TULSIRAMJI GAIKWAD-PATIL
College of Engineering & Technology
Mohgaon, Wardha Road, Nagpur - 441 108

An Autonomous Institute

DEPARTMENT OF ELECTRICAL ENGINEERING

B.Tech. Electrical Engineering
VII Semester

Syllabus

From
Academic Year 2024-25

Tulsiramji Gaikwad-Patil College of Engineering & Technology, Nagpur

(An Autonomous Institution Affiliated to RTM Nagpur University, Nagpur)

SCHEME OF INSTRUCTION & SYLLABI

Programme: Electrical Engineering

Scheme of Instructions: Final Year B.Tech. in Electrical Engineering

Semester – VII

Sr. No.	Course Category	Course Code	Course Title	L	T	P	Contact Hrs./Wk	Credits	CT1	CT2	TA/CA	ESE	TOTAL
1	PCC	BEE4701	Switchgear and Protection	3	-	-	3	3	15	15	10	60	100
2	PCC	BEE4702	Switchgear and Protection Lab	-	-	2	2	1	-	-	25	25	50
3	PCC	BEE4703	Internet of Things Lab	-	-	4	4	2	-	-	50	50	100
4	PEC	BEE4704-07	Program Elective-V	3	1	-	4	4	15	15	10	60	100
5	OEC	B$$XX01-16	Open Elective-III	4	-	-	4	4	15	15	10	60	100
6	OEC	B$$XX01-16	Open Elective-IV	4	-	-	4	4	15	15	10	60	100
7	OEC	B$$XX01-16	Open Elective-V	4	-	-	4	4	15	15	10	60	100
8	MCC	BAU4707	Behavioral and Interpersonal Skills	2	-	-	2	Audit	-	-	-	-	-
			Total	**20**	**01**	**6**	**27**	**22**	**75**	**75**	**125**	**375**	**650**

*There will be two presentations, based on seminar topic to be selected in consultation with guide preferably based on emerging trends.

* $$- CS, IT, EC, CE, ME, AE, BT

L- Lecture   T-Tutorial   P-Practical

CT1- Class Test 1   TA/CA- Teacher Assessment/Continuous Assessment

CT2- Class Test 2   ESE- End Semester Examination (For Laboratory End Semester performance)

Course Category	HSMC (Hum., Soc. Sc, Mgmt.)	BSC (Basic Sc.)	ESC (Engg. Sc.)	PCC (Programme Core courses)	PEC (Programme Elective courses)	OEC (Open Elective courses from other discipline)	Project / Seminar / Industrial Training	MCC (Mandatory Courses)
Credits	--	--	--	06	04	12	-	Yes
Cumulative Sum	09	2 5	21	55	18	18	04	--

PROGRESSIVE TOTAL CREDITS :128+22 =150

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Program: Electrical Engineering
List of Electives offered
By
Electrical Engineering Department

Program Elective- I	Program Elective- II	Program Elective- III	Program Elective- IV	Program Elective- V
Semester V	Semester V	Semester VI	Semester VI	Semester VII
BEE3507 - Solar Energy Utilization	BEE3511 - Wind Energy Utilization	BEE3607 - Biomass Energy and its Utilization	BEE3611 – Geothermal Energy Utilization	BEE4704 - Energy Audit and Management
BEE3508 - Utilization of Electrical Energy	BEE3512 – Power Plant Engineering	BEE3608 - Electrical Distribution System	BEE3612 - Elements of Substation Design	BEE4705 - Power System Operation & Control
BEE3509 - PLC – SCADA	BEE3513 - Robotics & Automation	BEE3609 - Industrial Automation	BEE3613 – Artificial Intelligence & its application	BEE4706 - Estimation and Costing in Electrical Engineering
BEE3510 -High Voltage Engineering	BEE3514 - Flexible AC Transmission System	BEE3610 – Power Quality	BEE3614 - Advanced Electrical Drives	BEE4707 – Digital Signal Processing

List of Open Elective

Sr. No.	Course Code	Course Title	Sr. No.	Course Code	Course Title
1	BCSXX01	Cyber Law and Ethics	9	BMEXX09	Nanotechnology and Surface Engineering
2	BCSXX02	Block chain Technology	10	BMEXX10	Automobile Engineering
3	BITXX03	Cyber Security	11	BEEXX11	Power Plant System
4	BITXX04	Artificial Intelligence	12	BEEXX12	Electrical Materials
5	BECXX05	Internet of Things	13	BAEXX13	Avionics
6	BECXX06	Embedded Systems	14	BAEXX14	Unmanned Aerial Vehicles
7	BCEXX07	Introduction to Art and Aesthetics	15	BBTXX15	Biomaterials
8	BCEXX08	Metro Systems and Engineering	16	BBTXX16	Food and Nutrition Technology

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Fourth Year (Semester-VII) B.Tech. Electrical Engineering

BEE4701: Switchgear & Protection

Teaching Scheme			Examination Scheme	
Lectures	3 Hrs/week		**CT-1**	15 Marks
Tutorial	0 Hrs/week		**CT-2**	15 Marks
Total Credit	3		**CA**	10 Marks
			ESE	60 Marks
			Total	100 Marks
			Duration of ESE: 03 Hrs 00 Min.	

Course Objective:

1	To introduce students with basic terminology of protective relaying, types of faults & components used in power system protection as well as to realize the importance of power system protection.
2	To make the students to understand different types of relays and protective schemes used in power system protection.
3	To aware students about construction, working, applications and arc interruption theory of different types of circuit breakers.

Course Contents		Hours
Unit I	**General Philosophy of protection:** Necessity of Protection, Nature and causes of faults, Types and effects of faults, Protective zones, Primary and Back up protection, Essential qualities of protective relays. Introduction of fuses, MCB, ELCB and their comparison. Classification of relays. Comparison of Electro-mechanical, Static and Numerical relays.	**(9)**
Unit II	**Overcurrent Protection:** Over current relaying, Time-Current characteristics, Current setting, Time setting, Relay coordination, Overcurrent protection schemes for medium voltage lines, directional-overcurrent relay, protection of parallel feeders and ring mains.	**(9)**
Unit III	**Distance Protection.:** Distance Protection of High Voltage lines, working principle and characteristic of Impedance relay, Mho relay, Reactance Relay, three step distance protection scheme with contact diagrams, effect of power swing, arc resistance, line length and source impedance on the operation of distance relays, Carries aided distance protection schemes with contact diagram, carrier current protection.	**(9)**
Unit IV	**Equipment Protection:** Protection of Generator & Transformer by differential relaying and other relays, Causes and remedies for mal operation of differential protection, protection of Induction motor against overloading and short circuits.	**(9)**
Unit V	**Switchgear:** Arc interruption theory, recovery and restriking voltages, RRRV, Breaking of inductive and capacitive currents. Construction & operation of Air Blast, SF6 and vacuum circuit breaker, Buchholz relay. Introduction to Digital relay.	**(9)**

Text Books

1	Sunil S. Rao, "Switchgear and Protection", Khanna Publication, 1992, New Delhi.
2	B. Ravindranath, M. Chander, "Power System Protection and Switchgear", New age International.
3	B. Ram, "Power System Protection and Switchgear", Tata McGraw Hill.
4	Y.G. Paithankar, S.R. Bhide, "Fundamentals of Power System Protection", Prentice Hall, India Second Edition,2010.

Reference Books

1	C. Russell Mason, "The art & Science of Protective Relaying", Willey,1956.
2	Warrington, "Protective Relaying Vol. I & II", Springer.
3	R. T., Lythall, "Switchgear Handbook", J & P Newness Butterworth, London.
4	A.T John & S.K. Salman, "Digital Protection for power Systm",2004.

Useful Links

https://onlinecourses.nptel.ac.in/noc24_ee64/preview

https://onlinecourses.nptel.ac.in/noc23_ee59/preview

	Course Outcomes	CL
BEE4701.1	**Understand** basic terminology of Protective relaying, different types of faults & components used in power system protection.	2
BEE4701.2	**Apply** overcurrent protection schemes for medium voltage lines.	3
BEE4701.3	**Apply** distance protection schemes for high voltage lines.	3
BEE4701.4	**Analyze** protection schemes used for protection of Generators, Transformers & Motors.	4
BEE4701.5	**Comprehend** switching phenomenon and working of circuit breakers.	4

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Fourth Year (Semester-VII) B. Tech. Electrical Engineering

BEE4702: Switchgear & Protection Lab

Teaching Scheme			Examination Scheme	
Practical	2 Hrs./week		**CA**	25 Marks
Total Credit	1		**ESE**	25 Marks
			Total	50 Marks
			Duration of ESE: 02 Hrs 00 Min.	

Course Outcomes (CO)

Students will be able to

1	**Determine** time-current characteristics of thermal overload relay, overcurrent relay & earth fault Relay.
2	**Demonstrate** the characteristics of MCB, HRC fuse & IDMT overcurrent relay.
3	**Determine** characteristics of transmission line for ABCD parameter of PIE & T network.
4	**Demonstrate** the working performance of reverse power relay & Buchholz relay.
5	**Analyze** performance of transmission line for various faults using MATLAB.

Sr. No.	List of Experiment	CO
1	Determine time-current characteristics of thermal overload relay.	CO1
2	Determine time-current characteristics of overcurrent & earth fault Relay.	CO1
3	Determine time-current characteristics of IDMT overcurrent relay.	CO2
4	Demonstrate the characteristics of MCB & HRC fuse.	CO2
5	Determine characteristics of transmission line for ABCD parameter of PIE network.	CO3
6	Determine characteristics of transmission line for ABCD parameter of T network.	CO3
7	Demonstrate the working performance of reverse power relay.	CO4
8	Demonstrate the working principle of Buchholz relay.	CO4
9	Analysis of transmission line for symmetrical faults using MATLAB.	CO5
10	Analysis of transmission line for asymmetrical faults using MATLAB.	CO5

Text Books

1	Sunil S. Rao, "Switchgear and Protection", Khanna Publication, 1992, New Delhi.
2	B. Ravindranath, M. Chander, "Power System Protection and Switchgear", New age International.
3	B. Ram, "Power System Protection and Switchgear", Tata McGraw Hill..

Reference Books

1	C. Russell Mason, "The art & Science of Protective Relaying", Willey,1956.
2	Warrington, "Protective Relaying Vol. I & II", Springer.
3	R. T., Lythall, "Switchgear Handbook", J & P Newness Butterworth, London.

Useful Links

1	https://onlinecourses.nptel.ac.in/noc24_ee64/preview
2	https://onlinecourses.nptel.ac.in/noc23_ee59/preview

Fourth Year (Semester-VII) B. Tech. Electrical Engineering

BEE4703: Internet of Things Lab

Teaching Scheme			Examination Scheme	
Practical	2 Hrs./week		**CA**	25 Marks
Total Credit	1		**ESE**	25 Marks
			Total	50 Marks
			Duration of ESE: 02 Hrs. 00 Min.	

Course Outcomes (CO)

Students will be able to

1	**Understand** the principles of digital input and output interfacing with Arduino microcontrollers.
2	**Demonstrate** proficiency in wiring and programming a push button to control the state of an LED.
3	**Analyze** and troubleshoot common issues that arise when interfacing push buttons with LEDs.
4	**Apply** knowledge of conditional statements and logical operations in Arduino programming to create responsive LED control systems.
5	**Develop** critical thinking skills by designing and implementing complex LED control scenarios.

Sr. No.	List of Experiment	CO
1	Controlling the Light Emitting Diode (LED) with a push button.	**CO1**
2	Interfacing the RGB LED with the Arduino.	**CO1**
3	Controlling the LED blink rate with the potentiometer interfacing with Arduino.	**CO2**
4	Detection of the light using photo resistor.	**CO2**
5	Interfacing of temperature sensor LM35 with Arduino.	**CO3**
6	Interfacing Servo Motor with the Arduino	**CO3**
7	Interfacing of the Active Buzzer with Arduino.	**CO4**
8	Interfacing of the Relay with Arduino.	**CO4**
9	Building Intrusion Detection System with Arduino and Ultrasonic Sensor.	**CO5**
10	Directional Control of the DC motor using Arduino.	**CO5**

Text Books

1	Jack Purdum, Beginning C for Arduino: Learn C Programming for the Arduino (Technology in Action), Apress, 1st Edition, 2012
2	Simon Monk, Programming Arduino: Getting Started with Sketches, Second Edition, McGraw Hill, 2016

Reference Books

1	Simon Monk, Programming Arduino Next Steps: Going Further with Sketches, Second Edition, McGraw Hill, 2018
2	Blum Richard, Arduino Programming in 24 Hours, Sams Teach Yourself, 1st Edition, Sams Publishing, 2014

Useful Links

1	https://onlinecourses.swayam2.ac.in/aic20_sp04/preview
2	https://onlinecourses.nptel.ac.in/noc21_cs17/preview

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Fourth Year (Semester-VII) B. Tech. Electrical Engineering

Program Elective- V: BEE4704 - Energy Audit and Management

Teaching Scheme			Examination Scheme	
Lectures	3 Hrs./week		**CT-1**	15 Marks
Tutorial	1 Hrs./week		**CT-2**	15 Marks
Total Credit	4		**CA**	10 Marks
			ESE	60 Marks
			Total	100 Marks
			Duration of ESE: 03 Hrs 00 Min.	

Course Objective:

1	To give students principles and practices of energy audit and management in various industrial, commercial, and residential settings.
2	To enable students, learn techniques for assessing energy consumption, identifying inefficiencies, and developing strategies for optimizing energy usage.
3	To gain the knowledge and skills necessary to conduct comprehensive energy audits and implement effective energy management plans.

	Course Contents	Hours
Unit I	**Energy Conservation and Energy Audit:** Energy Conservation and its importance, Energy Strategy for the Future, Energy Conservation Act-2001 and its Features. Definition, Energy audit- need, Types of energy audit, Energy management (audit) approach-understanding energy costs, Bench marking, Energy performance, Matching energy use to requirement, maximizing system efficiencies, Optimizing the input energy requirements, Fuel and energy substitution, Energy audit instruments.	**(9)**
Unit II	**Electrical System:** Electricity billing, Electrical load management and maximum demand control, Power factor improvement and its benefit, Selection and location of capacitors, Performance assessment of PF capacitors, Distribution and transformer losses.	**(9)**
Unit III	**Electric Motors:** Types, Losses in induction motors, Motor efficiency, Factors affecting motor performance, Rewinding and motor replacement issues, Energy saving opportunities with energy efficient motors. **Pumps and Pumping System:** Types, Performance evaluation, Efficient system operation, Flow control strategies and energy conservation opportunities	**(9)**
Unit IV	**Lighting System:** Light source, Choice of lighting, Luminance requirements, and Energy conservation avenues. Energy Performance Assessment of Lighting Systems **Energy Efficient Technologies in Electrical Systems:** Maximum demand controllers, Automatic power factor controllers, Energy efficient motors, soft starters with energy saver, Variable speed drives, Energy efficient transformers, electronic ballast, Occupancy sensors, Energy efficient lighting controls, Energy saving potential of each technology.	**(9)**

Unit V	**Financial Management:** Investment-need, Appraisal and criteria, financial analysis techniques-Simple payback period, Return on investment, Net present value, Internal rate of return, Cash flows, Risk and sensitivity analysis; Financing options, Energy performance contracts and role of ESCOs. **Project Management:** Definition and scope of project, technical design, Financing, Contracting, Implementation and performance monitoring. Implementation plan for top management, Planning Budget, Procurement Procedures, Construction, Measurement & Verification.	**(9)**

Text Books

1	Energy Audit Approach for Beginners: A Practitioner's guide for Energy Manager & Auditors by S Babu & M Karthikkaruppu.
2	Investment Grade Energy Audit: Making Smart Energy Choices by James W. Brown and Shirley J. Hansen.
3	Energy Conservation and Audit [English] By R.P.Ajwalia.

Reference Books

1	Energy Audit and Management: Concept, Methodologies, Procedures, and Case Studies by Gokul Ganesan and L. Ashok Kumar
2	Handbook of Energy Audits, Ninth Edition by Albert Thumann, Terry Niehus, et al.

Useful Links

1	https://www.aipnpc.org/
2	https://beeindia.gov.in/en

	Course Outcomes	**CL**
BEE4704.1	**Understand** the principles and concepts of energy audit and management.	2
BEE4704.2	**Perform** electrical energy audits in industrial, commercial, and residential settings.	3
BEE4704.3	**Analyze** energy consumption patterns and identify opportunities for energy savings in electric motors and pumping system.	4
BEE4704.4	**Develop** and implement energy management plans to optimize energy usage in lighting system.	6
BEE4704.5	**Understand** basics of financial management and mechanisms that influence energy consumption through project management.	2

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Fourth Year (Semester-VII) B. Tech. Electrical Engineering

Program Elective- V: BEE4705 - Power System Operation & Control

Teaching Scheme			Examination Scheme	
Lectures	3 Hrs./week		**CT-1**	15 Marks
Tutorial	1 Hrs./week		**CT-2**	15 Marks
Total Credit	4		**CA**	10 Marks
			ESE	60 Marks
			Total	100 Marks
			Duration of ESE: 03 Hrs 00 Min.	

Course Objective:

1	To Introduce the Load Forecasting, Estimation components & techniques for load prediction.
2	To introduce the Unit Commitment Problem
3	To understand the solution methods of economic dispatch and static state estimation.

Course Contents		Hours
Unit I	**Load Forecasting**: Introduction – Estimation of Average and trend terms – Estimation of periodic components – Estimation of Stochastic components: Time series approach – Auto- Regressive Model, Auto-Regressive Moving – Average Models – Kalman Filtering Approach – On-line techniques for non-stationary load prediction.	**(9)**
Unit II	**Unit Commitment:** Constraints in unit commitment – Spinning reserve – Thermal unit constraints – Other constraints – Solution using Priority List method, Dynamic programming method - Forward DP approach Lagrangian relaxation method – adjusting.	**(9)**
Unit III	**Generation Scheduling:** The Economic dispatch problem – Thermal system dispatching with network losses considered – The Lambda – iteration method – Gradient method of economic dispatch – Economic dispatch with Piecewise Linear cost functions – Transmission system effects – A two generator system – coordination equations – Incremental losses and penalty factors-Hydro Thermal Scheduling using DP	**(9)**
Unit IV	**Power System Control:** Review of AGC and reactive power control -System operating states by security control functions – Monitoring, evaluation of system state by contingency analysis – Corrective controls (Preventive, emergency and restorative) - Energy control centre – SCADA system – Functions – monitoring, Data acquisition and controls – EMS system.	**(9)**
Unit V	**State Estimation:** Maximum likelihood Weighted Least Squares Estimation: - Concepts - Matrix formulation - Example for Weighted Least Squares state estimation; State estimation of an AC network: development of method – Typical results of state estimation on an AC network – State Estimation by Orthogonal Decomposition algorithm.	**(9)**

Text Books

1	O. I. Elgerd, Electric Energy System Theory - an Introduction, Tata McGraw Hill, New Delhi, 2nd Edition 2002.

2	L.P. Singh, Advance Power System Analysis and Dynamics, New Age International, 3rd Edition 2006
3	P. Venkatesh, B.V.Manikandan, Electrical Power System, PHI Publications, 2012

Reference Books	
1	A. K. Mahalanabis, D.P. Kothari. and S. I. Ahson, Computer Aided Power System Analysis and Control, Tata McGraw Hill publishing Ltd., 1988
Useful Links	
1	https://www.digimat.in/nptel/courses/video/108104052/L01.html

	Course Outcomes	**CL**
BEE4705.1	**Illustrate** in-depth understanding of Load Forecasting.	3
BEE4705.2	**Solve** the problems related to the economic dispatch of power, plant scheduling, and unit commitment.	4
BEE4705.3	**Analyze** various types of methods to understand the solution of economic dispatch and static state estimation.	4
BEE4705.4	**Identify** and explain the different methods of control and compensation involved in the operation of power systems.	3
BEE4705.5	**Apply** the State Estimation to AC network by different Algorithm.	3

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Fourth Year (Semester-VII) B. Tech. Electrical Engineering

Program Elective- V: BEE4706 - Estimation and Costing in Electrical Engineering

Teaching Scheme			Examination Scheme	
Lectures	3 Hrs./week		**CT-1**	15 Marks
Tutorial	1 Hrs./week		**CT-2**	15 Marks
Total Credit	4		**CA**	10 Marks
			ESE	60 Marks
			Total	100 Marks
			Duration of ESE: 03 Hrs 00 Min.	

Course Objective:

1	Emphasize estimating and costing for analyzing electrical projects' viability.
2	Provide practical exposure to designing and estimating electrical systems.
3	Enable students to estimate costs for everyday electrical projects.
4	Provide basic knowledge of estimation methods and their pros and cons.
5	Develop skills in preparing material schedules and estimates for electrical installations.

Course Contents		Hours
Unit I	**Design Considerations of Electrical Installations:** Electric Supply System, Three phase four wire distribution system, Protection of Electric Installation against over load, short circuit and Earth fault, Earthing, General requirements of Electrical Installations, testing of installations, Indian Electricity rules, Neutral and Earth wire, Types of loads, Systems of wiring, Service connections, Service Mains, Sub-Circuits, Location of Outlets, Location of Control Switches, Location of Main Board and Distribution Board, guide lines for Installation of Fittings, Load Assessment, Permissible voltage drops and sizes of wires, estimating and costing of Electrical installations.	**(9)**
Unit II	**Electrical Installation of Buildings and Small Industries:** Electrical installations for residential buildings – estimating and costing of material, Electrical installations for commercial buildings, Electrical installations for small industries.	**(9)**
Unit III	**Overhead and Underground Transmission and Distribution Lines:** Introduction, Supports for Transmission lines, Distribution lines – Materials used, Underground cables, Mechanical Design of overhead lines, Design of underground cables**.**	**(9)**
Unit IV	**Substations:** Introduction, Types of substations, Outdoor substation – Pole mounted type, Indoor substation, Floor mounted type.	**(9)**
Unit V	**Design of Illumination Schemes**: Introduction, Terminology in Illumination, laws of illumination, various types of light sources, Practical lighting schemes.	**(9)**

Text Books

1	Electrical Design Estimating and Costing, K.B. Raina, S.K. Bhattacharya, New Age International Publisher.
2	Design of Electrical Installations, Dr. V.K. Jain, Dr. Amitabh Bajaj, University Science Press.
3	Electricity pricing Engineering Principles and Methodologies, Lawrence J. Vogt, P.E., CRCPress

Reference Books	
1	Guide for Electrical Layout in residential buildings, Indian Standard Institution, IS:4648-1968
2	Electrical Installation buildings Indian Standard Institution, IS:2032.
3	Uppal, S.L. & Garg, G.C. Electrical Wiring, Estimating and Costing Khanna Publication ,2012
Useful Links	
1	http://en.wikipedia.org/wiki/Electrical_wiring
2	http://www.kpsec.freeuk.com/components/switch.htm
3	http://home.howstuffworks.com/electrical-tools.htm

	Course Outcomes	CL
BEE4706.1	**Analyze** the costs involved in electrical equipment, installations, and designs to assess their feasibility.	4
BEE4706.2	**Design and estimate** wiring, distribution lines, substations, and illumination systems for practical projects.	6
BEE4706.3	**Design** effective illumination systems for different settings.	6
BEE4706.4	**Understand** the types and ratings of substations used in electrical systems.	2
BEE4706.5	**Apply** estimation techniques to everyday electrical projects, enhancing problem-solving abilities for real-world situations.	3

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Fourth Year (Semester-VII) B. Tech. Electrical Engineering

Program Elective- V: BEE4707 - Digital Signal Processing

Teaching Scheme			Examination Scheme	
Lectures	3 Hrs./week		**CT-1**	15 Marks
Tutorial	1 Hrs./week		**CT-2**	15 Marks
Total Credit	4		**CA**	10 Marks
			ESE	60 Marks
			Total	100 Marks
			Duration of ESE: 03 Hrs 00 Min.	

Course Objective:

1	To gives the signal processing methods and transformation techniques required for all electrical engineering related courses.
2	To gives concepts of digital signal processing algorithms used in real time environment.
3	To gives basic understanding of analog and digital filter realization techniques and importance of filter.

	Course Contents	Hours
Unit I	**Introduction to Digital Signal Processing:** Introduction to Digital Signal Processing: Total Energy, Average Power Calculation, Discrete Time Signals & Sequences, Linear Shift Invariant Systems, Stability, and Causality. **Realization of Digital Filters:** Solution of Difference Equations Using Z-Transform, Realization of Digital Filters - Direct, Canonic forms.	**(9)**
Unit II	**Discrete Fourier Transforms:** DFS representation of periodic sequences, Properties of DFT. Linear Convolution of Sequences using DFT. Computation of DFT: Over-lap Add Method, Over-lap Save Method. Relation between DTFT, DFS, DFT and Z-transform, **Fast Fourier Transforms:** Fast Fourier Transforms (FFT) - Radix-2 Decimation-in-Time and Decimation-in-Frequency FFT Algorithms, Inverse FFT.	**(9)**
Unit III	**IIR Digital Filters:** Analog Filter Approximations - Butterworth and Chebyshev, Design of IIR Digital filters from Analog Filters, Step and impulse invariant techniques, Bilinear Transformation Method, Special transformations.	**(9)**
Unit IV	**FIR Digital Filters:** Characteristics of FIR Digital Filters. Frequency response, Design of FIR Digital Filters: Fourier method, Design of FIR Filters: using Window Techniques, Frequency Sampling technique, Comparison of IIR & FIR filters.	**(9)**
Unit V	**Multi-rate Digital Signal Processing:** Introduction, Down sampling, Decimation, Up sampling, Interpolation, Sampling Rate Conversion, Applications of Multi Rate Signal Processing. **Finite word length effects**: Limit cycles, Overflow oscillations, Round –off noise in IIR digital filters, Methods to prevent overflow, Dead band effects, Tradeoff between round off and overflow noise.	**(9)**

Text Books

1	Digital signal processing, principles, Algorithms and applications: john G. Proakis, Dimitris G. Manolakis, Pearson Education / PHI, 2007.

| 2 | Discrete time signal processing – A.V Oppenheim and R.W. Schaffer, PHI, 2009. |
| 3 | Fundamentals of Digital Signal Processing –Loney Ludeman, John Wiley, 2009. |

Reference Books	
1	Digital signal processing – Fundamentals and applications –Li Tan, Elsevier, 2008.
2	Fundamentals of digital signal processing using MATLAB –Robert J. Schilling, Sanda L. Harris, Thomson, 2007.
3	Digital signal processing – S. Salivahanan, A.Vallavaraj and C. Gnanapriya, TMH , 2009.
4	Discrete systems and digital signal processing with MATLAB –Taan S. EIAli, CRC press, 2009.
5	Digital Signal Processing – a Practical approach, Emmanuel C. Ifeachor and Barrie W. Jervis, 2nd edition, Pearson education, 2009

Useful Links	
1	http://nptel.ac.in/courses/117101055/
2	http://nptel.ac.in/courses/117104074/
3	http://nptel.ac.in/syllabus/117102060/

	Course Outcomes	**CL**
BEE4707.1	**Identify** characteristics of different digital systems like linear time-invariant systems and others.	3
BEE4707.2	**Describe** both the analog and digital systems in frequency domain analysis, realization and implementation.	3
BEE4707.3	**Understand** different signal processing algorithms.	2
BEE4707.4	**Determine** the various important characteristics of different transformation techniques used in digital signal processing.	3
BEE4707.5	**Design and simulate** different systems for real time applications.	6

HOD
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Tulsiramji Gaikwad-Patil College of Engineering and Technology
Wardha Road, Nagpur-441 108
NAAC Accredited (A+ Grade) & NBA Accredited
An Autonomous Institute affiliated to RTMNU Nagpur

Fourth Year (Semester-VII) B.Tech. Electrical Engineering
BAU4707: - Behavioral and Interpersonal Skills

Teaching Scheme			Examination Scheme	
Lectures	2 Hrs/week		CIE	-
Tutorial	0 Hrs/week		ESE	-
Total Credit	Audit		Total	-

Course Objective:

1	To help the students to understand their real self by recognizing different aspects of their self-concept that will lead to an increased self-confidence.
2	To train the students for communicating effectively in both formal as well as in informal settings.
3	To help the students to understand the importance of non-verbal aspects of effective communication.
4	To help the students to understand Emotion and emotional intelligence, Managing ones' own emotional reservoirs, effective dealing with emotions at work.
5	To facilitate the students in understanding the formation and function of group and team and to help them to learn the skills of a successful leader.
6	To help the students in understanding and practicing the goal setting process by recognizing the importance of each step involved in goal setting. The activities involved are designed to facilitate their career goal decision making.

Course Contents	Hours
Each individual has behavior patterns that are shaped by the context of his or her past. Most often, adapting the behavior to the changing context of the reality a person lives in becomes difficult which may lead to the reduction in personal effectiveness and natural self-expression. The main focus of this course is to equip the students with useful approaches to help in the deeper understanding of self and help individuals empower themselves to be the source of their own growth and development. The course will help students to learn effective communication skills, Group and team building skills and will help them learn the goal setting process and thus become more effective in achieving their goals. The broader objective of this course is to make the students aware about the different facets of self and to help them learn skills to strengthen their inner capacities. So that they are able to understand themselves, think and act effectively, to be able to communicate in an effective manner and to learn to lead and to form an effective team.. The activities to achieve the above objectives can be suggested as follows. • Motivational lectures • Group Discussions/activities • Case Study • Games/Stimulation Exercises • Role-Playing • Mindfulness training.	(08)

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