Shri Rawatpura Sarkar University, Raipur

Scheme of Teaching, Examination&

Syllabus for

B.Tech. (Electrical Engineering)

Semester-(VII)

(Effective from the session: 2022-23)

B.TECH ELECTRICAL
Semester-(VII)
2022-23

Four Years B.TechProgramme

Scheme of Teaching and Examination of B.Tech. SeventhSemester

(Electrical Engineering)

Outcome Based Education (OBE) and Choice Based Credit System (CBCS)

(Effective from the Academic Year 2022-2023)

S.No.	Course Code	Course Title	Hours / Week			Credits	Maximum Marks			Sem End Exam Duration (Hrs)
			L	T	P		Continuous Evaluation	Sem End Exam	Total	
1	BENEE701T	Switchgear & Protection	3	1	-	4	30	70	100	3
2	BENEE701P	Switchgear & Protection	-	-	2	1	15	35	50	-
3	BENEE702T	Modern Control System	2	1	-	3	30	70	100	3
4	BENEE703T	Electrical Drives	3	1	-	4	30	70	100	3
5	BENEE703P	Electrical Drives Lab	-	-	2	1	15	35	50	-
6	BENEE704T	Elective IV	2	1	-	3	30	70	100	3
7	BENEE705T	Elective V	3	1	-	4	30	70	100	3
8	BENEE706P	Programming and Simulation in MATLAB	-	-	2	1	15	35	50	-
9	BENEE707P	Project Phase-I	-	-	2	1	50	100	150	-
						22			800	

Elective IV

A. Power Apparatus System
B. Systems Software
C. Advanced Microprocessor
D. Digital Image Processing

Elective V

A. Energy Auditing and Management
B. Embedded system software in C
C. Soft Computing Techniques and Its Applications
D. Applied Optimization

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<table>
<tr><td>Course Title</td><td colspan="5">SWITCHGEAR & PROTECTION</td></tr>
<tr><td>Course Code</td><td colspan="5">BENEE701T</td></tr>
<tr><td rowspan="2">Course Credits</td><td>L</td><td>T</td><td>P</td><td>TC</td><td></td></tr>
<tr><td>3</td><td>1</td><td>0</td><td>4</td><td></td></tr>
<tr><td>Prerequisites</td><td colspan="5">Electrical power system</td></tr>
<tr><td>Course Objectives</td><td colspan="5">• To understand the principle of protective schemes and various faults in the Power SystemScenario.
• To study the various types of the circuit breakers, the arc quenching phenomena and the protection against overvoltages.
• To explain the students protection systems used for electric machines, transformers, bus bars, overhead and undergroundfeeders.</td></tr>
<tr><td>Course Contents</td><td colspan="5">UNIT- I
Protective Relays
Trip circuit & circuit Breaker, Current transformer & protection, instantaneous over current relay, I.D.M.T. Relay, Differential relay, Directional relay, Generalized torque expression, impedance relay, reactance relay, mho relay
UNIT-II
Generation, Transformer & Bus bar Protection
Generator protection – Differential protection of stator, inter turn fault protection, protection against unbalance loading, protection of rotor against ground fault, protection against field failure, protection against failure of prime mover, field suppression in alternators. Transformer protection – difficulties in differential protection, mode of C.T. connection for differential protection of three phase transformer, protection against magnetizing inrush current, core balance earth leakage protection. Bus bar protection- Differential protection, frame leakage protection.
UNIT-III
Feeder and Transmission line protection
Feeder protection- protection of ring main feeder, protection of parallel feeders. Transmission line protection-Over current protection of lines, Three step distance protection, effect of power swings on distance relay, Directional comparison carrier current protection, phase comparison carrier current protection, carrier aided distanceprotection.
UNIT-IV
Static Relays
Amplitude & phase comparators, duality between amplitude & phase comparators,</td></tr>
</table>

	circulating current amplitude comparators, coincidence type phase comparator, block spike phase comparator, integrating phase comparator, Hall effect sine phase comparator, Design of directional relay, reactance relay, mho relay, impedance relay, quadrilateral characteristics relay using cosine phase comparator and amplitudecomparator **UNIT-V** **Circuit Breakers** Initiation of Arc, High resistance arc interruption, current zero arc interruption, Recovery voltage, Factor affecting recovery voltage, Restriking voltage, Rate of Rise of Restriking Voltage, Breaking of capacitive current, current chopping, Resistance switching, Circuit Breaker rating, Circuit Breaker testing, Minimum oil circuit breaker, Air Blast circuit Breaker, SF-6 CircuitBreaker
Course Outcomes	**After studying the contents of the syllabus in detail the students will be able to:** • Design the relevant protection systems for the main elements of a powersystem. • Analyze overcurrent, differential, and ratio protection devices and their application in a coordinated protectionscheme. • Understand the stability problems and clearing of faults to mitigate these problems.
Text Books	1. Fundamentals of Power System Protection, Paithankar Y. G., Bhide S. R., Prentice Hall of India Limited, New Delhi , 2nd Edition,2010. 2. Power System Protection and Switchgear, Badri Ram, Vishwakarma D N.,Tata McGraw Hill Publishing House Limited, New Delhi, 2005.
Reference Books	1. Electrical Power Systems, Wadhwa, C.L., New Age International Publishers Limited, 2006, New Delhi,6th Edition, 2010 2. Switchgear Protection and Power Systems (Theory, Practice & Solved Problems, Sunil, S.Rao, Khanna Publishers Limited, New Delhi, 12th Edition,2008. 3. A Text Book on Power Systems Engineering, Soni, M.L., Gupta, P.V.,Bhatnagar, U.S. and Chakrabarti, A., Dhanpat Rai & Sons Company Limited, New Delhi,2008.

B.TECH ELECTRICAL
Semester-(VII)
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Course Title	**MODERN CONTROL SYSTEM**				
Course Code	**BENEE702T**				
Course Credits	**L**	**T**	**P**	**TC**	
	2	**1**	**0**	**3**	
Prerequisites	Control system engineering				
Course Objectives	• This course will introduce the students to develop new skills and analytical tools required to analyze and design methods for the control of both multivariable linear and nonlinearsystems. • It would give them opportunity to look at some of the research topics in modern control theory and dynamical systems and see how the theory of nonlinear and discrete dynamics and chaos can be used to engineer new controldevices				
Course Contents	**UNIT- I** **Non- Linear Control Systems** Introduction to non-linear system: Comparison of linear and non-linear systems, properties of non-linear systems, some common non-linearities (saturation, dead- zone, on-off, non-linearity, backlash, Hysteresis) and their describing functions, Singular points, Stability analysis of non-linear systems using describing function, Limit cycle. **UNIT-II** **State Space Analysis** Concept of state, state variable, State no uniqueness, state models for linear continuous time functions, Eigen vectors, invariance properties, diagonalization and Jordan canonical form Cayley Hamilton theorem, Computation of state transition matrix by different methods. state equations in CCF, OCF and Diagonal Canonical form. **UNIT- III** **Liapunov Stability Analysis of Linear and Non-Linear Systems** Introduction – basic concepts, Concept of stability – stability in the sense of Liapunov-absolute stability indirect method of Liapunov and direct method of Liapunov with four stability theorems, Liapunov Stability Analysis of Linear Systems, Liapunov function, Construction of Liapunov function for linear systems and non-linear systems – Krasovskii's method, variable gradient method. **UNIT-IV** **Control System Design by State Space** Pole placement design, Ackermann's Formula for Pole Placement, design of full and reduced order state observers, Ackermann's Formula for design of state observers, design of Servo system				

	UNIT-V **Optimal and Discrete System Control** Discrete System Control: Introduction, Impulse sampling and Data Hold, Reconstructing Original signals from Sampled signals, The Pulse Transfer Function, Mapping between the s Plane and the z Plane, Dominant characteristic equation Roots, Stability Analysis using Bilinear transformation Method and Jury's stability test. Optimal Control Systems: Introduction, Parameter Optimization and Optimal Control problems, Performance Index, (Elementary study)
Course Outcomes	**After studying the contents of the syllabus in detail the students will beable to:** • Decide in advance if a given dynamical system is controllable andobservable. • Design state feedback controllers to change the evolution of a dynamical system ofinterest. • Optimize the control system design to minimize the control energy spent or achieve control in minimumtime. • Complex dynamics of nonlinearsystems
Text Books	1. Control systems: Smarjit Ghosh, Pearson, Secondedition 2. Control Systems Principles and Design: M. Gopal, McGrawHill. 3. Modern Control Engineering: K. Ogata, PHI, Second edition,1991
Reference Books	1. Modern Control Engineering: Roy Choudhary,PHI. 2. Applied Nonlinear Control: Jaan Jacques E. Slotine and Weiping Li, Prentice Hall NJ, 1991. 3. Control Systems Technology: Curtis Johnson and HeidarMalki,Pearson. 4. Modern Control Systems: R. C. Dorf and R. H. Bishop,Pearson 5. Digital control systems: Benjamin C. Kuo. Oxford university Press, Second Edition.

B.TECH ELECTRICAL
Semester-(VII)
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<table>
<tr><td>Course Title</td><td colspan="5">ELECTRICAL DRIVES</td></tr>
<tr><td>Course Code</td><td colspan="5">BENEE703T</td></tr>
<tr><td rowspan="2">Course Credits</td><td>L</td><td>T</td><td>P</td><td>TC</td><td></td></tr>
<tr><td>3</td><td>1</td><td>0</td><td>4</td><td></td></tr>
<tr><td>Prerequisites</td><td colspan="5">Electrical machines</td></tr>
<tr><td>Course Objectives</td><td colspan="5">• Describe the structure of Electric Drive systems and their role in various applications
• Understand basic requirements placed by mechanical systems on electricdrives.
• Describe the operation of dc motor drives to satisfy four-quadrant operation to meet mechanical loadrequirements.
• Design torque, speed and position controller of motordrives.
• Describe the operation of induction machines in steady state that allows them to be controlled in induction-motordrives.
• Learn speed control of induction motor drives in an energy efficient manner using powerelectronics.
• Describe operation oftractions.</td></tr>
<tr><td>Course Contents</td><td colspan="5">UNIT- I
Electric Drives
Basic concept of electric drives its advantages and types, choice of electric drives, Fundamental equations, speed torque conversions and multi quadrant operation, drive parameters, component of load torque, nature and classification of load torques, calculation of time and energy loss in transient operation, steady state stability and load equalization.

UNIT-II
Control and Rating of Electric Drives
Modes of operation of electric drives, Closed loop control of drives, closed loop control of multi motor drives, Selection of motor power rating-Heating and Cooling of motors, Selection of motor power rating under different loading conditions, Continuous, Short and Intermittent periodic duty

UNIT- III
DC Drives
Review of dc motors and their performance, Braking: Regenerative braking, Dynamic braking, Plugging. Transient Analysis of separately excited dc motor with armature and field control, Transient Analysis of starting and dynamic braking of dc separately excited dc motor. Speed control, Controlled Rectifier fed dc drives: single phase and three phase half controlled and fully controlled, Multi quadrant operation of dc drives, Chopper Controlled dc drives.</td></tr>
</table>

	UNIT-IV **Induction and Synchronous Motor Drives** Review of conventional method of starting, and Speed control, Braking: Regenerative braking, Dynamic braking, Plugging. Speed control by stator voltage control, supply frequency control, Voltage source inverter (VSI) and current source inverter (CSI) fed three-phase induction motor drives, Static rotor resistance control induction motor drive, Slip power recovery drives. Synchronous motor drives: Speed control of synchronous motor using voltage and current source inverters, Self-controlled synchronous motordrives **UNIT-V** **TractionDrives** Electric Traction system, Nature of traction load, calculation of Traction drive rating and energy consumption, Important feature of traction drives, Motors employed in traction, Conventional method for AC and DC traction drives control, Semiconductor converter controlled drives employing DC motors, AC motors for 25 KV ACtraction.
Course Outcomes	**At the end of this course student will be able to:** • Electric drive systems for different mode ofoperations. • Operation oftractions. • Speed control of DC and AC machines using PowerElectronics. • Design of ratings on the basis of heating andcooling.
Text Books	1. Fundamentals of electrical drives, G K Dubey, 2 ndedition,NarosaPb 2. Electric Drives. Vedam Subramanyam, TMHPbs.
Reference Books	1. Electric Motor Drives, R. Krishnan, PHIPb 2. Modern Power Electronics and A C Drives, B K Bose, PearsonEducation 3. Electrical Machines, Drives and Power Systems, Theodore Wildi, Pearson Sixth Edition

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<table>
<tr><td>Course Title</td><td colspan="5">POWER APPARATUS SYSTEM</td></tr>
<tr><td>Course Code</td><td colspan="5">BENEE704TA</td></tr>
<tr><td rowspan="2">Course Credits</td><td>L</td><td>T</td><td>P</td><td>TC</td><td></td></tr>
<tr><td>2</td><td>1</td><td>0</td><td>3</td><td></td></tr>
<tr><td>Prerequisites</td><td colspan="5">Power system</td></tr>
<tr><td>Course Objectives</td><td colspan="5">• To gain knowledge about Transmission system components (Tower, accessories, sagetc).
• To study insulation coordination and surgeprotection.
• To understand various groundingsystems.
• To know basic concept of reliability of system in view.
• To study Transmission and distribution system components.</td></tr>
<tr><td>Course Contents</td><td colspan="5">UNIT- I
Transmission System Components:
Types Of Insulator , Conductors, Towers , Span, Conductor Configuration Spacing, Clearance , Sag & Tension Calculation, Voltage Distribution Over The Insulator String , String Efficiency , Selection of Conductor Size, Number of Circuit , Ground Wire, Surge Impedance Loading.

UNIT-II
Distribution System :
Types, Primary & Secondary Distribution System, Voltage Drop In AC & DC System, Selection of Distribution Voltage , Size of Conductor, Kelvin’s Low, General Design Consideration Load Estimation Substation Equipment Protection System, Design of A Typical Distributions System (Rural / Town/ Industrial)

UNIT- III
Power System Grounding:
Different Methods, Isolated Neural , Solid Grounding, Effective Grounding, Resistance & Impedance Grounding, Zig Zag Transformer Grounding, Effect of Grounding on System Over Voltages. Merits & Demerits Of Various Grounding Systems..

UNIT-IV
Surge Protection & Insulation coordination :
External & Internal Overvoltage Mechanism of Lightening Discharge , Wave Shapes Of Stroke Current, Line Design On Direct Stroke Over Voltage Protection , Earth Wire, Rod Gap , TRF , Expulsion Tube , Surge Diverter Selection Of BIL , International Recommendation , Selection of Arrestor Rating, Coordination of Protector Devices With ApparatusInsulation.

UNIT-V
Reliability of Transmission and distribution System:
Definitions : Outage , Bath Tub Curve , Causes of Failures, Two State Model, Failure & Repair Rate, Probability Density Function, Reliability of Series / Parallel System , Reliability Planning , Preparation of Reliability</td></tr>
</table>

	Models. Numerical problems related to Reliability of Transmission and distribution system.
Course Outcomes	**At the end of this course student will be able to:** • Understand Transmission system components. (Tower, accessories, conductor, sag etc). • Studied insulation coordination and surgeprotection. • Understand about various grounding systems. Correlate basic concept of reliability with Reliability of transmission and DistributionSystem.
Text Books	1. Power System Analysis & Design, BR Gupta S.ChandPublications 2. Substation Design & Equipment, Gupta &Sation – DhanpatRai.Publications An Introduction to Reliability and Maintainability Engineering, Ebeling; Tata McGraw Hill
Reference Books	1. Transmission & Distribution,WestinghouseElectrical Power System Design, M. V. Deshpande (TMH)

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2022-23

Course Title	**SYSTEM SOFTWARE**				
Course Code	**BENEE704TB**				
Course Credits	**L**	**T**	**P**	**TC**	
	2	**1**	**0**	**3**	
Prerequisites	Computer engineering				
Course Objectives	• This subject aims to give an idea of system softwares in a computersystem. • It gives knowledge of its structure, main elements like macros, loader andlinker. • It also introduces the macros and various software tools of systemsoftware.				
Course Contents	**UNIT- I** **Machine structure:** Memory, registers, Data & instruction Formats C Languages Vs Assembly Languages, Addressing Modes, Data Transfer operations, Arithmetic Instructions, Compare & Branch Instructions, Logical & shift Operations, Subroutines in Assembly Languages. **UNIT-II** **Assemblers:** Introduction to Translators: Interpreters vs. Compliers, Definition of an assembler, Symbol Tables, Table Processing-Search & sort Techniques, Design of an Assembler, Assembler Directives & Assembler Schemes, Single pass & multi pass Translators, Intermediate Code Forms, and List Generation & Error Indication **UNIT- III** **Macros & Conditional Assembly:** Macro Definition, Feature of Macro facility, Macroinstruction arguments, conditional Macro Expansion, Label in macros, Macro calls within macros, Use of macros, Implementation of Macros in assemblers **UNIT-IV** **Loaders Features & Linker Editors:** Automatic Library Search, Loader Design Options, Load Address & Address Origin, Loading Libraries, Program Forms &self Relocation. Linkage Editors, Dynamic Linking, Bootstrap Loaders. **UNIT-V** **Software Tools:** Text Editors: Word Processors, MS DOS EDLIN editor, Binary File Editors MS DOS DEBUG Editor, Debug command line Arguments, Loading & manipulating of addresses &data..				

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Course Outcomes	**At the end of this course student will be able to:** • Analyze basic machine structure andfunctioning. • Assembler and its Designprocess • Design software tools within systemsoftware
Text Books	1. System Software: An Introduction To Systems Programming, 3/E, Leland L, Beck and D. Manjula,Pearson 2. System Programming by J.J.Donovan(TMH) 3. Microcomputer System: 8086/8088 & Family-Architecture & Design by Liu & Gibson, PHI
Reference Books	1. Advanced Dos by Michael Hyman & Ray Duncan(Ms-press). 2. Ms-Dos User's manual(MS-Press). 3. Structured programming in Assembly Languages for IBM-PC by William C.Runnion.

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Course Title	**ADVANCED MICROPROCESSOR**				
Course Code	**BENEE704TC**				
Course Credits	**L**	**T**	**P**	**TC**	
	2	**1**	**0**	**3**	
Prerequisites	Microprocessor & interfacing				
Course Objectives	• To develop understanding of the architectures of advancedmicroprocessors • To get knowledge of microprocessor basedsystems • To acquire the skills in the programming and applications of theseprocessors • To understand various interfacingconcepts • To understand various interfacing circuits necessary for variousapplication				
Course Contents	**UNIT- I** **Architecture and Instruction set for 8086:** Architecture and pin configuration of 8086, instruction format, addressing modes, data transfer instruction, arithmetic instructions, Branching & Looping Instructions, NOP and Halt, Flag Manipulation Instructions, Logical, shift and Rotate Instruction, Byte and String Manipulation: string Instructions; REP Prefix, Table Translation, Number Format conversions. Assembler Directives and Operators; Assembly Process; Translation of assembler Instructions, Programming of Microprocessor 8086. **UNIT-II** **System Bus Structure:** Basic 8086/8088 system bus architecture, Minimum mode Configuration, Maximum mode Configuration; memory interfacing with 8086/8088 in minimum and maximum mode; system Bus standards. Interrupts of Microprocessor 8086. **UNIT- III** **Advanced Microprocessor architecture:** CPU 80386 Architecture and functional pin diagram, Function of Bus Interface unit, Execution unit, control unit, Instruction decoder Unit, Segmentation unit & page unit, General purpose Registers, Flag Register, Test & Debug Register, and Pipelining. Addressing mode and Instruction set of microprocessor 80386. **UNIT-IV** **Task and Modes of Operation:** Real mode, Virtual Mode, Protected Mode, Page based Virtual Memory, Single level tasks: Segment Register, segment descriptors, Local descriptor table, Global Descriptor Register, Interrupt Descriptor Register, Multilevel tasks: Gate Descriptor, Task state segment, Task switch; Task gate descriptors, Related Instructions, Page descriptors, addressing technique. Address Calculation, Segment and Page Protection, Scaling; Bit Addressing, Programmer invisible register, CacheMemory, Virtual memory, Types of cache.				

	UNIT-V Multiprocessor Configuration & Interfacing Numeric data Processor 8087; I/O Processor 8089, Communication between CPU and IOP, Related Instruction; Interfacing and programming of programmable peripheral interface 8255 and programmable interrupt controller 8259 with
Course Outcomes	**At the end of this course student will be able to:** • Describe the features and use of advancedmicroprocessors • Compare and contrast the features of different members of a microprocessor family. • Design memory, I/O, and interrupt interfaces to themicroprocessor. • Develop software to control anapplication.
Text Books	1. Microcomputer Systems: 8086/8088 Family – Architecture, Programming, and Design; Y.Liu and G.A. Gibson;PHI. 2. Advanced Microprocessors and Peripherals, K. M. Bhurchandi and A. K. Ray, McGraw Hill,India. 3. The X86 Microprocessors: Architecture And Programming (8086 To Pentium), Lyla B. Das, Pearson
Reference Books	1. 80386 Microprocessor Handbook: C.H.Pappas and W.H. Murray: Osborne McGraw Hill 2. The Intel Microprocessors, Barry B. Brey,Pearson

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Course Title	**DIGITAL IMAGE PROCESSING**				
Course Code	**BENEE704TD**				
Course Credits	**L**	**T**	**P**	**TC**	
	2	**1**	**0**	**3**	
Prerequisites	Principles of digital signal processing				
Course Objectives	• This course is designed to teach students the fundamentals of digitalimage. • The primary objective of this course is to introduce students to basic principles of digital images, image data structures, and image processingalgorithms.				
Course Contents	**UNIT- I** **Fundamentals of Image Processing** Origins of Digital Image Processing, Examples of fields that use Digital Image Processing, Fundamental steps, Components, Elements of Visual Perception, Light and the Electromagnetic Spectrum, Sensing and Acquisition, Sampling and Quantization Relationship between Pixels. **UNIT-II** **Image Enhancement in the Spatial Domain** Gray Level Transformation, Histogram Processing, Enhancement using Arithmetic or Logic Operation, Basics of Spatial Filtering, Smoothing Spatial Filters, Sharpening Spatial Filters, Image Enhancement in the Frequency Domain, Introduction to the Fourier Transform, Smoothing frequency – Domain Filters, Sharpening Frequency Domain Filters. **UNIT- III** **Image Restoration** Models of Image Degradation, Noise Models, Restoration in the presence of Noise, Periodic Noise Reduction, Linear, Position-Invariant Degradations, Inverse Filtering. **UNIT-IV** **Colour Image Processing** Fundamentals, Colour models, Pseudocolour Image Processing, Basics of Full-Colour Image Processing, Colour Transformations, Smoothening and Sharpening, Colour segmentation, Noise in Colour Images. **UNIT-V** **Image Compression** Fundamentals, Image Compression Models, Elements of Information Theory, Error Free compression, Lossy Compression, Image Compression Standards..				

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Course Outcomes	**At the end of this course student will be able to:** • Understand the digital image processing fundamentals, hardware and software, digitization, enhancement andrestoration • Apply image processing techniques in time and frequencydomains. • Work in the field of technicalcommunication.
Text Books	1. Digital Image Processing by Rafael E. Gonzalez & Richard E. Woods, LPE, Pearson, India. 2. Fundamentals of Digital Image Processing by Anil. K. Jain, LPE, Pearson Edu. India.
Referenc e Books	1. Digital image Processing by William .K. Pratt, John Wiley & Sons Publisher

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<table>
<tr><td>Course Title</td><td colspan="5">ENERGY AUDITING AND MANAGEMENT</td></tr>
<tr><td>Course Code</td><td colspan="5">BENEE705TA</td></tr>
<tr><td rowspan="2">Course Credits</td><td>L</td><td>T</td><td>P</td><td>TC</td><td></td></tr>
<tr><td>3</td><td>1</td><td>0</td><td>4</td><td></td></tr>
<tr><td>Prerequisites</td><td colspan="5">Basic electrical engineering</td></tr>
<tr><td>Course Objectives</td><td colspan="5">• Familiarizing with management especially with management in energy sector engineering. Fundamentals of product strategymanagement.
• Studying methods of energy accounting and energy auditing in energy sector, industry and finalconsumption.
• Finding opportunities to increase the rational use ofenergy.</td></tr>
<tr><td>Course Contents</td><td colspan="5">UNIT- I
Overview
History of Energy Management: Energy forecasting, Limitations of energy resources. Renewable energy recourses. Load management. Energy management. Demand side management (DSM) Energy conservation in realistic distribution system. Short term load forecasting for de-centralized load management.

UNIT-II
Energy Situation and Global Energy Sources
World energy consumption. Energy in developing countries. Firewood crises. Indian energy sources. Nonconventional renewable energy sources. Potential of renewable energy sources. Solar energy types. Wind energy. Wave, tidal and OTEC. Super- conductors in power system. Wind power generation for large scale generation of electricity. Wind driven induction generators.

UNIT- III
Energy Auditing as Applicable to an Industry
Classification of energy audit System optimization. Power factor improvement. Preventive maintenance. Process modification. Non-conventional energy sources. Electricity tariffs. Types of off-peak tariffs

UNIT-IV
Elements of Energy Auditing and Metering Methodologies (Case Studies):
Capacity utilization. Technology up-gradation. Fine tuning, Energy conservation. Concept and methods of energy conservation.

UNIT-V
Demand Side Management
Introduction to DSM. Concept of DSM. Benefits from DSM. DSM techniques. Time of day pricing, Multiutility exchange model. Time of day pricing models for planning, load management. Load priority technique. Peak clipping. Peak shifting. Valley filling. Strategic conservation. Energy efficient equipment,Socioeconomic</td></tr>
</table>

	awareness programs.
Course Outcomes	**At the end of this course student will be able to:** • Understand basics of demand side management and mechanisms (technical, legal or financial) that influence energyconsumption. • Recogniz opportunities for increasing rational use ofenergy. • Learn the basics of energy auditing with application on differentsectors.
Text Books	1. Energy Demand: Analysis, Management and Conservatioin, Ashok.V.Desai(ED), Wiley Eastern Ltd., NewDelhi. 2. Energy technology, S. Rao, Parulekar, KhannaPbs.
Reference Books	**1.** Demand Side Management , Jyothi Prakash, Tata McGraw-HillPublishers. **2.** Renewable Energy Sources and Conservation Technology,N.K.Bansal, KleemanMillin, TataMcGraw-Hill

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<table>
<tr><td>Course Title</td><td colspan="5">EMBEDDED SYSTEM SOFTWARE IN C</td></tr>
<tr><td>Course Code</td><td colspan="5">BENEE705TB</td></tr>
<tr><td rowspan="2">Course Credits</td><td>L</td><td>T</td><td>P</td><td>TC</td><td></td></tr>
<tr><td>3</td><td>1</td><td>0</td><td>4</td><td></td></tr>
<tr><td>Prerequisites</td><td colspan="5">C language</td></tr>
<tr><td>Course Objectives</td><td colspan="5">• Learn the basic components and structure of a C program, learn to define variables, and use operators and operands to create C expressions andstatements.
• Develop the students to write their own programs using standard language infrastructure regardless of the hardware or softwareplatform.
• Introduce the student with embedded software concepts used in embedded system.
• Develop an understanding of the technologies behind the embedded computing systems</td></tr>
<tr><td>Course Contents</td><td colspan="5">UNIT- I
Introduction to C language
The C language and its advantages, Structure of a C program – preprocessor directives, declaration and definition, Writing C programs, Building an executable version of C program, Debugging and executing C program.
C Language Fundamentals
Identifiers and keywords, Data types, Arithmetic, unary, logical, bit-wise, assignment and conditional operators, Declarations, Expressions, Statements and symbolic constants, Input/Output management, Decision making and Branching, Decision making and looping

UNIT-II
Functions, Arrays, Pointers and Structures Defining and accessing functions, Passing arguments to functions, The C standard library functions, Defining and processing arrays, Passing arrays to a function, 2-dimensional arrays, String Manipulation, Pointer Arithmetic, Types of functions(parameterized and non- parameterized), Controlstructures.

UNIT- III
Programming Techniques of Embedded C Introduction to embedded system, Choice of - processor, programming language and operating system, Development of embedded software
Introducing the AVR Family (Elementary treatment)
Introduction, The external interface of the Standard ATMEGA16(only), Reset requirements, Clock frequency and performance, Memory issues, I/O pins, Timers, Interrupts, Serial interface, Parallel interface, internal PWM, ADC.</td></tr>
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Course Contents	**UNIT-IV** Reading and writing I/O Pins Introduction, Basic techniques for reading from port pins, Reading and writing bytes, Reading and writing bits (simple version), Reading and writing bits (generic version), The need for pull-up resistors, Dealing with key de-bounce, Reading switch inputs and Counting, Creating 'hardware delays' using Timer 0 and Timer 1, 'timeout' mechanisms, Creating and testing loop timeouts and hardware timeouts, interrupts and its examples **UNIT-V** **Hardware Interfacing** LED interfacing, LCD interfacing, motor interfacing (DC motor, PWM servo, stepper), 4X4 matrix interfacing, sensor interfacing (analog and digital).
Course Outcomes	**At the end of this course student will be able to:** • Be the familiar with basic concepts of computerprogramming • Write their programs efficiently using the C programminglanguage. • Introduce the student with embedded software concepts used in embedded system • Get educated and trained with practical job orientedknowledge. Develop practical skills to cater to the industryrequirements
Text Books	1. Schaums outline of Theory and Problems of programming with C : B. S. Gottfried, TataMcGraw-Hill 2. Embedded C - Michael J. Pont, 2nd Ed., Pearson Education,2008 Embedded C programming and Atmel AVR, 2 nd edition, Richard Barntt, Sarah Cox and Larry O' Cull , Delmar CengageLearning.
Reference Books	1. Let us C: Yashwant Kanetker, BPBPublications 2. C – programming: E.Balagurusamy Tata McGrawHill 3. The 'C' programming language: B.W.Kernighan and D.M.Ritchie,PHI Embedded Software Development with C: Qian, Haring and Cao,Springer

B.TECH ELECTRICAL
Semester-(VII)
2022-23

<table>
<tr><td>Course Title</td><td colspan="5">Soft Computing Techniques and Its Applications</td></tr>
<tr><td>Course Code</td><td colspan="5">BENEE705TC</td></tr>
<tr><td rowspan="2">Course Credits</td><td>L</td><td>T</td><td>P</td><td>TC</td><td></td></tr>
<tr><td>3</td><td>1</td><td>0</td><td>4</td><td></td></tr>
<tr><td>Prerequisites</td><td colspan="5">NIL</td></tr>
<tr><td>Course Objectives</td><td colspan="5">• To explain the basic knowledge representation, problem solving, and learning methods of soft computing techniques and Artificial Intelligence, Applications of soft computing techniques in intelligent-system engineering, Assess the applicability in solving engineering problems</td></tr>
<tr><td>Course Contents</td><td colspan="5">UNIT- I
Introduction of soft computing techniques
Introduction of soft computing techniques, Conventional Hard computing, Origin and history of different soft computing techniques, it basic principle and comparison with hard computing.
UNIT-II
Biological Neural Network
Introduction to Biological neural network, human brain, structure of Human Brain, its characteristics and functioning.
UNIT- III
Artificial Neural Network & Its Applications
Introduction to Artificial Neural Network: Evolution of ANN, Basic neuron modeling, comparison between ANN and human brain, characteristics, neuron models/ Architectures, activation functions, Learning (Supervised & Unsupervised) strategies, Back propagation network, Kohonen's Self organization map, competitive network. Applications of Neural network.
UNIT-IV
Fuzzy Logic& Its Applications
Fuzzy Logic: Introduction to classical sets and operations, Fuzzy set theory and operations, Fuzzy set versus crisp set, Crisp relation & fuzzy relations, Membership functions, Fuzzy rule base, fuzzification and defuzzification methods, fuzzy inference systems, Applications of fuzzy logic.
UNIT-V
Genetic algorithms and its applications
Genetic algorithm: Introduction, working principle, Basic operators and Terminologies like individual, gene, encoding, fitness function and reproduction, Genetic modeling: Significance of Genetic operators, cross over, mutation, GA optimization problems.</td></tr>
</table>

Course Outcomes	• **At the end of this course student will be able to:** • Learn the evolution of different Soft Computing techniques. • Know the details of different Soft Computing/ Artificial Intelligence (AI) techniques: Artificial Neural Network, Fuzzy systems and Genetic Algorithm. • Simulate different ANN, Fuzzy systems and Genetic Algorithm in Matlab software. • 4. Undertake projects on Soft Computing/ArtificialIntelligence application in power system, protection and power electronics area.
Text Books	1. HowardB Demuth, Mark H Beale, Orlando de Jesus, "Neural Network Design", 2Nd edition, Martin Hagan, 2014. 2. S. N. Shivnandam, "Principles of soft computing", Wiley, Third edition, 2018. 3. S. Rajasekaran, G. A. Vijayalakshmi Pai, " Neural Networks, Fuzzy Systems and Evolutionary Algorithms: Synthesis and Applications ", PHI Learning, 2nd edition, 2017.
Reference Books	1. Devendra K. Chaturvedi, "Soft Computing: Techniques and Its Applications in Electrical Engineering", Springer, 2008. 2. Edited by Kevin Warwick, Arthur Ekwue, Rag Aggarwal, "Artificial Intelligence Techniques in Power Systems (Energy Engineering)", Institution of Engineering and Technology, 1997. 3. El-Hawary, M., "Electric Power Applications of Fuzzy Systems", Wiley-IEEE Press, 1st edition, 1998.

B.TECH ELECTRICAL
Semester-(VII)
2022-23

<table>
<tr><td>Course Title</td><td colspan="5">APPLIED OPTIMIZATION</td></tr>
<tr><td>Course Code</td><td colspan="5">BENEE705TD</td></tr>
<tr><td rowspan="2">Course Credits</td><td>L</td><td>T</td><td>P</td><td>TC</td><td></td></tr>
<tr><td>3</td><td>1</td><td>0</td><td>4</td><td></td></tr>
<tr><td>Prerequisites</td><td colspan="5">NIL</td></tr>
<tr><td>Course Objectives</td><td colspan="5">• To expose students regarding the utility of optimization techniques for engineering design</td></tr>
<tr><td>Course Contents</td><td colspan="5">UNIT- I
Introduction
Vectors, Matrices, Eigen values and Eigenvector, Optimization and Design, Formulation of objective function, Incorporating constraints in objective function, Engineering Applications of optimization.
UNIT-II
Unconstrained Optimization Algorithm
Optimality criteria, Dynamic Optimization, Unidirectional search, Direct search methods, Gradient Search methods, Simplex search method, Hooke-Jeeves pattern search method, Optimization toolbox (MATLAB).
UNIT- III
Constrained Optimization Algorithm
Kuhn Tucker Condition, Rosen’s Gradient projection method, Penalty function method, Optimization toolbox (MATLAB).
UNIT-IV
Nontraditional and Machine Learning Based Optimization Algorithms
Genetic Algorithm, Differential Evolution and Particle Swarm Optimization, Formulation of optimization problem with multiple objectives, Pareto Optimality, NSGA (Non-sorted genetic algorithm), Machine Learning for optimization.
UNIT-V
Artificial Neural Network & Its Applications
Introduction to Artificial Neural Network: Evolution of ANN, Basic neuron modeling, comparison between ANN and human brain, characteristics, neuron models/ Architectures, activation functions, Learning (Supervised & Unsupervised) strategies, Back propagation network,</td></tr>
</table>

Course Outcomes	• **At the end of this course student will be able to:** • Infer the application of optimization techniques for engineering design • Formulate a design task as an optimization problem • Appreciate the specific attributes of gradient based and search based techniques • Infer the applicability of evolutionary optimization techniques 5. Apply optimization techniques to solve problems in different engineering domains.
Text Books	1. S S Rao, "Engineering Optimization- Theory and Practice", newage publishers, Third edition,2013. 2. Kalyanmoy Deb, "Optimization for Engineering Design, Algorithms and Examples", Prentice Hall India Learning Private Limited, Second edition, 2012. 3. Kalyanmoy Deb, "Multiobjective Optimization Using Evolutionary Algorithms", Wiley,2010.
Reference Books	1.Devendra K. Chaturvedi, "Soft Computing: Techniques and Its Applications in Electrical Engineering", Springer, 2008. 2.Edited by Kevin Warwick, Arthur Ekwue, Rag Aggarwal, "Artificial Intelligence Techniques in Power Systems (Energy Engineering)", Institution of Engineering and Technology, 1997. 3.El-Hawary, M., "Electric Power Applications of Fuzzy Systems", Wiley-IEEE Press, 1st edition, 1998.

B.TECH ELECTRICAL
Semester-(VII)
2022-23

Course Title	**SWITCHGEAR PROTECTION LAB**				
Course Code	**BENEE701P**				
Course Credits	**L**	**T**	**P**	**TC**	
	0	**0**	**2**	**1**	
Prerequisites	Electrical power system				
Course Objectives	• To study the various types of the circuit breakers, the arc quenching phenomena and the protection against overvoltages. • To explain the students protection systems used for electric machines, transformers, bus bars, overhead and undergroundfeeders.				
Course Contents	**List of Experiments:** (At least Ten experiments are to be performed by each student) 1. To study Over Current Relay static type & drawcharacteristics. 2. To study Under Voltage relay Electromechanical type & draw characteristics. 3. To study Over Voltage relay Electromechanical type & draw characteristics. 4. To study IDMT Over Current relay Electromechanical Type & draw current verses timecharacteristics. 5. To study IDMT earth fault relay Electromechanical type draw current verses timecharacteristics. 6. To study operating characteristics of percentage-biased differential relays tp plot the characteristics of percentage biased Differential relay for 20%,30% and40%, 7. To study the construction and operation of BuchholzRelay. 8. To study the characteristics of Instantaneousrelays. 9. To study Static type Negative Sequencerelay. 10. To study the time-grading protection of feeder [simulationModel]. 11. To study the current-grading protection of feeder [simulationModel]. 12. To study the time-current grading protection of feeder [simulation Model]. 13. To plot the characteristics of Directional Over Currentrelay 14. To study different types of circuitbreakers. 15. To study different protection schemes foralternators.				
Course Outcomes	**At the end of this course student will be able to:** • Analyze over current, differential, and ratio protection devices and their application in a coordinated protectionscheme. • Understand the stability problems and clearing of faults to mitigate these problems.				

Text Books	1. Fundamentals of Power System Protection, Paithankar Y. G., Bhide S. R., Prentice Hall of India Limited, New Delhi , 2nd Edition,2010. 2. Power System Protection and Switchgear, Badri Ram, Vishwakarma D N., Tata McGraw Hill Publishing House Limited, New Delhi,2005

B.TECH ELECTRICAL
Semester-(VII)
2022-23

<table>
<tr><td>Course Title</td><td colspan="5">ELECTRIC DRIVES LAB</td></tr>
<tr><td>Course Code</td><td colspan="5">BENEE703P</td></tr>
<tr><td rowspan="2">Course Credits</td><td>L</td><td>T</td><td>P</td><td>TC</td><td></td></tr>
<tr><td>0</td><td>0</td><td>2</td><td>1</td><td></td></tr>
<tr><td>Prerequisites</td><td colspan="5">Electrical machines</td></tr>
<tr><td>Course Objectives</td><td colspan="5">• Design torque, speed and position controller of motordrives.
• Describe the operation of induction machines in steady state that allows them to be controlled in induction-motordrives.
• Learn speed control of induction motor drives in an energy efficient manner using powerelectronics.
Describe operation of tractions.</td></tr>
<tr><td>Course Contents</td><td colspan="5">LIST OF EXPERIMENTS

(At least Ten experiments are to be performed by each student)
1. To study the heating time constant for a Continuous DutyMotor
2. To Study the heating time constant of a Short time DutyMotor
3. To Study the cooling time constant of a Short time DutyMotor
4. To Study the heating time constant of a Short Time DutyMotor
5. To Study the cooling time constant for an Intermittent DutyMotor
6. Performance and speed control of D.C drive using 3-phase fullconverter
7. Performance and operation of a four quadrant chopper on D.Cdrive
8. Study and performance of electrical Dynamic braking and Plugging of D.C shunt motor
9. Study of V/F control operation of 3-ϕ Inductionmotor
10. Simulation of PWM VSI/CSI fed 3-ϕ Induction motor control using MATLAB/PSPICE/PSIMsoftware
11. Study of solid state stator voltage control of 3-ϕ Induction motor (using AC voltage regulator)
12. Performance and speed control of 3-ϕ Induction motor using 3-ϕ voltage sourceinverter
13. To study frequency control Synchronous motordrive
14. Study of AC motors for 25KV Ac traction 15. Study of Resistance wielding and Arc welding</td></tr>
<tr><td>Course Outcomes</td><td colspan="5">At the end of this course student will be able to:
• Electric drive systems for different mode ofoperations.
• Operation oftractions.
• Speed control of DC and AC machines using PowerElectronics.</td></tr>
</table>

	• Design of ratings on the basis of heating andcooling.
Text Books	1. Fundamentals of electrical drives, G K Dubey, 2 ndedition,NarosaPb 2. Electric Drives. Vedam Subramanyam, TMHPbs.

<table>
<tr><td>Course Title</td><td colspan="5">PROGRAMMING AND SIMULATION IN MATLAB</td></tr>
<tr><td>Course Code</td><td colspan="5">BENEE706P</td></tr>
<tr><td rowspan="2">Course Credits</td><td>L</td><td>T</td><td>P</td><td>TC</td><td></td></tr>
<tr><td>0</td><td>0</td><td>2</td><td>1</td><td></td></tr>
<tr><td>Prerequisites</td><td colspan="5">Basic knowledge of Matlab</td></tr>
<tr><td>Course Objectives</td><td colspan="5">• To familiarize the student in introducing and exploringMATLAB
• To enable the student on how to approach for solving Engineering problems using simulationtools.
• To provide a foundation in use of this softwares for real timeapplications.</td></tr>
<tr><td>Course Contents</td><td colspan="5">LIST OF EXPERIMENTS
MATLAB Basics:

Variables and arrays, initialising, multidimensional arrays, subarrays, array and matrix operations, built-in basic MATLAB functions, display of output data, introduction to simple and multiple plots with colour, style, legends, etc.
1. Create a matrix and determine the size, display every element of z, create subarrays z(: ,2:5) and z(:,2:3:5).
2. Input two 4 x 4 arrays A and B and do the following:
A. Find the maximum and minimum values in each column of A and B.
B. Find the maximum and minimum values in each row of A and B.
C. Find the maximum and minimum values of A and B.
D. Find the result of the expressions A+B, A*B, A.*B, A./B, A.\B.
E. Find transpose and inverse of A and B.
F. Find rank of A and B
G. Reshape the matrices to another array of different size.
3. Create linear plots with different colors and lines for the following data giving title and axes markings:
<table><tr><td>X</td><td>0</td><td>0.5</td><td>1</td><td>1.5</td><td>2</td><td>2.5</td><td>3</td><td>3.5</td><td>4</td><td>4.5</td><td>5</td></tr><tr><td>Y</td><td>10</td><td>10</td><td>16</td><td>24</td><td>30</td><td>38</td><td>52</td><td>68</td><td>82</td><td>96</td><td>123</td></tr></table>
4 Make a three dimensional plot for the function.</td></tr>
</table>

Course Outcomes	**At the end of this course student will be able to:** • Articulate importance of software's in research by simulationwork. • Write basic mathematical, electrical, electronic problems inMatlab. • Simulate basic electrical circuit inSimulink.
Text Books	1. Power system analysis, HaddiSaddat **2.** Introduction to MATLAB,Palm

Course Title	Project Phase-I				
Course Code	BENEE707P				
Course Credits	**L**	**T**	**P**	**TC**	
	-	**-**	**2**	**1**	
Prerequisites	-				
Course Objectives	• To provide knowledge of Basic Electric Circuit Concepts. • Specific: Project should target a specific goal • Measurable: It should be quantifiable • Realistic: It should be realistic in nature				
Course Contents	**List of experiments:** **(At least Ten experiments are to be performed by each student)** 1. The basic objective of the Mini Project is to inculcate the habit of enquiry, Team work, Confidence to tackle newproblems and to develop their skill so that they can successfully make their minor / major project in higher semesters. 2. The Mini Project model must be prepared INHOUSE (in college) on their own. For this, components must be brought bythe students and Tools/ Accessories will be provided by the institute. It is again highlighted that the mini project MUST beprepared in the Project Lab / Workshop in the presence of supervisor. 3. The Mini Project must be submitted along with typed report, in the same format as the report for Major project issubmitted. The report will be Soft wound with transparent sheet stapled at the top and bottom , Stapled side must becovered with Tape. 4. Projects may be selected from Electrical / Electronic Magazines, books, journals. Highly advance circuit usingMicrocontroller etc are not expected at this stage. Common Mini Projects may also be prepared. 5. Mini project must be Hardware based working model.Software based projects are not permitted as mini project.				
Course Outcomes	**At the end of this course student will be able to:** • Handle all major tools • Install ceiling fan and regulator				

	• Check fluorescent lamp with industrial project
Text Books	1. Experiments in basic electrical engineering, S.K.Bhattacharya. 1. Basic shop practical, Mehta & Gupta 2. Practical in electrical engineering, Dr. N.K.Jain