BACHELOR OF TECHNOLOGY IN ELECTRICAL AND ELECTRONICS ENGINEERING (TOP UP)

FIRST SEMESTER

Code	Module Title	Theory	Practical	Credits
BEE 312	Career Development	2	0	2
BTE 322	Electrical Installation	1	4	3
	Elective Module	6	6	9
Students are required to Select only from **ONE** of the Electrical Engineering Optional Modules.				
Total		**12**	**10**	**14**

Code	Module Title	Theory	Practical	Credits
TELECOMMUNICATION				
BTE302	Satellites Communication	2	2	3
BTE312	Digital Communication	2	4	3
BTE322	Digital Signal Processing	2	2	3
ELECTRIC POWER ENGINEERING				
BPE302	Substation Systems design, Implementation and Maintenance	2	2	3
BPE312	Power Systems Protection and Control II	2	2	3
BPE322	Energy Policy and Planning	3	0	3

SECOND SEMESTER

COURSE	COURSE TITLE	THEORY	PRACTICAL	CREDITS
BEE 401	Internship Programme	0	26	13

NB: 6 MONTHS INDUSTRIAL INTERNSHIP BEGINS AFTER THE END OF SEMESTER ONE.

THIRD SEMESTER

BEE402	Research Methods	3	0	**3**
BEE412	Technical Report Writing and Presentation	3	0	3
BEE412	Innovation and Sustainability in Engineering	3	0	3
	Electives	4	4	6

Students are to select two electives from any one of the options.

Code	Module Title	Theory	Practical	Credits
TELECOMMUNICATION				
BTE 402	Microwave principle and Antenna Installation	2	2	3
BTE 412	Information Theory And Coding	3	0	3
BTE 422	Optical Fibre Communication	3	0	3
BTE 432	Fault Diagnosis and Rectification in Telecom Apparatus and Systems	2	2	3
ELECTRIC POWER ENGINEERING				
BPE 402	Electrical Integration of Renewable	2	2	3
BPE 412	Power Systems Design and Simulation	2	2	3
BPE 424	Reliability Engineering & Application to Power Systems	3	0	3

B'Tech Electrical/Electronic Engineering			
Module Title	**Career Development**		
Module Code	**BEE 322**		
Year:	3	Semester:	2
Credit value	3		
Unit of Competence	**Manage Personal Career Development**		
Unit Description	This unit deals with the knowledge, skills and attitudes required for managing one's career and professional development, succeeding on the job, retaining jobs, and engaging in life-long learning.		
Elements of Competence	**Performance Criteria**		
BEE 322.1 Develop and maintain positive self-concept	1.1 Build positive self-concept. 1.2 Relate self-concept to influences on life and work. 1.3 Develop abilities to maintain positive self-concept.		
BEE 322.2 Demonstrate career planning and development skills	2.1 Prepare Personal Development Plans (PDP) 2.2 Establish short- and long-term career goals. 2.3 Construct a career portfolio. 2.4 Explore the nature and demands of careers. 2.5 Practice continuous self-assessment and goal modification for personal and professional growth. 2.6 Participate in career exploration activities.		
BEE 322.3 Apply effective job search skills	3.1 Constantly search for job advertisements in the print and electronic media. 3.2 Complete a personal and aptitude and interest inventory. 3.3 Prepare effective resumes and curriculum vitae for job applications. 3.4 Develop effective interview skills. 3.5 Participate in organized job-shadowing activities.		
BEE 322.4 Demonstrate sound workplace ethics	4.1 Identify and model sound workplace ethics, such as loyalty, punctuality, and initiative. 4.2 Develop personal work ethic through work experience. 4.3 Describe the importance of work ethic practised in the workplace. 4.4 Demonstrate regular attendance, promptness, and willingness to follow instructions and complete assigned tasks. 4.5 Demonstrate appropriate personal and professional attitudes and behaviours. 4.6 Demonstrate awareness of legal responsibilities related to individual performance, safety and customer satisfaction. 4.7 Demonstrate knowledge of various types of harassment and discrimination at work. 4.8 Take steps to protect the privacy of co-workers and customers.		

BEE 322.5 Develop job retention and life-long learning skills	5.1 Maintain an employment/career portfolio. 5.2 Identify and explain strategies for balancing work and family roles. 5.3 Demonstrate understanding of the need for life-long learning in a rapidly changing job market. 5.4 Explain various strategies to maintain employment in the face of job reductions. 5.5 Demonstrate interpersonal skills needed for job retention.

Essential Knowledge and Skills to be Acquired and Assessed

1. Building and maintaining a positive self-concept for career success.
2. Meaning of career development. Career development in a changing world. Career management competencies.
3. Relationship between work, family, society, and the economy.
4. Personal management competencies. Personal development for work: personal hygiene, health, nutrition, and personal grooming.
5. Exploration of careers. Sources of career information. Understanding the changing nature of work and life roles. Career decisions and career building across the lifespan.
6. Job search and interview skills. Preparation of resumes and curriculum vitae.
7. Work ethic and ethical conduct at the workplace. Work attitudes and work habits.
8. Retaining and progressing on the job.
9. Life-long learning

Range of Variables (Contexts, Conditions, and Resources)

1. Job advertisements in newspapers and in the electronic media.
2. Opportunities to visit and undergo job-shadowing in industry.
3. Interest inventories and aptitude tests.
4. Ethical standards and ethical sheets

B'Tech Electrical/Electronic Engineering			
Module Title	**Electrical Installation**		
Module Code	**BEE 332**		
Year:	3	Semester:	2
Credit value	3		
Unit of Competence	**Install electrical wiring systems**		
Unit Description	This competency unit involves the knowledge, skills and ability to install wiring enclosures, cable support systems and accessories.		
Elements of Competence	**Performance Criteria**		
BEE 332.1 Plan and prepare to install wiring	1.1 Identify and obtain Occupational Health and Safety (OHS) procedures for the required task and given work area. 1.2 Follow OHS risk control measures throughout the entire work process. 1.3 Consult appropriate personnel and determine the nature, location, requirements and sequence for the installation. 1.4 Identify, apply and monitor relevant standards, codes, specifications and enterprise procedures. 1.5 Identify, obtain and inspect resources and materials/ components needed for the installation in accordance with established procedures. 1.6 Plan work in detail outlining sequences and priorities for the maintenance of security and capacity in accordance with site requirements. 1.7 Resolve coordination and isolation requirements with appropriate personnel and affected individuals or groups. 1.8 Prepare work area in accordance with work requirements and site procedures. 1.9 Check preparatory work to ensure that no damage has occurred.		
BEE 332.2 Install wiring enclosure/ support systems	2.1 Confirm required isolations in accordance with OHS regulations and procedures. 2.2 Position and secure enclosures/ support systems in accordance with work plans and drawings. 2.3 Install wiring enclosure/ accessories and/ or support systems in accordance with job specifications and standard regulations. 2.4 Inspect the installed wiring enclosures/ support systems to ensure freedom from defects and damage.		
BEE 332.3 Install wiring	3.1 Confirm required isolations in accordance with OHS regulations and procedures. 3.2 Position, secure and label wiring in accordance with job specifications.		

	3.3 Install wiring in accordance with job specifications. 3.4 Inspect the installed wiring to ensure freedom from defects and damage. 3.5 Complete final job inspection and surrender permits in accordance with established procedures.
BEE 332.4 Complete and report installation activity	4.1 Complete work and notify personnel in accordance with site requirements. 4.2 Clean, restore and secure work site in accordance with established procedures to ensure safety. 4.3 Make final checks to ensure that the installed wiring conforms to requirements and enterprise procedures. 4.4 Document installed wiring and accessories and notify appropriate personnel in accordance with standard procedures.

Essential Knowledge, Skills and Attributes to be Acquired and Assessed

1. Planning and sequencing multiple tasks
2. Sourcing resources
3. Cables in buildings and structures, layout of site plan and isolation procedures
4. Conductor terminations
5. Technical standards, regulations and codes for general electrical installations.
6. Electrical wiring systems, equipment requirements, installation practice and workshop practice.
7. Communication skills to consult with operators and other relevant plant personnel to assist in locating faults
8. Reading and interpreting engineering drawings, technical manuals and manufacturers' data
9. Technical report writing
10. Application of personal protective equipment
11. Major hazards accompanying processes of installing electrical wiring
12. Safe work practices relevant to the required task

Range of Variables (Work contexts, Conditions and Resources)

1. Thermoplastic insulated (TPI) cable in conduit or trunking, Thermoplastic sheath (TPS) circular unenclosed, Fire performance cables, steel wire armoured, MIMS, data cables.
2. Types of circuits: circuits for control devices, Lighting, motors and their controls, socket outlets, transformers and their controls, switchboards and/or distribution boards and their controls, protection and/or metering devices.
   Cable support and mechanical protection devices: cable trays and racks, saddles, clips, ties and hangers, PVC conduits, heat shrink, spiral binding, insulation tapes, cable markers.

Module Title	**Satellite communication**		
Module Code	**BTE 302**		
Year:	3	Semester:	2
Credit value	3		
Unit of Competence	**Commission Satellite Communication Systems**		
Unit Description	This unit covers the setting-up and adjusting of satellite communication systems for optimum performance. It encompasses safe working practices, signal testing and analysis, adjusting equipment, following procedures and documenting		
Elements of Competence	**Performance Criteria**		
BTE 302.1 Prepare to set-up process measuring instruments	1.1 Identify OHS procedures for a given work area. 1.2 Follow established OHS risk control measures and procedures in preparation for the work. 1.3 Note safety hazards that have not previously been identified and implement established risk control measures. 1.4 Consult appropriate personnel are consulted to ensure the work is co-ordinated effectively with others involved on the work site. 1.5 Identify measurement parameters by reviewing transmission/reception requirements and equipment manufacturer's instructions. 1.6 Obtain tools, equipment and testing devices needed for the work in accordance with established procedures and checked for correct operation and safety. 1.7 Check preparatory work to ensure no unnecessary damage has occurred and complies with requirements. 1.8 1.8 Check circuits as being isolated where necessary in strict accordance OHS requirements and procedures.		
BTE 302.2 Set-up process measuring instruments	2.1 Follow OHS risk control measures and procedures for carrying out the work. 2.2 Connect testing/measuring devices are connected and set up in accordance with requirements for a particular control system. 2.3 Set up measuring instruments and adjust in accordance with transmission/reception requirements and equipment manufacturer's instructions. 2.4 Make adjustments to provide optimum transmission/reception performance within regulatory requirements. 2.5 Make decisions for dealing with unexpected situations from discussions with appropriate persons and job specifications and requirements. 2.6 Select methods for dealing with unexpected situations on the basis of safety and specified work outcomes.		

	2.7 Carry out Setting-up out efficiently without waste of materials or damage to apparatus, the surrounding environment or services and using sustainable energy principles.
BTE 302.3 Completion and report set-up activities.	3.1 Follow OHS risk control work completion measures and procedures. 3.2 Clean and make safe work site in accordance with established procedures. 3.3 Document adjustment settings and notify an appropriate person or persons in accordance with established procedures

Essential Knowledge, Skills and Attributes to be Acquired and Assessed

1. Understanding of the principles of satellite communication
2. Knowledge of the factors that affect satellite communication
3. Safe working practices satellite communication systems.
4. Satellite communication signal testing and analysis.
5. Use of measuring instruments to set-up processes.
6. Accessing work against industry requirements.
7. Technical report writing skills.

Range of variables (work contexts, conditions, and resources)

1. A representative range of microwave and satellite Communication systems in setting-up and adjusting two microwave/satellite comm.
2. Test plans.

BTE 312 DIGITAL COMMUNICATION SYSTEMS

Analogue to Digital Conversion: Noisy communications channels, The sampling Theorem, low pass signals and band pass signals, pulse Amplitude modulation, channel bandwidth for a PAM signal, Natural sampling, Flat top sampling, signal recovery & holding, Quantization of signal, Quantization error, pulse code modulation (PCM), Delta Modulation, adaptive delta modulation.

Digital Modulation Techniques: Binary phase shift keying, differential phase shift keying, differential encoded PSK, QPSK, Quadrate Amplitude shift keying (QASK) Binary frequency shift keying.

Data Transmission: Base band signal receiver, probability of error, the optimum filter, and white noise-the matched filter, probability of error of the matched filter, coherent reception: correlation, application of coherent reception in PSK and FSK. Correlation receiver for QPSK.

Noise in Pulse Code & Delta Modulation Systems: PCM transmission, calculation of quantization noise, the O/P signal power, the effect of thermal noise, O/P signal to noise ratio in PCM, Delta Modulation, Quantization noise in delta modulation, the O/P signal to quantization noise ratio in delta modulation, O/P signal to noise ratio in delta modulation.

Information Coding and Decoding: Coding for error detection and correction, Block coding – coding, anticoding, Hadamard code, Hamming code, Cyclic Codes, Convolution coding and decoding, Shannon Fano and Hoffman Codes.

Recommended Books

1. Digital communications by Ian A. Glover and Peter M. Grant
2. Digital Communication by Bernard Sklar
3. Digital and Analog Communication Systems by Couch
4. Digital Communication Techniques by Marvin K. Simon, Sami M. Hinedi, William
5. Principles of communication systems by Taub& Schilling
6. Communication System by Simon Haykin.
7. Introduction to Analog and Digital communication by SimpnHaykin and Michael Moher

BTE 322 DIGITAL SIGNAL PROCESSING

Discrete-time signals and systems

Basic elements of a digital signal processing system, Advantages of digital signal processing, Classification of signals, The concept of frequency in continuous-time and discrete-time domain, Discrete-time signals and systems, Analysis of discrete-time linear shift-invariant systems, Linearity, Causality and stability criterion, Discrete-time systems described by difference equations.

Discrete-time Fourier transform

The Fourier transform of discrete-time signals (DTFT), Properties of the DTFT, The frequency response of an LTI discrete-time system, Sampling and reconstruction of signals.

Discrete Fourier transform

Frequency domain sampling and the DFT, Properties of the DFT, Linear filtering methods based on the DFT, Efficient computation of the DFT: Decimation-in-time and decimation-infrequency fast Fourier transform algorithms.

z-transform

Introduction to the z-transform & the inverse z-transform, Properties of the z-transform, Relationship between the Fourier transform and the z-transform, Rational z-transforms & the system function, Analysis of linear time-invariant systems in the z-domain.

Digital filter structures

Digital filter categories, Realization structures for FIR & IIR digital filters, Implementation of digital filters.

Digital filter design

General considerations, Review of analogue filter design, Design of IIR digital filters: IIR digital filter design using the impulse invariance method and the bilinear transformation method, Design of linear phase FIR digital filters: FIR digital filter design using the windows method and the frequency-sampling method.

Recommended Books

1. Digital Signal Processing-Principles, Algorithms, and Applications by John G. Proakis&Dimitris G. Monolakis
2. Digital Signal Processing by Sanjit K Mitra
3. Digital Signal Processing by Alan V. Oppenheim & Ronald W. Schafer
4. Theory & Application of Digital Signal Processing by Rabiner& Gold
5. Digital Signal Processing Using MATLAB by Vinay K. Ingle & John G. Proakis
6. Digital Signal Processing by Li Tan&Jean Jiang

B'Tech Electrical/Electronic Engineering	
Module Title	**Substation System Design, Implementation and Maintenance**

Module Code	**BTE 302**		
Year:	3	Semester:	2
Credit value	3		
Unit of Competence	**Maintain Substation equipment (indoor and outdoor)**		
Unit Description	The describes the ability of the student to appropriately manage an electrical power substation.		
Elements of Competence	**Performance Criteria**		
BTE 302.1 Conduct routine checks at a substation	1.1. Perform in-depth analysis of technical/engineering data and providing results to management. 1.2. Inspect components such as control and meter boards, relays, circuit breakers and transformer lines to ensure operating efficiency. 1.3. Test substation components regularly and interpret test results. 1.4. Check transformer loading periodically 1.5. Check arcing horns and periodically 1.6. Work Safely Near Live Electrical Apparatus		
BTE 302.2 Diagnose fault at a substation	2.1. Check for faulty components by visual examination 2.2. Check for faulty components using appropriate instruments 2.3. Analyse the fault in the substation and symmetrical components		
BTE 302.3 Repair and replace faulty components at a substation	2.1. Isolate a substation for repair and maintenance work 2.2 Dismantle and reassemble components 2.3. Change transformer oil when required 2.4. Fix and Secure substation equipment 2.5. Resynchronise components after power separation during emergencies.		

Essential Knowledge, Skills and Attributes to be Acquired and Assessed

1. Substation equipment
2. Regulations, standards, codes, methods, practices, and advanced engineering principles necessary to perform complex or unique assignments.
3. Maintenance and testing requirements for common substation devices.
4. Ability to interpret the results from testing and maintenance.

5. Common problems at a substation

Range of Variables (Work contexts, Conditions and Resources)

1. Power transformers,
2. oil, air and
3. vacuum circuit breakers,
4. switchgear,
5. ground grid systems,
6. maintenance tool kit Power meters

BPE 312 POWER SYSTEMS PROTECTION AND CONTROL

Objectives; this is an advanced level studies on system operations, circuit breakers and projections.

System Operation:

Instrumentation: Voltage and current transformers, indicating and integrating meters. Central control, telemetry of data and control signals.

Circuit Breakers:

Are phenomena, are control, d.c and a.c interruption, recovery voltage transients, types of circuit breakers, rating, testing.

Protection:

Philosophy of power system protection current operated devices: Qualities required of protection:

Components of protection schemes; protection systems; distance protection; unit protection schemes; generator protection, transformer protection, feeder protection, busbar protection, protection using digital computers.

LOAD FREQUENCY CONTROLLERS: Proportional plus Integral control of single area and its block diagram representation, steady state response – Load Frequency Control and Economic dispatch control.

REACTIVE POWER CONTROL: Overview of Reactive Power control – Reactive Power compensation in transmission systems – advantages and disadvantages of different types of

compensating equipment for transmission systems; load compensation – Specifications of load compensator, Uncompensated and compensated transmission lines: shunt and Series Compensation.

TEXT BOOKS:

1. Power System Engineering By I.G. Nagarath & D.P. Kothari (Tmh Publications)

2. Electric Energy Systems Theory-An Introduction By Olle I. Elgerd (Tmh Edition)

Reference Books:

1. Advanced Power System Analysis And Dynamics By L.P. Singh, Wiley Eastern Limited, Third Edition

2. Power System Analysis By Hadi Sadat, Mc Graw Hill Pub

BPE 322 NERGY POLICY AND PLANNING

Objective

In this course, the students are to be introduced to the particular regulations that apply to renewable energy development.

Content

- Energy Policies, National and sectorial energy plan;
- Energy tariffs and subsidies;
- Private sector participation in power generation, distribution;
- Energy & development;
- Energy- Economy interaction;
- Energy investment planning;
- Energy pricing;
- Rural economic and social development considerations.

B'Tech Electrical/Electronic Engineering			
Module Title	**Microwave principle and Antenna Installation**		
Module Code	**BTE 402**		
Year:	3	Semester:	1
Credit value	3		
Unit of Competence	**Install Microwave and Antenna Waveguides**		
Unit Description	This unit covers the installation and testing of waveguides and antennae for microwave communications systems. It encompasses working safely and to installation standards, matching hardware and accessories with that specified for a given location, installation techniques, pre commission adjustment of antennas and waveguides and following instruction and procedures.		
Elements of Competence	**Performance Criteria**		
BTE 312.1 Prepare to install and microwave antennae and waveguides.	1.1 Identify and obtain OHS procedures for a given work area through established routines. 1.2 Follow established OHS risk control measures in preparation for the work. 1.3 Report on safety hazards that have not previously been identified are reported and seek advice on risk control measures from the work supervisor. 1.4 Obtain the nature and location of the work from work supervisor or other appropriate person to establish the scope of work to be undertaken. 1.5 Seek advice from the work supervisor and/or other appropriate person to ensure the work is coordinated effectively with others. 1.6 Establish sources of materials that may be required for the work in accordance with established routines. 1.7 Obtain tools, equipment and testing devices needed to carry out the work and check for correct operation and safety.		
BTE 312.2 Install and microwave antennae and waveguides.	2.1 Follow established OHS risk control measures for carrying out the work. 2.2 Check circuits/components as being isolated where necessary in strict accordance OHS requirements and procedures. 2.3 Install antennas in their specified locations and within limitation imposed by regulation. 2.4 Install hardware and accessories straight and square in the required locations and within acceptable tolerances. 2.5 Terminate cables and conductors at accessories 1. in accordance with manufacture's and job specifications and regulatory requirements		

	2.6 Follow procedures for referring non-routine events to immediate supervisor for directions. 2.7 Carry out installation is carried out efficiently without waste of materials or damage to apparatus, circuits or the surrounding environment and using sustainable energy practices.
BTE 312.3 Test and microwave antennae and waveguides and report.	3.1 Follow OHS work completion risk control measures and procedures. 3.2 Make pre-commissioning adjustments to the installation and the system to optimise performance in accordance with system specification. 3.3 Clean and make work site safe in accordance with established procedures. 3.4 Notify work supervisor of the completion of the installation work in accordance with established routines.

Essential Knowledge, Skills and Attributes to be Acquired and Assessed

1. Principles of transmitting microwave signals
2. Parameters to be considered during the selection of an antenna
3. Properties of waveguides selection of waveguide type
4. Safe working practices in installation of microwave and antenna waveguides.
5. Installation of microwave and antennae and waveguides.
6. Match hardware and accessories to a given location for microwave equipment installation.
7. Microwave equipment installation techniques.
8. Pre-commissioning adjustments for microwave systems.
9. Use environmental and sustainable energy practices.

Range of variables (work contexts, conditions, and resources)

1. Installing, connecting and adjusting any microwave antennae
2. Installing waveguides consisting of antennas, rectangular and curved sections, T sections, joints and couplers and on at least two occasions.
3. Industry microwave installations standards.

BTE 412	**INFORMATION THEORY AND CODING**

INSTRUCTIONAL OBJECTIVES

At the end of this course, the students are able to understand the

- Probability and Random process
- Several Source coding techniques
- Channel coding theorem and various codes

- Block codes

COURSE CONTENT

UNIT I	**REVIEW OF PROBABILITY THEORY**

Sample space - Conditional probability - some use probability distributions - probability distribution functions-stochastic - processes - statistical averages - Random variable and random process-covariance-Ergodic process - Markov process

UNIT II	**SOURCE CODING**

Mathematical model for information sources - Average mutual Information - Entropy in discrete and continuous cases definition and properties of entropy Joint and conditional entropy The problem of unique decipherable - instantaneous code - Kraft Mcmillan inequality

UNIT III	**DISCRETE AND ANALOG CODING**

Huffmann's coding Algorithm - Discrete stationery sources - The Lempel Ziv algorithm - optimum quantization Rate distortion function for memory less Gaussian source - Upper bound of R(D) scalar quantization - vector quantisation - Linear predictive coding

UNIT IV	**CHANNEL CODING**

Channel models - Binary symmetric channel - Discrete memory less channel - discrete input contentious output channel - Channel capacity - Shannon fundamental theorem - Shannon Hartley law and its implication Achieving channel capacity with orthogonal signals - channel reliability functions

UNIT V	**BLOCK AND CONVOLUTIONAL CODING**

Liner block codes - Hadamard code - Golay code - Cyclic code - encoders - BCH code - Error detection and correction capability - convolutional codes - convolutional encoder - viterbi algorithm

TEXTBOOKS

- Raymond W.Young,"A First course in information theory", Kluwer/Plenum, 2001

RECOMMENDEDBOOKS

- Rechand E Blahut, " Principles and Practices of Information Theory", Addison Wesley, 1988
- John G.Proakias, "Digital Communication", 4th edition, McGraw Hill Publication, 2001.
- Gray R.M, "Source Coding Theory", Kluwer Academic Publishers, Boston.,1989

BTE 422 OPTICAL & NETWORK COMMUNICATION SYSTEMS

Overview:

The Electromagnetic Spectrum, Properties of Light, Dual Nature of Light Concept of a photon, Wave Mode3l, Characteristics of light waves. Concepts of information, general communication systems, evolution of Basic Fiber Optic Communication System, Benefits and disadvantages of Fiber Optics. Transmission Windows. Transmission Through Optical Fiber, The Laws of Reflection and Refraction, Light rays and light waves, Reflection of light from optical surfaces, Refraction of light from optical interfaces, The Numerical Aperture (NA), The Optical Fiber, Types of Fiber.

Losses in Optical Fibre

Attenuation, Material absorption losses, linear and non-linear scattering losses, fiber bend loss, dispersion through inter modal dispersion and intra modal dispersion, overall fiber dispersion and polarization, Dispersion shifted and dispersion flattened fibers, attenuation and dispersion limits in fibers, Kerr nonlinearity, self-phase modulation, combined effect of dispersion and self-phase modulation.

Fibre Material, Couplers and Connectors

Preparation of optical fiber: liquid-phase techniques, vapour phase deposition techniques. Connector Principles, Fiber End Preparation, splices, connectors.

Optical Sources and Detectors

Sources: Basic principle of surface emitter LED and edge emitter LED- material used, structure, internal quantum efficiency and characteristics, LASER Diode - material used, structure, internal quantum efficiency and characteristics, working Principle and characteristics of

Distributed feedback (DFB) laser. Detectors: PIN photodiode - material used, working principle & characteristics, Avalanche Photodiode: - material used, working principle and characteristics

Optical Fiber Sensors

Intensity modulated sensor - general features, intensity modulation through light interruption, shutter multimode fiber sensors and reflective fiber optic sensors.

Advanced Topics

Optical TDM, SCM, WDM and Hybrid multiplexing methods.

Fiber Optic Networks, Transceivers for Fiber-Optic Networks, Semiconductor Optical Amplifiers, Erbium Doped Fiber Amplifiers (EDFAs), Elements of Architecture of Fiber-Optic Networks.

Recommended Books

1. Fiber-Optic Communication Systems by Govind P. Agrawal
2. Optical Fiber Communication by Gerd Keiser
3. Optical Networks (a practical perspective) by Rajiv Ramaswami, Kumar N. Sivarajan and Galen H. Sasaki
4. Optical Fiber Communication Principles & Practice by John M.Senior
5. Optical Communication Systems by John Gowar
6. Fundamentals of Fibre Optics in Telecommunication and sensor systmes by BishnuP.Pal,

B'Tech Electrical/Electronic Engineering			
Module Title	**Fault Diagnosis and Rectification in Telecom Apparatus and System**		
Module Code	**BTE 432**		
Year:	4	Semester:	2
Credit value	3		
Unit of Competence	**Diagnose and Rectify Faults in Telecommunication Apparatus and System**		
Unit Description	This unit covers fault diagnosis and rectification in telecommunication apparatus and systems. The unit encompasses safe working practices, interpreting diagrams, applying logical diagnostic methods and knowledge of telecommunication system		

	components, rectifying faults, safety and functional testing and completing the necessary service documentation.
Elements of Competence	**Performance Criteria**
BTE 432.1 Prepare to diagnose and rectify faults.	1.1 Follow OHS procedures for a given work area. 1.2 1.2Follow established OHS risk control measures and procedures in preparation for the work. 1.3 Document safety hazards that have not previously been identified and device risk control measures and implement in consultation with appropriate personnel. 1.4 Determine the extent of faults from reports and other documentation and from discussion with appropriate personnel. 1.5 Consult appropriate personnel to ensure the work is co-ordinated effectively with others involved on the work site. 1.6 1.6 Obtain tools, equipment and testing devices needed to diagnose faults in accordance with established procedures and check for correct operation and safety.
BTE 432.2 Diagnose and Rectify Faults	2.1 Follow OHS risk control measures and procedures for carrying out the work are. 2.2 Determine the need to test or measure live in strict accordance with OHS requirements and when necessary conduct within established safety procedures. 2.3 Check circuits/machines/plant as being isolate where necessary in strict accordance OHS requirements and procedures. 2.4 Apply logical diagnostic methods are applied to diagnose telecommunication apparatus and systems. 2.5 Test suspected fault scenarios as being the source of system problems. 2.6 Identify source of the fault and engage appropriately competent persons to rectify the fault where it is outside the scope of electronics. 2.7 Rectify faults in the electronic components of the system to its operation standard. 2.8 System is tested to verify that the system operates as intended and to specified requirements. 2.9 Make decisions for dealing with unexpected situations from discussions with appropriate persons and job specifications and requirements. 2.10 Select methods for dealing with unexpected situations are selected on the basis of safety and specified work outcomes. 2.11 Carry out diagnosis and rectification activities efficiently without waste of materials or damage to apparatus and the surrounding environment or services and using sustainable energy practices.

BTE 432.3 Complete and report fault diagnosis and rectification activities	3.1 Follow OHS work completion risk control measures and procedures. 3.2 Make safe work site safe in accordance with established safety procedures. 3.3 Document rectification of faults in accordance with established procedures. 3.4 3.4 Notify appropriate person or persons in accordance with established procedures, that the system faults have been rectified.

Essential Knowledge, Skills and Attributes to be Acquired and Assessed

1. Safe working practices and diagnosing and rectifying faults in telecommunication apparatus and systems.
2. Interpretation of circuit diagrams.
3. Application of methods to locate and rectify faults.
4. Test of repaired communication equipment.

Range of variables (work contexts, conditions, and resources)

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1. Diagnosing and rectifying at least four faults system faults in a representative range of electronic telecommunication apparatus and systems.
2. Communication fault conditions.
3. Communication system components.
4. Service Documentation.

BPE 402 Electrical Integration of Renewables

Rationale:	This module is meant to introduce the student to : • The characteristics of the Electrical Power System Network • The integration of electricity generators powered from renewable energy sources
Module code	ESE 223
Year: 2	Semester: I
Credit value	2 hours lectures, 2 hours laboratory/field work per week: 3 Credit Hours
Entry requirements	The student is expected to have the following prior background: □ Introduction to Applied Electricity and Electronics

Module Outline

Learning outcomes	After working this module the student will: • Understand why the variable nature of most renewable sources needs special consideration when integrating them into power networks • Be able to explain why there is a need to forecast demand, schedule generation and perform security and optimum dispatch studies in power systems • Appreciate the nature and the costs of generating electricity from various traditional and renewable plants • Be aware of the importance of aggregation of consumers and of renewable sources • Understand why the introduction of renewables will incur cycling and reserve costs and why energy from such sources may have to be discarded at high penetrations • Be aware of the likely escalating level of financial penalties associated to increments in penetration • Be able to consider the possibility of a 100% renewable energy supply
Assessment Criteria	The student is to participate in the following: • designated lectures • assigned laboratory or field works • organised field trips
Assessment Methods	Formative assessment: • Continuous assessment of written assignments. (10%) • Assessment of challenges in the form of laboratory/field works and written reports (10%) • Written test at mid-semester (20%) • Written test at the end of the semester (60%)

Student learning activities	Students are engaged in the following learning activities: • Practical Challenges; practical assignments that lead to load-flow (power-flow) and fault-level analysis in power system design and operation. • Skills and Knowledge; supporting learning activities which lead to increased skills and knowledge necessary for carrying out the practical challenges • Reflection & Planning; learning activities that involve reflection on the learning process and planning of further learning activities e.g.: – Looking back and reflecting on the practical challenges – Keeping lecture and field trips notes – Planning skills and knowledge learning activities
Facilitator guidance and support activities	The learning facilitator is involved in the following guidance and support activities: • Instructing students about the tasks at hand • Guiding students carrying out practical challenges • Supporting students' learning process • Delegating responsibility for learning process to students • Demonstrating skills • Passing on knowledge / theory • Observing students carrying out practical challenges
Learning and teaching materials	During the module, students can make use of the following learning materials: • Prescribed textbooks and lecturer's handouts • Information available in the electronic media.

Module Title	**BPE 412 Power Systems Design and Simulation**
Rationale:	This module is meant to provide the student with: • Exposure to various commercial available design and software for renewable energy planning.
Module code	ESE 303
Year:	3 Semester: 5
Credit value	2 hours lectures, 2 hours laboratory/field work per week: 3 Credit Hours
Entry requirements	The student is expected to have the following prior background: • Energy Systems

Module Outline

Learning outcomes	A student completing this course successfully, is competent to: • To suggest new renewable installations • To recommend renewable energy retrofits. • To select requirements for a chosen renewable energy system • Design a complete renewable system to fully meet the selected requirements • Perform all aspects of project design to include cost-benefit analysis, construction, control and final audit assessment of the completed energy system
Assessment Criteria	The student is to participate in the following: • designated lectures • assigned field works • organised field trips
Assessment Methods	Formative assessment: • Continuous assessment of practical challenges related to the facilities. • Assessment of challenges in the form of laboratory/field works • Written field work reports • Written test at mid-semester • Written test at the end of the semester
Student learning activities	Students are engaged in the following learning activities: • Practical Challenges; practical assignments that lead to realistic and authentic products or services that are relevant for the HND Renewable Energy Systems Engineer: - Software application for designing and simulating renewable energy planning. - Testing of simulated renewable retrofits and new installations - Exposure to software for the design of specific aspects of photo voltaic, bio-fuel and other technologies.
	• Skills and Knowledge; supporting learning activities which

	lead to increased skills and knowledge necessary for carrying out the practical challenges: - Production of computer models. • Reflection & Planning; learning activities that involve reflection on the learning process and planning of further learning activities *e.g.:* - Looking back and reflecting on the practical challenges - Keeping lecture and field trips notes - Planning skills and knowledge learning activities
Facilitator guidance and support activities	The learning facilitator is involved in the following guidance and support activities: • Instructing students about the tasks at hand • Guiding students carrying out practical challenges • Supporting students' learning process • Delegating responsibility for learning process to students • Demonstrating skills • Passing on knowledge / theory • Observing students carrying out practical challenges
Learning and teaching materials	During the module, students can make use of the following learning materials: • Prescribed textbooks and lecturer's handouts • Information available in the electronic media.

Unit of Competency: Reliability Engineering & Application to Power Systems
Unit Code: **B**EE 424
Qualification Level: B-Tech
Unit Descriptor

This unit covers analysis of reliability as applied to power systems in energy supply and distribution systems. The unit also encompasses safe working practices, interpreting diagrams and technical data, applying knowledge of energy supply apparatus to logical reliability analysis processes, testing and reporting work activities and outcomes.

Elements of Competence	Performance Criteria
EE 22.1 Prepare to diagnose and rectify faults	1.1 Identify and obtain OHS procedures for a given work area, 1.2 Follow established OHS risk control measures and procedures in preparation for the work. 1.3 Determine the extent of reliability from reports and other documentation for discussion with appropriate personnel

	1.4 Consult appropriate personnel to ensure the work is coordinated effectively with others involved on the work site 1.5 Obtain tools, equipment and testing devices needed to analyse reliability in accordance with established procedures and check them for correct operation and safety.
EE 22.2 Diagnose and rectify faults	2.1 Follow OHS risk control measures and procedures for carrying out the work. 2.2 Determine the need to test or measure live in strict accordance with OHS requirements and when necessary conduct within established safety procedures 2.3 Check circuits/machines/plant as being isolated where necessary in strict accordance OHS requirements and procedures 2.4 Logical analysis methods are applied to determine energy supply apparatus reliability employing measurements and estimations of system operating parameters referenced to system operational requirements 2.5 Test suspected fault scenarios as being the source of system problems 2.6 Identify cause of the faults and engage appropriate competent persons are to rectify the fault where it is outside the scope of the control system. 2.7 Rectify faults in the apparatus components to raise energy supply apparatus to its operation standard. 2.8 Test apparatus to verify that it operates as intended and to specified requirements 2.9 Make decisions for dealing with unexpected situations from discussions with appropriate persons and job specifications and requirements. 2.10 Select methods for dealing with unexpected situations on the basis of safety and specified work outcomes. 2.11 Carry out diagnosis and rectification activities efficiently without unnecessary waste of materials or damage to apparatus and the surrounding environment or services and using sustainable energy practices
EE 22.3 Complete and report fault diagnosis and rectification activities	3.1 Follow OHS work completion risk control measures and procedures 3.2 Make work site safe in accordance with established safety procedures. 3.3 Document rectification of faults in accordance with established procedures. 3.4 Appropriate person or persons notified, in accordance with established procedures, that the system faults have been rectified

Essential Knowledge, Skills and Attributes to be Acquired and Assessed

1. Current industry practices and technologies
2. Electrical power systems operations

3. Use and application of personal protective equipment
4. Safe work practices and procedures
5. Relevant hazards and control measures related to the competency
6. Basic probability theory – rules for combining probabilities of events –
7. Network Modelling and Reliability Analysis of Series, Parallel, Series-Parallel networks – complex networks – decomposition method
8. Reliability functions F (t), R (t), H (t) and their relationships – exponential distributions – Expected value and standard deviation of exponential
9. Generation system reliability analysis – reliability model of a generation system – recursive relation for unit addition and removal – load modeling – merging of generation load model – evaluation of transition rates for merged state model – cumulative probability, cumulative frequency of failure evaluation
10. Composite system reliability analysis decomposition method – distribution system reliability analysis – radial networks – weather effects on transmission lines – Evaluation of load and energy

Range of variables (Work contexts, conditions, and resources)

1. Measuring instruments
2. Company OHS procures
3. Sustainable energy Policy
4. Fault in energy supply network equipment
5. Diagnose and rectify at least four faults in control energy supply apparatus