FACULTY OF ENGINEERING & TECHNOLOGY

EVALUATION SCHEME & SYLLABUS
FOR
Bachelor of Technology
4th YEAR (VII & VIII Semester)

ELECTRICAL & ELECTRONICS ENGINEERING

ON

CHOICE BASED CREDIT SYSTEM (CBCS)

[Effective from the Session: 2019-20]

NEHRU GRAM BHARATI
(Deemed to be University)
KOTWA-JAMUNIPUR-DUBAWAL
PRAYAGRAJ

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EVALUATION SCHEME

B-TECH. ELECTRICAL & ELECTRONICS ENGINEERING

YEAR 4th / SEMESTER-VII

S. No.	Subject Code	Subject Name	Department	L-T-P	Th./Lab Marks	Sessional		Total	Credit
					ESE	CT	TA		
1		OPEN ELECTIVE COURSE-1	Other Deptt.	3--0--0	70	20	10	100	3
2		DEPTT ELECTIVE COURSE-3	Core Deptt.	3--0--0	70	20	10	100	3
3		DEPTT ELECTIVE COURSE-4	Core Deptt.	3--1--0	70	20	10	100	4
4	EEN-701	COMMUNICATION SYSTEMS	Core Deptt.	3--1--0	70	20	10	100	4
5	EEE-702	POWER SYSTEM PROTECTION	Core Deptt.	3--0--0	70	20	10	100	3
6	EEE-751	INDUSTRIAL AUTOMATION & PLC LAB	Core Deptt.	0--0--2	50		50	100	1
7	EEE-752	POWER SYSTEM LAB	Core Deptt.	0--0--2	50		50	100	1
8	EEN-753	INDUSTRIAL TRAINING	Core Deptt.	0--0--3			100	100	2
9	EEN-754	PROJECT-1	Core Deptt.	0--0--6			200	200	3
	TOTAL				**450**	**100**	**450**	**1000**	**24**

DEPTT. ELECTIVE COURSE-3

1. **EEE-070: Microprocessors and Microcontrollers**
2. **EEE-071: Utilization of Electrical Energy & Electric Traction**
3. **EEE-072: Introduction to Smart Grid**
4. **EEN-070: Introduction to Robotics**

DEPTT. ELECTIVE COURSE-4

1. **EEE-075: Industrial Automation and Control**
2. **EEE-076: Energy Efficiency & Conservation**
3. **EEE-077: Reliability Engineering**
4. **EEN-075: Telemetry & Data Transmission**

EVALUATION SCHEME

B-TECH. ELECTRICAL & ELECTRONICS ENGINEERING

YEAR 4th / SEMESTER-VIII

S. No.	Subject Code	Subject Name	Department	L-T-P	Th/Lab Marks	Sessional		Total	Credit
					ESE	CT	TA		
1		OPEN ELECTIVE COURSE-2	Other Deptt.	3--0--0	70	20	10	100	3
2		DEPTT ELECTIVE COURSE-5	Core Deptt.	3--1--0	70	20	10	100	4
3		DEPTT ELECTIVE COURSE-6	Core Deptt.	3--0--0	70	20	10	100	3
4	EEN-851	SEMINAR	Core Deptt.	0--0--3			100	100	2
5	EEN-852	PROJECT-2	Core Deptt.	0--0--12	350		250	600	12
	TOTAL				**560**	**60**	**380**	**1000**	**24**

DEPTT. ELECTIVE COURSE-5

1. **EEE-080: Advanced Control System**
2. **EEE-081: Introduction to Power Quality & FACTS**
3. **EEE-082: Power System Dynamics, Control and Monitoring (NPTEL)**
4. **EEN-080: Optical Fiber Communication**

DEPTT. ELECTIVE COURSE-6

1. **EEE-085: EHVAC &DC Transmission**
2. **EEE-086: Power Theft & Energy Management**
3. **EEE-087: Digital Image Processing**
4. **EEE-088: Antennas (NPTEL)**

EEN-701	COMMUNICATION SYSTEMS	L T P: 3 1 0	4 Credit

Unit-I: Amplitude Modulation:

Amplitude modulation, DSBSC, SSB and VSB modulation and demodulation schemes, AM transmitters and receivers, super-heterodyne receiver, IF amplifiers, AGC circuits Frequency division multiplexing.

Unit-II: Angle Modulation:

Frequency modulation, phase modulation Generation of frequency modulation FM receivers and demodulators

Noise: External noise, internal noise, Noise calculations, signal to noise ratio, Noise in AM and FM systems.

Unit-III: Pulse Communication:

Sampling Process, PAM, PWM, PPM and PCM, Delta modulation and adaptive delta modulation.
Digital Modulation:

Introduction, brief description of phase shift keying (PSK), Differential phase shift keying (DPSK), frequency shift Keying (FSK), Quadrature amplitude modulation (QAM) and time division multiplexing (TDM).

Unit-IV: Radio Propagation:

Ground waves, sky wave propagation, space waves, tropospheric scatter propagation,Satellite Communication- transponders, Geo-stationary satellite system, low earth and medium earth-orbit satellite system.Introduction to Cellular system Personal communication system (PCS), data communication with PCS.

Unit-V: Television:

TV systems and standards, scanning and synchronizing, common video and sound circuits,vertical and horizontal deflections, colour transmission and reception.

Fibre Optical Communication: Optical fibre and fibre cables, fibre characteristics and classification, fibre optic components and systems.

Text Books:

1. G. Kennedy and B. Davis , "Electronic Communication Systems" Tata McGraw Hill
2. Simon Haykin, " Communication Systems" John Wiley & Sons

Reference Books:

3. Roy Blake, " Wireless Communication Technology" Thomson Asia Pvt. Ltd. Singapore
4. B. P. Lathi, "Modern Analog and Digital Communication Systems" Oxford University Press.
5. Taub & Schilling, "Principles of Communication Systems" McGraw Hill.

EEE-702	POWER SYSTEM PROTECTION	L T P: 3 0 0	3 Credit

Unit I: Introduction to Protection System:

Introduction to protection system and its elements, functions of protective relaying, protective zones, primary and backup protection, desirable qualities of protective relaying, basic terminology.

Relays: Electromagnetic, attracted and induction type relays, thermal relay, gas actuated relay, design considerations of electromagnetic relay.

Unit-II: Relay Application and Characteristics:

Amplitude and phase comparators, over current relays, directional relays, distance relays, differential relay

Static Relays: Comparison with electromagnetic relay, classification and their description, over current relays, directional relay, distance relays, differential relay.

Unit-III: Protection of Transmission Line:

Over current protection, distance protection, pilot wire protection, carrier current protection, protection of bus, auto re-closing.

Unit-IV: Circuit Breaking:

Properties of arc, arc extinction theories, re-striking voltage transient, current chopping, resistance switching, capacitive current interruption, short line interruption, circuit breaker ratings.

Testing of Circuit Breaker: Classification, testing station and equipment, testing procedure, direct and indirect testing.

Unit-V: Apparatus Protection:

Protection of Transformer, generator and motor.

Circuit Breaker: Operating modes, selection of circuit breakers, constructional features and operation of Bulk Oil, Minimum Oil, Air Blast, SF6, Vacuum and d. c. circuit breakers.

Text Books:

1. S. S. Rao, “Switchgear and Protection”, Khanna Publishers.
2. B. Ravindranath and M. Chander, Power system Protection and Switchgear, Wiley Eastern Ltd.
3. B. Ram and D. N. Vishwakarma, “Power System Protection and Switchgear”, Mc. Graw Hill

Reference Books:

4. Y. G. Paithankar and S R Bhide, “Fundamentals of Power System Protection”, Prentice Hall of India.

5. T.S.M Rao, “Power System Protection: Static Relays with Microprocessor Applications” Tata Mcgraw Hill”.

6. A.R. Van C. Warrington,“Protective Relays- Their Theory and Practice, Vol. I & II” John Willey & Sons.

EEE-751	INDUSTRIAL AUTOMATION & PLC LAB	L T P: 0 0 2	1 Credit

Note: - Experiments shall be performed on following virtual lab links:

For Industrial Automation (minimum 5 experiments):

- **http://ial-coep.vlabs.ac.in/List%20of%20experiments.html?domain=Electrical%20Engineering**

For PLC (minimum 5 experiments):

- **http://plc-coep.vlabs.ac.in/List%20of%20experiments.html?domain=Electrical%20Engineering**

EEE-752	POWER SYSTEM LAB	L T P: 0 0 2	1 Credit

Note: - At least 10 experiments should be performed out of which 3 should be simulation based.

(A) Hardware Based:

1. To determine direct axis reactance (xd) and quadrature axis reactance (xq) of a salient pole alternator.

2. To determine negative and zero sequence reactances of an alternator.

3. To determine sub transient direct axis reactance (xd) and sub transient quadrature axis reactance (xq) of an alternator

4. To determine fault current for L-G, L-L, L-L-G and L-L-L faults at the terminals of an alternator at very low excitation

5. To study the IDMT over current relay and determine the time current characteristics

6. To study percentage differential relay

7. To study Impedance, MHO and Reactance type distance relays

8. To determine location of fault in a cable using cable fault locator

9. To study ferranti effect and voltage distribution in H.V. long transmission line using transmission line model.

10. To study operation of oil testing set.

(B) Simulation Based Experiments (using MATLAB or any other software)

11. To determine transmission line performance.

12. To obtain steady state, transient and sub-transient short circuit currents in an alternator

13. To obtain formation of Y-bus and perform load flow analysis

14. To perform symmetrical fault analysis in a power system

15. To perform unsymmetrical fault analysis in a power system

Text Books:

1. Hadi Sadat, “Power System Analysis” Tata McGraw Hill.

2. T.K. Nagsarskar & M.S. Sukhija, Power System Analysis’ Oxford University Press.

DEPARTMENTAL ELECTIVE-3

EEE-070	MICROPROCESSORS AND MICROCONTROLLERS	L T P: 3 0 0	3 Credit

Unit-I: Mode of operation of higher order processors: Real mode and protected mode Real mode and protected mode memory addressing, access right byte, Memory paging, System descriptors, Multi Tasking & TSS.

Unit-II: Instruction Set of higher order processors (8086 to Pentium): Comparison with 8086 in real mode: Generalized instruction set format Addressing Mode: DRAM & BRAM Categorization of instruction set of INTEL processors. Integer instructions: Data transfer instructions, arithmetic and logical operations, string instructions, branch control instructions, procedure call instruction and return instruction.

Unit-III: Processing of CALLS, INTERRUPTS & EXCEPTIONS: Privilege levels; ENTER and LEAVE Instructions, INT N. IRET. Interrupt processing sequence, Protected mode interrupts.

Unit-IV: Assembly Level Programming: ROM BIOS Routines, MS DOS BIOS Routines, Assembling a progam using Assembler, exe and. com programs. Mixed Language Programming: using Assembly with C/C ++

Unit-V: Microcontrollers: Introduction, basic functions, applications of 8-bit and 16-bit microcontrollers.

8-bit microcontrollers INTEL 8051: Internal Architecture, signals, memory organization and interfacing, Timing and control, port operations, interrupts and I/O addressing. Instruction Set and programming.

16-bit microcontrollers INTEL 8096: Architectural description, memory Organization and interfacing, I/O addressing, Interrupts, instruction set and programming.

Text Books:

1. Ray, A.K. & Burchandi, K.M., "Advanced Microprocessors and Peripherals: Architecture, Programming and Interfacing" Mc. Graw Hill.
2. Renu Sing & B.P. Singh, "Advanced Microprocessors and Microcontrollers" New Age International.
3. Krishna Kant, "Microprocessors and Microcontrollers" PHI Learning.
4. Brey, Barry B. "The INTEL Microprocessors" Pearson Education.

Reference Books:

1. Ayala, "The 8051 Micro Controller", Centage Learning.
2. Mazidi M.A., Maizidi J.G. Mckinlay R.D., "The 8051 Microcontroller and Embedded Systems" Pearson Education.
3. Rajkamal, "The concept and feature of microcontrollers 68HC11, 8051 and 8096", S.Chand Publisher, New Delhi
4. Peatman John, "Design with microcontroller", Mc.-Graw Hill Publishing.

EEE-071	UTILIZATION OF ELECTRICAL ENERGY AND TRACTION	L T P: 3 0 0	3 Credit

Unit-I: Electric Heating:

Advantages and methods of electric heating, Resistance heating, Electric arc heating, Induction heating, Dielectric heating

Unit-II: Electric Welding:

Electric Arc Welding Electric Resistance Welding Electronic welding control Electrolyte Process: Principles of electro deposition, Laws of electrolysis, applications of electrolysis

Unit-III: Illumination:

Various definitions, Laws of illumination, requirements of good lighting Design of indoor lighting and outdoor lighting systems Refrigeration and Air Conditioning: Refrigeration systems, domestic refrigerator, water cooler Types of air conditioning, Window air conditioner

Unit-IV: Electric Traction - I

Types of electric traction, systems of track electrification Traction mechanics- types of services, speed time curve and its simplification, average and schedule speeds Tractive effort, specific energy consumption, mechanics of train movement, coefficient of adhesion and its influence

Unit-V: Electric Traction – II

Salient features of traction drives Series – parallel control of dc traction drives (bridge transition) and energy saving Power Electronic control of dc and ac traction drives Diesel electric traction.

Text Books:

1. H. Partab, “Art and Science of Electrical Energy” Dhanpat Rai & Sons.

2. G.K. Dubey, “Fundamentals of Electric Drives” Narosa Publishing House

Reference Books:

3. H. Partab, “ Modern Electric Traction” Dhanpat Rai & Sons.

4. C.L. Wadhwa, “ Generation, Distribution and Utilization of Electrical Energy” New Age International Publications.

EEE-072	INTRODUCTION TO SMART GRID	L T P: 3 0 0	3 Credit

Unit-I: Introduction:

Introduction to Smart Grid: Evolution of Electric Grid, Concept of Smart Grid, Definitions, Need of Smart Grid, Functions of Smart Grid, Opportunities & Barriers of Smart Grid, Difference between conventional & smart grid, Concept of Resilient & Self Healing Grid, Present development & International policies in Smart Grid. Case study of Smart Grid. CDM opportunities in Smart Grid.

Unit-II: Smart Grid Technologies:

Introduction to Smart Meters, Real Time Prizing, Smart Appliances, Automatic Meter Reading (AMR), Outage Management System (OMS), Plug in Hybrid Electric Vehicles (PHEV), Vehicle to Grid, Smart Sensors, Home & Building Automation.

Unit-III: Smart Grid Technologies:

Smart Substations, Substation Automation, Feeder Automation, Geographic Information System (GIS), Intelligent Electronic Devices (IED) & their application for monitoring & protection, Smart storage like Battery, SMES, Pumped Hydro, Compressed Air Energy Storage, Wide Area Measurement System (WAMS), Phase Measurement Unit (PMU), PMUs application to monitoring & control of power system.

Unit-IV: Microgrids and Distributed Energy Resources:

Concept of microgrid, need & application of microgrid, formation of microgrid, Issues of interconnection, protection & control of microgrid, Plastic & Organic solar cells, thin flim solar cells, Variable speed wind generators, fuel cells, microturbines, Captive power plants, Integration of renewable energy sources.

Unit V: Power Quality Management in Smart Grid:

Power Quality & EMC in Smart Grid, Power Quality issues of Grid connected Renewable Energy Sources, Power Quality Conditioners for Smart Grid, Web based Power Quality monitoring.

Text Books:

1. Ali Keyhani, Mohammad N. Marwali, Min Dai, “Integration of Green and Renewable Energy in Electric Power Systems”, Wiley.
2. Clark W. Gellings, “The Smart Grid: Enabling Energy Efficiency and Demand Response”, CRC Press.
3. Janaka Ekanayake, Nick Jenkins, KithsiriLiyanage, Jianzhong Wu, Akihiko Yokoyama, “Smart Grid: Technology and Applications”, Wiley.
4. Jean Claude Sabonnadiere, NouredineHadjsaid, “Smart Grids”, Wiley Blackwell 19.
5. Stuart Borlase, “Smart Grids (Power Engineering)”, CRC Press.

Reference Books:

6. Andres Carvallo, John Cooper, “The Advanced Smart Grid: Edge Power Driving Sustainability”, Artech House Publishers July 2011.
7. James Northcote, Green, Robert G. Wilson “Control and Automation of Electric Power Distribution Systems (Power Engineering)”, CRC Press.
8. MladenKezunovic, Mark G. Adamiak, Alexander P. Apostolov, Jeffrey George Gilbert “Substation Automation (Power Electronice and Power Systems)”, Springer

9. R.C. Dugan, Mark F. McGranghan, Surya Santoso, H. Wayne Beaty, “Electrical Power System Quality”, 2nd Edition, McGraw Hill Publication.
10. Phadke, A.G., Thorp, J.S., “Synchronized Phasor Measurements and Their Applications”, Springer.
11. James Momoh, “Smart Grid: Fundamentals of Design and Analysis”, Wiley.

EEN-070	INTRODUCTION TO ROBOTICS	L T P: 3 0 0	3 Credit

UNIT I: INTRODUCTION

Specifications of Robots, Classifications of robots, Work envelope, Flexible automation versus Robotic technology, Applications of Robots, ROBOT KINEMATICS AND DYNAMICS Positions, Orientations and frames,

Mappings: Changing descriptions from frame to frame, Operators: Translations, Rotations and Transformations, Transformation Arithmetic, D-H Representation, Forward and inverse Kinematics of Six Degree of Freedom Robot Arm, Robot Arm dynamics.

UNIT II: ROBOT DRIVES AND POWER TRANSMISSION SYSTEMS

Robot drive mechanisms, hydraulic, electric – servomotor- stepper motor - pneumatic drives, Mechanical transmission method - Gear transmission, Belt drives, cables, Roller chains, Link - Rod systems - Rotary-to-Rotary motion conversion, Rotary-to-Linear motion conversion, Rack and Pinion drives, Lead screws, Ball Bearing screws,

UNIT III :MANIPULATORS

Construction of Manipulators, Manipulator Dynamic and Force Control, Electronic and Pneumatic manipulators

UNIT IV :ROBOT END EFFECTORS

Classification of End effectors – Tools as end effectors. Drive system for grippers-Mechanicaladhesive-vacuum-magnetic-grippers. Hooks&scoops. Gripper force analysis and gripper design. Active and passive grippers.

UNIT V: PATHPLANNING & PROGRAMMING:

Trajectory planning and avoidance of obstacles, path planning, skew motion, joint integrated motion – straight line motion-Robot languages -.computer control and Robot software.

TEXT BOOKS:

1. Deb S. R. and Deb S., “Robotics Technology and Flexible Automation”, Tata McGraw Hill Education Pvt. Ltd, 2010.

2. John J.Craig , “Introduction to Robotics”, Pearson, 2009. 3. Mikell P. Groover et. al., "Industrial Robots - Technology, Programming and Applications", McGraw Hill, New York, 2008.

REFERENCES:

1. Richard D Klafter, Thomas A Chmielewski, Michael Negin, "Robotics Engineering – An Integrated Approach", Eastern Economy Edition, Prentice Hall of India Pvt. Ltd., 2006.

2. Fu K S, Gonzalez R C, Lee C.S.G, "Robotics : Control, Sensing, Vision and Intelligence", McGraw Hill, 1987

DEPARTMENTAL ELECTIVE-4

EEE-075	INDUSTRIAL AUTOMATION AND CONTROL	L T P: 3 1 0	4 Credit

Unit 1: Need and benefit of automation, PLC system: applications of PLC, PLC modules, I/O module, Communication module, PID module, Input analog and digital devices, Output analog and digital devices.

Unit 2: PLC registers, PLC timer function, PLC counter function, PLC simple arithmetic and logical functions, PLC ladder logic diagram, Advanced PLC functions like SKIP, MASTER CONTROL RELAY, JUMP with non return, jump with return, Sequencer function

Unit 3: PLC applications: Bottling filling plant, Material handling elevator, 2-axis robot with sequencer control, Level control, Troubleshooting

Unit 4: Introduction to DCS, concept of DCS, hierarchy of DCS, function of each level of DCS, Introduction to supervisory Control and Data Acquisition system (SCADA), SCADA Architecture, Interfacing SCADA with PLC

Unit 5: Induction motor drive: V/F Control, Direct torque control, Stepper motor drives, AC and DC Servo motor drives, DC motor drives

Text Books:

1 Webb John W. and Reis A. Ronald, "Programmable Logic Controllers Principles and applications" PHI ,New Delhi, Latest edition

2 Bolton W, "Programmable Logic Controllers" Elsevier India Pvt. Ltd. New Delhi

3 John R Hackworth, "Programmable Logic Controllers" Pearson education New Delhi, Latest edition

4 C. D. Johnson, "Process Control Instrumentation" John Wiley & Sons

Reference Books:

1 Liptak, "Instrumentation Engineering Handbook" Chilton Book Company, Latest edition

2 Popovic & Bhatkar, "Distributed Computer Control for Industrial Automation" CRC Press, New Delhi, Latest edition

3 Krishna Kant, "Computer Based Industrial Control" PHI, New Delhi, Latest edition

4 Rashid M. H, "Power Electronics – Circuits, Devices and Applications" PHI / Pearson Education.

EEE-076	ENERGY EFFICIENCY & CONSERVATION	L T P: 3 1 0	4 Credit

Unit-I: Energy conservation:

Principles of Energy Conservation, Energy conservation Planning, Energy conservation in small scale industries, Large scale industries and in electrical generation, transmission and distribution, Energy conservation Legislation.

Unit-II Energy Audit: Aim of energy Audit, Strategic of Energy Audit, Energy management Team Consideration in implementing energy conservation Programme, Instruments for energy audit, Energy audit of Electrical Systems, HVAC, Buildings, Economic analysis.

Unit-III: Demand Side Management:

Concept and Scope of Demand Side Management, Evolution of Demand Side Management, DSM Strategy, Planning, Implementation and its application, Customer Acceptance & its implementation issues, National and International Experiences with DSM.

Unit-IV: Voltage and Reactive power in Distribution Systems:

Voltage and reactive power calculations and control, Voltage classes and nomenclature, voltage drop calculations, Voltage control, VAR requirements and power factor, Capacitors unit and bank rating, Protection of capacitors and switching, Controls for switched capacitors and fields testing.

Unit-V: Efficiency in Motors and Lighting system:

Load scheduling/shifting, Motor Drives-motor efficiency testing, energy efficient motors, and motor speed control. Lighting- lighting levels, efficient options, fixtures, day lighting, timers, Energy efficient windows, UPS selection, Installation operation and maintenance.

Indian Electricity Act 1956, Distribution Code and Electricity Bill 2003.

Text / Reference Books

1. Tripathy S.C., "Electric Energy Utilization and Conservation', Tata McGraw Hill.
2. Industrial Energy Conservation Manuals, MIT Press, Mass
3. "The Efficient Use of Energy", Edited by I.G.C.Dryden, Butterworths, London
4. Energy Management Handbook, Edited by W.C.Turner, Wiley, New York
5. L.C.Witte, "P.S.Schmidt, D.R.Brown, Industrial Energy Management and Utilization", HemispherePubl, Washington
6. Power Capacitor Handbook, Butterworth & Co (Publishers) Ltd
7. Electrical Systems Analysis and Design for Industrial Plants, Mcgraw-Hill Book Company.
8. IEEE Bronze Book, "Recommended Practice for Energy Conservation and cost effective planning in industrial facilities", IEEE Press

EEE-077	RELIABILITY ENGINEERING	L T P: 3 1 0	4 Credit

UNIT I: Introduction

Definition of reliability, types of failures, definition and factors influencing system effectiveness, various parameters of system effectiveness.

UNIT II: Reliability Mathematics

Definition of probability, laws of probability, conditional probability, Bay's theorem; variousdistributions; data collection, recovery of data, data analysis procedures, empirical reliabilitycalculations.

UNIT III: Reliability

Types of system- series, parallel, series parallel, stand by and complex; development of logic diagram, methods of reliability evaluation; cut set and tie-set methods, matrix methods event trees and fault trees methods, reliability evaluation using probability distributions, Markov method, frequency and duration method.

UNIT IV: Reliability Improvements

Methods of reliability improvement, component redundancy, system redundancy, types ofredundancies-series, parallel, series - parallel, stand by and hybrid, effect of maintenance.

UNIT V: Reliability Testing

Life testing, requirements, methods, test planning, data reporting system, data reduction and analysis, reliability test standards.

Text Books :

1. R.Billintan& R.N. Allan,"Reliability Evaluation of Engineering and Systems", Plenum Press.

2. K.C. Kapoor & L.R. Lamberson,"Reliability in Engineering and Design", John Wiley and Sons.

Reference Books:

3. S.K. Sinha & B.K. Kale,"Life Testing and Reliability Estimation", Wiley Eastern Ltd.

4. M.L. Shooman, "Probabilistic Reliability, An Engineering Approach", McGraw Hill.

5. G.H.Sandler,"System Reliability Engineering", Prentice Hall.

EEN-075	TELEMETRY & DATA TRANSMISSION	L T P: 3 1 0	4 Credit

Unit-I: Sampling Fundamentals:

Introduction to sampling and reconstruction processes, Sampling theorem, Alising Error and its remedies, Minimum sampling rate computation and Convolution.

Digital Modulation Techniques:

PCM, DPCM, DM code converters, Methods of binary data transmission: PSK, QPSK, FSK, Data Formats, Receiver probability errors, Phase ambiguity resolution and Differential encoding, Error detection and Error correction codes.

Unit-II & III: Data Handling System:

Block diagram of data handling systems and its components, Sensors, Signal conditioners, Multiplexing- high level and low level, ADC (SAR type, Dual slope type, Sigma Delta type, Ramp type and Flash type),Range and resolution computation, Serial and parallel data transmission protocols: Word Format, Frame format and Frame synchronizer codes.

Serial interfaces: RS 232C RS 422, RS423, interfaces and node to node switching protocol (X25), Configuration of serial interface devices, Multiplier & Concentrator, Block diagram of Data Modems and its components.

Data Reception Systems:

Bit synchronizers, Frame synchronizers, Sub-frame synchronizers and PLL.

Unit-IV: Remote Control:

Communication based processing control systems: Pipelines (Operational security and control components), Power system control and Programmable controllers for factory automation.

Command Systems: Tone command system, Tone digital command system and PCM instruction command systems.

Unit-V: Aerospace Telemetry:

Block Diagram of aerospace telemetry system and its components, Principles of telecontrol systems, Multiplexing techniques in tele-control, Industrial Tele-control installations, Reliability in telecontrol installations.

Text Books:

1. Patranabis," Telemetry Principles: Tata Mcgraw Hill.

2. Schweber," Data Communication " Mcgraw Hill.

3. Berder&Menjewlse," Telemetry Systems".

DEPARTMENTAL ELECTIVE-5

EEE-080	ADVANCED CONTROL SYSTEM	L T P: 3 1 0	4 Credit

Unit-I: State Space Analysis of Continuous System:

State space analysis, Solution of state equation, determination of state-transition matrix, using Laplace method, Similarity transformation method and Caley-Hamilton Method.

Unit-II: Analysis of Discrete System:

Concept of state feedback design, Determination of controllability Matrix and test of controllability, State feedback controller design via pole placement method, Concept of state observer design, Determination of the observability matrix and test of observability condition, Design of the full state observer using pole placement.

Unit-III: Nonlinear systems:

Nonlinear System Modeling Analysis of Nonlinear system (Inverted Pendulum)via Linearization, Describing function analysis of nonlinear system, Stability Analysis of Nonlinear system using Describing function Analysis.

Unit-IV: Phase Plan Analysis:

Construction of Phase portrait using Isoclines approach, Singular points, Phase plane analysis of 2^{nd} order linear system, Phase plane analysis of nonlinear control system.

Unit-V: Liapunov Stability Analysis:

Concept of stability in the sense of Liapunov. Linear system analysis using Liapunov approach, Determination of Liapunov functions using variable gradient method, Stability analysis of nonlinear systems.

Text Books:

1. M. Gopal, “Digital Control and State variable Methods”, Tata Mc Graw Hill.

2. Ajit K. Madal, “Introduction to Control Engineering: Modelling, Analysis and Design” New Age International.

3. K. Ogata, “ Modern Control Engineering”, PHI.

Reference Books:

1. B.C. Kuo, “Digital Control Systems” Sounders College Publishing

2. C.H.Houpis and G.B.Lamont,“Digital Control Systems:Theory,Hardware, Software” Mc Graw Hill.

EEE-081	INTRODUCTION TO POWER QUALITY & FACTS	L T P: 3 1 0	4 Credit

Unit-I: Introduction to Power Quality:

Terms and definitions of transients, Long duration Voltage Variations: under Voltage, Under Voltage and Sustained Interruptions; Short Duration Voltage Variations: interruption, Sag, Swell; Voltage Imbalance; Notching D C offset, waveform distortion; voltage fluctuation; power frequency variations.

Unit-II: Voltage Sag:

Sources of voltage sag: motor starting, arc furnace, fault clearing etc; estimating voltage sag performance and principle of its protection; solutions at end user level- Isolation Transformer, Voltage Regulator, Static UPS, Rotary UPS, and Active Series Compensator.

Unit-III: Electrical Transients:

Sources of Transient Over voltages- Atmospheric and switching transients- motor starting transients, pf correction capacitor switching transients, ups switching transients, neutral voltage swing etc; devices for over voltage protection.

Unit-IV: FACT Systems:

Introduction – Terms &Definition,Fact Controllers, Type of FACT devices i.e. SSC, SVC, TSC, SSS, TCSC, UPFC Basic relationship for power flow control.

Unit- V: Harmonics:

Causes of harmonics; current and voltage harmonics: measurement of harmonics; effects of harmonics on – Transformers, AC Motors, Capacitor Banks, Cables, and Protection Devices, Energy Metering, Communication Lines etc., Harmonic Mitigation Techniques.

Text Books:

1. Roger C Dugan, McGrahan, Santoso&Beaty, “Electrical Power System Quality” McGraw Hill
2. Arinthom Ghosh & Gerard Ledwich, “Power Quality Enhancement Using Custom Power Devices” Kluwer Academic Publishers
3. C. Sankaran, “Power Quality” CRC Press
4. S. Sivanagaraju& S. Satyanarayana, “Electric Power Transmission and Distribution” Pearson Education
5. Narain G. Hingorani& Laszlo Gyugyi “Understanding FACTS: Concepts and Technology of Flexible AC Transmission Systems” Wiley

EEE-082	POWER SYSTEM DYNAMICS, CONTROL AND MONITORING (NPTEL)	L T P: 3 1 0	4 Credit

Refer following web link for course details:

https://onlinecourses.nptel.ac.in/noc19_ee14/preview

EEN-080	OPTICAL FIBER COMMUNICATION	L T P: 3 1 0	4 Credit

Unit-I: Introduction:

Block diagram of optical fiber communication system, Advantages of optical fiber communication.

Optical fiber waveguides: Structure of optical wave guide, light propagation in optical fiber using ray theory, acceptance angle, numerical aperture, skew rays, wave theory for optical propagation, modes in a planar and cylindrical guide, mode volume, single mode fibers, cutoff wavelength, mode field diameter, effective refractive index and group and mode delay factor for single mode fiber.

Unit-II:

Transmission Characteristics of Optical fiber, Attenuation in optical fibers, intrinsic and extrinsic absorption, linear and non linear scattering losses, fiber bend losses. Dispersion and pulse broadening, intramodal and intermodal dispersion for step and graded index fibers, modal noise, over all fiber dispersion for multimode and monomode fiber, dispersion shifted fibers, modal birefringence and polarization maintaining fibers, Measurement of attenuation & Dispersion.

Unit-III: Optical Sources:

Basic concepts Einstein relations and population inversion optical feed back and threshold conditions, direct and indirect band gap semiconductors spontaneous and stimulated emission in p-n junction, threshold current density, H e t e r o junction & DH structure, semiconductor injection lasers structure & Characteristics of injection laser. Drawback and advantages of LED, DH, LED, LED structures and characteristics.

Unit-IV: Optical detectors:

Requirement for photo detections p-n photodiode, characteristics of photo detections, p-i-n and avalanche photodiodes, phototransistors & photoconductors.

Direct detection receiver performance considerations:

Noise sources in optical fiber communication, noise in p-n, p-i-n and APD receivers, Receiver structures.

Unit-V: Optical fiber communication systems:

Principal components of an optical fiber communication system, source limitations, optical transmitter circuits, LED and laser drive circuits, optical receiver block diagram, simple circuits for pre-amplifier, automatic gain control and equalization, Regenerative repeater, BER of optical receiver, channel losses, ISI penalty and optical power budgeting for digital optical fiber system, line coding, analog systems, Direct intercity and sub carrier intensity modulation using AM, FM and PM. Block diagram and detection principle of coherent optical fiber system. OTDR and Optical Power meter.

Text Book:

1. Optical fiber Communication: John M.S Senior PHI, 2nd Ed.

Reference Books:

2. Optical Communication: J. Gowar PHI, 2nd Ed.
3. Optical fiber Communication: G.E. Keiser Mc Graw-Hill, 3rd Ed.
4. Optoelectronics: Wilson & Hawkes PHI, 2nd Ed.

DEPARTMENTAL ELECTIVE-6

EEE-085	EHV AC & DC TRANSMISSION	L T P: 3 0 0	3 Credit

UNIT-I:

Need of EHV transmission, standard transmission voltage, comparison of EHV AC & DC transmission systems and their applications & limitations, surface voltage gradients in conductor, distribution of voltage gradients on sub-conductors, mechanical considerations of transmission lines, modern trends in EHV AC and DC transmission.

UNIT-II: EHV AC Transmission:

Corona loss formulas, corona current, audible noise – generation and characteristics corona pulses their generation and properties, radio interference (RI) effects, over voltage due to switching, ferroresonance, reduction of switching surges on EHV system, principle of half wave transmission.

UNIT-III: Extra High Voltage Testing:

Characteristics and generation of impulse voltage, generation of high AC and DC voltages, measurement of high voltage by sphere gaps and potential dividers. Consideration for Design of EHV Lines: Design factors under steady state limits, EHV line insulation design based upon transient over voltages. Effects of pollution on performance of EHV lines.

UNIT-IV: EHV DC Transmission – I:

Types of dc links, converter station, choice of converter configuration and pulse number, effect of source inductance on operation of converters. Principle of DC link control, converter controls characteristics, firing angle control, current and excitation angle control, power control, starting and stopping of DC link.

UNIT-V:EHV DC Transmission – II:

Converter faults, protection against over currents and over voltages, smoothing reactors, generation of harmonics, AC and DC filters, Multi Terminal DC systems (MTDC): Types, control, protection and applications.

Text Books:

1. R. D. Begamudre, “Extra High Voltage AC Transmission Engineering” Wiley Eastern.
2. K. R. Padiyar, “HVDC Power Transmission Systems: Technology and System Reactions” New Age International.
3. J. Arrillaga,“ High Voltage Direct current Transmission” IFFE Power Engineering Series 6, Peter Peregrinus Ltd, London.
4. M. S. Naidu & V. Kamaraju, “High Voltage Engineering” Tata Mc Graw Hill. Reference Books:
5. M. H. Rashid , “ Power Electronics : Circuits, Devices and Applications” Prentice Hall of India.
6. S. Rao, “EHV AC and HVDC Transmission Engineering and Practice” Khanna Publisher.
7. “EPRI, Transmission Line Reference Book, 345 KV and above” Electric Power Research Institute. Palo Alto, California, 1982

EEE-086	POWER THEFT AND ENERGY MANAGEMENT	L T P: 3 0 0	3 Credit

UNIT-I: Introduction:

Energy sources, Energy demand and supply, Energy crisis, Future Scenario, Menace of power theft, reasons for power pilferage, electricity loss and theft-National and Global Scenario, Security seals and tampering, harmonics and power theft, Control Over power theft.

UNIT-II: Power Theft in Electro-mechanical Meters:

Power theft in voltage circuit, by-passing meters, drilling holes on Electro-mechanical Meters, Insertion of film into meter, partial earth fault tampering, Missing Neutral Method.

Power Theft in Electronic Meters: Power theft by means of Electrostatic Discharge, Power theft by tampering printed circuit board, Power theft by tampering the frequency circuit, tampering on display circuits of energy meter, Introducing limit switch.

UNIT-III:

Energy system efficiency, Energy conservation aspects, Instrumentation and measurements.

Principles of Energy Management and Energy Audit:

General principles, Planning and program, Introduction to energy audit, General methodology, Site surveys, Energy systems survey, Energy audit, Instrumentation, Analysis of data and results.

UNIT-IV: Electrical Load and Lighting Management:

General Principles, Illumination and human comfort, Lighting systems, Equipment's, Electrical systems, Electrical load analysis, Peak load controls.

Demand Side Management: Concept and Scope of Demand Side Management, Evolution of Demand Side Management. DSM Strategy, Planning, Implementation and its application, Customer Acceptance & its implementation issues, National and International Experiences with DSM.

Text Books:

1. G.Sreenivasan, "Power Theft", PHI Learning Private Limited

2. AmlanChakrabarti, "Energy Engineering and Management", PHI Learning Private Limited

3. W R Murphy, G Mckay, "Energy Management", B.S. Publications

EEE-087	DIGITAL IMAGE PROCESSING	L T P: 3 0 0	3 Credit

Unit-I:Image:

Image formation, image geometry perspective and other transformation, sterio imaging elements of visual perception [60] Digital Image-sampling and quantization serial & parallel Image processing

Unit-II:Signal Processing:

Fourier, Walsh-Hadmard discrete cosine and Hotelling transforms and their properties, filters, correlators and convolvers, Histogram specification, smoothing, sharpening, frequency domain enhancement, pseudo-colour enhancement

Unit-III: Image Restoration:

Constrained and unconstrained restoration Wiener filter, characteristics of Wiener filter, geometric and radiometric correction Image data compression-Huffman and other codes transform compression, predictive compression two tone Image compression, block coding, run length coding, and contour coding.

Unit-IV: Segmentation Techniques

Thresholding approaches, region growing, relaxation, line and edge detection approaches, edge linking, supervised and unsupervised classification techniques

Unit-V: Practical Applications Finger print classification, signature verification, text recognition, map understanding, bio-logical cell classification. Analysis of biomedical images, Wavelet Transforms in One Dimension - The Discrete Wavelet Transform and The Continuous Wavelet Transform.

Text Books:

1.Ganzalez and Wood, “Digital Image Processing”, Addison Wesley, 1993.

2.AnilK.Jain, “Fundamental of Image Processing”, Pearson India.

References:

3.Rosenfeld and Kak, “Digital Picture Processing” vol.I&vol.II, Academic,1982

4.Ballard and Brown, “Computer Vision”, Prentice Hall, 1982

5.WayneNiblack, “An Introduction to Digital Image Processing”, Prentice

EEE-088	ANTENNAS (NPTEL)	L T P: 3 0 0	3 Credit

Refer following web link for course details:

https://onlinecourses.nptel.ac.in/noc19_ee19/preview