STATE COUNCIL FOR TECHNICAL EDUCATION AND VOCATIONAL TRAINING, ODISHA

TEACHING AND EVALUATION SCHEME FOR 6th Semester Electrical engineering (I&C) (wef 2020-21)

Subject Number	Subject Code	Subject	Periods/week			Evaluation Scheme			
			L	T	P	Internal Assessment/ Sessional	End Sem Exams	Exams (Hours)	Total
		Theory							
Th.1		Advance Communication Engineering	5	-		20	80	3	100
Th.2		Switchgear & Protective Devices	5	-		20	80	3	100
Th.3		Digital Signal Processing	4	1		20	80	3	100
Th.4		Elective (any one) a. Renewable Energy Sources b. Testing & Maintenance of Electrical Machine	4	1	-	20	80	3	100
		Total	18	02		80	320	-	400
		Practical							
Pr.1		Advance Communication Engineering Lab.			3	50	50	3	100
Pr.2		MATLAB & Processing Simulation Lab			3	25	50	3	75
Pr.3		Project Phase-II			8	50	100	3	150
Pr.4		Life skill			2	25	-	-	25
		Student Centered Activities(SCA)		-	3	-	-	-	-
		Total	-	-	*19*	*150*	*200*	-	*350*
		Grand Total	**18**	**02**	**19**	**230**	**520**	**-**	**750**

Abbreviations: L-Lecturer, T-Tutorial, P-Practical . Each class is of minimum 55 minutes duration

Minimum Pass Mark in each Theory subject is 35% and in each Practical subject is 50% and in Aggregate is 40%

SCA shall comprise of Extension Lectures/ Personality Development/ Environmental issues /Quiz /Hobbies/ Field visits/ cultural activities/Library studies/Classes on MOOCS/SWAYAM etc. ,Seminar and SCA shall be conducted in a section.

There shall be 1 Internal Assessment done for each of the Theory Subject. Sessional Marks shall be total of the performance of individual different jobs/ experiments in a subject throughout the semester

CURRICULLUM OF 6TH SEMESTER

For

DIPLOMA IN ELECTRICAL ENGINEERING

(I&C)

(Effective from 2020-21 Sessions)

STATE COUNCIL FOR TECHNICAL EDUCATION & VOCATIONAL TRAINING, ODISHA, BHUBANESWAR

TH.1. ADVANCE COMMUNICATION ENGINEERING

Name of the Course: Diploma in Electrical I&C			
Course code:	TH.1	Semester	6th
Total Period:	60	Examination	3 hrs
Theory periods:	5P / week	Class Test:	20
Tutorial:	-	End Semester Examination:	80
Maximum marks:	100		

A. RATIONALE:

The Communication has a wide long history, of application in different technology. This subject deals with different advanced techniques of Communication Engineering. The Microwave Engineering, Radar and Navigation aids an example of Communication system. The Satellite, Mobile and Optical Fiber Communication has today permeated almost every field of modern society. This has been incorporated in this subject.

B. OBJECTIVE:

After completion of this subject the student will be able to know:

1. Discuss the principles of RADAR system & types
2. State the various uses of radar in field of navigation system and aircraft Landing system.
3. Define & Describe Satellite Orbital patterns and categories(LEO,MEO& GEO)
4. Describe geostationary satellite, satellite earth station & Link Station.
5. Explain the working of direct broadcast system (DBS) & VSAT system.
6. Compare the advantage and disadvantage of optical fiber metallic cables
7. Describe how light wave propagate to optical fiber& .Know source & detector
8. Define the modes of propagation and index profile of optical fiber
9. Discuss the operation of Basic Telephone System & Electronic Telephone System.
10. Describe the working of a PBX.
11. Concept of wireless communication

C. Topic wise distribution of periods:

Sl. No.	Topics	Period
1.	RADAR & NAVIGATION AIDS	10
2.	SATELLITE COMMUNICATION	15
3.	OPTICAL FIBER COMMUNICATION	15
4.	TELECOMMUNICATION SYSTEM	10
5.	Data Communication	10
6.	WIRELESS COMMUNICATION	15
	Total:	**75**

D. COURSE CONTENTS:

1. RADAR & NAVIGATION AIDS.

1.1 Basic Radar, advantages & applications

1.2 Working principle of Simple Radar system , its types

1.3 Radar range equation &Performance factor of radar.
1.4 Working principle of Pulsed Radar system.
1.5 Function of radar indication and Working principle of moving target indicator.
1.6 Define Doppler effect&Working principle of C.W Radar.
1.7 Radar aids to Navigation
1.8 MTI Radar- working principle
1.8 Aircraft landing system.
1.9 Navigation Satellite System.(NAVSAT) & GPS System

2. SATELLITE COMMUNICATION

2.1 Basic Satellite Transponder & Kepler's Laws
2.2 Satellite Orbital patterns and elevation(LEO,MEO & GEO) categories
2.3 Concept of Geostationary Satellite, calculate its height, velocity & round trip time delay & their advantage & disadvantage
2.4 Working of the Satellite sub system
2.5 Satellite frequency allocation and frequency bands.
2.6 General structure of satellite Link system (Uplink, Down link, Transponder, Crosslink)
2.7 Working principle of direct broadcast system (DBS)
2.8 Working principle of VSAT system.
2.9 Define multiple accessing & name various types.
2.10 Time Division Multiple Accessing(TDMA) & Code Division Multiple Accessing (CDMA) – block diagram, its advantages & dis-advantages.
2.11 Satellite Application- Communication Satellite(MSAT), Digital Satellite Radio.
2.12 Working principle of GPS Receiver & Transmitter& applications.
2.13 Optical Satellite Link transmitter & Receiver

3. OPTICAL FIBER COMMUNICATION.

3.1 Basic principle of Optical communication.
3.2 Compare the advantage and disadvantage of optical fibres&metallic cables
3.3 Electromagnetic Frequency and wave line spectrum
3.4 Types of optical fibres&principles of propogation in a fibre using Ray Theory
3.5 Optical fiber construction
3.6 Define terms: Velocity of propagation, Critical angle, Acceptance angle numericalaperture
3.7 Optical fibre communication system- block diagram & working principle
3.8 Modes of propagation and index profile of optical fiber
3.9 Types optical fiber configuration: Single-mode step index, Multi-mode step index, Multi-mode Graded index
3.10 Attenuation in optical fibers – Absorption losses, scattering, losses, bending losses, core and cladding losses- Dispersion – material Dispersion, waveguide dispersion, Intermodal dispersion
3.11 Optical sources(Transmitter) & types – LED- semiconductor laser diodes
3.12 LASER -its working principles, block diagram using laser feedback control circuit
3.13 Optical detectors – PIN and APD diodes &Block diagram using

APDConnectors and splices –Optical cables - Couplers

3.14 Optical repeater & Single Channel system

3.15 Applications of optical fibres – civil, Industry and Military application

3.16 Concept of Wave Length Division Multiplexing (WDM) principles.

4. TELECOMMUNICATION SYSTEM

4.1 Working of Electronic Telephone System. (Telephone Set)

4.2 Function of switching system.& Call procedures

4.3 Space and time switching.

4.4 Numbering plan of telephone networks (National Schemes & International Numbering)

4.5 Working principle of a PBX & Digital EPABX.

4.6 Units of Power Measurement.

4.7 Working principle of Internet Protocol Telephone

4.8 Working principle of Internet Telephone

5. Data Communication

5.1 Basic concept of Data Communication

5.2 Architecture, Protocols and Standards

5.3 Data Communication Circuits

5.4 Types of Transmission & Transmission Modes

5.5 Data Communication codes

5.6 Basic idea of Error control & Error Detection

5.7 MODEM & its basic block diagram& common features Voice Band Modem

6. WIRELESS COMMUNICATION

6.1 Basic concept of Cell Phone,frequency reuse channel assignment strategic handoff co-channel Interference and system capacity of a Cellular Radio systems.

6.2 Concept of improving coverage and capacity in cellular system (Cell Splitting, Sectoring)

6.3 Wireless Systems and its Standards.

6.4 Discuss the GSM (Global System for Mobile) service and features.

6.5 Architecture of GSM system & GSM mobile station &channel types of GSM system.

6.6 working of forward and reveres CDMA channel,the frequency and channel specifications

6.7 Architecture and features of GPRS.

6.8 Discuss the mobile TCP, IP protocol.

6.9 Working of Wireless Application Protocol (WAP).

6.10 Features of SMS, MMS, 1G,2G, 3G, 4G& 5G Wireless network.

6.11 Smart Phone and discuss its features indicate through Block diagram.

Syllabus coverage up to Internal assessment

Chapters: 1, 2, 3 and 4.

Learning Resources:

1. Optical Fiber comm. Principles and practice John M.Senior.

2. Communication Systems by V. Chandra Sekhar-OXFORD
3. Microwave Engineering- M. Kulkarni – UMESH Pub
4. Telecommunication and the computer – James Martine
5. Advance Electronics Communication System-Wayne Tomasi
6. Principle of Electronics Telecommunication system – CoulsE.frenzel.
7. Satellite Comm.- Rebort M.Gagriardi
8. Optical Fiber Communication Essentials by Greb Keiser-TMH
9. Rader& Microwave engineering- G.S.N Raju
10. Optical Fibre communication system by SK Sarkar-Schand

TH.2. SWITCH GEAR AND PROTECTIVE DEVICES

Name of the Course: Diploma in Electrical I&C			
Course code:	TH.2	Semester	6th
Total Period:	75	Examination	3 hrs
Theory periods:	5P / week	Class Test:	20
Tutorial:	-	End Semester Examination:	80
Maximum marks:	100		

E. RATIONALE:

Switch gear and protection plays an important role in the protection of electrical power system. Since the demand of electrical power is increasing the job of generation, transmission & distribution of electrical energy is becoming very completed. To maintain the energy supply to the consumer switching producer with protection is to be maintained moreover new models of switch gear and protection circuits are also being developed. The use of interconnection bus with National power grid type of switch gear and protecting devices need to be trained in proper manners. In the subject information on above context has been included so that the updated knowledge can be given to the students.

F. OBJECTIVE:

After completion of this subject the student will be able to know:

1) The basic principles of protection of alternator, transformer and feeders.
2) Fuse and Circuit breaker.
3) Protective Relay.
4) Lighting Arrestor.
5) Calculation of symmetrical fault current.

G. Topic wise distribution of periods:

Sl. No.	Topics	Period
1	Introduction to switchgear	6
2	Fault calculation	10
3	Fuses	6
4	Circuit breakers	10
5	Protective relays	8
6	Protection of electrical power equipment and lines	6
7	Protection against over voltage and lighting	8
8	Static relay	6
	Total:	**75**

H. COURSE CONTENTS:

1. INTRODUCTION TO SWITCHGEAR

1.1 Essential Features of switchgear.
1.2 Switchgear Equipment.
1.3 Bus-Bar Arrangement.
1.4 Switchgear Accommodation.
1.5 Short Circuit.
1.6 Short circuit.
1.7 Faults in a power system.

2. FAULT CALCULATION

2.1 Symmetrical faults on 3-phase system.
2.2 Limitation of fault current.

2.3 Percentage Reactance.
2.4 Percentage Reactance and Base KVA.
2.5 Short – circuit KVA.
2.6 Reactor control of short circuit currents.
2.7 Location of reactors.
2.8 Steps for symmetrical Fault calculations.
2.9 Solve numerical problems on symmetrical fault.

3. FUSES

3.1 Desirable characteristics of fuse element.
3.2 Fuse Element materials.
3.3 Types of Fuses and important terms used for fuses.
3.4 Low and High voltage fuses.
3.5 Current carrying capacity of fuse element.
3.6 Difference Between a Fuse and Circuit Breaker.

4. CIRCUIT BREAKERS

4.1 Definition and principle of Circuit Breaker.
4.2 Arc phenomenon and principle of Arc Extinction.
4.3 Methods of Arc Extinction.
4.4 Definitions of Arc voltage, Re-striking voltage and Recovery voltage.
4.5 Classification of circuit Breakers.
4.6 Oil circuit Breaker and its classification.
4.7 Plain brake oil circuit breaker.
4.8 Arc control oil circuit breaker.
4.9 Low oil circuit breaker.
4.10 Maintenance of oil circuit breaker.
4.11 Air-Blast circuit breaker and its classification.
4.12 Sulphur Hexa-fluoride (SF6) circuit breaker.
4.13 Vacuum circuit breakers.
4.14 Switchgear component.
4.15 Problems of circuit interruption.
4.16 Resistance switching.
4.17 Circuit Breaker Rating.

5. PROTECTIVE RELAYS

5.1 Definition of Protective Relay.
5.2 Fundamental requirement of protective relay.
5.3 Basic Relay operation
  5.3.1. Electromagnetic Attraction type
  5.3.2. Induction type
5.4 Definition of following important terms
5.5 Definition of following important terms.
  5.5.1. Pick-up current.
  5.5.2. Current setting.
  5.5.3. Plug setting Multiplier.
  5.5.4. Time setting Multiplier.
5.6 Classification of functional relays
5.7 Induction type over current relay (Non-directional)
5.8 Induction type directional power relay.
5.9 Induction type directional over current relay.

5.10 Differential relay
5.10.1. Current differential relay
5.10.2. Voltage balance differential relay.
5.11 Types of protection

6. PROTECTION OF ELECTRICAL POWER EQUIPMENT AND LINES

6.1 Protection of alternator.
6.2 Differential protection of alternators.
6.3 Balanced earth fault protection.
6.4 Protection systems for transformer.
6.5 Buchholz relay.
6.6 Protection of Bus bar.
6.7 Protection of Transmission line.
6.8 Different pilot wire protection (Merz-price voltage Balance system)
6.9 Explain protection of feeder by over current and earth fault relay.

7. PROTECTION AGAINST OVER VOLTAGE AND LIGHTING

7.1. Voltage surge and causes of over voltage.
7.2. Internal cause of over voltage.
7.3. External cause of over voltage (lighting)
7.4. Mechanism of lightning discharge.
7.5. Types of lightning strokes.
7.6. Harmful effect of lightning.
7.7. Lightning arresters and Type of lightning Arresters.
7.7.1. Rod-gap lightning arrester.
7.7.2. Horn-gap arrester.
7.7.3. Valve type arrester.
7.8. Surge Absorber

8. STATIC RELAY:

8. 1 Advantage of static relay.
8. 2 Instantaneous over current relay.
8. 3 Principle of IDMT relay.

Syllabus coverage up to Internal assessment

Chapters: 1, 2, 3 and 4.

Learning Resources:

Sl.No	Title of the Book	Name of Authors	Publisher
1	Principle of power system	V. K. Mehta	S Chand
2.	Protection and Switchgear	Bhavesh Bhalja R.P Maheshwari Nilesh G. Chothani	OXFORD
2	Electrical power	Soni, Gupta and Bhatnagar	Dhanpat Rai & Sons
3	Power system protection & switch gear	Bhuvanesh Oza	TMH
4	Electrical Power	S. L. Uppal	Khanna Publisher
5	Protection and Switchgear	Raghuraman	SCITECH

TH.3. DIGITAL SIGNAL PROCESSING

Name of the Course: Diploma in Electrical I&C			
Course code:	TH.3	Semester	6th
Total Period:	60	Examination	3 hrs
Theory periods:	4P / week	Class Test:	20
Tutorial:	1P/ week	End Semester Examination:	80
Maximum marks:	100		

A. RATIONALE:

DSP, or Digital Signal Processing, as the term suggests, is the processing of discrete-time signals bydigital means. A signal in this context can mean a number of different things. Historically theorigins of signal processing are in electrical engineering, and a signal here means anelectrical signal carried by a wire or telephone line, or perhaps by a radio wave. Moregenerally, however, a signal is a stream of information representing anything from stockprices to data from a remote-sensing satellite. A digital signal consists of a stream of numbers,usually (but not necessarily) in binary form. The processing of a digital signal is done byperforming numerical calculationsDigital signal processing is a technology driven field which dates its growth where Computers and Digital Circuitry became fast enough to process large amount of data efficiently.

B. OBJECTIVE:

After completion of this subject the student will be able to know:

1. To provide background and fundamental materials in discrete time system, digital signal processing technique, design procedures of digital filters and discrete Fourier transform.
2. Understand signal system & signal processing.
3. Differentiate continuous time & discrete time signals.
4. Explain the concepts of frequency in continuous time, discrete time signals and harmonically related complex exponential.
5. Classify the signals like multi-channel, multidimensional, continuous time vs. discrete time signals and continuous valued vs. discrete valued signals.
6. Convert analog signal to digital & vice-versa.
7. State and explain sampling theorem &quantization of continuous-amplitude signals, sinusoidal signals., Analyze digital signal & system verses discrete time signals & systems.
8. Explain discrete time signals & classify discrete-time signals.
9. Describe discrete time systems will block diagrams, classification & interconnections.
10. Analyze liner invariant systems using different techniques.
11. Describe discrete time system using different equations.
12. Apply Z-transform on LTI systems.
13. Know discrete Fourier transform, its properties & state its application.
14. Study of Fast Fourier Transform algorithms & Digital Filters

C. Topic wise distribution of periods:

Sl. No.	Topics	Period
1.	Introduction of Signals, Systems & Signal processing	10
2.	DISCRETE TIME SIGNALS & SYSTEMS	14

3.	THE Z-TRANSFORM & ITS APPLICATION TO THE ANALYSIS OF LTI SYSTEM.	14
4.	DISCUSS FOURIER TRANSFORM: ITS APPLICATIONS PROPERTIES.	12
5.	FAST FOURIER TRANSFORM ALGORITHM & DIGITAL FILTERS	10
	TOTAL	**60**

D. COURSE CONTENTS:

1 Introduction of Signals, Systems & Signal processing

1.1 Basics of Signals, Systems & Signal processing- basic element of a digital signal processing system -Compare the advantages of digital signal processing over analog signal processing.

1.2 Classify signals - Multi channel& Multi-dimensional signals- Continuous time verses Discrete -times Signal. -Continuous valued verses Discrete -valued signals.

1.3 Concept of frequency in continuous time & discrete time signals- Continuous-time sinusoidal signals-Discrete-time sinusoidal signals-Harmonically related complex exponential.

1.4 Analog to Digital & Digital to Analog conversion & explain the following.

a. Sampling of Analog signal,
b. The sampling theorem.
c. Quantization of continuous amplitude signals,
d. Coding of quantized sample.
e. Digital to analog conversion.
f. Analysis of digital systems signals vs. discrete time signals systems.

2 DISCRETE TIME SIGNALS & SYSTEMS.

2.1 Concept of Discrete time signals.
- 2.1.1 Elementary Discrete time signals.
- 2.1.2 Classification Discrete time signal.
- 2.1.3 Simple manipulation of discrete time signal.

2.2 Discrete time system.
- 2.2.1 Input-output of system.
- 2.2.2 Block diagram of discrete- time systems
- 2.2.3 Classify discrete time system.
- 2.2.4 Inter connection of discrete -time system.

2.3 Discrete time time-invariant system.
- 2.3.1 Different techniques for the Analysis of linear system.
- 2.3.2 Resolution of a discrete time signal in to impulse.
- 2.3.3 Response of LTI system to arbitrary inputs using convolution sum.
- 2.3.4 Convolution & interconnection of LTI system - properties.
- 2.3.5 Study systems with finite duration and infinite duration impulse response.

2.4 Discrete time system described by difference equation.
- 2.4.1 Recursive & non-recursive discrete time system.

2.4.2 Determine the impulse response of linear time invariant recursive system.
2.4.3 Correlation of Discrete Time signals

3 **THE Z-TRANSFORM & ITS APPLICATION TO THE ANALYSIS OF LTI SYSTEM.**
- 3.1 Z-transform & its application to LTI system.
  - 3.1.1 Direct Z-transform.
  - 3.1.2 Inverse Z-transform.
- 3.2 Various properties of Z-transform.
- 3.3 Rational Z-transform.
  - 3.3.1 Poles & zeros.
  - 3.3.2 Pole location time domain behaviour for casual signals.
  - 3.3.3 System function of a linear time invariant system.
- 3.4 Discuss inverse Z-transform.
  - 3.4.1 Inverse Z-transform by partial fraction expansion.
  - 3.4.2 Inverse Z-transform by contour Integration

4 **: DISCUSS FOURIER TRANSFORM: ITS APPLICATIONS PROPERTIES.**
- 4.1 Concept of discrete Fourier transform.
- 4.2 Frequency domain sampling and reconstruction of discrete time signals.
- 4.3 Discrete Time Fourier transformation(DTFT)
- 4.4 Discrete Fourier transformation (DFT).
- 4.5 Compute DFT as a linear transformation.
- 4.6 Relate DFT to other transforms.
- 4.7 Property of the DFT.
- 4.8 Multiplication of two DFT & circular convolution

5 **FAST FOURIER TRANSFORM ALGORITHM & DIGITAL FILTERS.**
- 5.1 Compute DFT & FFT algorithm.
- 5.2 Direct computation of DFT.
- 5.3 Divide and Conquer Approach to computation of DFT
- 5.4 Radix-2 algorithm. (Small Problems)
- 5.5 Application of FFT algorithms
- 5.6 Introduction to digital filters.(FIR Filters)& General considerations
- 5.7 Introduction to DSP architecture, familiarisation of different types of processor

Syllabus coverage up to Internal assessment

Chapters: 1, 2, 3 and 4.

Learning Resources:

1. Digital signal processing principles algorithms & applications by J.G.Proakis& Dimities G. Manolakis, Peason.
2. Digital Signal Processing by Ramesh Babu
3. Digital signal processing By A.V.Oppenleim&W.Schafer.
4. Digital Signal Processing by S Salivahanan, AVallavaraj, C Gnanapriya Tata McGHill.

TH.4. RENEWABLE ENERGY SOURCES

(Elective- A)

Name of the Course: Diploma in Electrical I&C			
Course code:	TH.4(A)	Semester	6th
Total Period:	75	Examination	3 hrs
Theory periods:	4 P / week	Class Test:	20
Tutorial:	1 P / week	End Semester Examination:	80
Maximum marks:	100		

A. RATIONALE:

Renewable energy technologies enable us to create electricity, heat and fuel fromrenewable sources. Solar, wind, hydro, wave, heat-exchange, tidal, wave and bioenergy technologies are all powered by the sun, directly or indirectly. The movement of wind and water, the heat and light of the sun, the carbohydrates in plants, and the warmth in the Earth—all are energy sources that can supply our needs in a sustainable way. A variety of methods are used to convert these renewable resources into electricity. Each comes with its own unique set of technologies, benefits, and challenges. Solar energy—power from the sun—is a vast and inexhaustible resource that can supply a significant portion of our electricity needs. A range of technologies is used to convert the sun's energy into electricity, including solar collectors and photovoltaic panels.

B. OBJECTIVE:

After completion of this subject the student will be able to know:

1 Know abut Energy Situation and Renewable Energy Sources
2 DefineRenewable and Non-renewable Energy Sources
3 Know about Solar Radiation & Collectors
4 Explain Flat Plate Collectors
5 What are the Applications of Solar Energy.
6 Explain Solar Drying & Solar Pond
7 Know Passive Space Conditioning & Collectors
8 Know Energy losses
9 Define Solar Thermal Power Plants
10 Define Solar Photovoltaics
11 Explain Wind Energy & Wind Direction ,Measurements & Wind Direction Indicators
12 Explain Wind Energy Converters & Components of a Wind Power Plant
13 Explain Biomass system

C. Topic wise distribution of periods:

Sl. No.	Topics	Period
1	Energy Situation and Renewable Energy Sources	05
2	Solar Radiation & Collectors	06
3	Low-Temperature Applications of Solar Energy.	06
4	Passive Space Conditioning & Collectors	07
5	Solar Thermal Power Plants	08
6	Solar Photovoltaics	08
7	Wind Energy	05
8	Wind Energy Converters	08

9	Energy economics	07
	Total:	**60**

D. COURSE CONTENTS:

1. Energy Situation and Renewable Energy Sources

1.1 Renewable and Non-renewable Energy Sources
1.2 Energy and Environment
1.3 Origin of Renewable Energy Sources
1.4 Potential of Renewable Energy Sources
1.5 Direct-use Technology

2. Solar Radiation & Collectors

2.1 Solar Radiation Through Atmosphere
2.2 Terrestrial Solar Radiation
2.3 Measurement of Solar Radiation
2.4 Classification of Solar Radiation Instruments
2.5 Flat Plate Collectors
2.6 Optical Characteristics

3. Low-Temperature Applications of Solar Energy.

3.1 Swimming Pool Heating
3.2 Solar water Heating Systems
3.3 Natural Convection water Heating Systems
3.4 Solar Drying
3.5 Solar Pond

4. Passive Space Conditioning & Collectors

4.1 Principle Space conditioning
4.2 Passive building concepts- Heating, Direct gain, Indirect Gain, Passive Cooling, Shading,Paints, Collings
4.3 Construction of Concentrator
4.4 Energy losses

5. Solar Thermal Power Plants

5.1 Introduction
5.2 Solar Collection System
5.3 Thermal Storage for Solar Power Plants
5.4 Capacity Factor and Solar Multiple
5.5 Energy Conversion

6. Solar Photovoltaics

1.1 Band Theory of Solids, Physical Processes in a Solar Cell ,
1.2 Solar Cell Characteristics
1.3 Equivalent Circuit Diagram of Solar Cells
1.4 Cell Types - Crystalline Silicon Solar Cell , Solar Cells for Concentrating Photovoltaic Systems , Dye –sensitized Solar Cell (DSC)
1.5 Solar Module
1.6 Further System Components -Solar inverters ,Mounting Systems,Storage Batteries ,Other System Components
1.7 Grid-independent Systems -System Configuration
1.8 Grid-connected Systems -Small Roof Top Systems ,Medium-scale PV Generator ,Centralized System

7. Wind Energy

7.1 Wind Flow and Wind Direction

7.2 Wind Measurements
7.3 Measurement of Pressure Head
7.4 Hot wire Anemometer
7.5 Cup Anemometer (Robinson's Anemometer)
7.6 Wind Direction Indicators

8. Wind Energy Converters

8.1 Historical Development
8.2 Aerodynamic of Rotor Blade -Wind Stream Profile -Buoyancy Coefficient and the Drag Coefficient
8.3 Components of a Wind Power Plant -Wind Turbine -Tower -Electric Generators – Foundation
8.4 Power Control -Slow Rotors; Poor Control Mechanism -Control of Fast Rotors

9. Energy economics:

9.1 Present worth, Life cycle costing (LCC), Annual Life cycle costing(ALCC), Annual savings. calculations for Solar thermal system
9.2 Solar PV system,
9.3 Wind system,
9.4 Biomass system

Syllabus coverage up to Internal assessment

Chapters: 1, 2, 3 and 4.

Learning Resources:

1. Non-Conventional Energy Sources and Utilisation by R.K. Rajput, , S. Chand
2. Solar energy: Principles of Thermal Storage by S P Sukhatme, , Tata Mc Graw Hill
3. Non Conventional Energy Sources by N. K. Bansal
4. Non Conventional Energy Sources by B. H. Khan Tata Mc Graw Hill
5. Solar energy Utilization ByG.D.Rai: Khanna Publisher

TH.4.TESTING AND MAINTENANCE OF ELECTRICAL MACHINE

(Elective- B)

Name of the Course: Diploma in Electrical I&C			
Course code:	TH.4(C)	Semester	6th
Total Period:	60	Examination	3 hrs
Theory periods:	4 P / week	Class Test:	20
Tutorial:	1 P / week	End Semester Examination:	80
Maximum marks:	100		

A. RATIONALE:

This subject intends to be acquainted with application level technology, normally adopted in Industries, commercial, public utility departments such as Electrical transmission and distribution, Irrigation, Water supply etc. The knowledge in this subject will make the readers able for inspection, testing, installation and commissioning of electrical machines as per IS standards. This will help him to initiate total productive maintenance.

B. OBJECTIVE:

After completion of this subject the student will be able to:

1. To acquire knowledge on safety measures and precautions.
2. Testing of DC and AC rotating machines and transformers.
3. Identify common troubles in Electrical machines and switch gear.
4. Plan and carryout routine and preventive maintenance.
5. Install LV switch gear and maintain it.
6. Ascertain the condition of insulation and varnishing. (if necessary)
7. Initiate total productive maintenance.

C. Topic wise distribution of periods:

Sl. No.	Topics	Periods
1.	Installation, Commissioning and Testing of Machine	15
2.	Installation, Commissioning and Testing of Transformer	15
3.	Installation, Commissioning & Testing of Sub-station.	15
4.	Maintenance	15
	Total	**60**

D. COURSE CONTENTS

1. Installation, Commissioning and Testing of Machine:

1.1. Inspection of arrival of machine and inspection procedure before its installation.
1.2. Generalized procedure of installation of Electrical machines.
1.3. Electric wiring for motors and switch gears.
1.4. General requirement for Electric Installation according to Indian Electricity rules.
1.5. Necessity of starters and relays for both DC and AC machines.
1.6. Testing before giving supply and testing report.

2. Installation, Commissioning and Testing of Transformer:

2. 1 Basic idea on dispatch, inspection, storage and handling of transformer.
2. 2 Civil construction feature regarding connection like ventilation, noise level, space for free movement.
2. 3 Foundation and drainage of oil.
2. 4 Cabling and cable box for transformer.
2. 5 Provision for fire protection.
2. 6 Provision for bushing support location of switch gear.
2. 7 Steps for commissioning fitting of all accessories.
2. 8 Filling of oil, drying out.
2. 9 Charging the breather with fresh silica gel.
2. 10 Cleaning of bushing, fixing of conductor & cables, earthing of tank and cover, neutral earthing.
2. 11 Fixing of protection circuits and setting of relays.

3. Installation, Commissioning & Testing of Sub-station.

3 . 1 Design and planning of indoor substation.
3 . 2 General requirement of layout of indoor substation with key diagram.
3 . 3 Consideration of safe operation of substation
3 . 4 Installation of outdoor substation:
3.4.1 Selection of site, transport & receipt of transformer, checking of insulation resistance of the winding, testing of transformer oil, protection fittings, construction of mounting, earthing arrangement and final commissioning.
3 . 5 Testing and commissioning of substation.
3.5.1. Installation of control and relay panels.
3.5.2. Preliminary preparation.
3.5.3. Sequence card for erection of switch gear equipments.
3.5.4. Location of place
3.5.5. Unpacking
3.5.6. Foundation
3.5.7. Erection
3.5.8. Relays
3 . 6 Bus-bar earthing connection, Earthing.
3.6.1. Connection to main cable.
3.6.2. Safety precaution
3 . 7 Installation of outdoor circuit breaker:

3.7.1. Receipt and storage.
3.7.2. Civil works.
3.7.3. Various steps for installation.

3 . 8 Pre-commissioning tests.

4. Maintenance:

4.1 Fundamental of maintenance.
4.2 Preventive maintenance and planning.
[Daily, Weekly, Monthly, Half-yearly and Yearly maintenance.]
4.3 Advantages of Preventive maintenance:
4.4 Breakdown maintenance: List of tools / instruments and materials used for maintenance.
4.5 Making or Preparing Maintenance schedule of DC machines, Induction machines, Synchronous machines, Transformer, Transmission line, Distribution lines, Underground cables, Circuit breakers, Switch gear and protective relays and substations, SF-6 circuit breakers, Batteries in substation.

Syllabus coverage up to Internal assessment

Chapters: 1, and 2.

Learning Resources:			
Sl.No	**Title of the Book**	**Name of Authors**	**Name of Publisher**
1	Installation Commissioning & Maintenance of Electrical Equipments	Tarlok Singh	S. K. Kataria & Sons
2.	Installation Servicing and Maintenance	S N Bhattacharya	S Chand
3.	Testing Commissioning Operation and Maintenance of Electrical Equipments	S Rao	Khanna Publisher
4.	Hand book of Inspection, for all type of Electrical Instruments	Er. R. N. Sahoo	Orissa Power Generation consultants and services
5.	Installation, Maintenance and Repair of Electrical Machines and Equipments	Madhvi Gupta	Katson Books

Pr.1. ADVANCE COMMUNICATION ENGINEERING LAB

Name of the Course: Diploma in Electrical I&C			
Course code:	Pr.1	Semester	6th
Total Period:	45		
Theory periods:	3 P/Week	Sessional:	25
Maximum marks:	75	End Semester Examination:	50

A. RATIONALE:

In this Lab. The student will know the operation & application of RADAR trainer, Satellite Trainer, Optical Fiber kit Trainer & EPABX Trainer for various communication Technology & mobile communications.

B. OBJECTIVE:

After completion of this Laboratories/Practicals the student will be able to know:

1. Setup & Know the Optical Fiber Link including analog& digital.
2. Measure the losses of Optical Fiber.
3. Know EPABX /Satellite/ISDN trainer
4. Various waveform satellite communication Trainer
5. Knowabout mobile communication Trainer Kit

C. LIST OF PRACTICALS:

1. Setting up a fiber optic analog& digital link including source & detector.

2. Study of losses in Optical Fiber:
   a. Measurement of propagation loss.
   b. Measurement of bending loss.
   c. Measurement of connector loss.
   d. How connector loss is affected by fiber and quality

3. Measurement of Numerical aperture by using Optical Fibre Kit

4. Setting of AM, FM, PWM, Modulator & Demodulator using optical fiber kit.

5. Study the following experiments using EPABX Trainer Kit.

   a). To study extension to extension call pickup, direct onward dialing, autocall back, auto attendant, dynamic looking, last extension redial, conference call , call forward, simultaneous ringing, pulsing on trunk, follow me tone and DTMF dialing, Messages on hold, extension baring, trunk baring, caller id for extension to extension & trunk lines, individual memory, clobal memory, call waiting call conference

   b) Study of speech circuit using IC and its interface to line, pulse/tone dialing
   c) Study to subscriber ringing generation circuit and interface to the line.
   d) Study of telephone instrument trainer with caller id facility

6. Study of satellite communication Trainer Kit:
   a. To setup active & passive satellite communication link.
   b. To study up linking and downlinking of satellite signals.

c. To analyze the analog baseband (Voice & Video) Signals in satellite link.
d. To study the digital baseband signals in a satellite link.
e. To setup an analog FM/FDM satellite link

7. Study of Rader Trainer Kit.
a) Study of Doppler shift in Radar.
b) Speed detection & multiple reflections from object.
c) To find out the Time period and frequency of a moving pendulum for different heights.
d) To measure the size of moving objects using Radar.
e) To measure the distance traveled by moving a object.

8. Study of mobile communication Trainer Kit.

9. Study of ISDN Trainer Kit.
a) Basic Rate ISDN exchange with Protocol with Protocol Analyzer.
b) ISDN Telephone sets.
c) ISDN Terminal Adaptors.
d) Analog Telephone sets.

10 Visit to Telephone Exchange / Mobile Network / earth station / Rader Station.

Learning Resources:

1. Hand book of Experiments in Electrical and Communication Engg by s. Poornachandra Rao & B. Sasikala- VIKAS pub

PR.2. MATLAB & PROCESSING SIMULATION LAB

Name of the Course: Diploma in Electrical I&C			
Course code	Pr.2	Semester	6th
Total period:	45	Examination	3 hours
Practical periods	3 P/week	Sessional	25
Maximum marks :	75	End Semester Exam	50

A. RATIONALE:

This *Lab* This *lab* introduces you to implementation and performance aspects of digital linear filters through simple case studies; consolidates your past knowledge on theoretical *DSP*concepts by revisiting topics of quantization and filter phase. The *DSP lab* consists of four of hardware experiments illustrating the programming. The lab assignments contain a short *introduction* to the required theory.MATLAB is a software package for high-performance language for technicalcomputing. It integrates computation, visualization, and programming in an easy-to-use environment where problems and solutions are expressed in familiar mathematical notation. MATLAB was originally writtento provide easy access to matrix software developed by the LINPACK and ISPACK .Today, MATLAB engines incorporate the LAPACK and BLAS libraries,embedding the state of the art in software for matrix computation.MATLAB has evolved over a period of years with input from many users. Inenvironments, it is the standard instructional tool for introductory and advancedcourses in mathematics, engineering, and science. In industry,

B. OBJECTIVE:

After completion of this Laboratories/Practicals the student will be able to know:

I, MATLAB is the tool of choiceTypical uses include the following

1. Math and computation
2. Algorithm development
3. Data acquisition
4. Modeling, simulation, and prototyping
5. Data analysis, exploration, and visualization
6. Scientific and engineering graphics

C. LIST OF PRACTICALS: (***Any 15 experiment)***

A.

1. Write a program to subtract two 16 bit numbers
2. Write a program to multiply two 16 bit numbers
3. Write a program to glow LEDs by selecting switches using digital I/O
4. Write a program to read an analog input using analog to digital converter in start stop mode
5. Write a program to read an analog input using ADC in continuous conversion mode using ADC Interrupt
6. Write a program to read four analog inputs using auto sequencer using ADC of 2407/or Higher

7. Write a program to generate a three phase fixed pwm using event manager
8. Write a program to generate a Fixed Sine PWM
9. Write a program to generate pwm and vary the frequency of PWM using Potentiometer
10. Write a program to vary the speed of DC motor by varying the duty cycle of PWM and tabulate the speed of the motor with respect to Duty cycle
11. To represent basic signals like:Unit Impulse, Ramp, Unit Step,Exponential.
12. To generate discrete sine and cosine signals with given samplingfrequency.
13. To represent complex exponential as a function of real and imaginarypart.
14. To determine impulse and step response of two vectors usingMATLAB.
15. To perform convolution between two vectors using MATLAB.
16. To perform cross correlation between two vectors using MATLAB.
17. To compute DFT and IDFT of a given sequence using MATLAB.
18. To perform linear convolution of two sequence using DFT usingMATLAB.
19. To determine z-transform from the given transfer function and its ROCusing MATLAB.
20. To determine rational z-transform from the given poles and zeros usingMATLAB.
21. To determine partial fraction expansion of rational z-transform usingMATLAB.
22. To design a Type 1 Chebyshev IIR highpass filter using MATLAB.
23. To design an IIR Elliptic low pass filter using MATLAB.
24. To design an IIR Butterworth bandpass filter using MATLAB

Learning Resources:

Develop programming concepts of students reference Websites:

Demo lectures with power point presentations using LCD projector should be arranged to.

Pr.3.PROJECT PHASE- II

Name of the Course: Diploma in Electrical I&C			
Course code:	Pr.2	Semester	6th
Total Period:	120	Examination	3 hrs
Lab. periods:	8 P / week	Sessional	50
Maximum marks:	150	End Sem Examination	100

RATIONALE

Students' Project Work aims at developing innovative skills in the students whereby they apply the knowledge and skills gained through the course covered in many subjects and Labs, by undertaking a project. The prime emphasis of the project work is to understand and apply the basic knowledge of the principles of Electrical engineering and practices in real life situations, so as to participate and manage a large Electrical engineering projects, in future. Entire Project spreads over 5th and 6th Semester. Part of the Project covered in 5th Semester was named as *Project Phase-I* and balance portion to be covered in 6th Semester shall be named as *Project Phase-II*.

OBJECTIVES

After undergoing the Project Work, the student will be able to:

- Implement the theoretical and practical knowledge and skills gained through various subjects/courses into an application suitable for a real practical working environment, preferably in an industrial environment.
- Develop software packages or applications and implement these for the actual needs of the community/industry.
- Identify and contrast gap between the technological knowledge acquired through curriculum and the actual industrial need and to compensate it by acquiring additional knowledge as required.
- Carry out cooperative learning through synchronous guided discussions within the class in key areas, asynchronous document sharing and discussions, as well as prepare collaborative edition of the final project report.
- To achieve real life experience in Project design.
- To develop the skill of writing Project Report

Project Phase-I and Phase-II

The Project work duration covers 2 semesters(5th and 6th sem). The Grouping of students, selection of Project, assignment of Project Guide to the Group was done in the beginning of 5th semester under Project Phase-I. The students were allowed to study literature, any existing system and then define the Problem/objective of the Project. Preliminary work and Design of the system also have to be complete

in Phase-I. Development may also begin in this phase. Project Milestones are to be set so that progress can be tracked .

In Phase-II Development, Testing, Documentation and Implementation have to be complete. Project Report have to be prepared and complete in Phase-II. All Project reports should be organized uniformly in proper order, irrespective of group. Teacher Guides can make suitable alteration in the components of Task and schedule.

At the end of Project Phase-II in 6^{th} semester there shall be one presentation by each group on whole Project work undertaken by them.

A suggestive criterion for assessing student performance by the external (preferably person from industry) and internal (teacher) examiner is given in table below:

Sl. No.	**Performance Criteria**
1.	Selection of project assignment
2.	Planning and execution of considerations
3.	Quality of performance
4.	Providing solution of the problems or production of final product
5.	Sense of responsibility
6.	Self expression/ communication/ Presentation skills
7.	Interpersonal skills/human relations
8.	Report writing skills
9	Viva voce

The teachers are free to evolve other criteria of assessment, depending upon the type of project work.

It is proposed that the institute may organize an annual exhibition of the project work done by the students and invite leading Industrial organisations to such an exhibition.

The Project Report need to be prepared as per standard format and following is the indicative format. The Teacher Guide may make minor alteration keeping the sense in tact.

Organization of Project Report

1. Cover page:
   It should contain the following (in order)
   (i) Title of the Project

(ii) "Submitted in partial fulfillment of the requirements for the Diploma in <Branch Name>"
(iii) By Name of the Student(s)
(iv) Logo of the Institution
(v) Branch Name/Depart Name and Institution Name with Address
(vi) Academic Year

2. 1st Inner page
   Certificate:

   It should contain he following

   "This is to certify that the work in this Project Report entitled <Project Title> by <Name of student(s)> has been carried out under my supervision in partial fulfillment of the requirements for the Diploma in <Branch Name>" during session <session > in <Branch /Department Name> of <Institute name> and this work is the original work of the above student(s).

   Seal and signature of the Supervisor/Guide with date

3. 2nd Inner Page
   Acknowledgement by the Student(s)
4. Contents.
5. Chapter wise arrangement of Reports
6. Last Chapter: Conclusion
   It should contain

   (i) Conclusion
   (ii) Limitations
   (iii) Scope for further Improvement
7. References

Pr.4 LIFE SKILL

(Common to All Branches)

Practical	**2 Periods/ week**	**Sessional**	**50 Marks**
Total Periods	**30 Periods**	**Total Marks**	**50 Marks**

Objective: After completion of this course the student will be able to**:**

- Develop team spirit i.e. concept of working in team
- Apply problem solving skills for a given situation
- Use effective presentation techniques
- Apply task management techniques for given projects
- Enhance leadership traits
- Resolve conflict by appropriate method
- Survive self in today's competitive world
- Face interview without fear

DETAIL CONTENTS:

1. SOCIAL SKILL
Society, Social Structure, Develop Sympathy and Empathy Swot Analysis – Concept, How to make use of SWOT
Inter personal Relation**:** Sources of conflict, Resolution of conflict , Ways to enhance interpersonal relation

2. PROBLEM SOLVING
Steps of Problem solving**:**

- Identify and clarify the problem,
- Information gathering related to problem,
- Evaluate the evidence,
- Consider alternative solutions and their implications,
- Choose and implement the best alternative,
- Review
- Problem solving techniques:

1) Trial and error, 2) Brain storming, 3) Lateral (Out of Box) thinking

3. PRESENTATION SKILL

Body language , Dress like the audience
Posture, Gestures, Eye contact and facial expression.
STAGE FRIGHT, Voice and language – Volume, Pitch,

Inflection, Speed, Pause Pronunciation, Articulation,
Language, Practice of speech.
Use of AV aids such as Laptop with LCD projector, white board etc.

4. GROUP DISCUSSION AND INTERVIEW TECHNIQUES
Group Discussion:

Introduction to group discussion, Ways to carry out group discussion,

Parameters— Contact, body language, analytical and
logical thinking, decision making
Interview Technique :
Dress, Posture, Gestures, facial
expression, Approach Tips for handling
common questions.

5. WORKING *IN TEAM*
Understand and work within the
dynamics of a groups. Tips to work
effectively in teams,
Establish good rapport, interest with others and work
effectively with them to meet common objectives,
Tips to provide and accept feedback in a constructive and
considerate way , Leadership in teams, Handling frustrations in
group.

6. *TASK MANAGEMENT*
Introduction, Task identification,
Task planning , organizing and
execution, Closing the task

PRACTICAL

List of Assignment: *(Any Five to be performed including Mock Interview)*

1. *SWOT analysis:-*
Analyse yourself with respect to your strength and weaknesses, opportunities and threats. Following points will be useful for doing SWOT.
a) Your past experiences,
b) Achievements,
c) Failures,
d) Feedback from others etc.

2. *Solve the True life problem assigned by the Teacher.*

3. Working in a Team

Form a group of 5-10 students and do a work for social cause e.g. tree plantation, blood donation, environment protection, camps on awareness like importance of cleanliness in slum area, social activities like giving cloths to poor etc.(One activity per group where Team work shall be exhibited)

4. *Mock Interview*

5. **Discuss a topic in a group and prepare minutes of discussion.**
6. **Deliver a seminar for 5 minutes using presentation aids on the topic given by your teacher.**
7. **Task Management**

Decide any task to be completed in a stipulated time with the help of teacher. Write a report considering various steps in task management (with Break up into sub tasks and their interdependencies and Time)

Note: -1. Please note that these are the suggested assignments on given contents/topic. These assignments are the guide lines to the subject teachers. However the subject teachers are free to design any assignment relevant to the topic.

Note: -2. The following Topics may be considered for Seminar/GD in addition to other Topics at the discretion of the Teacher.

(Comparison with developed countries, Occupational Safety, Health Hazard, Accident & Safety, First-Aid, Traffic Rules, Global Warming, Pollution, Environment, Labour Welfare Legislation, Labour Welfare Acts, Child Labour Issues, Gender Sensitisation ,Harassment of Women at Workplace)

METHODOLOGY:

The Teacher is to explain the concepts prescribed in the contents of the syllabus and then assign different Exercises under Practical to the students to perform.

Books Recommended:-

Sl.No	Name of Authors	Title of the Book	Name of the Publisher
01	E.H. Mc Grath , S.J	Basic Managerial Skills for All	PHI
02	Lowe and Phil	Creativity and problem solving	Kogan Page (I) P Ltd
03	Adair, J	Decision making & Problem Solving	Orient Longman
04	Bishop , Sue	Develop Your Assertiveness	Kogan Page India
05	Allen Pease	Body Language	Sudha Publications Pvt. Ltd.