Shri Rawatpura Sarkar University, Raipur

Examination Scheme & Syllabus

for

B.Tech.(Electrical Engineering)

Semester-V

(Effective from the session: 2019-20)

SHRI RAWATPURA SARKAR UNIVERSITY, RAIPUR, CHHATTISGARH
FACULTY OF ENGINEERING

Four Years B.Tech. Programme

Scheme of Teaching and Examination of B.Tech. Fifth Semester

(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	BENEE501 T	Electrical Machines-II	3	1	-	4	30	70	100	3
2	BENEE501 P	Electrical Machines-II	-	-	2	1	15	35	50	-
3	BENEE502 T	Microcontroller & embedded system	3	1	-	4	30	70	100	3
4	BENEE502 P	Microcontroller & embedded system	-	-	2	1	15	35	50	-
5	BENEE503 T	Elective-II	2	1	-	3	30	70	100	3
6	BENEE504 T	Integrated Circuits	3	1	-	4	30	70	100	3
7	BENEE505 T	Control System Engg	3	1	-	4	30	70	100	3
8	BENEE505 P	Control System Engg	-	-	2	1	15	35	50	-
9	BENEE506 T	Communication Theory	2	1	-	3	30	70	100	3
10	BENEE507 P	Mini Project	-	-	2	1	15	35	50	-
						26			800	

Elective-II

A. Applied Numerical Analysis
B. Signal & Systems
C. Introduction to AI and ML
D. Computer System Architecture

<table>
<tr><td>Course Title</td><td colspan="5">ELECTRICAL MACHINES – II</td></tr>
<tr><td>Course Code</td><td colspan="5">BENEE501T</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>-</td><td>4</td><td></td></tr>
<tr><td>Prerequisites</td><td colspan="5">Electrical Machines – I</td></tr>
<tr><td>Course Objectives</td><td colspan="5">This course will enable students to:
The objective of this course is to provide knowledge about the fundamental of magnetic circuits, energy, force and torque of singly and multi-excited systems.
This course is also to expose the students to basic principles, construction and working of synchronous and three –phase induction machines.
The aim of this course is to give the knowledge of the equivalent circuits, parameter determination, operational constraints, starting mechanisms, conventional speed control methods, various tests and applications of synchronous and induction machines</td></tr>
<tr><td>Course Contents</td><td colspan="5">UNIT-I
Electrical Machines Principles:
Principle of electromechanical energy conversion singly excited magnetic system, co-energy and field energy, doubly excited magnetic system, MMF of concentrated and distributed windings, EMF equation, winding factors, rotating magnetic fields, torque production in synchronous and induction machines
UNIT-II
Synchronous Machines I:
Theory of non-salient pole synchronous machines, basic synchronous machine models, equivalent circuit and phasor diagrams of synchronous machines, saturation effects, armature reaction, open circuit, short circuit and ZPF lag tests on synchronous machines, synchronous reactance, SCR, voltage regulation of alternators by synchronous impedance, MMF and ZPF method, excitation systems of alternators, active and reactive power flows, Steady state power angle characteristics.
UNIT-III
Synchronous Machines II:
Parallel operation of synchronous machines, load sharing, operation of synchronous machines within finite bus bars, effect of excitation and prime mover input, synchronizing torque, V-curves, Salient pole synchronous</td></tr>
</table>

	machine: Theory of salient pole synchronous machines, two-reaction theory, phasor diagram, power angle characteristics, determination of Xd and Xq, stiffness of coupling synchronous motors, phasor diagrams, starting of synchronous machines. **UNIT-IV** **Three-phase Induction Machines-I:** Introduction, construction (Cage and slip-ring induction motors), principle of operation, equivalent circuit, phasor diagram, power across air-gap, torque and power output, torque-speed (slip) relationship, loss and efficiency estimation, No-load and block rotor test, circle diagram. **UNIT-V** **Three-phase Induction Machines-II:** Methods of starting of Induction motor-reactance, autotransformer, star-delta, Speed control of induction motor (rotor resistance control, stator voltage and frequency control, v/f control), cogging and crawling, double cage induction motors.
Course Outcomes	**At the end of this course student will be able to:** • Understand the energy, force and torque of single and multi-excited systems. • Understand the construction, working principles of synchronous and three-phase induction machines • Draw the equivalent circuit diagrams under various load conditions Analyzetheloadprofile,voltageregulationsandefficiencyinvariousoperatingconditions • Understand the needs and requirements of various types of machine operations like starting, speed control, tests etc.
Text Books	1. Electric Machines, Nagrath & Kothari, TMH Publications, 2. Electrical machines, B.R, Gupta, New Age International
Reference Books	1. Electrical Machinery, P.S.Bimbhra, Khanna Publishers, 2. Performance and design of AC machines, M.G.Say, CBS Publication. 3. Electric Machines ,P.K. Mukherjee & S.Chakravarti, DhanpatRai Publication 4. Earth and Earth rock dam Sherard,J L.,WoodwardR J,Gizienski, R J and Clevenger W A., , John Wiley. 5. Anderson, M G., and Richards, K S Slope Stability.

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<table>
<tr><td>Course Title</td><td colspan="5">MICROCONTROLLER & EMBEDDED SYSTEM</td></tr>
<tr><td>Course Code</td><td colspan="5">BENEE502T</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>-</td><td>4</td><td></td></tr>
<tr><td>Prerequisites</td><td colspan="5">Microprocessor</td></tr>
<tr><td>Course Objectives</td><td colspan="5">This course will enable students to:
To make students familiar with the basic blocks of microcontroller device and Embedded System in general.
To provide comprehensive knowledge of the architecture, features and interfacing with 8051 microcontroller.
To use assembly and high level languages to interface the microcontrollers to various applications.</td></tr>
<tr><td>Course Contents</td><td colspan="5">UNIT-I
Introduction to Microcontroller::
A brief History of Microcontrollers, Harvard Vs Von Neumann Architecture; RISC Vs CISC, Classification of MCS-51family based on their features (8051, 8052, 8031, 8751, AT89C51), Pin configuration of 8051. 8051 Processor Architecture and Instruction Set: Registers of 8051, Inbuilt RAM, Register banks, stack, on-chip and external program code memory ROM, power reset and clocking circuits, I/O port structure, Addressing modes, Instruction set and programming.
UNIT-II
Counter/Timer and Interrupts of 8051:
Introduction, Registers of timer/counter, Different modes of timer/counter, Timer/counter programming, Interrupt Vs Polling, Types of interrupts and vector addresses, register used for interrupts initialization, programming of external interrupts, Timer interrupts.
UNIT-III
Asynchronous Serial Communication and Programming:
Introduction to serial communication, RS232 standard, GPIB, Max 232/233 Driver, 8051 Serial Port Programming.
UNIT-IV</td></tr>
</table>

	Interfacing with 8051: Interfacing and programming of: ADC (0804,0808/0809,0848) & DAC (0808), stepper motor , 4x4 keyboard matrix, LCD, Interfacing (only) of different types of Memory , Address decoding techniques. **UNIT-V** **Embedded Systems:** Introduction to an Embedded Systems, Defining the Embedded System, Real Life Examples of Embedded Systems, Characteristics of Real-Time Embedded Systems, Basics Of Developing For Embedded Systems.
Course Outcomes	**At the end of this course student will be able to:** • To understand Microcontroller 8051 its architecture and its instruction set. • Gain knowledge about Counter/timer and interrupts in 8051 Microcontroller and Programming concepts. • Students will be able to do serial communication programming and gain knowledge of serial communication. • Students will be able to understand interfacing Microcontroller 8051 with devices.
Text Books	1. The 8051 Microcontroller and Embedded Systems using Assembly and C, Mazidi, Mazidi & McKinlay, 2ndEd., PHI.(Unit-I,II,III,IV) 2. Embedded system, Frank Vahid.(Unit-V)
Reference Books	1. 8051 Programming, Interfacing and Applications K. J. Ayala, Penram Pub. 2. 8 bit Microcontrollers & Embedded Systems Manual. 3. Programming and Customizing the 8051 Microcontroller, Predko; TMH 4. Microcontrollers: Architecture, Programming, Interfacing and System Design, Rajkamal, Pearson Education.

Course Title	**INTEGRATED CIRCUITS**				
Course Code	**BENEE504T**				
Course Credits	**L**	**T**	**P**	**TC**	
	3	**1**	**-**	**4**	
Prerequisites	Analog Electronics				
Course Objectives	**This course will enable students to:** • To introduce the basic building blocks of linear integrated circuits. • To teach the linear and non-linear applications of operational amplifiers. • To introduce the theory and applications of analog multipliers and PLL. • To teach the theory of ADC and DAC. • To introduce a few special functions integrated circuits.				
Course Contents	**UNIT–I** **Characteristics of Op Amp:** Fundamentals of monolithic ICs technology–realization –OPAMP Symbol and terminal characteristics, Block Schematic of OPAMP, Basics of Differential Amplifier (CMRR in terms of 'r' and 'h' parameter), Ideal and Practical OPAMP Characteristics, Open Loop and Closed Loop Configuration of OPAMP Input & Output impedance of closed loop OPAMP, Input Bias and Offset Currents, Input Offset Voltage, Input Offset-error compensation voltage series feedback and shunt feedback amplifiers, Inverting Amplifier, Non-Inverting Amplifier differential amplifier; frequency response of OP-AMP. **UNIT–II** **Applications of Op Amp-I:** Voltage Follower, summer, differentiator and integrator ,Voltage comparators , Zero Crossing Detector, Level Detector, Window Detector, peak detector, Precision Half Wave Rectifier, Precision Full Wave Rectifier - Instrumentation amplifier, Current to Voltage and voltage to current Converter, active clippers and clampers, Bridge Amplifier, Differentiator, Integrator, Logarithmic amplifier, Norton Amplifier. **UNIT–III** **Applications of Op Amp-II:**				

	S/H circuit, D/A converter (R-2R ladder and weighted resistor types), A/D converter -Dual slope, successive approximation and flash types, First and second order active filters, Phase Shifter, Oscilltors-Waveform generator (Square, Triangular, Saw-tooth) ,Schmitt trigger, multivibrator. **UNIT–IV** **Special ICs:** 555 Timer circuit: Functional block, characteristics & applications as Monostable and Astable multivibrator; 566-voltage controlled oscillator circuit; 565-phase lock loop circuit functioning and applications. **UNIT–V** **Application of ICs:** Analog multiplier ICs, Voltage regulator: characteristics, Regulator Performance parameters, Types of Voltage regulator ,Three Terminal IC Regulator (LM 317, LM 337, 78XX, 79XX), [Description, Schematic Diagram and Pin Diagram], dual power circuit design, Switched capacitor filters, General Purpose IC Regulator (723): Important features and Internal Structure.
Course Outcomes	**At the end of this course student will be able to:** • On completion of this course, the students will have a thorough understanding of operational amplifiers with linear integrated circuits. • Also students will be able to design circuits using operational amplifiers for various applications
Text Books	1. Integrated Circuits by K.R. Botkar, Khanna Publications. 2. Operational Amplifiers byR.Gayekwad,4thEd.,PearsonEducation
Reference Books	1. Pulse, Digital and Switching Waveforms by Millman & Taub, TMH Publishing Co. 2. Integrated Electronics by Millman & Halkias, TMH Publishing Co. 3. Operational Amplifiers and Linear Integrated Circuits, Lal Kishore, PHI 4. Design and Applications of Analog Integrated Circuits, Soclof, PHI

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Course Title	**CONTROL SYSTEM ENGINEERING**				
Course Code	**BENEE505T**				
Course Credits	**L**	**T**	**P**	**TC**	
	3	**1**	**-**	**4**	
Prerequisites	Network analysis & synthesis				
Course Objectives	**This course will enable students to:** • This course is intended to introduce the students to mathematical foundations of Control Theory. • The aim of the course is to allow them to develop new skills and analytical tools required to analyze and design methods for the control of linear systems.				
Course Contents	**UNIT-I** **Introduction to Control problem:** Concepts of Control Systems – Open Loop and closed control systems and their differences –examples of control systems – Classification of control systems, Feed-Back Characteristics: Effects of feedback; Stability, steady state accuracy, transient accuracy, disturbance rejection, insensitivity and robustness, Mathematical models –Differential equations– Translational and Rotational mechanical systems, thermal systems , liquid level systems, systems with dead time. **UNIT-II** **Control hardware and their models:** Transfer Function of DC Servo motor – AC Servo motor – Synchro transmitter and Receiver, pneumatic actuators, electro-pneumatic valves, Block diagram representation of systems–Block diagram algebra – Representation by Signal flow graph – Reduction using block diagram and mason's gain Formula. **UNIT- III** **Time response Analysis :** Standard test signals – Time response of second order systems – Time domain specifications –Steady state response – Steady state errors and error constants; Effects of proportional derivative, proportional integral systems, the concept of stability – Routh stability criterion – absolute and relative stability. Root Locus Technique: The root locus concept – construction of root loci – effects of adding poles and zeros to G(s)H(s) on the root loci.				

	UNIT- IV **Analysis in Frequency domain :** Polar Plots, Nyquist Plots and application of Nyquist criterion to find the stability, gain and phase margins Bode diagrams –Frequency domain specifications and Nichol's chart. **UNIT- V** **Introduction to design:** Compensator design (Cascade Lag, Cascade Lead, Cascade Lag-Lead) using root locus plots, compensator design (Cascade Lag, Cascade Lead, Cascade Lag-Lead) using Bode plots.
Course Outcomes	**At the end of this course student will be able to:** • By the end of this module, students will be able to use appropriate analytical tools to model and control a given physical system. • Students can decide in advance if a given dynamical system is stable and also develop a controller according to the desired specifications.
Text Books	1. Control Systems M.Gopal:TataMcGraw-Hill,1997. 2. Modern Control Engineering K. Ogata, PHI,Fourthedition.2003
Reference Books	1. Control Systems Engineering: I.J. Nagrath and M. Gopal; NewAge Intenational Publishers,Thirdedition,2002. 2. Control system Engineering:. K. Bhattacharya, Pearson, Second edition 3. Control Systems: Dhanesh N.Manik, Cengage Learning. 4. Automatic control systems: Benjamin C.Kuo,PrenticeHallofIndia,2002.

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<table>
<tr><td>Course Title</td><td colspan="5">COMMUNICATION THEORY</td></tr>
<tr><td>Course Code</td><td colspan="5">BENEE506T</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>-</td><td>3</td><td></td></tr>
<tr><td>Prerequisites</td><td colspan="5">Network analysis & synthesis</td></tr>
<tr><td>Course Objectives</td><td colspan="5">This course will enable students to:
The course provides an introduction to analog and digital communication systems.
This course responds to the needs of the engineering and technological paraphenia.</td></tr>
<tr><td>Course Contents</td><td colspan="5">UNIT- I
Amplitude Modulation:
Signal analysis (Elementary idea only), Properties of Fourier transform, Need of modulation, Amplitude modulation, Single tone and multi tone amplitude modulation, Amplitude Modulation Index, power relation. Generation and detection of AM wave, Suppressed carrier modulation and detection techniques.
UNIT–II
Angle Modulation:
Mathematical equation of frequency modulation (FM), frequency spectrum, phase modulation(PM), relationship between PM and FM, pre-emphasis and de-emphasis, adjacent channel interference, comparison of narrow band and wide band FM, generation of FM, reactance modulator.
UNIT – III
Pulse Modulation System:
Sampling theorem, Sampling of Low Pass and band pass signals, Aliasing, Aperture effect, Basic principles of PAM, PWM and PPM, their generation and detection, FDM, TDM, Comparison of TDM and FDM.
UNIT – IV
PCM and Digital Modulation Techniques:
Wave form coding techniques, Discretisation in time and amplitude, Quantization, PCM, PCM generator, Quantizer, Transmission band width in PCM, PCM receiver, quantization noise/error in PCM, Companding in PCM, Delta modulation, Adaptive delta modulation, DPCM, Comparison of different DPM methods. Introduction to Digital modulation, Digital modulation formats, Types of digital modulation techniques, Fundamentals of binary ASK, PSK and</td></tr>
</table>

	FSK, Generation of BASK, BPSK and BFSK and their coherent detection techniques. **UNIT – V** **Information Theory:** Introduction, Sources of information, Contents in DMS, Contents of a symbol, Entropy, Information rate, Discrete memory less channel, Conditional joint entropies, mutual information, Channel capacity, Source coding, Entropy coding, Coding efficiency.
Course Outcomes	**At the end of this course student will be able to:** • Acquire the generalize knowledge of communication system in the presents scenario. • Develop problem solving skills in complex communication networking
Text Books	1. Principles of Communication Systems –Taub and Shilling, Tata Mc Graw Hill. 2. A Text Book of Analog & Digital Communication–P.Chakrabarti, Dhanpat Rai & Co.
Reference Books	1. "Electrical Communication Systems", Kennedy, TMH. 2. "Digital Communications "Sanjay Sharma, S.K. Kataria &Sons, New Delhi

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Course Title	**ELECTRICAL MACHINE – II LABORATORY**				
Course Code	**BENEE501P**				
Course Credits	**L**	**T**	**P**	**TC**	
	-	**-**	**2**	**1**	
Prerequisites	Electrical Machines				
Course Objectives	**This course will enable students to:** • The objective of this course is to learn working of various machines their equivalent circuit, • To learn Parameter determination and applications. • To learn Starting mechanisms of machines. • To learn Speed control methods of machines. • To learn various tests and applications of machines.				
Course Contents	**List of Experiments:** **(At least Ten experiments are to be performed by each student).** 1. To study squirrel cage & slip ring type Induction motor and Synchronous motor with the help of Cut-view model or Dismantled Motor. 2. To determine the voltage regulation of 3 phase alternator by EMF method. 3. To determine the voltage regulation of 3 phase alternator by ZPF method. 4. To determine the voltage regulation of 3 phase alternator by Direct Loading. 5. To plot the V and inverted V- curve of synchronous Motor at No Load, and Full Load. 6. To perform synchronization of alternator with infinite bus by bright lamp method. 7. To determine Xd & Xq of a salient pole rotor type synchronous machine by slip test. 8. To determine the equivalent circuit parameters of 3-phase induction motor by No-Load &Block Rotor test 9. To Study DOL starter and provide connection to 3- phase Induction motor. 10. To Study Semi-Automatic Star-Delta starter and provide connection to 3-				

	phase Induction motor. 11. To study Contactor type starter for Forward/ Reverse operation of Induction motor 12. To study the speed control of a three phase slip ring I.M by adding external resistance to the rotor circuit. 13. To find Full load Efficiency of Induction Motor by drawing Circle Diagram. 14. Measurement of Speed of Induction Motor by Measuring Rotor Frequency. 15. 15. Visit to the substation of Institute and observe the sequence of operation to make DG set ON and OFF.
Course Outcomes	**At the end of this course student will be able to:** • Understand the fundamentals and working of alternator • Draw the equivalent circuit diagrams of various induction motor • Analyze the load profile, voltage regulations and efficiency under various operating conditions • Understand the working principle and construction of synchronous machines • Understand the needs and requirements of various types of operations like starting, speed control, tests etc.
Text Books	Electrical Machine V.K. Mehta Kahnna Publication

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<table>
<tr><td>Course Title</td><td colspan="5">MICROCONTROLLER & EMBEDDED SYSTEM</td></tr>
<tr><td>Course Code</td><td colspan="5">BENEE502P</td></tr>
<tr><td rowspan="2">Course Credits</td><td>L</td><td>T</td><td>P</td><td>T
C</td><td></td></tr>
<tr><td>-</td><td>-</td><td>2</td><td>1</td><td></td></tr>
<tr><td>Prerequisites</td><td colspan="5">Microprocessor</td></tr>
<tr><td>Course Objectives</td><td colspan="5">This course will enable students to:
To understand the basic concept of register their property, behavior and application.
To understand the concept of waves shaping circuit and constant power supply.</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. Write a microcontroller 8051 program to transfer the bytes into RAM locations starting at 50H,assuming that ROM space starting at 240H contains CHHATTISGARH by using – a) Counter, b) null char. for end of string .
2. Write a microcontroller 8051 program to get hex data on the range of 00-FFh from port 0 and convert it to decimal. Save the digits in R7, R6 and R5, where the least significant digit is in R7.
3. Write a microcontroller 8051 program to add two 16 Bit unsigned numbers. Operands are two RAM variables. Results to be in R1-R0 pair.
4. Write a microcontroller 8051 program to subtract an unsigned 16 Bit number from another. Operands are two RAM variables. Results to be in R1-R0 pair.
5. Write a microcontroller 8051 program to add two unsigned 32-bit numbers. Operands are two RAM variables. Results to be in R1-R0 pair.
6. Write a microcontroller 8051 program to add two 16 Bit signed numbers.
7. Write a microcontroller 8051 program to convert a binary number to equivalent BCD
8. Write a microcontroller 8051 program to convert a packed BCD number to two ASCII numbers and place them in R5 and R6.
9. Write a microcontroller 8051 program to calculate the square root of an 8-</td></tr>
</table>

	bit number using iterative method. 10. Write a microcontroller 8051 program that generates 2kHz square wave on pin P1.0, 2.5 kHz on pin P1.2and 25 Hz on pin P1.3. 11. Write a microcontroller 8051 program for counter 1 in mode 2 to count the pulses and display the state of the TL1 count on P2. Assume that the clock pulses are fed to pin T1. 12. Write a microcontroller 8051 program to transfer letter "N" serially at 9600 baud, continuously. Assume crystal frequency to be 11.0592 MHz. 13. Write a microcontroller 8051 program to transfer word "CSVTU" serially at 4800 baud and one stop bit, continuously. Assume crystal frequency to be 11.0592 MHz. 14. Write a microcontroller 8051 program to receive bytes of data serially, and put them in P1. Set the baud rate at 2400 baud, 8-bit data, and 1 stop bit. Assume crystal frequency to be 11.0592 MHz.
Course Outcomes	**At the end of this course student will be able to:** 1. Predict and design registers as per circuit requirement. 2. Learn to design parity checking circuit.
Text Books	The 8051 Microcontroller and Embedded Systems using Assembly and C, Mazidi, Mazidi & McKinlay, 2ndEd., PHI

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Course Title	**CONTROL SYSTEM ENGINEERING LABORATORY**				
Course Code	**BENEE505P**				
Course Credits	**L**	**T**	**P**	**T C**	
	-	**-**	**2**	**1**	
Prerequisites	Network Analysis & Synthesis				
Course Objectives	**This course will enable students to:** • To provide knowledge of Open Circuit Concepts. • To provide knowledge of Close Circuit Concepts • To provide Knowledge of P, PI,PID Controller. • To give the knowledge of analysis of Bode Plot.				
Course Contents	**List of experiments:** **(At least Ten experiments are to be performed by each student)** 1. To determine the gain of an open loop and closed loop system. 2. To study the effect of disturbance on an open loop and closed loop system. 3. Simulation of transfer function using Op-Amp (Analog Computer Trainer) 4. To determine the transfer function of a DC servomotor. 5. Determination of transfer function of an AC servomotor. 6. Characteristics of synchro-transmitter and receiver pair. 7. To study a potentiometer as an error detector. 8. Study of a basic electrically controlled hydraulic system. 9. Study of a basic electrically controlled pneumatic system 10. To Study the time response of a first and second order system. 11. Study of P, PI controller on second order system 12. Study of PID controller on second order system 13. Study of bode plot of a Type 0,Type I and Type II systems. 14. To study the lag compensator and lead compensator. 15. To study the lag-lead compensator.				

Course Outcomes	**At the end of this course student will be able to:** • Learn about the different types of servo-meter. • Converting a electrical circuit into graph and will be able to analyze the circuit graphically. • Analyze circuits with ideal, independent, and controlled voltage and current sources • Understand open loop & close loop system. • Understand about synchro-transmitter and receiver pair. • Understand about lag compensator and lead compensator.
Text Books	Control System B.S. Manke

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Course Title	**MINI PROJECT**				
Course Code	**BENEE507P**				
Course Credits	**L**	**T**	**P**	**TC**	
	-	**-**	**2**	**1**	
Prerequisites	**Basic Electrical Engineering**				
Course Objectives	**This course will enable students to:** • To provide knowledge of Basic Electric Circuit Concepts.				
Course Contents	1. The basic objective of the Mini Project is to inculcate the habit of enquiry, Team work, Confidence to tackle new problems 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 by the students and Tools/ Accessories will be provided by the institute. It is again highlighted that the mini project MUST be prepared 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 is submitted. The report will be Soft wound with transparent sheet stapled at the top and bottom , Stapled side must be covered with Tape. 4. Projects may be selected from Electrical / Electronic Magazines, books, journals. Highly advance circuit using Microcontroller 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				
Text Books					

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<table>
<tr><td>Course Title</td><td colspan="5">APPLIED NUMERICAL ANALYSIS</td></tr>
<tr><td>Course Code</td><td colspan="5">BENEE503TA</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>-</td><td>3</td><td></td></tr>
<tr><td>Prerequisites</td><td colspan="5">Mathematics – III</td></tr>
<tr><td>Course Objectives</td><td colspan="5">This course will enable students to:
The course provides an introduction to several fundamental algorithms for solving scientific and engineering problems and application.
This course responds to the needs of the engineering and physical sciences curricula by providing application oriented numerical methods.
The course will develop numerical methods aided by technology to solve algebraic, transcendental, and differential equations, and to calculate derivatives and integrals based on the available discrete data.</td></tr>
<tr><td>Course Contents</td><td colspan="5">UNIT– I
Nonlinear Equations:
Number representation and errors, Taylor Series, Determination of roots of polynomials and transcendental equations by secant method, Newton's method; convergence analysis, Newton’s method to solve system of nonlinear equations, polynomial equations, Newton’s method for polynomials, Bairstow’s method for quadratic factors.
UNIT – II
System of Linear Equations:
Matrix notation, eigen values and eigenvector, Solutions of linear algebraic e quations by Gauss Elimination and Gauss-Jordan methods, Iterative methods-Jacobi and Gauss-Seidel methods and their convergence analysis.
UNIT – III
Interpolation and Approximation:
Polynomial interpolation, Lagrangian and Newton forms, divided difference, Backward, Forward and central difference, Weierstrass approximation theorem, Least-squares approximations, Pade approximations, Uniform approximation
UNIT – IV</td></tr>
</table>

	Numerical Differentiation and Numerical Integration: Introduction, numerical differentiation, methods based on interpolation and finite differences, partial differentiation, Numerical Integration, Newton cotes rules, Trapezoidal rule, Simpson's rule, composite integration methods. **UNIT – V** **Ordinary Differential Equations:** Numerical solution of ordinary differential equations, Taylor series method, Euler and Modified Euler's method, Runge-Kutta methods, multi-step methods, Milne's method, predictor corrector methods.
Course Outcomes	**At the end of this course student will be able to:** • Find acceptable approximate solutions when exact solutions are either impossible or time-consuming. • Approximate a function using an appropriate numerical method for a given set of data. • Develop problem solving skills. • Devise alternate methods of solution better suited to the capabilities of computers.. • Describe difficulties that can arise because computers usually use finite precision, often non-decimal arithmetic.
Text Books	1. Numerical Methods for Scientific and Engineering computation: M.K. Jain, S.R.K. Iyengar and R.K. Jain, New Age International. 2. Applied Numerical Analysis C.F. Gerald and P.O. Wheatley, Pearson Education, Sixth edition.
Reference Books	1. Applied Numerical Methods with MATLAB for Engineers and Scientists: S.C. Chapra, McGraw-Hill. 2. Numerical Mathematics and Computing: W. Cheneyand D. Kincaid, Thomson Brooks/Cole, Vikas Publishing House, Fourth edition 3. Name of the Programme: Bachelor of Engineering : Duration of the Programme: Four Years Numerical Method: B.S. Grewwal, Khanna publication

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<table>
<tr><td>Course Title</td><td colspan="5">SIGNAL & SYSTEMS</td></tr>
<tr><td>Course Code</td><td colspan="5">BENEE503TB</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>-</td><td>3</td><td></td></tr>
<tr><td>Prerequisites</td><td colspan="5">Mathematics – III</td></tr>
<tr><td>Course Objectives</td><td colspan="5">• To study the properties and representation of discrete and continuous signals.
• To understand the complete of the nature of continuous and discrete signals and their applications in engineering systems.
• To study the sampling process and analysis of discrete systems using z-transforms.
• To understand the use of transforms for signal classification and analysis.
• To study the analysis and synthesis of discrete time systems.</td></tr>
<tr><td>Course Contents</td><td colspan="5">UNIT I
Introduction to Signals and Systems:
Definition of signals, Continuous and discrete time signals: Classification of Signals – Periodic-a periodic, even – odd, energy and power signals - Deterministic and random signals - complex exponential and sinusoidal signals - periodicity - properties of discrete time complex exponential unit impulse - unit step impulse functions - Transformation in independent variable of signals: time scaling, time shifting. Basic properties of continuous time systems: Linearity, Causality, time invariance, stability.
UNIT II
Fourier Series and Fourier Transform :
Determination of Fourier series representation of continuous time periodic signals -Explanation of properties of continuous time Fourier series, Continuous time Fourier Transform analysis with examples - properties of the Continuous time Fourier Transform basic properties, convolution in time and frequency domains.
UNIT III
Laplace Transform and Sampling Theorem:</td></tr>
</table>

	Laplace Transform analysis with examples - properties of Laplace Transform basic properties, convolution in time and frequency domains. Analysis and characterization of LTI systems using Laplace transform: Computation of impulse response and transfer function using Laplace transform. Representation of continuous time signals by its sample -Sampling theorem - Reconstruction of a Signal from its samples, aliasing - discrete time processing of continuous time signals, sampling of band pass signals. **UNIT IV** **Z – Transforms:** Basic principles of z-transform - z-transform definition- region of convergence - properties of ROC - Properties of z-transform - Poles and Zeros - inverse z-transform using Contour integration - Residue Theorem, Power Series expansion and Partial fraction expansion, Relationship between z-transform and Fourier transform. Computation of Impulse response and Transfer function using Z Transform, DTFT Properties and examples - LTI-DT systems - Characterization using difference equation. **UNIT V** **Random Signals:** Introduction to probability, Bayes Theorem- concept of random variable- probability density and distribution functions- function of a random variable, Moments- Independence of a random variable. Introduction to random process, Auto and cross correlation. Wide-sense stationary- ower spectral density White noise.
Course Outcomes	**At the end of this course student will be able to:** • Students will be able to understand the terminology of signals and basic engineering systems. • Students will understand the role of signals and systems in engineering design. • Students will have the understanding of the use of signals and basic system building blocks and their roles in large/complex system design. • Students will understand signal representation techniques and signal characteristics. • Students will understand the difference and the applications of analog versus discrete signals and the conversion between them. • Students will understand the process of sampling and the effects of under-sampling. • Students will understand the Fourier, Laplace and z-transforms.

Text Books	1. LAnand Kumar, Signals and Systems PHI 3rd edition, 2013. 2. Signals and Systems, Simon Haykin and Barry Van Veen, , John Wiley, 1999. 3. Signals and Systems: Oppenheim Alan- V- Willsky Alan. S- Pearson Edn.
Reference Books	1. Linear Systems and Signals : B. P.Lathi, Oxford university Press, 2005. 2. Signals and Systems: I J Nagrarth- Tata Mc Graw Hill,2001. 3. Signals and Systems: Farooq Husain- Umesh pub. 4. Adaptive signal processing: W Bernad- Pearson Edn.

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Course Title	**INTRODUCTION TO AI & ML**				
Course Code	**BENEE503TC**				
Course Credits	**L**	**T**	**P**	**TC**	
	2	**1**	**-**	**3**	
Prerequisites	**-**				
Course Objectives	**This course will enable students to:** ● To introduce the fundamentals of Artificial Intelligence and its applications. ● To learn the basics of machine learning and its associated terminologies. • To learn the length of artificial neural networks from its basics to variants of CNN.				
Course Contents	**UNIT– I** **Fundamentals of Artificial Intelligence (AI):** Concepts of intelligence, knowledge and learning, Problem formulation, State space search, Heuristic search, Knowledge representation, Constraint satisfaction, Uncertainty in AI, Brief introduction to Fuzzy logic and Genetic Algorithms, Popular Applications of AI. **UNIT – II** **Introduction to Machine Learning:** Basic definitions, Hypothesis space and inductive bias, Candidate elimination algorithms, Statistical learning, Evaluation, Cross-validation, Supervised learning, Unsupervised learning, Reinforcement learning, Regression, Classification, Clustering ,Association, Over fitting, Bias-Variance trade off, Regularization, Optimization, Activation functions. **UNIT – III** **Machine Learning Algorithms:** Linear Regression, Logistic Regression, K-Nearest Neighbor, Decision Trees, Support Vector Machine, Naïve Bayes, Random forest, Gradient boosting, Clustering Techniques: K-Mean, Fuzzy C means and Hierarchical Clustering. **UNIT – IV**				

	Neural Network: Introduction to Neural Networks, Biological Neuron model and extension to artificial Neuron models, McCullochPitts model,Perceptron, Multi-layer perceptron, Feed forward network Back-propagation, introduction to deep neural network. **UNIT – V** **CNN:** Convolution Neural Network (CNN), layers in CNN, CNN models for Image recognition (Alexnet,VGG, Resnet, Inception Net etc.).
Course Outcomes	**At the end of this course student will be able to:** ● Explain concepts and applications of Artificial Intelligence. ● Illustrate fundamentals and types of machine learning. ● Elucidate different supervised and unsupervised machine learning algorithms. ● Analyze and explain working of artificial neural network . ● Explain the concepts and working of Convolution Neural Network (CNN) and its well-known architectures.
Text Books	1. S. Russell and P. Norvig, Artificial Intelligence: A Modern Approach, 3rd edition, Pearson Education, 2015 2. Bishop, C. M. Neural Networks for Pattern Recognition Oxford University Press. 1995. 3. S. N. Sivanandam and S. N. Deepa, Principles of Soft Computing, Wiley India Pvt Ltd, 2011. 4. Tom M. Mitchell,Machine Learning, McGraw Hill Science Publication.
Reference Books	1. Elaine Rich and Kelvin Knight, Artificial Intelligence, 3rd edition, Tata McGraw Hill, 2017. 2. Dan.W. Patterson, Introduction to AI and Expert Systems – PHI, 2007. 3. Bishop C., Pattern Reorganization and Machine Learning, Berlin Springer Verlag. 4. E. Alpaydin, Introduction to Machine Learning, Prentice Hall of India, 2006.

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Course Title	**COMPUTER SYSTEM ARCITECTURE**				
Course Code	**BENEE503TD**				
Course Credits	**L**	**T**	**P**	**T C**	
	2	**1**	**-**	**3**	
Prerequisites	Computer Fundamentals				
Course Objectives	• To understand the structure, function and characteristics of computer systems. • To understand the design of the various functional units and components of computers. • To identify the elements of modern instructions sets and their impact on processor design. • To explain the function of each element of a memory hierarchy. • To identify and compare different methods for computer I/O.				
Course Contents	**UNIT-I** **Register Transfer and Micro-Operations:** Register Transfer Language, Register Transfer, Bus and Memory Transfer, three state buffers, memory transfer, micro operations, binary adders, binary adder subtractor, binary incrementer circuits. Logic Micro operations, hardware implementation, Shift micro operations, hardware implementation, Arithmetic and Logical Unit. **UNIT-II** **Basic Computer Organization :** Instruction codes, stored program organization, indirect address. Computer registers, common bus system. Computer instructions, instruction set completeness. Timing and control unit, fetch and decode, determining type of instruction, register reference instructions, memory reference instructions. Input-output configuration, input-output instructions, program interrupt, interrupt cycle. **UNIT-III** **Programming the Basic Computer:** Introduction, Machine language, assembly language, rules of the language, translation to binary, Program loops, Programming arithmetic and logic				

	operations, Logic operations, Shift operations. **UNIT-IV** **Micro Programmed Control:** Control memory, address sequencing, conditional branching, mapping of an instruction, subroutine, microprogram example, microinstruction format, symbolic microinstructions, fetch routine, symbolic microprogram, binary micro-program, Design of control unit, Micro program sequencer. **UNIT-V** **Central Processing Unit:** General register organization, control word, Stack organization, Register stack, memory stack, reverse polish notation, Instruction format, 3-2-1-0 address instructions. Addressing modes, Data Transfer and Manipulation, data transfer instructions, data manipulation instructions, arithmetic instructions, logical and bit manipulation instructions, shift instructions. Program control, status bit conditions, conditional branch instructions, subroutine-call-return instructions.
Course Outcomes	• Develop micro operation for a given digital circuit. • Develop micro operations for various computer instructions. • Program a basic computer. • Develop micro operations for a give microinstruction. • Analyse the CPU functioning.
Text Books	1. Computer System Architecture by M. M. Mano 2. Computer Architecture and Organization, J.P. Hayes Int'1 student edition, McGraw – Hill.
Reference Books	1. Structured computer organization 3rd Edn by A. Stannabaum. 2. Computer Organization by V.C.Hamacher et al McGraw. 3.Introduction of Digital computer Design by V. Rajaraman & T.Radhakrishnman. 4. Analog computation and simulation by V. Rajaraman PHI