INTEGRAL UNIVERSITY, LUCKNOW

DEPARTMENT OF ELETRICAL ENGINEERING

COURSE: ADVANCE POWER ELECTRONICS
COURSE CODE: EE513

COURSE OBJECTIVES:

- Knowledge and concept of voltage source inverter.
- Use of switching techniques/schemes and current source inverters.
- Knowledge and concept of multilevel inverters, its applications and control
- Identify and apply concept of resonant converters.
- Knowledge of synchronous rectifiers and matrix converters..

COURSE OUTCOMES (CO):

After completion of the course, a student will be able to

COURSE OUTCOME (CO)	DESCRIPTION
CO1	Know about the concepts of voltage source inverter
CO2	Identify and apply switching techniques/schemes and current source inverters.
CO3	Know about concept of multilevel inverters, its applications and control.
CO4	Identify and apply concept of resonant converters
CO5	Know about synchronous rectifiers and matrix converters.

CO-PO MAPPING:

	CO	**PO1** Engineering Knowledge	**PO2** Problem Analysis	**PO3** Design/development of solutions	**PO4** Conduct investigations into complex problems	**PO5** Modern tool usage	**PO6** Engineer and Society	**PO7** Environment and Sustainability	**PO8** Ethics	**PO9** Individual and Team work	**PO10** Communication	**PO11** Project Management and Finance	**PO12** Lifelong learning
CO1	Know about the concepts of voltage source inverter	3	2	2	1	1	3	3	1				3
CO2	Identify and apply switching techniques/schemes and current source inverters.	3	2	2	2	3	3	3					2
CO3	Know about concept of multilevel inverters, its applications and control.	3	2	2	1	1	3	3	1				3
CO4	Identify and apply concept of resonant converters.	3	2	2	2	3	3	3					2
CO5	Know about synchronous rectifiers and matrix converters.	3	3	3	3	3	3	2					2
3: Strong contribution, 2: average contribution, 1: Low contribution													

COURSE: POWER APPARATUS & SYSTEM MODELLING
COURSE CODE: EE514

COURSE OBJECTIVES:

- To develop knowledge on principles ofmodelling of synchronous generators
- To understand the fundamental concepts ofapplication of Parks transformation
- To provide advanced knowledge and understanding about the models of transmission line, transformer and load
- To analyze governors for thermal and hydro power plant
- To evaluate the performance of different excitation systems

COURSE OUTCOMES (CO):

After completion of the course, a student will be able to

COURSE OUTCOME (CO)	DESCRIPTION
CO1	Understands the basic concept of modelling of synchronous generators
CO2	Apply Parks transformation technique
CO3	Understand different models of transmission line, transformer and load
CO4	Analyze governors for thermal and hydro power plant
CO5	Evaluate the performance of AC and DC excitation system

CO-PO MAPPING:

	CO	**PO1** Engineering Knowledge	**PO2** Problem Analysis	**PO3** Design/development of solutions	**PO4** Conduct investigations into complex problems	**PO5** Modern tool usage	**PO6** Engineer and Society	**PO7** Environment and Sustainability	**PO8** Ethics	**PO9** Individual and Team work	**PO10** Communication	**PO11** Project Management and Finance	**PO12** Lifelong learning
CO1	Understands the basic concept of modelling of synchronous generators	3	2		1								
CO2	Apply Parks transformation technique	3	2					1					
CO3	Understand different models of transmission line, transformer and load	3	1										**2**
CO4	Analyze governors for thermal and hydro power plant	3	2										**1**
CO5	Evaluate the performance of AC and DC excitation system	3	2					1					
3: Strong contribution, 2: average contribution, 1: Low contribution													

COURSE: ADVANCE POWER SYSTEM ANALYSIS
COURSE CODE: EE515

COURSE OBJECTIVES:

- Knowledge of graph theory, bus admittance and impedance matrices
- Knowledge of algorithm of bus impedance matrix and short circuit studies using three-phase Impedance Z_{BUS}
- Knowledge of power flow solutions
- Knowledge of Contingency and security studies
- Knowledge of Modern energy control Techniques

COURSE OUTCOMES (CO):

After completion of the course, a student will be able to

COURSE OUTCOME (CO)	DESCRIPTION
CO1	Solve the problem of graph theory, bus admittance and impedance matrices
CO2	Able to attain the knowledge of algorithm of bus impedance matrix and short circuit studies using three-phase Impedance Z_{BUS}
CO3	Able to solve the problems of power flow solutions
CO4	Having knowledge of Contingency and security studies
CO5	Having knowledge of Modern energy control Techniques

CO-PO MAPPING:

	CO	**PO1** Engineering Knowledge	**PO2** Problem Analysis	**PO3** Design/development of solutions	**PO4** Conduct investigations into complex problems	**PO5** Modern tool usage	**PO6** Engineer and Society	**PO7** Environment and Sustainability	**PO8** Ethics	**PO9** Individual and Team work	**PO10** Communication	**PO11** Project Management and Finance	**PO12** Lifelong learning
CO1	Solve the problem of graph theory, bus admittance and impedance matrices	**2**	**3**	**3**	**3**		**2**						**3**
CO2	Able to attain the knowledge of algorithm of bus impedance matrix and short circuit studies using three-phase Impedance Z_{BUS}	**2**	**3**	**3**	**3**		**2**						**3**
CO3	Able to solve the problems of power flow solutions	**1**	**3**	**3**	**3**		**2**						**3**
CO4	Having knowledge of Contingency and security studies	**1**	**2**	**3**	**3**		**2**						**3**
CO5	Having knowledge of Modern energy control Techniques	**2**	**3**	**3**	**3**		**2**						**3**
3: Strong contribution, 2: average contribution, 1: Low contribution													

COURSE: POWER SYSTEM DYNAMICS & CONTROL

COURSE CODE: EE517

COURSE OBJECTIVES:

- To understand the students about dynamics of Power systems. To develop ability for analysis of system stability and obtain the solution of transient problems.
- To analyze the modeling of synchronous machine by applying fundamental law's.
- To realize and examine the excitation systems and response the behavior of prime mover controllers in different system.
- To recognize the concepts of dynamics of synchronous generator Connected to Infinite Bus by investigation in real time domain.
- To execute the analysis of transient and voltage stability by various parameters and comparison with angle stability.

COURSE OUTCOMES (CO):

After completion of the course, a student will be able to

COURSE OUTCOME (CO)	DESCRIPTION
CO1	Given a Power System Dynamics Problems, students shall be able to represent this in various conventional models, identify type of system, apply vector algebra, and formulate the expression in different System Model and solve using mathematical terms.
CO2	Given a Modeling of Synchronous Machine with sources, student shall be able to analyze System Simulation and evaluate the Steady State Performance using Equivalent Circuit of Synchronous Machine.
CO3	For a Excitation systems & Prime Mover Controllers, student shall be able to generate its analytical response by Standard Block Diagram and examine, analyze and evaluate the characteristics by State Equations and Load Modeling.
CO4	For a given System Model, students shall be able to identify its characteristics and for Stator Equation, select suitable design of application of Network Equation, develop various combination for System Simulation Small Signal and large signal analysis with Block Diagram Representation for Single Machine System,.
CO5	Given a Modeling and Analysis of Transient and Voltage Stability, student shall be able to define its Stability Evaluation, solve/ analyze, and modify energy functions for direct stability evaluation;

CO-PO MAPPING:

CO	**PO1** Engineering Knowledge	**PO2** Problem Analysis	**PO3** Design/development of solutions	**PO4** Conduct investigations into complex problems	**PO5** Modern tool usage	**PO6** Engineer and Society	**PO7** Environment and Sustainability	**PO8** Ethics	**PO9** Individual and Team work	**PO10** Communication	**PO11** Project Management and Finance	**PO12** Lifelong learning
CO1	3	3	2									
CO2	3	3	2	2	2							
CO3	3	3	1									**2**
CO4	3	2	3	2	3					2	2	
CO5	3	3	3			2	1					
3: Strong contribution, 2: average contribution, 1: Low contribution												

COURSE: POWER GENERATION OPERATION AND CONTROL
COURSE CODE: EE-520

COURSE OBJECTIVES:

- To provide students the knowledge of optimization techniques used in the power system and Load Frequency Control (LFC)
- To provide a solid foundation in mathematical and engineering fundamentals required to control the governing system in Turbine models.
- To provide the knowledge of Hydrothermal scheduling, reactive power control.
- The basic objective of security in power generation operation and control.
- The review of optimization, economic dispatch problems, formulation of optimal power flow problems, and their solution methods.

COURSE OUTCOMES	
CO1	Introduce to the important "terminal" characteristics for thermal and hydroelectric power generation systems. Introduce mathematical optimization methods and apply them to practical operating problems involving both economic analysis and network analysis.
CO2	Introduce total real power loss in the network increases the total generation demand, and generation schedule to be adjusted by shifting generation to reduce flows on transmission system. Analyze and implement the power flow problem and its solution. Introduce the coordination equations, incremental losses, and penalty factors.
CO3	Implementation of unit combinations and dispatch for a certain load demand for solving unit commitments problem. Understand the constraints in unit commitment and implementation these constraints for solving the different solution methods for unit commitment problem.
CO4	Introduce and implement the generation scheduling in systems with limited energy supplies. Understand, analyze and solve the hydrothermal coordination problem and examples of solution techniques.
CO5	Introduce the methods that are used in modern control systems for power generation systems. Introduce power system operation areas that are undergoing significant, evolutionary changes. Discuss the new techniques for attacking old problems and new problems areas that are arising for changes in the system development patterns, regulatory structures, and economics.

CO- PO MAPPING											
	PO1 Engineering Knowledge	**PO2** Problem Analysis	**PO3** Design/development of solutions	**PO4** Conduct investigations into complex problems	**PO5** Modern tool usage	**PO6** Engineer and Society	**PO7** Environment and Sustainability	**PO8** Ethics	**PO9** Individual and Team work	**PO10** Communication	**PO11** Project Management and Finance
CO1	3	2	3	3	2	3	2		2		2
CO2	3	1	3	1	2	1			1		1
CO3	3	2	3	3	2	1	2		1	1	2
CO4	3	1	3	2	2	1			1	1	1
CO5	3	2	2	2	3	2	2	1	2	2	2

INTEGRAL UNIVERSITY, LUCKNOW
DEPARTMENT OF ELECTRICAL ENGINEERING

COURSE: POWER SYSTEM STABILITY
COURSE CODE: EE-522/ EEE-522
COURSE CREDIT: 4

PREREQUISITES:

Subject	Description	Level of study
None		

COURSE OBJECTIVES:

- Knowledge of different types of power system stability
- To get knowledge of energy function
- To attain knowledge of modelling of machines
- To study about power system stabilizer
- To have the knowledge of voltage stability.

COURSE OUTCOMES (CO):

After completion of the course, a student will be able to

COURSE OUTCOME (CO)	DESCRIPTION
CO1	Understand the power system stability
CO2	Understand the energy function
CO3	Knowledge of single and multi machine system
CO4	Knowledge of power system stabilizer
CO5	Knowledge of voltage stability

CO-PO MAPPING:

	CO	**PO1** Engineering Knowledge	**PO2** Problem Analysis	**PO3** Design/development of solutions	**PO4** Conduct investigations into complex problems	**PO5** Modern tool usage	**PO6** Engineer and Society	**PO7** Environment and Sustainability	**PO8** Ethics	**PO9** Individual and Team work	**PO10** Communication	**PO11** Project Management and Finance	**PO12** Lifelong learning
CO1	Understand the power system stability	**3**	**1**	**1**	**1**	**1**	**1**	**1**					**3**
CO2	Understand the energy function	**3**	**3**	**3**	**2**	**2**	**1**						**3**
CO3	Knowledge of single and multi machine system	**3**	**3**	**3**	**2**	**2**	**1**						**3**
CO4	Knowledge of power system stabilizer	**3**	**2**	**2**	**2**	**2**	**1**	**1**					**3**
CO5	Knowledge of voltage stability	**3**	**1**	**1**	**1**	**1**	**1**	**1**					**3**
3: Strong contribution, 2: average contribution, 1: Low contribution													

COURSE: FACTS DEVICES & HVDC TRANSMISSION
COURSE CODE: EE611

COURSE OBJECTIVES:

- To understand the use of different power electronic devices in HVDC Transmission.
- To impart knowledge of different Voltage Source Converters used in HVDC Transmission
- To impart knowledge of different Self and Line Commutated Current Sourced Converters used in HVDC Transmission..
- To understand working and characteristics of different FACTS devices used in HVDC Transmission.
- To understand working and characteristics and comparison of Combined Compensators used in HVDC Transmission. To understand working of Interline power flow controller.

COURSE OUTCOMES (CO):

After completion of the course, a student will be able to

COURSE OUTCOME (CO)	DESCRIPTION
CO1	**Understand** the different type power electronic devices and their characteristics, used for FACTS controller, **Recognized** different issues in ac power transmission, **.Implement** of different FACTS controller for power flow control
CO2	**Impart** knowledge of working, control function and behavior under different loading condition of various type of Voltage Source Converters used in power Transmission,
CO3	**Developed** complete understanding of different type of Self and Line Commutated Current Sourced Converters used power flow control, Analyze between VSC & CSI
CO4	**Explain** basic objectives of using series and shunt compensator**, Understand** working, characteristics and control of different FACTS devices used in power transmission.
CO5	**Understand** working, characteristics and comparison of Combined Compensators used for power flow control, **Explain** the working and control of Interline power flow controller

CO-PO MAPPING:

	Erudition of Knowledge	Critical Thinking	Problem Solving	Research Skill	Usage of Modern tools	Collaborative and Multidisciplinary work	Project Management and Finance	Communication	Life-long Learning	Ethical Practices and Social Responsibility	Independent and Reflective Learning
CO1	3	3	3	2	1	2	1	2	2	1	1
CO2	3	3	2	2	2	1	1	2	3	1	1
CO3	3	3	1	1	2		1	2	2	1	
CO4	3	3	2	2	2		-	2	3	1	-
CO5	3	3	2	2	2	-	-	2	2	1	1
3: Strong contribution, 2: average contribution, 1: Low contribution											

COURSE: SOFT COMPUTING IN SOLAR PV AND WIND ENERGY CONVERSION SYSTEMS
COURSE CODE: EE621

COURSE OBJECTIVES:

- Knowledge and concept of electricity generation through Solar PV system.
- Use of soft computing techniques in electricity generation through Solar PV system.
- Knowledge and concept of electricity generation through Wind energy conversion system.
- Use of soft computing techniques in electricity generation through Wind energy.
- Designing of hybrid power generation systems using soft computing.

COURSE OUTCOMES (CO):

After completion of the course, a student will be able to

COURSE OUTCOME (CO)	DESCRIPTION
CO1	Know about the concept of electricity generation through Solar PV system.
CO2	Identify and apply soft computing techniques in electricity generation through Solar PV system
CO3	Know about concept of electricity generation through Wind energy conversion system.
CO4	Identify and apply soft computing techniques in electricity generation through Wind energy.
CO5	Design hybrid power generation systems using soft computing.

CO-PO MAPPING:

	CO	**PO1** Engineering Knowledge	**PO2** Problem Analysis	**PO3** Design/development of solutions	**PO4** Conduct investigations into complex problems	**PO5** Modern tool usage	**PO6** Engineer and Society	**PO7** Environment and Sustainability	**PO8** Ethics	**PO9** Individual and Team work	**PO10** Communication	**PO11** Project Management and Finance	**PO12** Lifelong learning
CO1	Know about the concept of electricity generation through Solar PV system.	**3**	**2**	**2**	**1**	**1**	**3**	**3**	**1**				**3**
CO2	Identify and apply soft computing techniques in electricity generation through Solar PV system	**3**	**2**	**2**	**2**	**3**	**3**	**3**					**2**
CO3	Know about concept of electricity generation through Wind energy conversion system.	**3**	**2**	**2**	**1**	**1**	**3**	**3**	**1**				**3**
CO4	Identify and apply soft computing techniques in electricity generation through Wind energy.	**3**	**2**	**2**	**2**	**3**	**3**	**3**					**2**
CO5	Design hybrid power generation systems using soft computing.	**3**	**3**	**3**	**3**	**3**	**3**	**2**					**2**
3: Strong contribution, 2: average contribution, 1: Low contribution													