	Lab activities, attendance, journal	Lab Course Faculty	During Week 15 to Week 18 Marks Submission at the end of Week 18	40
Week 1 indicates starting week of a semester. The typical schedule of lab assessments is shown, considering a 26-week semester. The actual schedule shall be as per academic calendar. 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.				

Assessment Plan based on Bloom's Taxonomy Level (Marks) (For lab Courses)				
Bloom's Taxonomy Level	**LA1**	**LA2**	**Lab ESE**	**Total**
Remember				
Understand				
Apply	10	10	10	**30**
Analyze	10	10	15	**35**
Evaluate	10	10	15	**35**
Create				
Total Marks	**30**	**30**	**40**	**100**

Walchand College of Engineering, Sangli

(Government Aided Autonomous Institute)

AY 2021-22

Course Information	
Programme	M. Tech. (Power System Engineering)
Class, Semester	Second Year M. Tech., Sem IV
Course Code	5PS621
Course Name	Professional Elective 6: Deregulated Power System
Desired Requisites:	Power System Engineering

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	3 Hrs/week	**T1**	**T2**	**ESE**	**Total**
Tutorial	-	20	20	60	100
Practical	-				
Interaction	-	**Credits: 3**			

Course Objectives	
1	To deliver the knowledge of basic concepts and terminologies used in restructuring and deregulation.
2	To explain the difference between integrated and restructured power system.
3	To impart knowledge of various trading models, market architecture and market power.

Course Outcomes (CO) with Bloom's Taxonomy Level		
At the end of the course, the students will be able to,		
CO1	**Recognize** recent changes occurring in the structure of power supply utilities and electric supply market.	Remember
CO2	**Explain** the problems associated with deregulation.	Understand
CO3	**Solve** some problem associated with deregulate power system.	Apply

Module	**Module Contents**	**Hours**
I	**Introduction to Basic Concepts** Basic Concept and definitions, privatization, restructuring, transmission open access, wheeling, deregulation, components of deregulated system, advantages of competitive system.	6
II	**Power System Restructuring** An overview of the restructured power system, Difference between integrated power system and restructured power system. Explanation with suitable practical examples.	6
III	**Deregulation of Power Sector** Separation of ownership and operation, Deregulated models, pool model, pool and bilateral trade model, multilateral trade model.	6

IV	**Competitive Electricity Market** Independent System Operator activities in pool market, Wholesale electricity market characteristics, central auction, single auction power pool, double auction power pool, market clearing and pricing, Market power and its Mitigation Techniques, Bilateral trading, Ancillary services.	6
V	**Transmission Pricing** Marginal pricing of electricity, nodal pricing, zonal pricing, embedded cost, Postage stamp method, Contract path method, Boundary flow method, MW-mile method, MVA – mile method, Comparison of different methods.	6
VI	**Congestion Management** Congestion management in normal operation, explanation with suitable example, Total Transfer Capability (TTC), Available Transfer Capability (ATC).	6

Text Books	
1	Loi Lei Lai," *Power System Restructuring and Deregulation: Trading, Performance and Information Technology"*, John Wiley & Sons Ltd., UK, 2001.
2	M. Shahidhpour, M. Alomoush, *"Restructured Electrical power systems: Operating, Trading and Volatility",* Marcel Dekker Inc., New York, 2001.
3	H. Lee, Willis, W. G. Scott, *"Distributed Power Generation: Planning and Evaluation"*, Marcel Dekker Inc., New York, 2000.
References	
1	Lorrin Philipson, H. Lee Willis, *"Understanding Electric Utilities and Deregulation",* Marcel Dekker Inc., New York, 1998.
2	K. Bhattacharya, M.H.J. Bollen, J. E. Daalder, *"Operation of Restructured Power Systems"*, Kulwer Academic Publishers, Massachausetts, USA, 2001.
3	M. Shahidhpour, H. Yamin, Z. Li, *"Market of Operations in Electric Power Systems: Forecasting Scheduling, and Risk Management"*, John Wiley & Sons Ltd., New York, 2002.
Useful Links	
1	

CO-PO Mapping						
	Programme Outcomes (PO)					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1	2					
CO2		3				
CO3			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 (for Theory Course)
The assessment is based on 2 in-semester examinations in the form of T1 (Test-1) and T2 (Test-2) of 20 marks each. Also there shall be 1 End-Sem examination (ESE) of 60 marks. T1 shall be typically on modules 1 and 2, T2 based typically on modules 3, 4 and ESE shall be on all modules with nearly 50% weightage on modules 1 to 4 and 50% weightage on modules 5, 6.

Assessment Plan based on Bloom's Taxonomy Level (Marks) For Theory Course					
Bloom's Taxonomy Level		**T1**	**T2**	**ESE**	**Total**
1	Remember				
2	Understand				
3	Apply	10		20	**30**
4	Analyze	10	10	20	**30**
5	Evaluate		10	20	**40**
6	Create				
Total		**20**	**20**	**60**	**100**

Walchand College of Engineering, Sangli

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AY 2021-22

Course Information	
Programme	M. Tech. (Power System Engineering)
Class, Semester	Second Year M. Tech., Sem IV
Course Code	5PS622
Course Name	Professional Elective 6: Smart Grid
Desired Requisites:	Power System Engineering, Power Electronics

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	3 Hrs/week	**T1**	**T2**	**ESE**	**Total**
Tutorial	-	20	20	60	100
Practical	-				
Interaction	-	**Credits: 3**			

Course Objectives	
1	To provide the advance knowledge in the field of smart – grid technology
2	To make the students aware of research avenues in the field of smart grid technology
3	To develop the skills of simulation and analysis of smart grid systems.

Course Outcomes (CO) with Bloom's Taxonomy Level		
At the end of the course, the students will be able to,		
CO1	**Explain** various concepts associated with smart grid.	Understand
CO2	**Apply** smart grid concept to power system monitoring, communication and protection.	Apply
CO3	**Analyse** tools for smart grid's performance, stability and computational analysis.	Analyse

Module	**Module Contents**	**Hours**
I	**Smart grid architecture** Introduction, smart grid verses today's grid, computational intelligence, power system enhancement, smart grid market drivers, architecture of smart grid, and function of smart grid components.	8
II	**Smart grid technologies** Introduction to Smart Meters, Automatic Meter Reading(AMR), Outage Management System(OMS), Plug in Hybrid Electric Vehicles(PHEV) & more, Substation Automation, Feeder Automation, Geographic Information System (GIS), Intelligent Electronic Devices(IED) & their application for monitoring & protection	6
III	**Transmission aspects** Wide area Monitoring Systems (WAMS), PMU and PDCs, PMU placement, linear state estimation, System security under smart grid environment, Concept of Resilient & Self-Healing Grid, adaptive relaying using PMUs	6

IV	**Communication aspects** Elements of communication and networking: architectures, standards and adaptation of power line communication (PLCC), zigbee, GSM, and more; machine to machine communication models for the smart grid; Home area networks (HAN) and neighbourhood area networks (NAN); reliability, redundancy and security aspects.	6
V	**Performance analysis tool for smart grid design** Load flow in smart grid, load flow methods, congestion management flow effect, load flow for smart grid design, dynamic stochastic optimal power flow (DSOPF), DSOPF application to smart grid. Static security assessment and contingencies study for the smart grid.	6
VI	**Stability analysis tools and computational tools for smart grid** Voltage stability assessment and its techniques, angle stability assessment and state estimation, optimization techniques, classical optimization methods, Heuristic optimization, evolutionary computational Techniques, Hybrid optimization techniques and application to smart grid.	6

Text Books	
1	Janaka Ekanayake, Nick Jenkins, Kithsiri Liyanage, Jianzhong Wu, Akihiko Yokoyama, "*Smart Grid: Technology and Applications*".
2	G. M. Masters, "*Renewable and Efficient Electric Power Systems"*, John Wiley & Sons Inc., 2004.
References	
1	Gilbert N. Sorebo, Michael C. Echols, *"Smart grid security: An end to end view of security in new Electrical grid"* CRC press, Taylor &Fancis group, 2011.
2	S. P. Chowdhary, P. Crosley and S. Chowdhary, *"Micro-grids and active distribution networks"*, The institution of engineering and technology, London, 2009.
3	J. S. Thorp, A.G. Phadke, *"Synchronized Phasor Measurement and Their Applications"* Springer 2008.
Useful Links	
1	http://nptel.ac.in/downloads/117105077
	http://www.nptelvideos.in/2012/12/digital-communication.html
	https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-450-principles-of-digital-communications-i-fall-2006/video-lectures/

CO-PO Mapping						
	Programme Outcomes (PO)					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1		3				
CO2	1					
CO3	3	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 (for Theory Course)
The assessment is based on 2 in-semester examinations in the form of T1 (Test-1) and T2 (Test-2) of 20 marks each. Also there shall be 1 End-Sem examination (ESE) of 60 marks. T1 shall be typically on modules 1 and 2, T2 based typically on modules 3, 4 and ESE shall be on all modules with nearly 50% weightage on modules 1 to 4 and 50% weightage on modules 5, 6.

Assessment Plan based on Bloom's Taxonomy Level (Marks) For Theory Course					
Bloom's Taxonomy Level		**T1**	**T2**	**ESE**	**Total**
1	Remember				
2	Understand	10		20	
3	Apply	10	10	20	**30**
4	Analyze		10	20	**30**
5	Evaluate				**40**
6	Create				
Total		**20**	**20**	**60**	**100**