Scheme of Teaching and Examination for

6th Semester of 3 Years Diploma in Electrical Engineering

Duration of Semester : **14 Weeks**

Student Contact Hours : **36 Hrs**

Total Marks : **800**

Effective from: 2017 -18 Session

Sl. No.	Name of Subject	Subject Code	Subject	Teaching Scheme			Examination Scheme					
				L	T	P	Hours of Exam	Full Marks of Subject	Final Exam / committee marks	Internal Assessment	Pass Marks Final / Ext. Exam	Pass Marks in Subjects
1.	Industrial Engineering & Management	601	Theory	3	-	-	3	100	80	20	26	40
2.	Utilization of Electrical Energy	ELE 604	Theory	3	-	-	3	100	80	20	26	40
3.	Power Electronics	ECE 504	Theory	3	-	-	3	100	80	20	26	40
4.	Elective III	ELE 605/606/607	Theory	3	-	-	3	100	80	20	26	40
5.	Elective IV	ELE608/ECE507/ ECE511/ELE609	Theory	3	-	-	3	100	80	20	26	40
6.	Power Electronics Lab	ECE513	Sessional	-	-	2	-	50	30	20	-	25
7.	Utilization of Electrical Energy Lab	ELE 610	Sessional	-	-	2	-	50	30	20	-	25
8.	Elective III lab	ELE611/612/613	Sessional	-		2	-	50	30	20	-	25
9.	Elective IV Lab	ELE614/ECE515/ ECE519/ELE615	Sessional	-		2	-	50	30	20	-	25
10	Project Work	603	Sessional	-	-	4	-	50	30	20	-	25
11	Professional Practices	602	Sessional	-	-	4	-	50	30	20	-	25
Total Hours of Teaching per week :				**15**		**16**						

Elective III (Energy Conservation & Audit- ELE605/ Renewable Energy Sources-ELE606/Bye laws for Electrical Enginers-ELE607)

Elective IV (Smart Grid-ELE608/VLSI-ECE507 /DSP-ECE511/ Communication System-ELE609)

Total Marks: Theory : Practical : Sessional :

L : Lecture, T : Tutorial P : Practical

Note:
1. Period of Class hours should be of 1 hrs duration as per AICTE norms.
2. Remaining Hrs every week has been marked for students for Library and Student Centered Activities.
3. Drawing / Graphics / Practical / Sessional examinations will be held at parent institution.
4. Board will depute examiner for Practical examination.
5. Regarding sessional examination the parent institution will form a three member committee and this committee will examine the sessional records and hold viva of the examinee for 60 % marks allotted to the subject. Marks for remaining 40 % will be provided by the Faculty concerned on the basis of evaluation of each job / work throughout the semester.

Subject : Industrial Engineering & Management (Common Paper)

Subject Code : 601

Full Marks : 80+20= 100

L	T	P
3	0	0

Rationale:

After completion of three years of technical training, Polytechnic students are expected to enter in to the World of Work. The business environment is altogether different and new to the students. A proper introduction and understanding of Business Processes is therefore essential for all Polytechnic students. Management is a subject which deals with basics of Management science required to understand the processes the in Industrial & Commercial environment. This will enable the students of Polytechnic to become familiar and to understand various Business Organizational structures, their functioning and the Role these technicians will have to play in these setups with responsibilities.

Industrial Engineering is concerned with the design, improvement and installation of integrated systems of people, materials, equipment and energy. Polytechnic students must be able to analyze the use and cost of the resources of the organization in order to achieve the objective, i.e. to increase productivity, profits etc. and carryout the policies efficiently and effectively.

Objective:

The students will able to:

1. Familiarize environment in the world of work.
2. Explain the importance of management process in Business.
3. Identify various components of management.
4. Describe Role & Responsibilities of a Technician in an Organizational Structure.
5. Apply various rules and regulations concerned with Business & Social responsibilities of the technician.

Detailed Syllabus

1. **Productivity :** **02 Hrs**

   Production and productivity, importance of productivity, factors affecting productivity, means of increasing productivity.

2. **Plant Layout and Material Handling :** **02 Hrs**

Definition of plant layout, objectives of good plant layout, principles of plant layout, types of plant layout, flow pattern, steps in planning the layout for a new enterprise, definition of material handling, functions and principles of material handling, material handling devices.

3. **Work Study :** **04 Hrs**

Definition, concept and need for work study, objectives of method study and work measurement, basic procedure/steps in method study, recording technique, critical examination, principles of motion economy, stop watch procedure for collecting time study data, including performance rating and allowances, work sampling.

4. **Production Planning and Control (PPC) :** **04 Hrs**

Definition and objectives of PPC, functions of PPC, routing, scheduling, loading, dispatching, production control definition and objectives, principle of sound production control system.

5. **Material, Purchase and Stores Management :** **04 Hrs**

Definition, functions& objectives of materials management, inventory control, economic order quantity (EOQ), ABC analysis. Objectives of purchasing department, buying techniques, purchasing procedure (steps involved in one complete purchasing cycle); functions of stores department, location and layout of stores, receipt and issue of materials.

6. **Quality Control and TQM :** **04 Hrs**

Meaning of quality and quality control, dimensions of quality, quality circle, concept and definition of TQM, elements of TQM, Kaizen, 5 'S' and six sigma.

7. **Management :** **04 Hrs**

Various definition, concept of management, levels of management, administration and management, scientific management by F. W. Taylor. Principles of management (14 principles of Henry Fayol). Functions of management - planning, organizing, coordinating, directing, controlling, decision making.

8. **Organizational Management :** **04 Hrs**

Organization - definition, steps in forming organization. Types of organization. Types of organization - line, line and staff, functions, project type. Departmentation- Organized and decentralized, authority and responsibility, span of control (management). Forms of ownership - proprietorship, partnership, joint stock company, co-operative society, govt. sector.

9. **Human Resource Management :** **06 Hrs**

Personnel Management – Introduction, definition, function. Staffing – Introduction to HR, Introduction to HR Planning, Recruitment procedure. Personnel- Training & Development – Types of training, Induction, Skill enhancement. Leadership & Motivation – Leadership- Styles & types, Motivation- Definition, Intrinsic, &Extrinsic, Moslow's theory of Motivation and its significance. Safety Management – Causes of accident, Safety Procedures. Introduction, Objectives & feature of Industrial Legislation such as – Factory act, ESI act, Workman compensation act, Industrial dispute act and salary & wages.

10. **Financial Management :** **04 Hrs**

Financial Management- Objectives & Functions. Capital Generation & Management- Types of capitals, Sources of finance. Budgets and accounts- Types of budgets, Production budget (including varience report), Labour budget, Introduction to Profit & Loss Accounts (Only concept), Balance sheet etc.

11. **Entrepreneurship :** **04 Hrs**

Concept and definition of entrepreneur and entrepreneurship, factors influencing entrepreneurship, entrepreneurial characteristics, need for promotion of entrepreneurship and small scale industries, steps in setting up a small scale industrial enterprise.

References Books :

1. Industrial Engineering and Management by O. P. Khanna
2. Industrial Engineering and Production Management by M. Mahajan.
   Publisher :Dhanpat Rai Publication (P) Ltd. New Delhi

3. Business Administration and Management by Dr. S. C. Saksena
   Publisher :Sahitya Bhawan, Agra.

Subject : Utilization of Electrical Energy
Subject Code : ELE604
Full Marks : 80+20=100
Hours : 42

Contents: Theory

Chapter	Name of the Topic	Hours
01	**Illumination:** 1.1 Definitions of Terms Used in Illumination: Light, Luminous Flux, Luminous Intensity, Lumen, Candle Power, Illumination, Lux or Meter Candle, Mean Horizontal Candle Power (MHCP), Mean Spherical Candle Power (MSCP), Mean Hemi-spherical Candle Power (MHSCP), Reduction Factor, Lamp Efficiency, Specific Consumption, Glare, Space-Height Ratio, Utilisation Factor, Maintenance Factor, Depreciation Factor, Waste Light Factor, Absorption Factor, Reflection Factor, Solid Angle. 1.2 Laws of Illumination: - Law of Inverse Squares - Lambert's Cosine Law. (No Numerical) 1.3 Sources of Light: Construction, Working and Applications of Following Lamps: - Incandescent Lamps. - Halogen Lamps. - Low Pressure Mercury Vapour Lamps (Fluorescent Tube). - High Pressure Mercury Vapour Lamps. - Sodium Vapour Lamps. - Compact Fluorescent Lamps (C.F.L.) - Metal Halide Lamps - LED Lamps - Neon Signs. 1.4 – Basic Principles of Light Control. 1.5 – Types of Lighting Schemes. Direct, Semi-direct, Semi-indirect, Indirect, General Lighting. 1.6 – Design of Lighting Scheme: Objectives of Lighting Scheme. Factors to be considered While Designing the Lighting Scheme. (Simple Numericals) 1.7 - Factory Lighting: - General Requirements - Types of Installations: General Lighting, Local Lighting, Emergency Lighting. 1.8 – Lumen or Light Flux Method of Lighting Calculations. (Simple Numericals) 1.9 – Flood Lighting - Flood Lighting Purposes. - Classification of Projectors. - Location and Mounting of Projectors. (Simple Numericals) [no numerical]	05

02	**Electric Heating and Welding: Electric Heating:** 2.1.1– Advantages of Electric Heating. 2.1.2 – Modes of Transfer of Heat: - Conduction, Convection and Radiation. 2.1.3 – Classification of Electric Heating Methods: 2.1.4 – Resistance Heating:(Construction & Operation) - Direct Resistance Heating: Salt Bath Furnace. - Indirect Resistance Heating: Resistance Ovens, Requirements of Heating Element Material, Causes of Failure of Heating Elements, Methods of Temperature Control. - Applications of Resistance Heating. 2.1.5 – Arc Heating: (Construction & Operation) - Direct Arc Furnace: - Indirect Arc Furnace. - Applications of Arc Heating. 2.1.6 –Induction Heating: (Construction & Operation) - Core Type Induction Furnaces: Ajax Wyatt Furnace. - Coreless Induction Furnace. - Applications of Induction Heating. (Simple Numericals on Melting Furnaces) 2.1.7 – Dielectric Heating: - Principle of Dielectric Heating. - Advantages of Dielectric Heating - Limitations of Dielectric Heating. - Applications of Dielectric Heating. (Simple Numericals on Dielectric Heating) 2.1.8 Eddy current heating Principle, advantages and applications	05
	Electric Welding: 2.2.1– Methods of Electric Welding: Electric Arc Welding, Resistance Welding. 2.2.2 – Resistance Welding: - Principle of Resistance Welding. - Advantages of Resistance Welding. - Types of Resistance Welding - (Only List) 2.2.3 – Spot Welding Machine. 2.2.4 – Electric Arc Welding: - Formation and Characteristics of Electric Arc. - Effect of Arc Length. - Arc Blow. 2.2.5 – Polarity in DC Welding: 2.2.6 – Electrodes for Metal Arc Welding: 2.2.7 – V-I Characteristics of Arc Welding . 2.2.8 – Arc Welding Machines:[only list] - DC Welding Machines – MG Set, AC Rectified Welding Unit. - AC Welding Machines – Welding Transformer.	05
03	**Elevators:** 3.1 Types of electric elevators 3.2 Size and shape of elevator car 3.3 Speed of elevators 3.4 Location of elevator machine 3.5 Types of elevator machines, elevator motors 3.6 Power transmission gears braking 3.7 Safety in elevators	04

04	**Electric Drives:** 4.1 – Introduction: - What is drive? - Drives – Mechanical Drive and Electric Drive. 4.2 – Advantages and Disadvantages of Electric Drive. 4.3 – Factors Governing Selection of Electric Motors. 4.4 - Nature of Electric Supply: 3 φ & 1φ AC and DC. 4.5 - Type of Drive: Group Drive & Individual Drive. 4.6 - Nature of Load: Nature of the Mechanical Load, Matching of the Speed Torque Characteristics of the Motor with that of the Load, and Starting Conditions of the Load. 4.7 - Electrical Characteristics: (Only DC Series, Three Phase and Single Phase Induction Motors are to be dealt) - Running Characteristics: Three Typical Speed Torque Characteristics – Inverse, Constant Speed and Drooping. - Starting Characteristics: Starting Torque only. (No Starters). - Speed Control: Suitability to Economic and Efficient Speed Control Methods (Above and Below Normal Speed). - Braking Characteristics: Plugging, Rheostatic Braking and Regenerative Braking, as Applied to DC Series and Three Phase Induction Motor.Only characteristics and applications of following motors D.C. Series ,1phase A.C. Series, 1phase I.M., 3phase I.M., Universal motor, Stepper motor. Requirements of Motors used in following applications, stone crushing, textile industry, paper manufacturing industry, rolling mill, chemical industry. 4.8 - Mechanical Features: - Type of Enclosure as per IS - Type of Bearings - Type of Transmission for Drive - Noise Level. 4.9 - Size and Rating of Motor: - Load Cycles for – Continuous Loads, Short Time Loads, Intermittent Loads, Continuous Operation with Short Time Loads and Continuous Operation with Intermittent Loads. - Duty Cycles. - Standard Ratings for Motors as per ISS.	07
	- Estimation of Rating of a Motor. (Simple Numericals on Estimating Size of Continuously Rated Motor) - Load Equalisation. (No Calculations) 4.10 - Cost: - Capital Cost - Running Cost (Losses, p.f., Maintenance).	

05	**Electric Traction:** 5.1 – Requirements of an Ideal Traction System. 5.2 – Traction Systems: - Non-electric Traction Systems. - Electric Traction Systems: Straight Electric Traction, Its advantages and Disadvantages. Diesel Electric Traction, Its advantages and Disadvantages. 5.3 - Systems of Track Electrification: DC System, Composite System – Single Phase to Three Phase System and Single Phase AC to DC System (Kando System). Advantages and Disadvantages of Single Phase 25 KV AC System Over DC System. 5.4 – Traction Mechanics: - Units Used in Traction Mechanics. - Types of Services. - Speed Time Curve. - Simplified Speed Time Curve (No Derivation) - Average Speed and Schedule Speed. - Factors Affecting The Schedule Speed. - Tractive Effort [No Derivation] - Specific Energy Consumption [No Derivation] - Factors Affecting Specific Energy Consumption. - Coefficient of Adhesion. (Simple Numerical on Simplified Speed Time Curves and Specific Energy Consumption) 5.5 – Traction Motors: - Desirable Characteristics of Traction Motors, Special features of traction motor.only advantages ,disadvantages and applications of following motors - Suitability of DC Series Motor for Traction. - Suitability of Three Phase Induction Motor for Traction. , LIM, 1phase ac series motor. 5.6 - Traction Motor Control: - Requirements. - Traction Control of DC Locomotives and EMUs: Series Parallel Control Combined with Rheostatic Control, Transition from Series to Parallel Combination (Open Circuit Transition, Shunt Transition and Bridge Transition), Energy Efficiency and Limitations of Series Parallel cum Rheostatic Control, Chopper Control of Motors in DC Traction Systems. - Traction Control System of AC Locomotives: Tap Changer, Step less Voltage Control through Use of Thyristors, PWM	10
	5.7 – Braking: - Requirements of a Braking System. - Mechanical Braking: Vacuum Braking, Com- pressed Air Braking, Hand Brake for Parking. - Electric Braking: Rheostatic Braking and Regenerative Braking. (No Derivation and No Numericals). - Sequence of Braking - Dead Man's Handle	

06	Economic Aspects of Utilising Electrical Energy: 6.1 – Economic Aspects of Utilising Electrical Energy. 6.2 – Costing of Electrical Energy: Fixed Charges, Semi Fixed Charges and Running Charges. 6.3 – Formulation of Electrical Tariffs. 6.4 – Various Types of Tariffs: Tariffs in force for Domestic, Commercial and Industrial Consumers.Simple,Block rate,Two part,Three part, KVA, MD, P.F. Tarriffs. 6.5 – Power Factor Improvement: Causes of Low Power Factor, Disadvantages of Low Power Factor, Power Factor Improvement by using Static Capacitors, Location of Capacitors for Power Factor Improvement, Most Economical Power Factor. Automatic Power Factor Controller (Derivation and Simple Numericals) 6.6 – Energy Conservation: Importance and need of Energy Conservation, Measures for Energy Conservation in (i) Electric Drives (ii) Electric Traction (iii) Electric Heating (iv) Refrigeration and Air Conditioning (v) Illumination.	06
	Total	**42**

Subject : Utilization of Electrical Energy Lab
Subject Code : ELE610

List of Experiments

1. Study of different types of Lamps (Incandescent Lamps. Halogen Lamps. - Low Pressure Mercury Vapour Lamps (Fluorescent Tube,- High Pressure Mercury Vapour Lamps. - Sodium Vapour Lamps. - Compact Fluorescent Lamps (C.F.L.), - Metal Halide Lamps, - LED Lamps, - Neon Signs)
2. Calculation of loads in terms of provision of lighting
3. V-I Characteristics of Arc Welding .
4. Study of Types of elevator motors and elevator system.
5. Study of Power transmission gears braking
6. Speed Control: Suitability to Economic and Efficient Speed Control Methods.
7. Experiment on Braking Characteristics in reference to Plugging and Rheostatic Braking
8. Study of Traction systems
9. Experiment on Power factor improvement.
10. Study of Refrigeration and Air Conditioning.

Books:

Sr. No.	Author	Title	Publisher
01	H. Partab	Art & Science of Utilisation of Electrical Energy	Dhanpat Rai & Sons
02	J. B. Gupta	Utilisation of Electric Power & Electric Traction.	S. K. Kataria & Sons
03	G. C. Garg	Utilisation of Electric Power & Electric Traction.	Khanna Publishers
04	J. Upadhyay S. N. Mahendra	Electric Traction	Allied Publisher Ltd.
05	G. K. Dubey	Fundamentals of Electrical Drives	Narosa Publishing House.

Subject : Power Electronics
Subject Code : ECE504
Total Hours : 42
Full Marks : 80 + 20 = 100

Content:

1. Power semiconductor devices PNPN diodes, DIACS Thyristors, TRIACS, G.T.O. devices. Power Transistors, Power MOSFET, Rating, Losses and Cooling. Triggering circuits for SCR's, UJT, Blocking Oscillators, Schmitt trigger circuits – Power MOS gate drive circuits.

10 hrs

2. Uncontrolled and controlled Rectifiers : Single phase and poly phase Bridge rectifiers. Transformer ratings. Inductive load, free wheeling diodes. Converter operation: Overlap, power factor, inversion, regulation, P-pulse converters, power factor control via PWM converters

6 hrs

3. D.C. line commutation : Series and parallel capacitor turn off, resonant turn off, impulse commutation. D.C. Choppers : Principles, classification, use.

6 hrs

4. Frequency conversion : Cycloconverter single and three phase circuits, blocked group operation, circulating current mode. Single phase and three phase inverters, constant voltage source and constant current source inverters, HF inverters for heating.

12 hrs

5 Application: D.C. and A.C. drives, S.M.P.S., Resonant converters, A.C. Line Filters, ratio, interference suppression. HDVC transmission.

8 hrs

BOOKS :

1. Ramamurthy M – An Introduction to Thysistors and their applications

2. Lauder C W - Power Electronics, 3rd Edn. MHI 1993

3. Sen P C – Power Electronics, TMH

4. Rashid M H – Power Electronics, PHI Pub.

5. Dubey S K – Thysistorised Power Controller; John Wiley & Sons

6. Singh M D & Khanchandni : Power Electronics ; TMH Pub.

7. Dewan S B & Stranghen A – Power Semiconductors circuit

8. Mohan N, Underland T M & Robbins W P : Power Electronics, John Wiley & Sons.

9. Bose B K : Modern Power Electronic ; Jaico Pub. House

10. Dubey G.K.: Thyristorised Power Controllers, New Age International

11. Subramanyam: Power Electronics, New Age International

12. Sugandhi: Thyristors: Theory & Applications, New Age International

Subject : Power Electronics Lab
Subject Code : ECE513

1. study of v-i characteristics of an scr.
2. study of v-i characteristics of a triac.
3. study of different trigerring circuits for thyristor.
4. study of uni- junction transistor (ujt) trigerring circuit.
5. study of a firing circuit suitable for single phase half controlled convertor.
6. simulation on the single phase ac-dc uncontrolled convertor with & without the source inductance.
7. Simulation of a single phase ac to controlled dc convertor with & without the source inductance.
8. single phase half controlled bridge convertor with two thyristors & two diodes.
9. single phase fully controlled bridge convertor using four thyristors.
10. pspice simulation of dc to dc step down chopper.
11. pspice simulation of single phase controller with r-l load.
12. pspice simulation of pwm bridge invertor of r-l load using mosfet.

Subject : Energy Conservation & Audit (Elective III)
Subject Code : ELE605
Full Marks : 80+20=100
Hours : 42

1. Energy Audit Methodology and recent trends. 11 Hrs

General Philosophy, need of Energy Audit and Management, EC Act, Definition and Objective of Energy Management, General Principles of Energy management. Energy Management Skills, Energy Management Strategy. Economics of *implementation* of energy optimization projects, its constraints, barriers and limitations, Financial Analysis: Simple Payback, IRR, NPV,

Discounted Cash flow;

Report-writing, preparations and presentations of energy audit reports, Post monitoring of energy conservation projects, MIS, Case-studies / Report studies of Energy Audits. Guidelines for writing energy audit report, data presentation in report, findings recommendations, impact of renewable energy on energy audit recommendations. Instruments for Audit and Monitoring Energy and Energy Savings, Types and Accuracy. Case studies of implemented energy cost optimization projects in electrical utilities as well as thermal utilities.

2. Electrical Distribution and Utilization: 11 Hrs

Electrical Systems, Transformers loss reductions, parallel operations, T & D losses, P.F. improvements, Demand Side management (DSM), Load Management, Harmonics & its improvements Energy efficient motors and Soft starters, Automatic power factor Controllers, Variable speed drivers, Electronic Lighting ballasts for Lighting, LED Lighting, Trends and Approaches. Study of 4 to 6 cases of Electrical Energy audit and management (Power factor improvement, Electric motors, Fans and blowers, Cooling Towers, Industrial/Commercial Lighting system,

3. Thermal Systems: 10 Hrs

Boilers- performance evaluation, Loss analysis, Water treatment and its impact on boiler losses, integration of different systems in boiler operation. Advances in boiler technologies, FBC and PFBC boilers, Heat recovery Boilers- it's limitations and constraints. Furnaces- Types and classifications, applications, economics and quality aspects, heat distributions, draft controls, waste heat recovering options, Furnaces refractory- types and sections. Thermic Fluid heaters, need and applications, Heat recovery and its limitations. Insulators- Hot and Cold applications, Economic thickness of insulation, Heat saving and application criteria. Steam Utilization Properties, steam distribution and losses, steam trapping, Condensate, Flash steam recovery.

4. System Audit of Mechanical Utilities: 10 Hrs

Pumps, types and application, unit's assessment, improvement option, parallel and series operating pump performance. Energy Saving in Pumps & Pumping Systems. Bloomers (Blowers) types & application, its performance assessment, series & parallel operation applications & advantages. Energy Saving in Blowers Compressors types & applications, specific power consumption, compressed air system & economic of system changes. Energy Saving in Compressors & Compressed Air Systems Cooling towers, its types and

performance assessment & limitations, water loss in cooling tower. Energy Saving in Cooling Towers .Study of 4 to 6 cases of Energy Audit & Management in Industries (Boilers, Steam System, Furnaces, Insulation and Refractory, Refrigeration and Air conditioning, Cogeneration, Waste Heat recovery etc.)Study of Energy Audit reports for various Industries and Organizations.

Subject : Energy Conservation & Audit Lab (Elective III)
Subject Code : ELE611

List of Experiments

1. Calculation of energy units based on points
2. Selection of points based on illumination required in any room of installation
3. Report writing about faults and excessive billing
4. Impact of solar system installation for 10 % load in any establishment
5. Power Factor improvement.
6. Study of FBC & PFBC.
7. Study of Boilers and Properties of fittings on them.
8. Study of Pumps
9. Study of Pumps in series operation.
10. Study of Pumps in parallel operation

Reference Books:

1. Energy Audit and Management, Volume-I, IECC Press
2. Energy Efficiency in Electrical Systems, Volume-II, IECC Press
3. Energy Management: W.R.Murphy, G.Mckay, Butterworths Scientific
4. Energy Management Principles, C.B.Smith, Pergamon Press
5. Industrial Energy Conservation, D.A. Reay, Pergammon Press
6. Energy Management Handbook, W.C. Turner, John Wiley and Sons, A Wiley Interscience
7. Industrial Energy Management and Utilization, L.C. Witte, P.S. Schmidt, D.R. Brown, Hemisphere Publication, Washington, 1988
8. Hand Book of Energy Audits, Albert Thumann, P.E., C.E.M. William J. Younger, C.E.M., CRC Press

Subject : Renewable Energy Sources (Elective III)
Subject Code : ELE606
Full Marks : 80+20=100
Hours : 42

Content:

INTRODUCTION [8 hours]
World Energy Use – Reserves of Energy Resources – Environmental Aspects of Energy Utilisation – Renewable Energy Scenario in Jharkhand, India and around the World – Potentials – Achievements / Applications – Economics of renewable energy systems.

SOLAR ENERGY [8 hours]
Solar Radiation – Measurements of Solar Radiation – Flat Plate and Concentrating Collectors – Solar direct Thermal Applications – Solar thermal Power Generation – Fundamentals of Solar Photo Voltaic Conversion – Solar Cells – Solar PV Power Generation – Solar PV Applications.

WIND ENERGY [8 hours]
Wind Data and Energy Estimation – Types of Wind Energy Systems – Performance – Site Selection – Details of Wind Turbine Generator – Safety and Environmental Aspects

BIO–ENERGY [9 hours]
Biomass direct combustion – Biomass gasifiers – Biogas plants – Digesters – Ethanol production – Bio diesel – Cogeneration – Biomass Applications

OTHER RENEWABLE ENERGY SOURCES [9 hours]
Tidal energy – Wave Energy – Open and Closed OTEC Cycles – Small Hydro-Geothermal Energy – MSD, Hydrogen and Storage – Fuel Cell Systems – Hybrid Systems.

Subject : Renewable Energy Sources Lab (Elective III)

Subject Code : ELE612

List of Experiments:

1. Study of Solar Unit
2. Study of Solar Dryer
3. Study of Solar Panels and Storage System.
4. Study of Wind Mills
5. Study of Wind turbine generator
6. Impact of Wind Speed on Turbine Generator
7. Visit to Biogas Plant
8. Generation of Bio diesel from Biomass
9. Study of Wave Energy Generator
10. Study of Hybrid Energy Generation System

TEXT BOOKS:

- Rai. G.D., “Non Conventional Energy Sources”, Khanna Publishers, New Delhi, 2011.
- Twidell, J.W. & Weir, A., “Renewable Energy Sources”, EFN Spon Ltd., UK, 2006.

REFERENCES:

- Sukhatme. S.P., “Solar Energy”, Tata McGraw Hill Publishing Company Ltd., New Delhi, 1997.
- Godfrey Boyle, “Renewable Energy, Power for a Sustainable Future”, Oxford University Press, U.K., 1996.
- Tiwari. G.N., Solar Energy – “Fundamentals Design, Modelling & Applications”, Narosa Publishing House, New Delhi, 2002.
- Freris. L.L., “Wind Energy Conversion Systems”, Prentice Hall, UK, 1990.
- Johnson Gary, L. “Wind Energy Systems”, Prentice Hall, New York, 1985
- David M. Mousdale – “Introduction to Biofuels”, CRC Press, Taylor & Francis Group, USA 2010
- Chetan Singh Solanki, Solar Photovoltaics, “Fundamentals, Technologies and Applications”, PHI Learning Private Limited, New Delhi, 2009.

Subject : Bye Laws for Electrical Engineers (Elective III)
Subject Code : ELE 607
Full Marks : 80+20=100
Hours : 42

Content-

1.	Energy Consumption Rules & Laws	04 Hrs
2.	Power point and power calculation in domestic and industrial, commercial establishment Rules	06 Hrs
3.	Energy Audit and Billing/Tariff Rules	06 Hrs
4.	Different Consumers supply Voltage Regulation and Limitations Rules.	05 Hrs
5.	Different BS & ISO Standards for electrical appliances	05 Hrs
6.	Compensation Rules related to Electrical Accidents	04 Hrs
7.	Electrical cables and wires Rules	04 Hrs
8.	Rules Related to High Power Units locations in Domestic areas.	04 Hrs
9.	Workman eligibility and compensation rules for Electricians	04 Hrs

Subject : Bye Laws for Electrical Engineers Lab (Elective III)
Subject Code : ELE 613

List of Experiments

Report Writing based on the following topics

1 Energy Consumption Rules & Laws
2. Power point and power calculation in domestic and industrial Rules.
3. Electrical commercial establishment Rules
4. Energy Audit and Billing/Tariff Rules
5. Different Consumers supply Voltage Regulation and Limitations Rules.
6. Different BS & ISO Standards for electrical appliances
7. Compensation Rules related to Electrical Accidents
8. Electrical cables and wires Rules
9. Rules Related to High Power Units locations in Domestic areas.
10. Workman eligibility and compensation rules for Electricians.

Books:

1. Different Act & Laws Promulgated by GoI
2. Different Rules Adopted by Jharkhand Govt related to Electrical supply and Transmission

Subject : Smart Grid (Elective IV)
Subject Code : ELE608
Full Marks : 80+20=100
Hours : 42

Content

1. Introduction to Smart Grid, Architecture of Smart Grid System, Standards for Smart Grid System, Elements and Technologies of Smart Grid System 6 Hrs

2. Communication Technologies for Power System:

   Fiber Optical Networks, WAN based on Fiber Optical Networks, IP based Real Time data Transmission, Substation communication network, Zigbee.Information System for Control Centers (ICCS): ICCS Configuration, ICCS communication Network, ICCS Time Synchronization.
   E-Commerce of Electricity, GIS, GPS 8 Hrs

3. Integration, Control and Operation of Distributed Generation:
   Distributed Generation Technologies and its benefits, Distributed Generation Utilization Barriers, Distributed Generation integration to power grid. 10 Hrs

4. Monitoring the smart grid: 10 Hrs
   Load dispatch centers, wide-area monitoring control and protection of Micro

5. Micro grid: 8 Hrs
   Integration of distributed energy sources; concept, operation, control and protection of Micro

Subject : Smart Grid Lab (Elective IV)
Subject Code : ELE614

List of Experiments"

1. Study of Architecture of Smart Grid
2. Fiber Optical Network Study
3. Study of Smart Control Panel at sub station
4. Study of Smart metering of Consumers
5. Optimization of Energy Consumption through Smart Grid
6. Study of Load Dispatch through Smart Grid
7. Study of Phasor Measurement Unit
8. Study of Concept of Islanding
9. Study of communication infrastructure for Smart Grid
10. Study of Smart Billing System

Reference Books:

1. Smart power grids by A Keyhani, M Marwali.
2. Computer Relaying for Power Systems by ArunPhadke
3. Microgrids Architecture and control by Nikos Hatziargyriou
4. Renewable Energy Systems by Fang Lin Luo, Hong Ye
5. Voltage-sourced converters in power systems_ modeling, control, and applications by Amirnaser Yazdani, Reza Iravani" grid. Hybrid Power Systems: Integration of conventional and non- conventional energy sources.

Subject : VLSI (Elective-IV)
Subject Code : ECE507
Total Hours : 42
Full Marks : 80 + 20 = 100

Content-

1. Introduction: 8 hrs
   Introduction to Computer-aided design tools for digital systems. Hardware description languages, Introduction to VHDL, Data objects, Classes and data types, Operators, Overloading, and Logical operators. Types of delays, Entity and Architecture declaration Introduction to behavioral, dataflow and structural models
2. VHDL Statements: 6 hrs
   Assignment statements, Sequential Statements and Process, Conditional Statements, Case Statements, Array and Loops, Resolution Functions, Packages & Libraries, Concurrent Statements.
3. Applications of VHDL: 8 hrs
   Combinational Circuit Design such as such as Multiplexers, Encoders, Decoders, Code Converters, Comparators, and Implementation of Boolean functions etc., Sequential Circuit Design such as Shift registers, Counters etc.
4. Review of MOS Devices: 6 hrs
   MOS Structure, Enhancement & Depletion Transistor, Threshold Voltage, MOS device design equations MOS Transistor Models. NMOS, PMOS, CMOS.
5. Basic Electrical Properties and Circuit Concepts: 8 hrs
   The NMOS Inverter and Transfer Characteristics pull up and pull down ratios of NMOS, alternative forms of pull up the CMOS Inverter and transfer characteristics. CMOS Inverter Delays. Driving large Capacitive loads, Propagation delays and effect of wiring capacitance.
6. Circuit Characterization and Performance Estimation: 6 hrs
   Estimation of R, C, L, Switching Characteristics-delay models. Power dissipation. Scaling of MOS circuits. Effect of device scaling on circuit performance.

Subject : VLSI Lab (Elective-IV)
Subject Code : ECE515

List of Experiments: Combinational Design Exercises

1. Design of basic Gates: AND, OR, NOT.
2. Design of universal gates
3. Design of 2:1 Mux using other basic gates
4. Design of 2 to 4 Decoder
5. Design of Half-Adder, Full Adder, Half Substractor, Full Substractor
6. Design of 3:8 Decoder
7. Design of 8:3 Priority Encoder
8. Design of 4 Bit Binary to Grey code Converter

9. Design of 4 Bit Binary to BCD Converter using sequential statement

10. Design an 8 Bit parity generator (with for loop and Generic statements)

11. Design of 2,s Complementary for 8-bit Binary number using Generate statements Sequential Design Exercises

12. Design of all type of Flip-Flops using (if-then-else) Sequential Constructs

13. Design of 8-Bit Shift Register with shift Right, Rhisft Left, Load and Synchronous reset.

14. Design of Synchronous 8-bit Johnson Counter.

15. Design of Synchronous 8-Bit universal shift register (parallel-in, parallel-out) with 3- state output (IC 74299)

16. Design of 4 Bit Binary to BCD Converter using sequential statement.

17. Design counters (MOD 3, MOD 5, MOD 8, MOD 16)

18. Design a decimal up/down counter that counts up from 00 to 99 or down from 99 to 00.

19. Design 3-line to 8-line decoder with address latch

Recommended Text Books:

1. ―A VHDL Primmer‖: Bhasker; Prentice Hall 1995.

2. Weste and Eshrighian, ―Principle of CMOS VLSI Design‖ Pearson Education, 2001.

3. Pucknell D A and Eshraghian K, ―Basic VLSI Design‖, Prentice Hall India, New Delhi (2003).

4. Fundamentals of Digital Logic with VHDL Design: Brown and Vranesic; TMH(2000)

5. S. M. Kang, Y. Lebiebici, ―CMOS digital integrated circuits analysis & design‖ TMH, 3rd Edition.

Subject : Digital Signal Processing (Elective-IV)
Subject Code : ECE511
Total Hours : 42
Full Marks : 80 + 20 = 100

Content-

UNIT I Introduction: 14

Limitations of analog signal processing, Advantages of digital signal processing and its applications; Some elementary discrete time sequences and systems; Basic elements of digital signal processing such as convolution, correlation and autocorrelation, Concepts of stability, causality, linearity, difference equations. DFT and its properties; Linear Periodic and Circular convolution; Linear Filtering Methods based on DFT; Fast Fourier Transform algorithm using decimation in time and decimation frequency techniques; Goertzel algorithm.

UNIT II The Z Transform: 8 hrs

Introduction, Z-Transform, Region of convergence; Inverse Z Transform methods, properties of Z transform.

UNIT III Design of Digital Filters: 14 hrs

Structures of realization of discrete time system, direct form, Cascade form, parallel form and lattice structure of FIR and IIR systems. Linear Phase FIR filters; Design methods for FIR filters; IIR filter design by Impulse Invariance, Bilinear Transformation, Matched Z-Transformation, Analog and Digital Transformation in the Frequency Domain. Finite Precision Effects: Fixed point and Floating point representations, Effects of coefficient unitization, Effect of round off noise in digital filters, Limit cycles.

UNIT IV DSP Processors: 6 hrs

Architectures of ADSP and TMS series of processor.

RECOMMENDED TEXT BOOK

1. Digital Signal Processing Principles, Algorithms and Application John G Proakis, Dimtris G Manolakis 4th 2009.

Books Recommended

1. Discrete-Time Signal Processing Alan V Oppenheim, Ronald W Schafer, John R Back 2nd 2008, Prentice Hall.
2. Digital Signal Processing S. Salivahan, A Vallavaraj, Gnanpiya 1st 2008 Tata McGraw Hill.
3. Digital Signal Processing-A computer based approach S. K. Mitra 1st 2006 Tata McGraw Hill
4. Jervis, —Digital Signal Processingl, Pearson Education India.
5. Introduction to Digital Signal Processing Johny R. Johnson 1st 2006, Prentice Hall.

Subject : Digital Signal Processing Lab (Elective-IV)
Subject Code : ECE519

List of Experiments:

Perform the following exercises using MATLAB

To develop elementary signal function modules (m-files) for unit sample, unit step, exponential and unit ramp sequences.

2. Write a program in MATLAB to generate standard sequences.

3. Write a program in MATLAB to compute power density spectrum of a sequence.

4. To develop program modules based on operation on sequences like signal Shifting, signal folding, signal addition and signal multiplication.

5. Write a program in MATLAB to verify linear convolution.

6. Write a program in MATLAB to verify the circular convolution.

7. To develop program for finding magnitude and phase response of LTI system Described by system function H(z).

8. To develop program for finding response of the LTI system described by the difference equation.

9. To develop program for computing inverse Z-transform.

10. To develop program for computing DFT and IDFT.

11. To develop program for conversion of direct form realization to cascade form realization.

12. To develop program for cascade realization of IIR and FIR filters.

13. To develop program for designing FIR filter.

14. To develop program for designing IIR filter.

15. To write a MATLAB program for noise reduction using correlation and autocorrelation methods.

Subject : Communication System (Elective-IV)
Subject Code : ELE609
Full Marks : 80+20=100
Hours : 42

Content -

Chapter	Chapter Name & Content	Hours
1	**Introduction to electronic communication** 1.1 Importance 1.2 Block diagram of communication system 1.3 Modulation 1.3.1 Need for modulation 1.4 Types of Electronics communications 1.4.1 Simplex 1.4.2 Duplex – Full & Half 1.4.3 Digital 1.4.4 Analog 1.5 Applications of communication 1.6 The electromagnetic spectrum (different bands &their frequencies) 1.7 Concept of Transmission band width.	04
2	**Amplitude modulation & Frequency modulation** 2.1 Definition 2.2 Modulation index – definition, its effect on modulated signal, simple numerical. 2.3 Mathematical representation of amplitude modulated wave & its meaning (concept of sidebands) 2.4 Bandwidth requirement 2.5 Representation of AM signal in time & frequency domain. 2.6 Power relation in AM wave, simple numerical. 2.7 Frequency modulation (definition) 2.8 Definition – Deviation ratio, max. Deviation ratio. 2.8 Mathematical representation of frequency modulation and its meaning. 2.9 Representation of frequency modulated signal in time domain and frequency domain. 2.10 Bandwidth representation – simple numerical 2.11 FM signal generation using reactance modulator circuit (transistorized) 2.12 Concept with graph – pre emphasis and de-emphasis. 2.13 Block diagram of FM transmitter explanation with waveform (Armstrong frequency modulation system)	09
3	**Wave Propagation** 3.1 Fundamental of electromagnetic wave. 3.2 Transverse electromagnetic wave, Polarization. 3.3 Ground wave 3.4 Ionosphere 3.5 Sky wave propagation 3.6 Concept of actual height and virtual height. 3.7 Definition – critical frequency, max. useable frequency, skip distance, fading	06

	3.8 Space wave propagation. 3.9 Duct propagation 3.10 Troposphere scatter propagation	
4	**Introduction of Digital communication** 4.1 Basic digital communication system, block diagram 4.2 Channel capacity – definition, Hartley's law, Shannon – Hartley theorem, Channel capacity equation, channel noise and its effect, entropy 4.3 Advantages and disadvantages of digital communication	**04**
5	**Pulse Communication** 5.1 Introduction, comparison with Continuous Wave Modulation, advantages 5.2 Sampling theorem, Nyquist rate, aliasing, natural & Flat top sampling. 5.3 PAM, PWM, PPM definition, generation, block diagram, waveform analysis, and their comparison. 5.4 Pulse code modulation- block diagram of PCM transmitter & receiver, sampling quantization, quantization error, compading, inter symbol interference 5.5 Delta modulation – block diagram of DM, slope overload, granular noise. 5.6 ADM, DPCM, block diagram and its working.	**14**
6	**Multiplexing and Multiple Access** 6.1 Need of Multiplexing, TDM, FDM definition block diagram and their comparison. 6.2 Introduction to WDM. 6.3 Access technique TDMA, FDMA, CDMA (only concept), advantages of TDMA over FDMA.	**05**
	Total	**42 hours**

Subject : Communication System Lab (Elective-IV)
Subject Code : ELE615

Based on the theoretical paper, faculty will be decide minimum 10 Experiments to be performed by the Students.

Books:

SI. No.	Subject Name	Author's Name	Publication
1	Electronic Communication System	George Kennedy	TMH
2	Electronic Communication	Dennish Roddy& John Colen	PHI
3	Communication Electronics - Principles& Applications	Louis E Frenzel -3rd edition	TMH
4	Communication System	Sanjay Sharma	S.K. Kateria & sons
5	Digital Communication	Siman Haykin	John wiley& sons
6	Analog & Digital Communication	HSU & Mitra	TMH

Subject : Professional Practices (Common Paper)
Subject Code : 602

Rationale:

Most of the diploma holders join industries. Due to globalization and competition in the industrial and service sectors the selection for the job is based on campus interviews or competitive tests.

While selecting candidates a normal practice adopted is to see general confidence, ability to communicate and attitude, in addition to basic technological concepts.

The purpose of introducing professional practices is to provide opportunity to students to undergo activities which will enable them to develop confidence. Industrial visits, expert lectures, seminars on technical topics and group discussion are planned in a semester so that there will be increased participation of students in learning process.

Activities to be undertaken:

Students are expected to undertake these activities:

1. Acquire information from different sources (Print and electronic) on the topics of specialization and related to the subjects of II and final year. The class is to be divided in groups of not more than five to six students in a group and all groups are to be allotted topic of their choice. The topic should not be repeated to other group for originality of work to be performed by the group. This activity will develop interdependence and leadership among the students.

2. Prepare notes for given topic at point no 1. The notes will be in form of a project report, having all the sections of report. The report should not be of 30 – 50 pages.

3. Prepare presentation and Present the learning and finding on given topic in a seminar. The presentation should be prepared in Power Point module having more than 25 slides. All students should be asked to deal with suitable parts decided by the group itself.

4. Interact with peers to share thoughts. After the final presentation the students should be encouraged to interact with the faculty members, students' fellows and other experts for suggestions and advanced and structured learning.

5. Undertake industrial visit of their area and choice. Prepare a report on industrial visit. Expert lectures on the topic selected may be invited for the students and these expert lectures also the students should be asked to prepare a report and present the same in seminar or have a group discussion before the expert and faculty members.

6. Develop entrepreneurial traits. Students group may be asked to have a field survey and product assessment and analysis for a product of their choice. Prepare a report for all the inputs of their requirement and submit it for evaluation.

7. To prepare for start ups. Expert lectures for exploring this option may be arranged as this is also a viable option and much talked about option for self employment and avail the encouragement by the government.

Based on the above rationales students will advised to develop traits under guidance of dedicated faculty members / mentors.