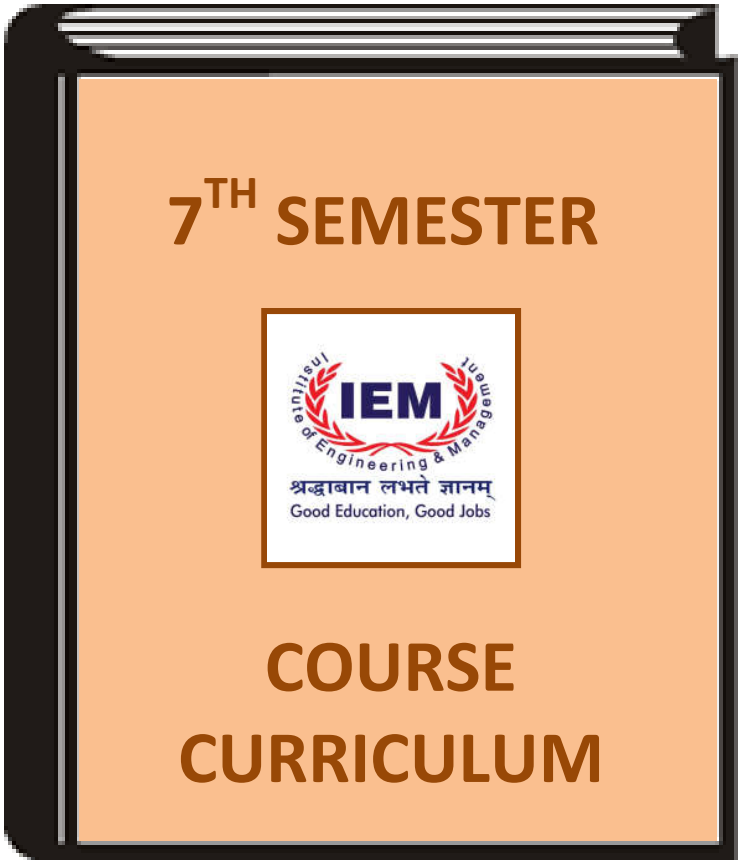
DEPARTMENT OF ELECTRICAL ENGINEERING



INSTITUTE OF ENGINEERING & MANAGEMENT

Course: EE-701 ELECTRIC DRIVES

PROGRAMME:**ELECTRICAL ENGG**	DEGREE:**B. TECH**
COURSE: Electric Drives	SEMESTER: **7** CREDITS: **4**
COURSE CODE: **EE701**	COURSE TYPE: **Theory**
COURSE AREA/DOMAIN: **Electrical machines and application of Power Electronics**	CONTACT HOURS: 4 **(weekly)**
CORRESPONDING LAB COURSE CODE (IFANY):**EE791**	LABCOURSE NAME: ELECTRIC DRIVES LABORATORY

Course pre-requisites

CODE	COURSE NAME	DESCRIPTION	SEM.
EE401	**Electrical Machines -I**	DC machines and AC machines	**4**
EE501	**Electrical Machines -II**	AC Machines	**5**
EE603	**Power Electronics**	Rectifier, Chopper, Inverter, AC voltage controllers	**6**

Course Objectives

1. To produce Electrical Engineering graduates who have strong foundation in understanding the basic concepts of Electric drives and their analysis with strong engineering knowledge and technical competence. (PEO1)

Course Outcomes

1. Students would be able to understand the basic characteristics of an electric motor drive.
2. Students would be able to understand the criterion behind the selection of a particular motor for any particular application.
3. Students would be able to design an open loop based system as well as a closed loop system for any electrical drive for controlling the speed and other relevant parameters efficiently.
4. Students would be able to develop and analyze any kind of electrical drive suitable for different industrial problems.

Programme Outcomes 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 problems (PO 2.)
3. An ability to design and conduct experiments as well as to interpret data (PO 3.)
4. An ability to design a system or process to meet the desired result within technical and socio-economic constraints issues (PO 4.)
5. An ability to function as a member in a multi-disciplinary team (PO 5.)
6. A recognition of the need for engaging in lifelong learning (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		√	√	√					
CO4				√	√			√	

Syllabus

UNIT	DETAILS	HOURS
I	**Electric Drive:** Concept, classification, parts and advantages of electrical dives. Types of Loads, Components of load toques, Fundamental torque equations, Equivalent value of drive parameters for loads with rotational and translational motion. Determination of moment of inertia, Steady state stability, Transient stability. Multiquadrant operation of drives. Load equalization	5
II	**Motor power rating:** Thermal model of motor for heating and cooling, classes of motor duty, determination of motor rating for continuous, short time and intermittent duty, equivalent current, torque and power methods of determination of rating for fluctuating and intermittent loads. Effect of load inertia & environmental factors.	5
III	**Stating of Electric Drives:** Effect of starting on Power supply, motor and load. Methods of stating of electric motors. Acceleration time Energy relation during stating, methods to reduce the Energy loss during starting. **Braking of Electric Drives:** Types of braking, braking of DC motor, Induction motor and Synchronous motor, Energy loss during braking.	8
IV	**DC motor drives:** Modeling of DC motors, State space modeling, block diagram & Transfer function, Single phase, three phases fully controlled and half controlled DC drives. Dual converter control of DC drives. Power factor, supply harmonics and ripple in motor current chopper controlled DC motor drives.	6

V	**Induction motor drives:** Stator voltage variation by three phase controllers, Speed control using chopper resistance in the rotor circuit, slip power recovery scheme. Pulse width modulated inverter fed and current source inverter fed induction motor drive. Volts/Hertz Control, Vector or Field oriented control.	6
VI	**Synchronous motor drives:** Variable frequency control, Self Control, Voltage source inverter fed synchronous motor drive, Vector control.	5
VII	Introduction to Solar and Battery Powered Drive, Stepper motor, Switched Reluctance motor Drive **Industrial application:** Drive consideration for Textile mills, Steel rolling mills, Cement mills, Paper mills, Machine tools. Cranes & hoist drives.	5

Gaps in the syllabus - to meet industry/profession requirements

S.NO.	DESCRIPTION	PROPOSED ACTIONS	PO MAPPING
1	Grid connectivity with renewable energy	Extra Class	1.

Topics beyond syllabus/advanced topics

S.NO.	DESCRIPTION	HOURS
1	Methods to connect renewable energy sources with grid	1

Web Source References

S.NO.	URL
1	http://freetutorials.name/Reference1/Electrical_Engineering.html

Books References:

1. Electric motor drives, R. Krishnan, PHI.
2. Electric Motor & Drives. Austin Hughes, Newnes.
3. Modern Power Electronics & Ac drives, B.K. Bose, Pearson Education.

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

SL NO	DAY	MODULE	CONTENT
1	DAY1	Module 1	Concept, classification, parts and advantages of electrical dives. Types of Loads
2	DAY2		Components of load toques, Fundamental torque equations
3	DAY3		Equivalent value of drive parameters for loads with rotational and translational motion. Determination of moment of inertia.
4	DAY4		Steady state stability, Transient stability
5	DAY5		Multiquadrant operation of drives. Load equalization.
6	DAY6	Module 2	Thermal model of motor for heating and cooling, classes of motor duty
7	DAY7		determination of motor rating for continuous, short time and intermittent duty
8	DAY8		equivalent current, torque and power methods of determination of rating for fluctuating and intermittent loads
9	DAY9		Effect of load inertia & environmental factors
10	DAY10		Problems
11	DAY11	Module 3	Effect of starting on Power supply, motor and load
12	DAY12		Methods of stating of electric motors.

13	DAY13		Acceleration time Energy relation during stating
14	DAY14		methods to reduce the Energy loss during starting.
15	DAY15		Types of braking, braking of DC motor
16	DAY16		braking of Induction motor
17	DAY17		braking of Synchronous motor
18	DAY18		Energy loss during braking
19	DAY19	Module 4	Modeling of DC motors
20	DAY20		State space modeling, block diagram & Transfer function
21	DAY21		Single phase, three phases fully controlled and half controlled DC drives
22	DAY22		Single phase, three phases fully controlled and half controlled DC drives
23	DAY23		Dual converter control of DC drives.
24	DAY24		Power factor, supply harmonics and ripple in motor current chopper controlled DC motor drives.
25	DAY25	Module 5	Stator voltage variation by three phase controllers
26	DAY26		Speed control using chopper resistance in the rotor circuit
27	DAY27		slip power recovery scheme
28	DAY28		Pulse width modulated inverter fed and current source inverter fed induction motor drive
29	DAY29		Volts/Hertz Control
30	DAY30		Vector or Field oriented control
31	DAY31	Module 6	Variable frequency control
32	DAY32		Self Control
33	DAY33		Voltage source inverter fed synchronous motor drive,
34	DAY34		Vector control.
35	DAY35		Problems
36	DAY36	Module 7	Introduction to Solar and Battery Powered Drive
37	DAY37		Stepper motor
38	DAY38		Switched Reluctance motor Drive
39	DAY39		Drive consideration for Textile mills, Steel rolling mills, Cement mills, Paper mills
40	DAY40		Machine tools. Cranes & hoist drives
41	DAY41		Problems

Course: EE-702- UTILISATION OF ELECTRIC POWER

PROGRAMME:**ELECTRICAL ENGG**	DEGREE:**B. TECH**
COURSE:**UTILISATION OF ELECTRIC POWER**	SEMESTER: **7** CREDITS: **4**
COURSECODE: **EE-702**	COURSE TYPE: **Theory**
COURSE AREA/DOMAIN: **ELECTRICAL MACHINE**	CONTACTHOURS: 4 **(weekly)**
CORRESPONDINGLABCOURSE CODE (IFANY):**NA**	LABCOURSE NAME:**NA**

Course pre-requisites

CODE	COURSE NAME	DESCRIPTION	SEM.
EE-401	**Electrical Machine**	Electrical Traction, Heating mechanism	**4**

Course Objectives

1. To gain knowledge about the Illumination, Electrical Traction system, Electrical Heating and their Industrial applications. (PEO1)

Course Outcomes

1. To get the basic idea of Illumination and Electrical traction system and its application.
2. To differentiate between the types of Electrical Heating and its uses.
3. To gain information about the function of Electrolysis and its Industrial Aspects.

Programme Outcomes addressed in this course

1. An ability to apply knowledge of different traction technology. (PO 1.)
2. An ability to work on multidisciplinary projects (PO 4.)
3. The broad education necessary to understand the impact of engineering solutions in a global, Economic, environmental, and context (PO 8.)
4. A knowledge of contemporary issues (PO. 9)

PO / CO	PO 1	PO 2	PO 3	PO 4
CO1	√		√	√
CO2	√	√		√
CO3		√	√	

Syllabus

Module	Content	Hour
1	**Electric Traction :** Requirement of an ideal traction system, Supply system for electric traction, Train movement (speed time curve, simplified speed time curve, average speed and schedule speed), Mechanism of train movement (energy consumption, tractive effort during acceleration, tractive effort on a gradient, tractive effort for resistance, power & energy output for the driving axles, factors affecting specific energy consumption, coefficient of adhesion). Electric traction motor & their control: Parallel and series operation of Series and Shunt motor with equal and unequal wheel diameter, effect of sudden change of in supply voltage, Temporary interruption of supply, Tractive effort and horse power. Use of AC series motor and Induction motor for traction. Traction motor control: DC series motor control, Multiple unit control, Braking of electric motors, Electrolysis by current through earth, current collection in traction system, Power electronic controllers in traction system.	16
2	**Illumination:** The nature of radiation, Polar curve, Law of illumination, Photometry (Photovoltaic cell, distribution photometry, integrating sphere, brightness measurement), Types of Lamps: Conventional and energy efficient, Basic principle of light control, Different lighting scheme & their design methods, Flood and Street lighting.	08
3	**Electric Heating welding:** Types of heating, Resistance heating, Induction heating, Arc furnace, Dielectric heating, Microwave heating.	08
4	**Electrolytic processes**: Basic principles, Faraday's law of Electrolysis, Electro deposition, Extraction and refining of metals, Power supply of Electrolytic processes.	08

Gaps in the syllabus - to meet industry/profession requirements

S.NO.	DESCRIPTION	PROPOSED ACTIONS	PO MAPPING
1	Different types of electrical welding process	Extra Class	a.

Topics beyond syllabus/advanced topics

S.NO.	DESCRIPTION	HOURS
1	Different types of temperature measurement in the process of Electrical Heating	1

Web Source References

S.NO.	URL
1	http://www.electrical4u.com

Books References:

1. Generation Distribution and Utilization of Electrical Energy, C.L.Wadhawa, New Age International Publishers.
2. Art and Science of Utilization of Electrical Energy, H. Partab, DhanpatRai& Sons.
3. Utilisation of Electric Energy, E.Openahaw Taylor, Orient Longman.

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	General introduction of utilization of power
2	Day 2		Requirement of an ideal traction system, Supply system for electric traction
3	Day 3		Train movement (speed time curve, simplified speed time curve, average speed and schedule speed)
4	Day 4		Mechanism of train movement (energy consumption, tractive effort during acceleration,tractive effort on a gradient, tractive effort for resistance
5	Day 5		Power & energy output for the driving axles, factors affecting specific energy consumption, coefficient of adhesion

6	Day 6		Electric traction motor & their control
7	Day 7		Parallel and series operation of Series and Shunt motor with equal and unequal wheel diameter
8	Day 8		Effect of sudden change of in supply voltage
9	Day 9		Temporary interruption of supply
10	Day 10		Tractive effort and horse power
11	Day 11	I	Use of AC series motor and Induction motor for traction
12	Day 12		Traction motor control : DC series motor control
13	Day 13		Multiple unit control, Braking of electric motors, Electrolysis by current through earth
14	Day 14		current collection in traction system
15	Day 15		Power electronic controllers in traction system.
16	Day 16		Numerical from Electrical Traction
17	Day1 7	II	The nature of radiation, Polar curve
18	Day 18		Law of illumination, Photometry
19	Day 19		Photovoltaic cell, distribution photometry, integrating sphere, brightness measurement
20	Day 20		Types of Lamps: Conventional and energy efficient
21	Day 21	II	Basic principle of light control
22	Day 22		Different lighting scheme & their design methods
23	Day 23		Flood and Street lighting.
24	Day 24		Numerical from Illumination
25	Day 25	III	Advantage of Electrical Heating over Conventional Heating
26	Day 26		Types of heating
27	Day 27		Resistance heating
28	Day 28		Induction heating
29	Day 29		Arc furnace
30	Day 30		Dielectric heating
31	Day 31	IV	Microwave heating.
32	Day 32		Numerical from electrical heating
33	Day 33		Basic principles, Faraday's law of Electrolysis
34	Day 34		Electro deposition
35	Day 35		Extraction and refining of metals
36	Day 36		Power supply of Electrolytic processes
37	Day 37		Power supply of Electrolytic processesContd..
38	Day 38		Numerical from electrolysis
39	Day 39		University question paper discussion
40	Day 40		Introduction to electrical welding

Course: EE703(EE)- POWER SYSTEM III

PROGRAMME: **ELECTRICAL ENGG.**	DEGREE:**B. TECH**
COURSE:**POWER SYSTEM- III**	SEMESTER: **VII** CREDITS: **4**
COURSE CODE: **EE703(A)(EE)**	COURSE TYPE: **Theory**
COURSE AREA/DOMAIN: **Operation & Control of Power System**	CONTACT HOURS: 3 **(weekly)**
CORRESPONDING LAB COURSE CODE (IFANY):	LABCOURSE NAME:

Course pre-requisites

CODE	COURSE NAME	DESCRIPTION	SEM.
EE502	POWER SYSTEM-I	Machines & Power generation	5
EE602	POWER SYSTEM-II	Stability, fault & Protection	6

Course Objectives

1. To study & analyse the economic aspect of power system.
2. To study about the control of generators
3. To study and analyze the different compensation techniques & their protection in transmission lines.

Course Outcomes

1 . Analyze and compute the economic aspect of power system .
2. To Identify the different controlling techniques of generators.
3. Application of different compensation & protection techniques in transmission lines.

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	√	√	√					√	√

Syllabus

UNIT	DETAILS	HOURS
I	**Objectives of Power System Operation:** Power Systems in Restructured Environment; Distributed and Dispersed Generation; Environment Aspects of Electric Power Generation	6
II	**Economic Operation of Energy Generation Systems:** Generation Cost Curves; Economic Operation of Thermal System; Plant Scheduling; Transmission Loss and Penalty Factor; Hydro-Thermal Scheduling; Concept of Reserves and Constraints; Unit Commitment.	10
III	**Automatic Generation Control:** Concept of AVR and ALFC Loops, Significance of Double Loop in ALFC; Exciter and VAR Control; Single Area Load Frequency Control; Two Area Load Frequency Control; Frequency Response.	8
IV	**Compensation in Power System:** Reactive Power Sensitivity and Voltage Control; Load Compensation with Capacitor Banks; Line Compensation with Reactors; Shunt and Series Compensation; Fixed Series Capacitors; Thyristor Controlled Series Capacitors; Introduction to SVC and STATCOM.	8
V	**Power System Transients:** Types of System Transients; Overvoltage in Transmission Lines; Propagation of Surges and Travelling Waves; Protection Against Lightning and Surges;	8

Gaps in the syllabus - to meet industry/profession requirements

S.NO.	DESCRIPTION	PROPOSED ACTIONS	PO MAPPING
1	Optimal Power flow	Extra Class	a.

Topics beyond syllabus/advanced topics

S.NO.	DESCRIPTION	HOURS
1	Optimal Power flow.	2

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**	Power Systems in Restructured Environment;;
3	**3**		Distributed Generation
4	**4**		Dispersed Generation
5	**5**		Environment Aspects of Electric Power Generation

6	**6**	**II**	Generation Cost Curves
7	**7**		Economic Operation of Thermal System without loss
8	**8**		Economic Operation of Thermal System with loss
9	**9**		Plant Scheduling
10	**10**		Transmission Loss and Penalty Factor
11	**11**		Hydro-Thermal Scheduling
12	**12**		Concept of Reserves and Constraints
13	**13**		Unit Commitment
14	**14**		Numericals
15	**15**	**III**	Concept of AVR and ALFC Loops
16	**16**		Significance of Double Loop in ALFC
17	**17**		Exciter and VAR Control
18	**18**		Single Area Load Frequency Control
19	**19**		Two Area Load Frequency Control
20	**20**		Frequency Response
21	**21**		Numerical
22	**22**	**IV**	Reactive Power Sensitivity and Voltage Control
23	**23**		Load Compensation with Capacitor Banks
24	**24**		Line Compensation with Reactors
25	**25**		Shunt and Series Compensation
26	**26**		Fixed Series Capacitors
27	**27**		Thyristor Controlled Series Capacitors
28	**28**		Introduction to SVC and STATCOM
29	**29**		Numerical
30	**30**	**V**	Types of System Transients
31	**31**		Overvoltage in Transmission Lines
32	**32**	**V**	Propagation of Surges
33	**33**		Travelling Waves
34	**34**		Protection Against Lightning
35	**35**		Protection Against surges

Course: EE 704 D (EE)- Renewable & Non conventional Energy

PROGRAMME: ELECTRICAL ENGINEERING	DEGREE:**B. TECH**
COURSE: Renewable & Non conventional Energy	SEMESTER: **7** CREDITS: **3**
COURSE CODE: EE 704 D	COURSE TYPE: **Theory**
COURSE AREA/DOMAIN: **Renewable energy utilization**	CONTACT HOURS: 3 **(weekly)**
CORRESPONDING LAB COURSE CODE (IFANY): **NA**	LABCOURSE NAME: **NA**

Course pre-requisites

CODE	COURSE NAME	DESCRIPTION	SEM.
ME(EE)411	Thermal Power Engineering	**Analysis of thermal properties, power calculation etc.**	**4**

Course Objectives

1. Explain the general principles and technology of energy systems.
2. Present a methodology of analyzing energy systems.
3. Explore economic, political and environmental issues around the use of renewable energy sources.
4. Explain the technological principles of solar, wind, geothermal and micro-hydro energy systems, biomass energy, and fuel cell.
5. Survey the technological principles of solar energy in green building.
6. Suggest evaluation strategies for energy scenarios and solutions to the existing problems.

Course Outcomes

1. To provide students an appreciation for the needs of alternative and "clean" energy technologies and resources.
2. To teach the prevalent types and applications of renewable energy systems and expose students to near-term implementations of the technology.
3. To teach students the basic principles of operation of prevalent renewable energy converters.
4. To train students to apply thermal science fundamentals to the design/analysis of renewable energy system components.

Programme Outcomes addressed in this course

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1		✓							✓
CO2	✓	✓	✓	✓					
CO3	✓	✓							
CO4	✓		✓						

Syllabus

UNIT	DETAILS
I	**Introduction to Energy sources:** Renewable and non-renewable energy sources, energy consumption as a measure of Nation's development; strategy for meeting the future energy requirements Global and National scenarios, Prospects of renewable energy sources. Impact of renewable energy generation on environment, Kyoto Protocol.
II	**Solar Energy**: Solar radiation – beam and diffuse radiation, solar constant, earth sun angles, attenuation and measurement of solar radiation, local solar time, derived solar angles, sunrise, sunset and day length. Flat plate collectors, concentrating collectors, Solar air heaters-types, solar driers, storage of solar energy-thermal storage, solar pond , solar water heaters, solar distillation, solar still, solar cooker, solar heating & cooling of buildings, photo voltaic – solar cells, different types of PV Cells, Mono-poly Crystalline and amorphous Silicon solar cells. Design of PV array. Efficiency and cost of PV systems & its applications. PV hybrid systems.
III	**Wind Energy:** Principle of wind energy conversion; Basic components of wind energy conversion systems; wind mill components, various types and their constructional features; design considerations of horizontal and vertical axis wind machines: analysis of aerodynamic forces acting on wind mill blades and estimation of power output; wind data and site selection considerations.
IV	**Energy from Biomass:** Biomass conversion technologies, Biogas generation plants, classification, advantages and disadvantages, constructional details, site selection, digester design consideration, filling a digester for starting, maintaining biogas production, Fuel properties of bio gas, utilization of biogas
V	**Geothermal Energy:** Estimation and nature of geothermal energy, geothermal sources and resources like hydrothermal, geo-pressured hot dry rock, magma. advantages, disadvantages and application of geothermal energy, prospects of geothermal energy in India.
VI	**Energy from Ocean:** Ocean Thermal Electric Conversion (OTEC) systems like open cycle, closed cycle, Hybrid cycle, prospects of OTEC in India. Energy from tides, basic principle of tidal power, single basin and double basin tidal power plants, advantages, limitation and scope of tidal energy. Wave energy and power from wave, wave energy conversion devices, advantages and disadvantages of wave energy.
VII	**Magneto Hydrodynamic power generation:** Principle of MHD power generation, MHD system, Design problems and developments, gas conductivity, materials for MHD generators and future prospects.
VIII	**Hydrogen Energy:** Introduction, Hydrogen Production methods, Hydrogen storage, hydrogen transportation, utilization of hydrogen gas, hydrogen as alternative fuel for vehicles.
IX	**Fuel cell:** Introduction, Design principle and operation of fuel cell, Types of fuel cells, conversion efficiency of fuel cell, application of fuel cells

Gaps in the syllabus - to meet industry/profession requirements

S.NO.	DESCRIPTION	PROPOSED ACTIONS	PO MAPPING
1	Energy Planning	Extra Class	PO2
2	Waste to energy technology	Extra Class	PO2

Topics beyond syllabus/advanced topics

S.NO.	DESCRIPTION	HOURS
1	Energy Planning	3
2	Waste to energy technology	4

Web Source References

S.NO.	URL
1	http://maxwell.sze.hu/~marcsa/MegujuloEnergiaforrasok/Books/renewable%20energy%20resources.pdf

Books References:

1. Renewable Energy – G. Boyle, 2nd edition, OUP, 2010.

2. Renewable Energy Resources- Twidell, J & Weir, T, 2nd edition, Taylor & Francis, 2006.

3. Non Conventional Energy Resources- B.H. Khan, T M H, 2010.

4. Non Conventional Energy Sources- G.D. Rai, Khanna Publishers.

5. Renewable energy resources and emerging technologies, D.P. Kothari, Prentice Hall of India Pvt. 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

LESSON PLAN ME 703B (Renewable Energy Systems)			
S. NO.	**Day**	**Module**	**Introduction to Energy sources:**
1	Day 1	I	Renewable and non-renewable energy sources, energy consumption as a measure of Nation's development; strategy for meeting the future energy requirements
2	Day 2		Global and National scenarios, Prospects of renewable energy sources.
3	Day 3		Impact of renewable energy generation on environment, Kyoto Protocol.
			Solar Energy:
4	Day 4	II	Beam and diffuse radiation, solar constant, earth sun angles, attenuation and measurement of solar radiation, local solar time
5	Day 5		Derived solar angles, sunrise, sunset and day length. flat plate collectors, concentrating collectors
6	Day 6		Solar air heaters-types, solar driers, storage of solar energy-thermal storage, solar pond , solar water heaters, solar distillation, solar still, solar cooker, solar heating & cooling of buildings
7	Day 7		Photo voltaics - solar cells, different types of PV Cells, Mono-poly Crystalline and amorphous Silicon solar cells.
8	Day 8		Design of PV array. Efficiency and cost of PV systems & its applications. PV hybrid systems
			Wind Energy:
9	Day 9	III	Principle of wind energy conversion; Basic components of wind energy conversion systems,
10	Day 10		Wind mill components, various types and their constructional features, design considerations of horizontal and vertical axis wind machines: analysis of aerodynamic forces acting on wind mill blades and estimation of power output
11	Day 11		Wind data and site selection considerations
			Energy from Biomass:
12	Day 12	IV	Biomass conversion technologies, Biogas generation plants, digester design consideration, filling a digester for starting,
13	Day 13		Classification, advantages and disadvantages, constructional details, site

			selection,
14	Day 14		Maintaining biogas production, Fuel properties of bio gas, utilization of biogas
			Geothermal Energy:
15	Day 15	**V**	Estimation and nature of geothermal energy.
16	Day 16		Geothermal sources and resources like hydrothermal, geo-pressured hot dry rock, magma.
17	Day 17		Advantages, disadvantages and application of geothermal energy, prospects of geothermal energy in India.
			Energy from Ocean:
18	Day 18	VI	Ocean Thermal Electric Conversion (OTEC) systems like open cycle, closed cycle, Hybrid cycle, prospects of OTEC in India
19	Day 19		Energy from tides, basic principle of tidal power, single basin and double basin tidal power plants, advantages, limitation and scope of tidal energy.
20	Day 20		Wave energy and power from wave.
21	Day 21		Wave energy conversion devices, advantages and disadvantages of wave energy.
			Magneto Hydrodynamic power generation:
22	Day 22	VII	Principle of MHD power generation, MHD system
23	Day 23		Design problems and developments, gas conductivity
24	Day 24		Materials for MHD generators and future prospects
			Hydrogen Energy:
25	Day 25	VIII	Introduction, Hydrogen Production methods.
26	Day 26		Hydrogen storage, hydrogen transportation, utilization of hydrogen gas.
27	Day 27		Hydrogen as alternative fuel for vehicles.
			Fuel cell:
28	Day 28	IX	Introduction, Design principle and operation of fuel cell
29	Day 29		Types of fuel cells, conversion efficiency of fuel cell
30	Day 30		Application of fuel cells

Course: EE705A- COMPUTER NETWORK

PROGRAMME: ELECTRICAL ENGINEERING	DEGREE:**B. TECH**
COURSE: **COMPUTER NETWORK**	SEMESTER: **7** CREDITS: **3**
COURSECODE: **EE 705A**	COURSE TYPE: **Theory**
COURSE AREA/DOMAIN: Overview of Computer Networks, how they are connected & how it works, detail description of different layers & characteristics of each layer.	CONTACT HOURS: **3(weekly)**
CORRESPONDING LAB COURSE CODE (IF ANY): EE792A	LABCOURSE NAME: **COMPUTER NETWORK LAB**

Course pre-requisites

Basic knowledge about digital electronics & digital signals concepts of computer hardware fundamentals including digital signal processing etc.

Course Objectives

1. To understand the fundamentals of computer network systems.
2. To develop the understanding regarding the applications of fundamental ideas of signal processing as well as in basic computer hardware like router, cables, switches etc. in modern engineering aspect.

Course Outcomes

5. Students would understand the basic principles of digital communication.
6. Students would have a clear knowledge of TCP/IP Layered Architecture.
7. Students would understand the basic concept of basic encoding like line encoding & block encoding techniques.
8. Students would be able to design the real life applications and projects through the concept of modern networking system.

Program Outcomes addressed in this course

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

Syllabus

MODULE	DETAILS	HOURS
I	Introduction, Data communications: components, data representation (ASCII, ISO etc.), direction of data flow (simplex, half duplex, full duplex); network criteria, physical structure(type of connection, topology), categories of network (LAN, MAN,WAN); Internet: brief history, Protocols and standards; Reference models: OSI reference model, TCP/IP reference model, their comparative study. Overview of data (analog & digital), signal (analog & digital), transmission (analog & digital) & transmission media (guided & unguided), Circuit Switching: time division & space division switch, TDM bus; Telephone Network.	10
II	Types of errors, framing (character and bit stuffing), error detection & correction methods; Flow control; Protocols: Stop & wait ARQ, Go-Back-N ARQ, Selective repeat ARQ, HDLC; Point to Point Protocol, LCP, NCP, Token Ring; Reservation, Polling, Multiple access protocols: Pure ALOHA, Slotted ALOHA, CSMA, CSMA/CD, CSMA/CA Traditional Ethernet	10
III	Internetworking & devices: Repeaters, Hubs, Bridges, Switches, Router, Gateway; Addressing: IP addressing, sub netting; Routing : techniques, static vs. dynamic routing , Unicast Routing Protocols: RIP, OSPF, BGP; Other Protocols: ARP, IP, ICMP, IPV6. Process to Process delivery; UDP; TCP; Congestion Control: Open Loop, Closed Loop choke packets; Quality of service: techniques to improve QoS: Leaky bucket algorithm, Token bucket algorithm.	12
IV	Introduction to DNS, SMTP, SNMP, FTP, HTTP & WWW; Security: Cryptography (Public, Private Key based), Digital Signature, Firewalls. ISDN services & ATM, DSL technology, Cable Modem: Architecture and operation in brief. Wireless LAN: IEEE 802.11, Introduction to blue-tooth.	8

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

Sl. No.	Topic(s) to be included	PROPOSED ACTIONS	PO MAPPING
1	different types of cables with color coding & connections	Extra Class	PO1,PO3
2	fast Ethernet & gigabit Ethernet (in details)		
3	Details of Wireless Communications.		

Topics beyond syllabus/advanced topics

S.NO.	DESCRIPTION	HOURS
1	Wireless Communication & Its Application in Industry & Commercial Uses	2

Web Source References

S.NO.	URL
1	http://www.tutorialspoint.com/computer_fundamentals

Text Books:

1. Data Communications and Networking (3rd Ed.), A. Forouzan , TMH
2. Computer Networks (4th Ed.), A. S. Tanenbaum, Pearson Education/PHI
3. Data and Computer Communications (5th Ed.), W. Stallings, PHI/ Pearson Education

Reference Books:

1. Computer Networking -A top down approach featuring the internet, Kurose and Rose Pearson Education
2. Communication Networks, Leon, Garica, Widjaja, TMH
3. Communication Networks, Walrand, TMH.
4. Internetworking with TCP/IP, vol. 1, 2, 3(4th Ed.), Comer, Pearson Education/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	Introduction, Data communications: components, data representation (ASCII, ISO etc.),direction of data flow (simplex, half duplex, full duplex); network criteria, physical structure(type of connection, topology)
2	Day 2		categories of network (LAN, MAN,WAN); Internet: brief history, Protocols and standards
3	Day 3		Reference models: OSI reference model
4	Day 4		TCP/IP reference model, their comparative study.
5	Day 5		Overview of data (analog & digital), signal (analog & digital), transmission (analog & digital)
6	Day 6		Transmission media (guided & unguided)
7	Day 7		Circuit Switching: time division & space division switch
8	Day 8		TDM bus; Telephone Network
9	Day 9	II	Details of types of errors, framing (character and bit stuffing)
10	Day 10		Different types of error detection & correction methods
11	Day 11		Flow control; Protocols: Stop & wait ARQ, Go-Back-N ARQ, Selective repeat ARQ,
12	Day 12		HDLC; Point to Point Protocol, LCP, NCP
13	Day 13		Token Ring; Reservation, Polling, Multiple access
14	Day 14		Protocols: Pure ALOHA, Slotted ALOHA
15	Day 15		CSMA, CSMA/CD
16	Day 16		CSMA/CA
17	Day 17		Traditional Ethernet Details
18	Day 18	III	Internetworking & devices: Repeaters, Hubs, Bridges, Switches, Router, Gateway
19	Day 19		Addressing: IP addressing
20	Day 20		sub netting; Routing related details & problems
21	Day 21		Techniques, static vs. dynamic routing
22	Day 22		Unicast Routing Protocols: RIP, OSPF, BGP
23	Day 23		Continuation of Previous Topic
24	Day 24		Other Protocols: ARP, IP, ICMP, IPV6
25	Day 25		Process to Process delivery
26	Day 26		Details of UDP & TCP
27	Day 27		Congestion Control: Open Loop, Closed Loop
28	Day 28		choke packets; Quality of service
29	Day 29		Techniques to improve QoS: Leaky bucket algorithm

30	Day 30		Token bucket algorithm
31	Day 31	IV	Introduction to DNS & Details
32	Day 32		SMTP, SNMP, FTP Protocols
33	Day 33		Details of HTTP Protocols & WWW
34	Day 34		Security: Cryptography (Public, Private Key based)
35	Day 35		Digital Signature, Firewalls
36	Day 36		ISDN services & ATM
37	Day 37	IV	DSL technology, Cable Modem: Architecture and operation in brief
38	Day 38		Wireless LAN: IEEE 802.11
39	Day 39		Blue-tooth Technology

Course: EE-791 ELECTRIC DRIVES LABORATORY

PROGRAMME: **ELECTRICAL ENGG.**	DEGREE:**B. TECH.**
COURSE: **Electric Drives Laboratory**	SEMESTER: 7 CREDITS: **2**
COURSECODE: **EE791**	COURSE TYPE: **Practical**
COURSE AREA/DOMAIN:**AC and DC drives, Braking operation**	CONTACT HOURS: **3 (weekly)**
CORRESPONDING THEORY COURSE CODE (IFANY): **EE701**	THEORY COURSE NAME: **Electric Drives**

Course pre-requisites

CODE	COURSE NAME	DESCRIPTION
EE 401	ELECTRICAL MACHINE-I	Knowledge of different types of DC machines.
EE 501	ELECTRICAL MACHINE-II	Knowledge of different types of AC machines.
EE 603	POWER ELECTRONICS	Knowledge of Thyristor,IGBT,BJT and different types of Transistors.

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) :

1. Students would be able to understand the concept of different electrical drives by performing simulation and appreciate the result based on analysis.
2. Students would be able to conduct different hardware experiments on dc motor drive as well as on ac motor drive.
3. Students would be able to implement their own ideas for controlling the speed as well as other relevant parameters of different motors using PLC.
4. Students would be able to design any kind of electrical drive suitable for different industrial problems.

Programme Outcomes 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 problems (PO 2.)
3. An ability to design and conduct experiments as well as to interpret data (PO 3.)
4. An ability to design a system or process to meet the desired result within technical and socio-economic constraints issues (PO 4.)
5. An ability to function as a member in a multi-disciplinary team (PO 5.)
6. A recognition of the need for engaging in lifelong learning (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		√	√		√				
LO4					√	√		√	

LIST OF EXPERIMENTS:

1. Study of thyristor controlled DC Drive.
2. Study of Chopper fed DC Drive.
3. Study of AC Single phase motor-speed control using TRIAC.
4. PWM Inverter fed 3 phase Induction Motor control using PSPICE / MATLAB / PSIM Software.
5. VSI / CSI fed Induction motor Drive analysis using MATLAB/DSPICE/PSIM Software.
6. Study of V/f control operation of 3Φ induction motor drive.
7. Study of permanent magnet synchronous motor drive fed by PWM Inverter using Software.
8. Regenerative / Dynamic braking operation for DC Motor - Study using software.
9. Regenerative / Dynamic braking operation of AC motor - study using software.
10. PC/PLC based AC/DC motor control operation.

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: EE791

Days	Experiment Performed
1	Introduction and brief description of different types of experimental set-up.
2	Study of thyristor controlled DC Drive.
3	Study of AC Single phase motor-speed control using TRIAC.
4	Study of V/f control operation of 3Φ induction motor drive.
5	PC/PLC based AC/DC motor control operation.
6	VSI / CSI fed Induction motor Drive analysis using PSIM Software.
7	PWM Inverter fed 3 phase Induction Motor control using PSIM Software.
8	Regenerative / Dynamic braking operation for DC Motor - Study using software.
9	Study of Chopper fed DC Drive
10	Regenerative / Dynamic braking operation of AC motor - study using software.
11	Study of permanent magnet synchronous motor drive fed by PWM Inverter using Software.

Course: EE 792A – COMPUTER NETWORK LABORATORY

PROGRAMME:**ELECTRICAL ENGINEERING**	DEGREE:**B. TECH**
COURSE: COMPUTER NETWORK LABORATORY	SEMESTER: **7** CREDITS: **2**
COURSE CODE: EE 792A	COURSE TYPE: **Practical**
COURSE AREA/DOMAIN: Clear idea about different Network Commands & Socket Programming and Different Networking devices like Router, Switch etc.	CONTACT HOURS: 3 **(weekly)**
CORRESPONDING THEORY COURSE CODE (IFANY): **EE 705A**	THEORY COURSE NAME:**COMPUTER NETWORK**

Course pre-requisites

CODE	COURSE NAME	DESCRIPTION
EC(EE)302, CS 201	**Digital Electronic Circuits & Basic C Programming**	Knowledge of Digital Communication & Programming concepts

Laboratory Educational Objectives (LEOs) :

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

2. **Problem Solving Skills:** Develop problem solving capability in order to propose and apply effective mathematical solutions. **(L-II)**

Laboratory Outcomes (Los) :

- **LO – 1 :**Apply appropriate algorithms and handle them appropriately to perform different computations.
- **LO – 2 :**Identify the strength and limitations of computing and establish a relationship between Problem & Problem Solving strategy.
- **LO – 3 :**Design and analysis different algorithms to meet desired tasks and tests it using appropriate testing strategy.

After completing this course, students will be able:

- To identify the different algorithmic paradigms of programming.
- To understand the basic operation of C Programming & C Functions.

ProgrammeOutcomes addressed in this course

1. An ability to apply the knowledge of mathematics, science & 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 analyze and interpret data. **(PO – 3)**
4. A recognition of the need for engaging in lifelong learning. **(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:

EE 792A – COMPUTER NETWORK LABORATORY

1. Inter Process Communication (Message Queues)
2. NIC Installation and Configuration (WINDOWS)
3. Networking Cables, Connectors, Hardware (Repeater, Router HUB, Bridge)
4. TCP ECHO Program (Client/ Server Program)
5. UDP ECHO Program (Client/ Server Program)
6. TCP Chat Program (Client/ Server Program)
7. UDP Chat Program (Client/ Server Program)
8. TCP Time Program (Client/ Server Program)
9. UDP Time Program (Client/ Server Program)
10. TCP Stop & Wait ARQ Implementation (Client/ Server Program)
11. UDP Stop & Wait ARQ Implementation (Client/ Server Program)

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 792A

Days	Experiment Performed
1	NIC Installation and Configuration In LINUX
2	Networking Cables, Connectors, Hardware (Repeater, Router HUB, Bridge)
3	TCP Chat Program for Client & Server
4	TCP ECHO Program for Client & Server
5	**1st VIVA VOCE and Pending experiment clearing.**
6	UDP ECHO Program (Client/ Server Program)
7	UDP CHAT Program (Client/Server)
8	TCP Time Program (Client/Server)
9	UDP Time Program(Client/Server)
10	TCP Stop & Wait ARQ Implementation (Client/ Server Program)
11	UDP Stop & Wait ARQ Implementation (Client/ Server Program)
12	**2nd VIVA VOCE and Pending experiment clearing.**

Course: EE 782 Electrical System Design Laboratory

PROGRAMME: **ELECTRICAL ENGINEERING.**	DEGREE:**B. TECH.**
COURSE: **Electrical System Design Laboratory**	SEMESTER: 7 CREDITS: **2**
COURSECODE: **EE 782**	COURSE TYPE: **Practical**
COURSE AREA/DOMAIN: **Design of electrical machines, power system etc.**	CONTACT HOURS: **3 (weekly)**
CORRESPONDING THEORY COURSE CODE (IFANY): **NA**	THEORY COURSE NAME: **NA**

Course pre-requisites

CODE	COURSE NAME	DESCRIPTION
EE-401	Electric Machine-I	Principle and operations of electrical machines

Laboratory Educational Objectives (LEOs) :

Conceptual Understanding: Develop students' understanding through laboratory activities to solve problems related to key concepts taught in the classroom.

Models: Identify the strength and limitations of theoretical models and establish a relationship between measured data and underlying physical principles.

Debugging Skills: Develop debugging capability in order to propose and apply effective engineering solutions.

Laboratory Outcomes (Los):

After completing this course, students will be able:

1. To identify the basic equations for modeling of the electrical systems.
2. Design and build a model to meet desired specifications.

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	√		√	√	√				√

LIST OF EXPERIMENTS:

Group-A	• Designing a heating element with specified wattage, voltage and ambient temperature. • Designing an air core grounding reactor with specified operating voltage, nominal current and fault current.
Group-B	• Designing the power distribution system for a small township. • Designing a double circuit transmission line for a given voltage level and power (MVA) transfer. • Wiring and installation design of a multistoried residential building (G+4,not less than 16 dwelling flats with a lift and common pump) • Designing of a substation
Group-C	• Designing an ONAN distribution transformer. • Designing a three phase squirrel cage induction motor. • Designing a three phase wound rotor induction motor. • Designing a split phase squirrel cage induction motor for a ceiling fan or a domestic pump. • Designing a permanent magnet fractional hp servo motor.

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: EE 782

Days	Experiment Performed
1	Designing a heating element with specified wattage, voltage and ambient temperature.
2	Designing an air core grounding reactor with specified operating voltage, nominal current and fault current.
3	Principles of ONAN distribution transformer design
4	Assignment on ONAN distribution transformer
5	Principles of three phase squirrel cage induction motor design
6	Assignment on three phase squirrel cage induction motor
7	Principles of three phase wound rotor induction motor design
8	Assignment on three phase wound rotor induction motor
9	Principles of split phase squirrel cage induction motor design
10	Assignment on ceiling fan and a domestic pump design