DEPARTMENT OF ELECTRICAL ENGINEERING

6TH SEMESTER

COURSE CURRICULUM
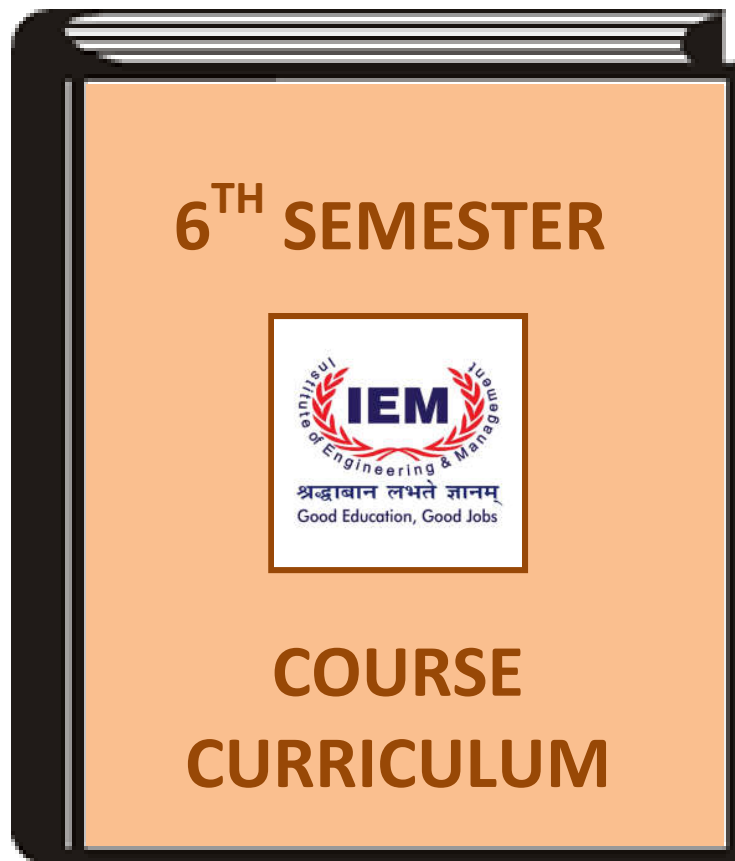
INSTITUTE OF ENGINEERING & MANAGEMENT

Course: EE601-Control System-II

PROGRAMME:**ELECTRICAL ENGINEERING**	DEGREE:**B. TECH**
COURSE:**Control system-II**	SEMESTER: **6** CREDITS: **4**
COURSECODE: **EE601**	COURSE TYPE: **Theory**
COURSE AREA/DOMAIN: I**dea about modern control system, System Dynamics, State-space analysis, Discrete system study, Non-linear dynamics**	CONTACTHOURS: 4 **(weekly)**
CORRESPONDINGLABCOURSE CODE (IFANY):**EE691**	LABCOURSE NAME: **Control system-II Laboratory**

Course pre-requisites

CODE	COURSE NAME	DESCRIPTION	SEM.
EE503	**Control System-I**	Transfer function model, analogous system analysis, time domain and frequency domain analysis	**5**

Course Objectives

1. Produce Electrical Engineering graduates who have strong foundation in mathematics,basic control engineering to enhance them withmodern processed based control engineering knowledge and technicalcompetence in engineering application. (PEO1)

Course Outcomes

1. Students would be able to apprehend dynamics of modern control system.
2. Students would be able to understand the application of processed based control technology.
3. Students would be able to realize system control analysis introducing differential equations.

ProgrammeOutcomes addressed in this course

1. An ability to apply knowledge of mathematics, science, and engineering. (PO. 1)
2. An ability to identify, formulate and solve engineering problem. (PO. 2)
3. An ability to design and conducts experiments as well as interpret data. (PO. 3)
4. An ability to design a system or process to meet the desired result within technical and socio-economic constraints. (PO. 4)

PO \ CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9
CO1	√	√						√	
CO2	√		√	√					
CO3		√	√						√
CO4		√	√	√					√

Syllabus

UNIT	DETAILS	HOURS
I	**State variable model of continuous dynamic systems:** Converting higher order linear differential equations into State Variable (SV) form. Obtaining SV model from Transfer Function. Obtaining characteristic equation and transfer functions from SV model. Obtaining SV equation directly for R-L-C and spring-massdashpot systems. Concept and properties associated with state equations. Linear transformations on state variables. Canonical forms of SV equations. Companion forms. Solutions of state equations. State transition matrix, properties of state transition matrix. Controllability and Observability. Linear state variable feedback controller, the pole allocation problems. Linear system design by state variable feedback.	10
II	**Analysis of discrete time (sampled data) systems using Z-transform**: Difference equation. Inverse Z transforms. Stability and damping in Z domain. Practical sampled data systems and computer control system. Practical and theoretical samplers. Sampling as Impulse modulation. Sampled spectra and aliasing. Anti-aliasing filters. Zero order hold. Approximation of discrete (Z-domain) controllers with ZOH by Tustin transform and other methods. State variable analysis of sampled data system. Digital compensator design using frequency response	10
III	**Introduction to nonlinear systems**: Block diagram and state variable representation of nonlinear systems. Characteristics of common nonlinearities. Phase plane analysis of linear and nonlinear second order systems. Methods of obtaining phase plane trajectories by graphical method, isoclines method. Qualitative analysis of simple control systems by phase plane methods. Describing function analysis. Limit cycles in nonlinear systems. Prediction of limit cycles using describing function technique. Stability concepts for nonlinear systems. BIBO Vs state stability. Definitions of Lyapunov functions. Lyapunov analysis of LTI systems, Asymptotic stability, Global asymptotic stability. The first and second methods of Lyapunov to analyze nonlinear systems	12

Gaps in the syllabus - to meet industry/profession requirements

S.NO.	DESCRIPTION	PROPOSED ACTIONS	PO MAPPING
1	Fractional Order control system analysis	Extra Class	9

Topics beyond syllabus/advanced topics

S.NO.	DESCRIPTION	HOURS
1	Fractional Order control system analysis and application	1

Web Source References

S.NO.	URL
1	http://http://fomcon.net/

Books References:

1. Digital Control & State Variable Methods, M. Gopal, 2nd Edition, TMH
2. Discrete Time control system, K. Ogata, Prentice Hall, 1995
3. Digital Control system, B.C. Kuo, Oxford University Press.

Delivery/Instructional Methodologies

S.NO.	DESCRIPTION
1	Chalk and Talk
2	Power Point Presentation, Tutorial Video

Assessment Methodologies

S.NO.	DESCRIPTION	TYPE
1	Student Assignment	Direct
2	Tests	Direct
3	University Examination	Direct
4	Student Feedback	Indirect

Course Plan

S. NO.	Day	Module	Topic
1	Day 1		Converting higher order linear differential equations into State Variable (SV) form.
2	Day 2		Obtaining SV model from Transfer Function.
3	Day 3		Obtaining characteristic equation and transfer functions from SV model
4	Day 4		Obtaining SV equation directly for R-L-C and spring-massdashpot systems.
5	Day 5	I	Concept and properties associated with state equations. Linear transformations on state variables
6	Day 6		Canonical forms of SV equations. Companion forms. Solutions of state equations.
7	Day 7		State transition matrix, properties of state transition matrix.
8	Day 8		Controllability and Observability
9	Day 9		Linear state variable feedback controller, the pole allocation problems
10	Day 10		Linear system design by state variable feedback.
11	Day 11	II	Difference equation. Inverse Z transforms.
12	Day 12		Stability and damping in Z domain

13	Day 13		Practical sampled data systems and computer control system.
14	Day 14		Practical and theoretical samplers. Sampling as Impulse modulation
15	Day 15		Sampled spectra and aliasing
16	Day 16		Anti-aliasing filters. Zero order hold
17	Day 17		Approximation of discrete (Z-domain) controllers with ZOH by Tustin transform and other methods
18	Day 18		Tustin transform and other methods
19	Day 19		State variable analysis of sampled data system.
20	Day 20		Digital compensator design using frequency response
21	Day 21		Block diagram and state variable representation of nonlinear systems.
22	Day 22		Characteristics of common nonlinearities. Phase plane analysis of linear and nonlinear second order systems
23	Day 23		Methods of obtaining phase plane trajectories by graphical method, isoclines method
24	Day 24		Qualitative analysis of simple control systems by phase plane methods
25	Day 25		Describing function analysis. Limit cycles in nonlinear systems
26	Day 26	III	Prediction of limit cycles using describing function technique
27	Day 27		Stability concepts for nonlinear systems. BIBO Vs state stability
28	Day 28		Definitions of Lyapunov functions. Lyapunov analysis of LTI systems
29	Day 29		Asymptotic stability
30	Day 30		Global asymptotic stability
31	Day 31		The first and second methods of Lyapunov to analyze nonlinear systems
32	Day 32		The first and second methods of Lyapunov to analyze nonlinear systems(cont.)

Course: EE602(EE)- POWER SYSTEM II

PROGRAMME:**ELECTRICAL ENGG.**	DEGREE:**B. TECH**
COURSE:**POWER SYSTEM- II**	SEMESTER: **VI** CREDITS: **4**
COURSE CODE: **EE602(EE)**	COURSE TYPE: **Theory**
COURSE AREA/DOMAIN: **Transmission, Distribution & Protection**	CONTACT HOURS: 1 **(weekly)**
CORRESPONDING LAB COURSE CODE (IFANY):**EE692**	LABCOURSE NAME: **POWER SYSTEM Lab-II**

Course pre-requisites

CODE	COURSE NAME	DESCRIPTION	SEM.
EE502	**POWER SYSTEM-I**	Machines & Power generation	**5**

Course Objectives

1. To study & analyse the stability of power line,faults arising in unstable system and its protection.
2. To study about load flow or power flow with the help different numerical tools.
3. To understand and gain knowledge about different components present in a distribution susbstation.
4. To understand and develop the single line diagram of all the above components required for analysis in a power system.

Course Outcomes

1. Analyse and compute the stability of a system.

2. Identify the faults, calculate their parameters and able to clear the fault.

3. To compute and simulate power flow through different interconnecting lines of a power system.

4. To model and analyse the distribution substation & to construct the single line diagram.

Programme Outcomes addressed in this course

PO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9
CO1	√	√						√	
CO2	√	√	√	√				√	√
CO3	√	√	√		√			√	√
CO4		√	√					√	√

Syllabus

UNIT	DETAILS	HOURS
I	**Representation of Power system components:** Single-phase representation of balanced three phase networks, the one-line diagram and the impedance or reactance diagram, per unit (PU) system.	2
II	**Distribution substation:** Types of substations, location of substations, substation equipments and accessories, earthling (system & equipment), feeder and distributors, radial and loop systems.	6
III	**Load flow studies:** Network model formulation, formation of Ybus , load flow problem, Gauss-Siedel method, Newton-Raphson method, Decoupled load flow studies, comparison of load flow methods.	8
IV	**Power system stability:** Steady state stability, transient stability, equal area criteria, swing equation, multi machine stability concept.	4
V	**Faults in Electrical systems:** Transient on a transmission line, short circuit of a synchronous machine under no load & loaded condition, Symmetrical component transformation, sequence impedance and sequence network of power system, synchronous machine, transmission lines and transformers, Symmetrical component analysis of Unsymmetrical faults, single line-to –ground fault, line to-line fault, double line-to- ground fault.	8
VI	**Power system protection:** Protective zones, Relaying elements and quantities. Protective relays, basic requirements and type of protection, phase and amplitude comparator, grading (time & current), Classification of Electromagnetic relays, Directional relay, Distant relay, Differential relay, basic aspects of static and digital relays, relay protection scheme for transformer, feeder, generators and motors., Circuit breakers, circuit breaking transients, transient recovery voltage, current chopping and resistance switching, circuit breaker rating, arc and arc extinction, Circuit breaker types, oil circuit breaker, vacuum circuit breaker, air blast circuit breaker, SF6 circuit breaker and operating mechanism, advantages and disadvantages of different types.	17

Gaps in the syllabus - to meet industry/profession requirements

S.NO.	DESCRIPTION	PROPOSED ACTIONS	PO MAPPING
1	Open circuit fault and its precautions, stability analysis of double circuit lines	Extra Class	a.

Topics beyond syllabus/advanced topics

S.NO.	DESCRIPTION	HOURS
1	Open circuit fault and its precautions.	2
2.	stability analysis of double circuit lines	1

Web Source References

S.NO.	URL
1	http://nptel.ac.in/courses/108102047/

Books References:

1. Modern Power System Analysis, D.P. Kothari & I.J. Nagrath, 4th Edition, Tata McGraw Hill.
2. Switchgear protection and power systems, Sunil S Rao, Khanna Publications.
3. A Course in Power System, J. B. Gupta, Katson Books.
4. Electrical Power Systems, C. L. Wadhwa, New Age International Publishers.
5. Electrical Power Systems, Ashfaq Husain, CBS Publishers & Distributers.
6. Principles of Power System, V. K. Mehta, Rohit Mehta, S. Chand & company Ltd.

Delivery/Instructional Methodologies

S.NO.	DESCRIPTION
1	Chalk and Talk
2	Power Point Presentation

Assessment Methodologies

S.NO.	DESCRIPTION	TYPE
1	Student Assignment	Direct
2	Tests	Direct
3	University Examination	Direct
4	Student Feedback	Indirect

Course Plan

S. NO.	Day	Module	Topic
1	1		**Introduction to the subject**
2	2	I	Single-phase representation of balanced three phase networks, the one-line diagram and the impedance or reactance diagram.
3	3		per unit (PU) system
4	4		Problems
5	5	II	Types of substations, location of substations
6	6		substation equipments and accessories
7	7		earthling (system & equipment)
8	8		feeder and distributors
9	9		radial and loop systems
10	10		Numericals and doubt clearing session
11	11	III	Network model formulation
12	12		formation of Ybus
13	13		load flow problem
14	14		Gauss-Siedel method
15	15		Newton-Raphson method
16	16		Decoupled load flow studies
17	17		comparison of load flow methods
18	18		Numericals and doubt clearing session
19	19	IV	Steady state stability, transient stability
20	20		equal area criteria

21	21	IV	swing equation, multi machine stability concept
22	22		Numericals and doubt clearing session
23	23	V	Transient on a transmission line
24	24		short circuit of a synchronous machine under no load & loaded condition
25	25		Symmetrical component transformation
26	26		sequence impedance and sequence network of power system, synchronous machine,transmission lines and transformers
27	27		Symmetrical component analysis of unsymmetrical faults
28	28		Three phase fault and single line-to –ground fault
29	29		line-to-line fault
30	30		double line-to- ground fault
31	31		Numericals and doubt clearing session
32	32	VI	Protective zones, Relaying elements and quantities
33	33		Protective relays, basic requirements and type of protection
34	34		Phase and amplitude comparator, grading (time & current)
35	35		Classification of Electromagnetic relays, Directional relay
36	36		Distant relay, Differential relay, basic aspects of static and digital relays
37	37		Relay protection scheme for transformer
38	38		Relay protection scheme for feeder
39	39		Relay protection scheme for generator
40	40		Relay protection scheme for motor
41	41		Circuit breakers, circuit breaking transients

42	42		transient recovery voltage, current chopping and resistance switching, circuit breaker rating, arc and arc extinction
43	43		circuit breaker types, oil circuit breaker
44	44		vacuum circuit breaker
45	45	VI	air blast circuit breaker
46	46		SF6 circuit breaker and operating mechanism
47	47		advantages and disadvantages of different types
48	48		Numericals and doubt clearing session

Course: EE603- Power Electronics

PROGRAMME:**ELECTRICAL ENGINEERING**	DEGREE:**B. TECH**
COURSE: **Power Electronics**	SEMESTER: **6** CREDITS: **4**
COURSE CODE: **EE603**	COURSE TYPE: **Theory**
COURSE AREA/DOMAIN: **Use of electronics devices in high power applications**	CONTACT HOURS: 4 **(weekly)**
CORRESPONDING LAB COURSE CODE (IFANY):**EE693**	LABCOURSE NAME: **Power Electronics Lab**

Course pre-requisites

CODE	COURSE NAME	DESCRIPTION	SEM.
ES101	**Basic Elect. & Electronics Engg.-I**	Basic Electronics	1
ES201	**Basic Elect. & Electronics Engg.-II**	Basic Electronics	2

Course Objectives

1. To describe the role of Power semiconductor devices in power electronics
2. To understand the operation o f thyristors and their characteristics with commutation techniques
3. To learn the basic concepts of operation of DC choppers
4. To analyze and synthesize pulse width modulated inverters, controlled rectifiers and AC voltage controllers
5. To Learn the role of Power Electronics in utility-related applications

Course Outcomes

On successful completion of this course students should be able to

1. Become adept at using various power electronic devices for different applications and Understand the different types of power electronic switching devices with their switching speed
2. Develop the capability to analyze the concepts and protection circuits for different types power electronic devices
3. Learn the primitive concepts of SCRs, its characteristics and gate triggering circuits
4. Possess an ability to understand the differences between different types commutation circuits for SCR
5. Control different rectifier circuits using SCRs
6. Know the fundamental concepts of DC-DC converter (chopper)
7. Learn about importance of inverter, its principle of operation & control technique
8. Learn the basic principle & control techniques of various types of AC controllers
9. Apply the knowledge in real life applications

Programme Outcomes addressed in this course

PO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9
CO1	√							√	
CO2	√	√	√						
CO3			√						
CO4		√	√						
CO5		√	√	√					
CO6		√	√	√					√
CO7		√	√	√					√
CO8		√	√	√					√
CO9	√			√	√			√	√

Syllabus

Chapter 1 : Introduction	4L
Concept of power electronics, application of power electronics uncontrolled converters, advantages and disadvantages of power electronics converters, power electronics systems; power diodes, power transistors, power MOSFETS, IGBT and GTO	
Chapter 2 : PNPN devices	5L
Thyristors, brief description of members of Thyristor family with symbol, V-I characteristics and applications; Two transistor model of SCR, SCR turn on methods, switching characteristics gate characteristics, ratings, SCR protection, series and parallel operation; gate triggering circuits; different commutation techniques of SCR	
Chapter 3 : Phase controlled converters	6L
Principle of operation of single phase and three phase half wave, half controlled converters with R, R-L and RLE loads; Principle of operation of single phase and three phase full controlled converters with R, R-L and RLE loads; effects of free wheeling diodes on the performance of converters Effects of source inductance on the performance of converters; External performance parameters of converters, techniques of power factor improvement; single phase and three phase dual converters	
Chapter 4 : DC-DC converters	5L
Principle of operation, control strategies; step up and step down choppers; types of choppers circuits based on quadrant of operation; performance parameters, multiphase choppers switching mode regulators	
Chapter 5 : Inverters	10L
Definition, classification of inverters based on nature of input source, wave shape of output voltage; method of commutation & connections; Principle of operation of single phase bridge inverter with R and R-L loads; Principle of operation of three phase bridge inverter with R and R-L loads; performance parameters of inverters; methods of voltage control and harmonic reduction of inverters; Brief idea of Resonant pulse inverters	
Chapter 6 : AC controllers	6L
Principle of on-off and phase control, Single phase and three phase controllers with R and R-L loads. Principle of operation of cycloconverters, circulating and non circulating mode of operation single phase to single phase step up and step down cycloconverters Three phase to single phase Cycloconverters, three phase to three phase Cycloconveter	
Chapter 7 : Applications	4L
Speed control of AC and DC motors; High voltage DC transmission. Static circuit breaker Static VAR controller. Uninterrupted power supply (UPS)	

Gaps in the syllabus - to meet industry/profession requirements

S.NO.	DESCRIPTION	PROPOSED ACTIONS	PO MAPPING
1	Importance of heat sink and its design procedure and layout	Extra Class	PO3
2	Design of Filter components to reduce the harmonics	Extra Class	PO4
3	Buck-Boost chopper	Extra Class	PO9
4	Concept of Space Vector Pulse Width Modulation and comparison with other control techniques	Extra Class	PO9

Topics beyond syllabus/advanced topics

S.NO.	DESCRIPTION	HOURS
1	Applications in Renewable Energy sector and interconnected grid system	1

Web Source References

S.NO.	URL
1	http://nptel.ac.in/courses/108101038/

Books References:

4. Power Electronics, P.S. Bhimra, Khanna Publishers.
5. Power Electronics, M.H. Rashid, PHI.
6. Power Electronics, Mohan,Undeland & Riobbins, Wiley India
7. Element of power Electronics, Phillip T Krein, Oxford

Delivery/Instructional Methodologies

S.NO.	DESCRIPTION
1	Chalk and Talk
2	Power Point Presentation

Assessment Methodologies

S.NO.	DESCRIPTION	TYPE
1	Student Assignment	Direct
2	Tests	Direct
3	University Examination	Direct
4	Student Feedback	Indirect

Course Plan

S. NO.	Day	Module	Topic
1	Day 1	I	Concept of power electronics, application of power electronics
2	Day 2		Uncontrolled converters, advantages and disadvantages of power electronics converters, power electronics systems
3	Day 3		Power diodes, power transistors
4	Day 4		Power MOSFETS and IGBT
5	Day 5	II	Thyristors, brief description of members of Thyristor family with symbol, V-I characteristics and applications
6	Day 6		Two transistor model of SCR, SCR turn on methods,switching characteristics
7	Day 7		gate characteristics, ratings, SCR protection, series and parallel operation
8	Day 8		gate triggering circuits
9	Day 9		different commutation techniques of SCR
10	Day 10	III	Principle of operation of single phase and three phase half wave, half controlled converters with R, R-L and RLE loads
11	Day 11		Principle of operation of single phase and three phase full controlled converters with R, R-L and RLE loads
12	Day 12		Effects of free wheeling diodes on the performance of converters
13	Day 13		Effects of source inductance on the performance of converters
14	Day 14		External performance parameters of converters, techniques of power factor improvement
15	Day 15		Single phase and three phase dual converters
16	Day 16	IV	Principle of operation, control strategies
17	Day 17		Step up and step down choppers
18	Day 18		Types of choppers circuits based on quadrant of operation
19	Day 19		Performance parameters, multiphase choppers
20	Day 20		Switching mode regulators
21	Day 21	V	Definition, classification of inverters based on nature of input source, wave

			shape of output voltage
22	Day 22		Method of commutation & connections
23	Day 23		Principle of operation of single phase bridge inverter with R and R-L loads
24	Day 24		Principle of operation of single phase bridge inverter with R and R-L loads
25	Day 25		Principle of operation of three phase bridge inverter with R and R-L loads
26	Day 26		Principle of operation of three phase bridge inverter with R and R-L loads
27	Day 27		Performance parameters of inverters
28	Day 28		Methods of voltage control and harmonic reduction of inverters
29	Day 29		Methods of voltage control and harmonic reduction of inverters
30	Day 30		Brief idea of Resonant pulse inverters
31	Day 31	VI	Principle of on-off and phase control,
32	Day 32		single phase and three phase controllers with R and R-L loads.
33	Day 33		Principle of operation of cycloconverters, circulating and non circulating mode of operation
34	Day 34		Single phase to single phase step up and step down cycloconverters
35	Day 35		Three phase to single phase Cycloconverters,
36	Day 36		Three phase to three phase Cycloconvetter
37	Day 37	VII	Speed control of AC and DC motors
38	Day 38		High voltage DC transmission. Static circuit breaker
39	Day 39		Static VAR controller.
40	Day 40		Uninterrupted power supply (UPS)

Course: EE 604C- OBJECT ORIENTED PROGRAMMING

PROGRAMME: ELECTRICAL ENGINEERING	DEGREE:**B. TECH**
COURSE: **OBJECT ORIENTED PROGRAMMING**	SEMESTER: **6** CREDITS: **3**
COURSECODE: **EE 604C**	COURSE TYPE: **Theory**
COURSE AREA/DOMAIN: OBJECT ORIENTED DESIGN, Java class structure, Properties of Object Oriented Language. Java Application Design	CONTACT HOURS: **3(weekly)**
CORRESPONDING LAB COURSE CODE (IF ANY): EE694C	LABCOURSE NAME: **Object Oriented Programming Lab**

Course pre-requisites

Basic knowledge about c programming language, basic software application development etc

Course Objectives

1. To understand the fundamentals of Object Oriented Systems
2. To develop the understanding regarding the applications of fundamental ideas of Object Oriented systems in modern software engineering aspect.

Course Outcomes

4. Students would understand the basic principles of Object Oriented modeling and programming.
5. Students would have a clear knowledge Object Oriented Code structure and the interrelation amongst various classes and packages.
6. Students would understand the basic concept of JAVA programming language via classes, objects, polymorphism, and inheritance property.
7. Students would be able to design the real life applications and projects through the concept of Object Oriented Language.

Programme Outcomes addressed in this course

PO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	This correlate highly with PEO3 and PEO5
CO1		√	√	√					√	
CO2		√	√	√						
CO3		√	√	√				√		
CO4		√	√	√	√			√	√	

Syllabus

UNIT	DETAILS	HOURS
I	**Object oriented Design** Concept of Object oriented programming language, Major and minor elements, Object, Class, relationship among objects, aggregation, links, relationship among classes ,association, aggregation using instantiation, meta-class, grouping constructs	10
II	**Object oriented concept:** Difference between OOP and other conventional programming, advantages and disadvantages. Class, object, message passing, inheritance, encapsulation, polymorphism	4
III	**Basic concepts of Object oriented programming using Java:** **Class & Object properties:** Basic concepts of Java programming-advantages of Java, bytecode & JVM, data types, access specifiers, operators, control statements & array. **Objects & Classes:** creation of class, object, constructor, finalize and garbage collection, use of method overloading, this keyword, use of objects as parameter & methods returning objects, call by value & call by reference, static variables & methods, garbage collection, nested and inner classes, basic string handling concepts. **Strings:** (discuss char(), compare(), equals(), equalsIgnorecase(), indexOf(), length(), substring(), toCharArray(),toLowercCase(), tostring(), methods), concept of mutable and immutable string. **Command Line Argument**: command line arguments, basics of I/O operations-keyboard input using BufferedReader & Scanner classes. **Reusability properties**: Super class & subclasses including multilevel hierarchy, process of constructor calling in inheritance, use of super and final keywords with super() method, dynamic method dispatch, use of abstract classes, & methods, interfaces. **Package:** Creation of packages, importing packages, member access for packages. **Exception handling**: Exception handling basics, different types of exception classes, use of try & catch with throw, throws & finally, creation of user defined exception classes. **Multi threading**: Basics of multithreading, main thread, thread life cycle, creation of multiple threads, thread synchronization, inter thread communication, deadlocks for threads, suspending & resuming threads. **Applet Programming (using swing**): Basics of applet programming, applet life cycle, difference between application & applet programming, parameter passing in applet in applets, concept of delegation event model and listener, I/O in applets, use of repaint(), getDocumentBase(), getCodeBase() methods, layout manager (basic concept), creation of buttons (JButton class only) & text fields**.**	22

Gap Analysis in Syllabus- To meet Industry/Professional Requirements:-

Sl. No.	Topic(s) to be included	PROPOSED ACTIONS	PO MAPPING
1	loops and enhanced loops **Advanced Features**: Introduction to Generics , Autoboxing and Auto Unboxing feature. **JAVA Utility Classes** : Implementation of different kind of lists, hash table, hash map, iterators.	Extra Class	PO1,PO2

Topics beyond syllabus/advanced topics

S.NO.	DESCRIPTION	HOURS
1	Java Swing and Its applications in Industry	2

Web Source References

S.NO.	URL
1	http://www.**java**tpoint.com/**java-tutorial**

Text Books:
1. Complete reference JAVA- Herbert Schildt, MacGrawHill.
2. JAVA How to Program – Dietel and Dietel , Pearson Education
3. Object Oriented Programming with C++ and Java, D. Samanta, PHI
4. Programming with JAVA – E Balaguruswami

Reference Books:
1. Object Oriented Modeling and design, James Rambaugh & Michael Blaha, PHI
2. Object oriented system Development, Ali Bahrami, Mc Graw Hill.
3. Object Oriented Modeling and design, James Rambaugh & Michael Blaha, PHI.

Delivery/Instructional Methodologies

S.NO.	DESCRIPTION
1	Chalk and Talk
2	Power Point Presentation

Assessment Methodologies

S.NO.	DESCRIPTION	TYPE
1	Student Assignment	Direct
2	Tests	Direct
3	University Examination	Direct
4	Student Feedback	Indirect

Course Plan

S. NO.	Day	Module	Topic
1	Day 1	I	Concept of Object oriented programming language, Major and minor elements
2	Day 2		Object, Class, relationship among objects
3	Day 3		Aggregation, links, relationship among classes
4	Day 4		meta-class, grouping constructs
5	Day 5		aggregation using instantiation using examples
6	Day 6	II	Difference between OOP and other conventional programming
7	Day 7		advantages and disadvantages
8	Day 8		Class, object, message passing with details & examples
9	Day 9		Overview of Inheritance
10	Day 10		Overview of Encapsulation
11	Day 11		Overview of Polymorphism
12	Day 12	III	Basic concepts of Java programming-advantages of Java
13	Day 13		Bytecode & JVM, data types, access specifiers, operators
14	Day 14		Control statements & array.
15	Day 15		Creation of class, object, constructor
16	Day 16		finalize and garbage collection, use of method overloading
17	Day 17		this keyword, use of objects as parameter & methods returning objects, call

			by value & call by reference
18	Day 18		static variables & methods, garbage collection, nested and inner classes, basic string handling concepts
19	Day 19		char(), compare(), equals(), equalsIgnorecase(), indexOf(), length(), substring(), toCharArray(),toLowercCase(), tostring(), methods of String Class
20	Day 20		Concept of mutable and immutable string.
21	Day 21		Detail description of command line arguments, basics of I/O operations
22	Day 22	III	Keyboard input using BufferedReader & Scanner classes.
23	Day 23		Reusability properties: Super class & subclasses including multilevel hierarchy
24	Day 24		process of constructor calling in inheritance, use of super and final keywords with super() method
25	Day 25		Dynamic Method Dispatch, use of abstract classes, & methods, interfaces
26	Day 26		Creation of packages, importing packages
27	Day 27		member access for packages
28	Day 28		Exception handling basics, different types of exception classes
29	Day 29		Use of try & catch with throw, throws & finally
30	Day 30		Creation of user defined exception classes.
31	Day 31		Basics of multithreading, main thread, thread life cycle, creation of multiple threads
32	Day 32		thread synchronization, inter thread communication, deadlocks for threads
33	Day 33		Suspending & Resuming threads
34	Day 34		Basics of applet programming, applet life cycle, difference between application & applet programming
35	Day 35		Parameter passing in applet in applets, concept of delegation event model and listener
36	Day 36		I/O in applets, use of repaint(), getDocumentBase(), getCodeBase() methods, layout manager (basic concept), creation of buttons (JButton class only) & text fields

Course: EE 605A: Digital Signal Processing

PROGRAMME: ELECTRICAL ENGINEERING	DEGREE:**B. TECH**
COURSE:**DIGITAL SIGNAL PROCESSING**	SEMESTER: **6** CREDITS: **3**
COURSE CODE: **EE 605A**	COURSE TYPE: **Theory**
COURSE AREA/DOMAIN: **Basic idea about Signal and system**	CONTACT HOURS: 3 **(weekly)**
CORRESPONDING LAB COURSE CODE (IFANY):NA	LABCOURSE NAME: **NA**

Course pre-requisites

CODE	COURSE NAME	DESCRIPTION	SEM.
EE 605A	**Digital Signal Processing**	Signal Processing & study of systems	**6**

Course Objectives

1. To produce Computer Science & Engineering graduates who have strong foundation in mathematics, Basic science subjects & basic engineering to prepare the students with strong engineering knowledge and technical competence. (PEO1)

Course Outcomes

1. Students would be able to understand characteristics of different electrical and electronics elements.
2. Students would be able to understand the application of electrical and electronics fundamentals to modern technology.
3. Students would be able appreciate working various electrical and electronics equipments

Programme Outcomes addressed in this course

1. An ability to apply knowledge of mathematics, science, and engineering. (PO 1.)
2. An ability to function on multidisciplinary teams (PO 4.)
3. The broad education necessary to understand the impact of engineering solutions in a global, Economic, environmental, and context (PO 8.)

PO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9
CO1	√			√				√	
CO2	√	√			√				
CO3		√			√				

Syllabus

UNIT	DETAILS	HOURS
I	Discrete-time signals: Concept of discrete-time signal, basic idea of sampling and reconstruction of signal, sampling theorem, sequences,-periodic, energy, power, unit-sample, unit step, unit ramp & complex exponentials, arithmetic operations on sequences. LTI systems: Definition, representation, impulse response, derivation for the output sequence, concept of convolution, graphical, analytical and overlap-add methods to compute convolution supported with examples and exercise, properties of convolution, interconnection of LTI systems with physical interpretations, stability and causality conditions, recursive and non recursive systems.	10
II	Discrete Time Fourier Transform(DTFT): Concept of frequency in discrete and continuous domain and their relationship (radian and radian/sec), freq. response in the discrete domain. Discrete system's response to sinusoidal/complex inputs (DTFT), Representation of LTI systems in complex frequency domain. Z- Transforms: Definition, mapping between s-plane & z-plane, unit circle, convergence and ROC, properties of Z-transform, Z-transform on sequences with examples & exercises, characteristic families of signals along with ROC, convolution, correlation and multiplication using Z- transform, initial value theorem, Perseval's relation, inverse Ztransform by contour integration, power series & partial-fraction expansions with examples and exercises. Discrete Fourier Transform: Concept and relations for DFT/IDFT, Relation between DTFT & DFT. Twiddle factors and their properties, computational burden on direct DFT, DFT/DFT as linear transformation, DFT/IDFT matrices, computation of DFT/IDFT by matrix method, multiplication of DFTs, circulation convolution, computation of circular convolution by graphical, DFT/IDFT and matrix methods, linear filtering using DFT, aliasing error, filtering of long data sequencesOverlap-Save and Overlap-Add methods with examples and exercises. Fast Fourier Transforms: Radix-2 algorithm, decimation-in-time, decimation-in-frequency algorithm, signal flow graph, Butterflies, computations in one place, bit reversal, examples for DIT & DIF FFT Butterfly computations and exercises.	15

III	Filter design: Basic concepts of IIR and FIR filters, difference equations, design of Butterworth IIR analog filter using impulse invariant and bilinear transform, design of linear phase FIR filters no. of taps, rectangular, Hamming and Blackman windows. Effect of quantization.	7
IV	Digital Signal Processor: Elementary idea about the architecture and important instruction sets of TMS320C 5416/6713 processor, writing of small programs in assembly Language. FPGA: Architecture, different sub-systems, design flow for DSP system design, mapping of DSP alrorithms onto FPGA.	8

Gaps in the syllabus - to meet industry/profession requirements

S.NO.	DESCRIPTION	PROPOSED ACTIONS	PO MAPPING
1	Design of Chebyshev Filter	Tutorial Class	1

Topics beyond syllabus/advanced topics

S.NO.	DESCRIPTION	HOURS
1	Optical Signal Processing	1

Web Source References

S.NO.	URL
1	http://dspguru.com/dsp/books/favorites

Books References:

1. Digital Signal Processing: Principles, Algorithms & Application, J.C. Proakis & M.G. Manslakis, PHI
2. Digital Signal Processing-A computer based approach, S. Mitra, TMH

Delivery/Instructional Methodologies

S.NO.	DESCRIPTION
1	Chalk and Talk
2	Power Point Presentation

Assessment Methodologies

S.NO.	DESCRIPTION	TYPE
1	Student Assignment	Direct
2	Tests	Direct
3	University Examination	Direct
4	Student Feedback	Indirect

Course Plan

S. NO.	DAY	MODULE	TOPIC
1	DAY 1	MODULE – I : Discrete-time signals	Concept of discrete-time signal, basic idea of sampling and reconstruction of signal, sampling theorem
2	DAY 2	MODULE – I : Discrete-time signals	sequences,-periodic, energy, power,
3	DAY 3	MODULE – I : Discrete-time signals	unit-sample, unit step, unit ramp & complex exponentials, arithmetic operations on sequences.
4	DAY 4	MODULE – I : LTI systems:	Definition, representation, impulse response, derivation for the output sequence,
5	DAY 5	MODULE – I : LTI systems:	concept of convolution, graphical,
6	DAY 6	MODULE – I : LTI systems:	analytical and overlap-add methods to compute convolution supported with examples and exercise,
7	DAY 7	MODULE – I : LTI systems:	NUMERICAL PROBLEMS
8	DAY 8	MODULE – I : LTI systems:	properties of convolution
9	DAY 9	MODULE – I : LTI systems:	interconnection of LTI systems with physical interpretations, stability and causality conditions

10	DAY 10	MODULE – I : LTI systems:	recursive and non recursive systems
11	DAY 11	MODULE – I : LTI systems:	NUMERICAL PROBLEMS
12	DAY 12	MODULE – II : Discrete Time Fourier Transform(DTFT):	Concept of frequency in discrete and continuous domain and their relationship (radian and radian/sec),
13	DAY 13	MODULE – II : Discrete Time Fourier Transform(DTFT):	freq. response in the discrete domain. Discrete system's response to sinusoidal/complex inputs (DTFT),
14	DAY 14	MODULE – II : Discrete Time Fourier Transform(DTFT):	Representation of LTI systems in complex frequency domain.
15	DAY 15	MODULE – II : Z-Transforms:	Definition, mapping between s-plane & z-plane, unit circle, convergence and ROC,
16	DAY 16	MODULE – II : Z-Transforms:	properties of Z-transform, Z-transform on sequences with examples & exercises,
17	DAY 17	MODULE – II : Z-Transforms:	characteristic families of signals along with ROC, convolution, correlation and multiplication using Z- transform,
18	DAY 18	MODULE – II : Z-Transforms:	initial value theorem, Perseval's relation, inverse Ztransform by contour integration,
19	DAY 19	MODULE – II : Z-Transforms:	power series & partial-fraction expansions with examples and exercises.
20	DAY 20	MODULE – II : Z-Transforms:	NUMERICAL PROBLEMS
21	DAY 21	MODULE – II : Discrete Fourier Transform:	Concept and relations for DFT/IDFT, Relation between DTFT & DFT.
22	DAY 22	MODULE – II : Discrete Fourier Transform:	Twiddle factors and their properties, computational burden on direct DFT, DFT/DFT as linear transformation,
23	DAY 23	MODULE – II : Discrete Fourier Transform:	DFT/IDFT matrices, computation of DFT/IDFT by matrix method,
24	DAY 24	MODULE – II : Discrete Fourier Transform:	multiplication of DFTs, circulation convolution, computation of circular convolution by graphical, DFT/IDFT and matrix methods
25	DAY 25	MODULE – II : Discrete Fourier Transform:	linear filtering using DFT, aliasing error, filtering of long data sequencesOverlap-Save and Overlap-Add methods with examples and exercises.
26	DAY 26	MODULE – II : Fast Fourier Transforms:	Radix-2 algorithm, decimation-in-time, decimation-in-frequency algorithm,
27	DAY 27	MODULE – II : Fast	signal flow graph, Butterflies, computations in

		Fourier Transforms:	one place, bit reversal, examples for DIT & DIF FFT Butterfly computations and exercises.
28	DAY 28	MODULE – III : Filter design:	Basic concepts of IIR and FIR filters, difference equations,
29	DAY 29	MODULE – III : Filter design:	design of Butterworth IIR analog filter using impulse invariant and bilinear transform
30	DAY 30	MODULE – III : Filter design:	design of linear phase FIR filters no. of taps, rectangular, Hamming and Blackman windows. Effect of quantization.
31	DAY 31	MODULE – IV : Digital Signal Processor:	Elementary idea about the architecture and important instruction sets of TMS320C 5416/6713 processor,
32	DAY 32	MODULE – IV : Digital Signal Processor:	writing of small programs in assembly Language.
33	DAY 33	MODULE – IV : FPGA:	Architecture, different sub-systems,
34	DAY 34	MODULE – IV : FPGA:	design flow for DSP system design, mapping of DSP alrorithms onto FPGA.

Course: EE691 Control System - II LABORATORY

PROGRAMME:**ELECTRICAL ENGG.**	DEGREE:**B. TECH.**
COURSE: **Control System – II**	SEMESTER: 6 CREDITS: **2**
COURSECODE: **EE 691**	COURSE TYPE: **Practical**
COURSE AREA/DOMAIN:	CONTACTHOURS: **3 (weekly)**
CORRESPONDINGTHEORYCOURSE CODE (IFANY):**EE601**	THEORYCOURSE NAME:**Control System -II**

Course pre-requisites

CODE	COURSE NAME	DESCRIPTION
EE593	Control System-I	Matrices handling in Matlab, Matlabploting and basic programming
EE593	Control System-I	Simulink, Stability analysis, concept controller design

Laboratory Educational Objectives (LEOs) :

1. **Conceptual Understanding:** Develop students' understanding through laboratory activities to solve technical problems related to key concepts taught in the classroom. **(L-I)**

2. **Debugging Skills:**Cultivate debugging competence in order to propose and apply effectivecontrol engineering solutions. **(L-III)**

Laboratory Outcomes (Los) :

1. **Instrumentation:** Apply appropriate instruments and handle them carefully and safely to make measurements of physical quantities or perform data analysis.**(LO – 1)**
2. **Models:** Identify the forte and limitations of theoretical modelsand establish a relationship between measured data andunderlying physical principles. **(LO – 2)**
3. **Design:**Presenting Controllers design and MatLabsimulation ,Design and build a hardware part to meet desired specifications and tests it using appropriate testingstrategy and/or equipments. **(LO – 3)**

After completing this course, students will be able:
- ❖ To identify the different controllers in control engineering arena.
- ❖ The students will understand the basic operation of modern control system design.
- ❖ To realize MatLab computation by simulink.

Programme Outcomes addressed in this course:

1. An ability to apply the knowledge of mathematics, science and engineering. **(PO-1)**
2. An ability to identify, formulate and solve engineering problems. **(PO-2)**
3. An ability to design and conduct experiments as well as to interpret data. **(PO-3)**

PO LO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9
LO1	√	√		√					
LO2	√		√	√					
LO3		√	√						√

LIST OF EXPERIMENTS:

1. Study of a practical position control system obtaining closed step responses for gain setting corresponding to over-damped and under-damped responses. Determination of rise time and peak time using individualized components by simulation.
2. Tuning of P, PI and PID controller for first order plant with dead time using Z-N method.
3. Design of Lead, Lag and Lead-Lag compensation circuit for the given plant transfer function. Analyze step response of the system by simulation.
4. Obtain Transfer Function of a given system from State Variable model and vice versa. State variable analysis of a physical system - obtain step response for the system by simulation.
5. State variable analysis using simulation tools. To obtain step response and initial condition response for a single input, two-output system in SV form by simulation.
6. Performance analysis of a discrete time system using simulation tools. Study of closed response of a continuous system with a digital controller and sample and hold circuit by simulation.
7. Study of the effects of nonlinearity in a feedback controlled system using time response.
8. Study of effect of nonlinearity in a feedback controlled system using phase plane plots.

Delivery/Instructional Methodologies

S.NO.	DESCRIPTION
1	Chalk and Talk
2	Study Material

Assessment Methodologies

S.NO.	DESCRIPTION	TYPE
1	Student Assignment	Direct
2	Tests	Direct
3	University Examination	Direct
4	Student Feedback	Indirect

Course Plan: EE 691

Days	Experiment Performed
1	Study of a practical position control system obtaining closed step responses for gain setting corresponding to over-damped and under-damped responses.
2	Tuning of P, PI and PID controller for first order plant with dead time using Z-N method.
3	Design of Lead, Lag and Lead-Lag compensation circuit for the given plant transfer function.
4	Obtain Transfer Function of a given system from State Variable model and vice versa.
5	Performance analysis of a discrete time system using simulation tools.
6	Study of the effects of nonlinearity in a feedback controlled system using time response.
7	Study of effect of nonlinearity in a feedback controlled system using phase plane plots.
8	VIVA VOCE and Pending experiment clearing.

Course: EE 692 Power System-II LABORATORY

PROGRAMME: **ELECTRICAL ENGG.**	DEGREE:**B. TECH.**
COURSE: **POWER SYSTEM -II Laboratory**	SEMESTER: 6 CREDITS: **2**
COURSECODE: **EE 692**	COURSE TYPE: **Practical**
COURSE AREA/DOMAIN:**RELAY,CT,PT,FAULT ANALYSIS and LOAD FLOW**	CONTACT HOURS: **3 (weekly)**
CORRESPONDING THEORY COURSE CODE (IFANY): **EE602**	THEORY COURSE NAME: **POWER SYSTEM– II**

Course pre-requisites

CODE	COURSE NAME	DESCRIPTION
EE402	ELECTRIC & ELECTRONIC MEASUREMENT	Knowledge of different types of measuring instrument and basic idea of CT,PT
EE 501	ELECTRICAL MACHINE-II	Knowledge of different types of AC machines.
EE 502	POWER SYSTEM-I	Knowledge of power generation and transmission and distribution.

Laboratory Educational Objectives (LEOs) :

1. **Conceptual Understanding:** Develop students' understanding through laboratory activities to solve problems related to fault detection and analysis.
2. **Debugging Skills:** Develop debugging capability in order to propose and apply effective engineering solutions like economic load dispatch.

Laboratory Outcomes (LOs) :

1. Explicate the function of various types of static relays.
2. Express the concept of static distance protection and pilot relaying schemes.
3. Apply various protective devices and its coordination techniques to distribution system.
4. Identify and analyze the real time power system problems.
5. Elucidate the concepts used for the measurement of high voltages and currents and design corresponding circuits.
6. Analyze and distinguish load forecasting and price forecasting methods.

After completing this course, students will be able:

- ❖ To carry out a short circuit analysis study for symmetrical and unsymmetrical faults and are able to interpret the results of the analysis.
- ❖ To understand the procedure and steps needed to implement a load flow system study and interpret the results provided by the software.
- ❖ To know how to carry out a transient analysis study for faults of various durations on the system.

Programme Outcomes addressed in this course

1. An ability to design and conduct experiments, as well as to analyze and interpret data. (PO – 2)
2. An ability to identify, formulate and solve engineering problems. (PO – 5)
3. An ability to apply the knowledge of mathematics,science and engineering.(PO-1)
4. A recognition of the need for engaging in lifelong learning.(PO-8)
5. An ability to design a system or process to meet the desired result within technical and socio-economic constraints.(PO-4)
6. A knowledge of contempory issues.(PO-9)
7. An understanding of professional and ethical responsibility.(PO-7)

PO \ LO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9
LO1		√			√			√	
LO2				√			√	√	
LO3				√	√		√	√	
LO4	√	√					√	√	√
LO5					√	√		√	√
LO6	√	√						√	√

LIST OF EXPERIMENTS:

Power System Laboratory-II
1. Study of the characteristics of on delay relay and off delay relay.
2. Test to find out polarity, ratio and magnetization characteristics of CT and PT.
3. Test to find out characteristics of (a) under voltage relay (b) earth fault relay.
4. Study on DC load flow.
5. Study on AC load flow using Gauss-seidel method.
6. Study on AC load flow using Newton Raphson method.
7. Study on Economic load dispatch. 8. Study of different transformer protection schemes by simulation.
8. Study of different transformer protection schemes by simulation.
9. Study of different generator protection schemes by simulation.
10. Study of different motor protection schemes by simulation.
11. Study of different characteristics of over current relay.
12. Study of different protection scheme for feeder.

Delivery/Instructional Methodologies

Sl.NO.	DESCRIPTION
1	Chalk and Talk
2	Study Material

Course Plan: EE692

Days	Experiment Performed
1	Introduction and brief description of different types of experimental set-up.
2	Test to find out characteristics of under voltage relay.
3	Test to find out characteristics of earth fault relay.
4	Study of different characteristics of over current relay.
5	1st VIVA VOCE and Pending experiment clearing.
6	Study of the characteristics of on delay relay and off delay relay.
7	Test to find out polarity, ratio and magnetization characteristics of PT
8	Study on Economic load dispatch.
9	2nd VIVA VOCE and Pending experiment clearing.

Assessment Methodologies

S.NO.	DESCRIPTION	TYPE
1	Student Assignment	Direct
2	Tests	Direct
3	University Examination	Direct
4	Student Feedback	Indirect

Course: EE 693 Power Electronics Laboratory

PROGRAMME: **ELECTRICAL ENGINEERING**	DEGREE:**B. TECH.**
COURSE: **Power Electronics Lab**	SEMESTER: 6 CREDITS: **2**
COURSECODE: **EE 693**	COURSE TYPE: **Practical**
COURSE AREA/DOMAIN: **Use of electronics devices in high power applications**	CONTACT HOURS: **3 (weekly)**
CORRESPONDING THEORY COURSE CODE (IFANY): **EE 603**	THEORY COURSE NAME: **Power Electronics**

Course pre-requisites

CODE	COURSE NAME	DESCRIPTION
ES101	**Basic Elect. & Electronics Engg.-I**	Basic Electronics
ES201	**Basic Elect. & Electronics Engg.-II**	Basic Electronics

Laboratory Educational Objectives (LEOs) :

1. **Conceptual Understanding:** Develop students' understanding through laboratory activities to solve problems related to key concepts taught in the classroom.
2. **Design:** Design and build hardware part to meet desired specifications and tests it using appropriate testing strategy and/or equipments.
3. **Debugging Skills:** Develop debugging capability in order to propose and apply effective engineering solutions.
4. **Models:** Identify the strength and limitations of theoretical models and establish a relationship between measured data and underlying physical principles.

Laboratory Outcomes (LOs):

After completing this course, students will be able:
1. To identify the basic elements of the power electronic engineering.
2. To understand the basic operation of SCR and Triac.
3. To understand the basic operation of various power converter.

Programme Outcomes addressed in this course

PO / LO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9
LO1	√		√					√	
LO2	√	√	√		√				
LO3		√	√		√				√

LIST OF EXPERIMENTS:

1. Study of the characteristics of an SCR
2. Study of the characteristics of a Triac
3. Study of different triggering circuits of an SCR
4. Study of firing circuits suitable for triggering SCR in a single phase full controlled bridge
5. Study of the operation of a single phase full controlled bridge converter with R and R-L load
6. Study of performance of single phase half controlled symmetrical and asymmetrical bridge converters
7. Study of performance of step down chopper with R and R-L load
8. Study of performance of PWM bridge inverter using MOSFET as switch with R and R-L load
9. Study of performance of single phase controlled converter with and without source inductance
10. Study of performance of step up and step down chopper with MOSFET, IGBT and GTO as switch
11. Study of performance of single phase half controlled symmetrical and asymmetrical bridge
12. Study of performance of three phase controlled converter with R & R-L load
13. Study of performance of three phase AC controller with R and R-L load
14. Study of performance of a Cycloconverter
15. Study of performance of a Dual converter

Delivery/Instructional Methodologies

S.NO.	DESCRIPTION
1	Chalk and Talk
2	Study Material

Assessment Methodologies

S.NO.	DESCRIPTION	TYPE
1	Student Assignment	Direct
2	Tests	Direct
3	University Examination	Direct
4	Student Feedback	Indirect

Course Plan: EE 693

Days	Experiment Performed
1	Introduction and Familiarisation with simulating software
2	Study of the characteristics of an SCR
3	Study of the characteristics of a Triac
4	Study of different triggering circuits of an SCR
5	Study of firing circuits suitable for triggering SCR in a single phase full controlled bridge
6	Study of the operation of a single phase full controlled bridge converter with R and R-L load
7	Study of performance of single phase half controlled symmetrical and asymmetrical bridge converters
8	Study of performance of step down chopper with R and R-L load
9	Study of performance of PWM bridge inverter using MOSFET as switch with R and R-L load
10	Study of performance of single phase controlled converter with and without source inductance
11	Study of performance of step up and step down chopper with MOSFET, IGBT and GTO as switch
12	Study of performance of single phase half controlled symmetrical and asymmetrical bridge
13	Study of performance of three phase controlled converter with R & R-L load
14	Study of performance of three phase AC controller with R and R-L load
15	Study of performance of a Cycloconverter
16	Study of performance of a Dual converter

Course: EE-694C **OBJECT ORIENTED PROGRAMMING LABORATORY**

PROGRAMME: **ELECTRICAL ENGINEERING**	DEGREE:**B. TECH.**	
COURSE: OBJECT ORIENTED PROGRAMMING LABPRATORY	SEMESTER: 6	CREDITS: **2**
COURSECODE: **EE 694C**	COURSE TYPE: **Practical**	
COURSE AREA/DOMAIN: **OBJECTORIENTED APPLICATION DESIGN USING JAVA**	CONTACT HOURS: **3 (weekly)**	
CORRESPONDING THEORY COURSE CODE (IFANY): **EE 604C**	THEORY COURSE NAME: **OBJECT ORIENTED PROGRAMMING**	

Course pre-requisites

Basic knowledge of computer, basic knowledge of programming language

Laboratory Educational Objectives (LEOs) :

1. **Conceptual Understanding:** Develop students' understanding through laboratory activities to solve problems related to key concepts taught in the classroom. **(L-I)**

2. **Debugging Skills:** Develop debugging capability in order to propose and apply effective engineering solutions. **(L-III)**

Laboratory Outcomes (Los):

7. **Implementation:** Apply appropriate methods and functions and structure them in a proper way to solve real life problems. **(LO – 1)**
8. **Debugging:** Identify the errors and the fault that have been done during the program modeling and rectify them and apply test cases for understanding the proper functionality of the application.. **(LO – 2)**
9. **Design:** Realize the application of the object oriented technology and design the highly robust application software by implementing the proper object oriented modeling paradigm.. **(LO – 3)**

After completing this course, students will be able:
- ❖ To identify the basic elements of object oriented technology and modeling.
- ❖ The students will understand the basic features of object oriented software and can be able to find out the error during design.
- ❖ Can able to architect the object oriented applications.

Programme Outcomes addressed in this course

1. An ability to design and conduct experiments, as well as to analyze and interpret data. **(PO – 2.)**
2. An ability to identify, formulate and solve engineering problems. **(PO – 5.)**
3. An ability to use the techniques, skills, and modern engineering tools necessary for engineering Practice. **(PO – 8.)**

PO\LO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9
LO1	√		√					√	
LO2	√	√			√				
LO3		√	√		√				

LIST OF EXPERIMENTS:

1. implement java program on class, constructor,
2. implement java program for method overloading,
3. Implement java program on inheritance, method overriding.
4. Implementation of java program for dynamic method dispatch.
5. Implement java program on wrapper class, arrays.
6. Implement java program on interface, multiple interface and extending interface.
7. Implementation of java program for caching exception using try catch.
8. Implement java program for generating exception using throw and throws.
9. Implement java program of packages and access control mechanism.
10. Implement java program on Applet and basic elements of swing.
11. Implement java program on Multithreading using thread class and Runnable interface.
12. Various method invocation for multi threading.(sleep(), notify(),yield())

Delivery/Instructional Methodologies

S.NO.	DESCRIPTION
1	Chalk and Talk
2	Study Material

Assessment Methodologies

S.NO.	DESCRIPTION	TYPE
1	Student Assignment	Direct
2	Tests	Direct
3	University Examination	Direct
4	Student Feedback	Indirect

Course Plan: Object Oriented Programming Laboratory EE-694C

Days	Experiment Performed
1	Basic understanding of java compiler and printing Hello Message in Java
2	Implement java program on class, constructor, and parameterized constructor.
3	Implement java program for method overloading.
4	Implement java program on inheritance, method overriding.
5	Implementation of java program for dynamic method dispatch.
6	Implement java program on wrapper class, arrays.
7	**1st Viva Voce and pending experiment clearing**
8	Implement java program on interface, multiple interface and extending interface.
9	Implementation of java program for caching exception using try catch.
10	Implement java program for generating exception using throw and throws.
11	Implement java program of packages and access control mechanism.
12	Implement java program on Applet and basic elements of swing.
13	Implement java program on Multithreading using thread class and Runnable interface.
14	Various method invocation for multi threading.(sleep(), notify(),yield())
15	**2nd Viva Voce and pending experiment clearing**