

FACULTY COURSE ASSESSEMENT REPORT(FCAR)

Course Coordinator:	Prof. Hemalata R. Zinage	Class Strength:23
Semester: VIII	Subject: Power System Operation & Control	Code: 17EE81

- **I. Program Outcomes (POs):** Engineering Graduates will be able to:
 - 1. **Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
 - 2. **Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
 - 3. **Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
 - 4. **Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
 - 5. **Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
 - 6. **The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
 - 7. **Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
 - 8. **Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
 - 9. **Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
 - 10. **Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
 - 11. **Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
 - 12. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.



II. Program Specific Outcomes (PSOs):

The graduates of the program will be able to;

PSO1	Apply knowledge & competencies to analyze & design electrical & electronics circuits,									
	control and power systems, machines & industrial drives.									
PSO2	Use software/hardware tools for the design, simulation and analysis of electrical and									
	electronics systems.									

III. Course Outcomes (COs): The student, after successful completion of the course, will be able to:

СО	Description	Mapped POs	RBTL
C415.1	Describe various levels of controls in power systems, the vulnerability of the system, components, architecture and configuration of SCADA and solve unit commitment problems	PO1,PO2,PO3,PO4,PO5 PO8,PO10,PO12	L3
C415.2	Explain issues of hydrothermal scheduling and solutions to hydro thermal problems	PO1,PO2,PO3,PO4,PO5 PO8,PO10,PO12	L3,L4
C415.3	Explain basic generator control loops, and develop & analyze mathematical models of Automatic Load Frequency Control	PO1,PO2,PO3,PO4,PO5 PO8,PO10,PO12	L3,L4
C415.4	Explain automatic generation control, voltage and reactive power control in an interconnected power system.	PO1,PO2,PO3,PO4,PO5 PO8,PO10,PO12	L3,L4
C415.5	Explain reliability, security, contingency analysis, state estimation and related issues of power systems.	PO1,PO2,PO3,PO4,PO5 PO8,PO10,PO12	L3,L4

IV. Mapping of Course Outcomes (COs) to Program Outcomes (POs):

$\begin{array}{c} POs \rightarrow \\ \hline COs \downarrow \end{array}$	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
C415.1	3	3	2	1	2	-	-	2	-	2	-	1
C415.2	3	3	2	1	2	-	-	2	-	2	-	1
C415.3	3	3	2	1	2	-	-	2	-	2	-	1
C415.4	3	3	2	1	2	-	-	2	-	2	-	1
C415.5	3	3	2	1	2	-	-	2	-	2	-	1
Average	3	3	2	1	2	-	-	2	-	2	-	1



V. Mapping of Course Outcomes (COs) to Program Specific Outcomes (PSOs):

PSOs	PSO 1	PSO 2
COs		
C415.1	3	1
C415.2	3	1
C415.3	3	1
C415.4	3	1
C415.5	3	1
Average	3	1

VI. Justification of CO-PO Mapping:

Mapping	Justification
C415.1-PO1	A strong correlation since explaining the concept of mathematical modeling of AVR & ALFC loops requires the knowledge of mathematics and electrical engineering sciences.
C415.1-PO2	A strong correlation forming the mathematical modeling of AVR & ALFC loops requires a certain level of problem analysis skills based on literature research. However, first principles of mathematics, science are required.
C415.1-PO3	A medium correlation since forming the mathematical models of AVR & ALFC loops requires knowledge on designing/developing solutions considering public safety and environmental issues.
C415.1-PO4	A low correlation since explaining the concept requires design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
C415.1-PO5	A low correlation since explaining the concept requires knowledge about usage of modern engineering /software tools.
C415.1-PO8	A medium correlation since after studying these concept students require to apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
C415.1-PO10	A moderate correlation since the study of various levels of controls in power systems, the vulnerability of the system, components, architecture and configuration of SCADA and solve unit commitment problems may contribute for improvement of Verbal/Non-Verbal communication.
C415.1-PO12	A low correlation since understanding various levels of controls in power systems, the vulnerability of the system, components, architecture and configuration of SCADA and solve unit commitment problems will help to continue the learning process.
C 415.2-PO1	A strong correlation since explaining the concept of controlling voltage and reactive power requires the knowledge of mathematics and electrical engineering sciences.
C415.2-PO2	A medium correlation since explaining the concept requires a certain level of problem analysis skills based on literature research. However, first principles of mathematics, science are required.
C415.2-PO3	A medium correlation since explaining the concept require a certain level of knowledge on designing / developing solutions considering public safety and environmental issues
C415.2-PO4	A low correlation since explaining the concept requires design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
C415.2-PO5	A low correlation since explaining the concept requires knowledge about usage of modern engineering /software tools.



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C415.2-PO8	A medium correlation since after studying these concept students require to apply ethical
	principles and commit to professional ethics and responsibilities and norms of the
	engineering practice.
C415.2-PO10	A moderate correlation since the study of issues of hydrothermal scheduling and solutions
	to hydro thermal problems may contribute for improvement of Verbal/Non-Verbal
	communication.
C415.2-PO12	A low correlation since understanding issues of hydrothermal scheduling and solutions to
	hydro thermal problems will help to continue the learning process.
C415.3-PO1	A strong correlation since explaining the concept requires the knowledge of mathematics
	and electrical engineering sciences.
C415.3-PO2	A medium correlation since explaining the concept requires a certain level of problem
	analysis skills based on literature research. However, first principles of mathematics,
	science are required.
C415.3-PO3	A medium correlation since explaining the concept require a certain level of knowledge
	on designing / developing solutions considering public safety and environmental issues
C415.3-PO4	A low correlation since explaining the concept requires design of experiments, analysis
C415.2 DO5	and interpretation of data, and synthesis of the information to provide valid conclusions.
C415.3-PO5	A low correlation since explaining the concept requires knowledge about usage of modern
C415 2 DO9	A madium correlation since after studying these concept students require to apply athical
C415.5-PO8	A medium contraction since after studying these concept students require to apply ethical principles and commit to professional othics and responsibilities and norms of the
	engineering practice
C/15 3-PO10	A moderate correlation since the study of basic generator control loops and develop $\&$
0413.3-1010	analyze mathematical models of Automatic Load Frequency Control systems may
	contribute for improvement of Verbal/Non-Verbal communication.
C415.3-PO12	A low correlation since understanding basic generator control loops, and develop &
	analyze mathematical models of Automatic Load Frequency Control will help to continue
	the learning process.
C415.4-PO1	A strong correlation since explaining the concept require the knowledge of mathematics
	and electrical engineering sciences
C415.4-PO2	A medium correlation since explaining the concept requires a certain level of problem
	analysis skills based on literature research. However, first principles of mathematics,
	science are required.
C415.4- PO3	A medium correlation since explaining the concept require a certain level of knowledge
	on designing / developing solutions considering public safety and environmental issues
C415.4- PO4	A low correlation since explaining the concept requires design of experiments, analysis
C415 4 D05	and interpretation of data, and synthesis of the information to provide valid conclusions.
C415.4-PO5	A low correlation since explaining the concept requires knowledge about usage of modern
C415 4 DO9	Construction of the studying these concept students require to engly athiest
C415.4-PO8	A medium correlation since after studying these concept students require to apply etincal
	engineering practice
$C_{A15} A_{-} PO10$	A moderate correlation since the automatic generation control voltage and reactive power
010	aontrol in an interconnected neuron may contribute for improvement of Verbal/Ner
	control in an interconnected power may contribute for improvement of verbal/Non-
	Verbal communication.



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C415.4-PO12	A low correlation since understanding automatic generation control, voltage and reactive
	power control in an interconnected power will help to continue the learning process.
C415.5- PO1	A strong correlation since explaining the concept require the knowledge of mathematics
	and electrical engineering sciences.
C415.5- PO2	A medium correlation since explaining the concept requires a certain level of problem
	analysis skills based on literature research. However, first principles of mathematics,
	science are required
C415.5- PO3	A medium correlation since explaining the concept require a certain level of knowledge
	on designing / developing solutions considering public safety and environmental issues.
C415.5- PO4	A low correlation since explaining the concept requires design of experiments, analysis
	and interpretation of data, and synthesis of the information to provide valid conclusions.
C415.5-PO5	A low correlation since explaining the concept requires knowledge about usage of modern
	engineering /software tools.
C415.5-PO8	A medium correlation since after studying these concept students require to apply ethical
	principles and commit to professional ethics and responsibilities and norms of the
	engineering practice.
C415.5-PO10	A moderate correlation since the study of reliability, security, contingency analysis, state
	estimation and related issues of power systems may contribute for improvement of
	Verbal/Non-Verbal communication.
C415.5-PO12	A low correlation since understanding reliability, security, contingency analysis, state
	estimation and related issues of power systems will help to continue the learning process.

VII. **Justification of CO-PSO Mapping :**

Mapping	Justification
C415-PSO1	A strong correlation since after studying power system operation & control students will
	develop an ability to demonstrate knowledge & competencies to analyze & design
	electrical power systems.
C415-PSO2	A low correlation since after studying the various concepts of power system operation and
	control students will develop an ability to use software tools for the design, simulation
	and analysis of electrical power systems to some extent.

VIII. **Bench Mark Setting**

CO attainment of previous year is 1.55, which is greater than the set target. So it is taken as set target for current academic year.



IX. DIRECT ASSESSMENT OF COs, POs & PSOs ATTAINMENT

Teaching Methodology:

- Lecture by Teacher
- PPT or Online demo etc.

Assessment Tools:

- Continuous assessment
- Laboratory experiments
- End semester exam

1. Assessment through Assignment:

A: Appeared R: Reached

Low =1 (50-59 %)

Medium =2 (60-69 %) High =3 (above 70 %)

	Assi en	gnm t-1	Assi en	gnm t-2	Assi en	gnm t-3	Assi ent	gnm t-4	Assi en	gnm t-5	Attain ment	Attain	
COs	А	R	A	R	A	R	A	R	А	R	CO in Percent age	level of CO	Mapped PO
C415.1	23	23									100.00	3	PO1,PO2,PO3,PO4,PO5, PO8,PO10,PO12
C415.2			23	23							100.00	3	PO1,PO2,PO3,PO4,PO5, PO8,PO10,PO12
C415.3					23	23					100.00	3	PO1,PO2,PO3,PO4,PO5, PO8,PO10,PO12
C415.4							23	23			100.00	3	PO1,PO2,PO3,PO4,PO5, PO8,PO10,PO12
C415.5									23	23	100.00	3	PO1,PO2,PO3,PO4,PO5, PO8,PO10,PO12





2. Assessment through Internal Marks:

A: Appeared R: Reached Low =1 (50-59 %) Medium =2 (60-69 %) High =3 (above 70 %)

		IA-1			IA-2			IA-3		IA-3		IA-3		Attainment level of CO	Mapped PO											
COs	Q.No.1 OR Q. No. 2		Q.No.3 OR Q. No. 4		Q.N 0 Q.	Q.No.1 OR Q. No. 2		Q.No.3 OR Q. No. 4		Q.No.3 OR Q. No. 4		Q.No.3 OR Q. No. 4		Q.No.3 OR Q. No. 4		Q.No.3 OR Q. No. 4		Q.No.3 OR Q. No. 4		Q.No.3 OR Q. No. 4		Q.No.1 OR Q. No. 2		No.3 PR No. 4		
	А	R	А	R	A	R	Α	R	А	R	А	R														
C415.1	23	22	23	22									3	PO1,PO2,PO3,PO4,PO5,PO8,PO10,PO12												
C415.2					23	23							3	PO1,PO2,PO3,PO4,PO5,PO8,PO10,PO12												
C415.3							23	22					3	PO1,PO2,PO3,PO4,PO5,PO8,PO10,PO12												
C415.4									23	23			3	PO1,PO2,PO3,PO4,PO5,PO8,PO10,PO12												
C415.5											23	23	3	PO1,PO2,PO3,PO4,PO5,PO8,PO10,PO12												



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3. Semester End Exam Assessment Based on VTU Exam Results:

COs Attainment Levels:

FCD: S+, S, &A = 3;

FC (B) = 2;

Pass: C,D,& E = 1; Fail = 0

Total no. of Students Appeared	23					
Class/Grade↓	Total Number of Students	Course (COs) Attainment Through Semster End Exams				
FCD/S+, S, A	0	0				
FC/B	4	8				
PASS/C,D,E	19	19				
Total Percentage of Passing	100.00%	1.17				





4. CO Attainment: <u>CO Attainment through Direct Assessment Method</u>

COs	Attainment Through Assignment (X)	Attainment Through IA Test (Y)	Attainment Through Semester End Exam (Z)	Attainment level of CO	Mapped POs
				[0.2(X+Y)/2]+0.8Z	
C415.1	3	3	1.17	1.54	PO1,PO2,PO3,PO4,PO5,PO8,PO10,PO12
C415.2	3	3	1.17	1.54	PO1,PO2,PO3,PO4,PO5,PO8,PO10,PO12
C415.3	3	3	1.17	1.54	PO1,PO2,PO3,PO4,PO5,PO8,PO10,PO12
C415.4	3	3	1.17	1.54	PO1,PO2,PO3,PO4,PO5,PO8,PO10,PO12
C415.5	3	3	1.17	1.54	PO1,PO2,PO3,PO4,PO5,PO8,PO10,PO12
C	O Attainment	through Direc	t Assessment Method	1.54	





5. PO Attainment for the Entire Course:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
C415	1.54	1.54	1.03	0.51	1.03	0.00	0.00	1.03	0.00	1.03	0.00	0.51

POs attainment value for the present course = (Mapped value * CO attainment average)/3



6. PSO Attainment for the Entire Course:

CO/PSO	PSO1	PSO2
C415	1.54	0.51

PSOs attainment value for the present course = (Mapped value * CO attainment average)/3





7. Target Attainment:

CO attainment target is taken as 2, as attained value of previous year is less than set target.

Set Target Value	2
Attained Value	1.54
New Target Level for the next Exam	2



8. Course Coordinator Remarks:

S. No.	Observations	Comments
1	Impact of Delivery	Delivery methods are satisfactory. Pedagogy used to deliver lectures is
	Methods	quite satisfactory.
2	Course Outcome	Overall attainment of all course outcomes is moderate as it is observed
	Attainment	in CO attainment table.
3	Scope for	Attainment of COs through Semester End Exam (SEE) need to be
	Improvement	improved.
4	Additional comments	NI:1
	(if any)	1811



X. INDIRECT ASSESSMENT OF PO & PSO THROUGH COURSE EXIT SURVEY (CES)

CO Attainment Value through Course Exit Survey: 2.66

PO Attainment = (Mapped value * CES attainment value)/3

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
C415	2.66	2.66	1.77	0.89	1.77	0.00	0.00	1.77	0.00	1.77	0.00	0.89

PSO Attainment = (Mapped value * CES attainment value)/3

CO/PSO	PSO1	PSO2
C415	2.66	0.89

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