Shri Rawatpura Sarkar University, Raipur (C.G.)

Scheme of Teaching and Examination and Syllabus

for

Diploma (Electrical Engineering)

Semester-(V)

(Effective from the session: 2022-23)

SHRI RAWATPURA SARKAR UNIVERSITY, RAIPUR, CHHATTISGARH
FACULTY OF ENGINEERING

Three Years Diploma in Engineering Programme

Scheme of Teaching and Examination of Diploma in Engineering 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	DENEE501T	Modern Instrumentation & Microcontroller	3	1	-	4	30	70	100	3
2	DENEE501P	Modern Instrumentation & Microcontroller	-	-	2	1	15	35	50	-
3	DENEE502T	Estimation and Costing	2	1	-	3	30	70	100	3
4	DENEE503T	Power Electronics	3	1	-	4	30	70	100	3
5	DENEE503P	Power Electronics	-	-	2	1	15	35	50	-
6	DENEE504T	Elective I	3	1	-	4	30	70	100	3
7	DENEE505T	Electrical Machines - II	3	1	-	4	30	70	100	3
8	DENEE505P	Electrical Machines - II	-	-	2	1	15	35	50	-
9	DENEE506P	Industrial Training/Report Writing, Seminar	-	-	2	1	15	35	50	-
						23			700	

Elective I

A. Power System Operation and Control
B. Smart Grid Technology
C. Power Apparatus System
D. Digital Control System

E. Applied Optimization

F. Artificial intelligence

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FACULTY OF ENGINEERING

Course Title	**Modern Instrumentation & Microcontroller**				
Course Code	**DENEE501T**				
Course Credits	**L**	**T**	**P**	**TC**	
	3	**1**	**-**	**4**	
Prerequisites	Digital Electronics				
Course Objectives	• The objective of this course is to provide knowledge about the fundamentals of Microprocessors & Micro Controller and their evolution internal architecture and construction. • This course is also useful to provide the knowledge of various supporting chips provided with the Microprocessor 8085 and Microcontroller 8051. • The aim of this course is to give the knowledge of various instructions, basic programming with Microprocessors 8085 and Microcontroller 8051. • The aim of this course is to give the knowledge of data transfer schemes, Instruction format and addressing modes.				
Course Contents	**UNIT I** **Microprocessor 8085 Architecture:** Fundamentals of Microprocessor Architecture. 8-bit Microprocessor and Microcontroller, Architecture of 8085, Pin Configuration and their Function; internal registers & flag register, memory-stack organization, Generation of Control Signals, de-multiplexing of address / data bus, Instruction Fetch Cycle, Execute Cycle, Instruction Cycle. **UNIT II** **Instruction Set and Programming with 8085:** Instruction for Data Transfer, Arithmetic, Logical Operations and Branching Operation. Stacks, Subroutine and Related Instructions. Elementary Concept of Timing Diagram and Machine Cycle. Addressing Modes, Instructions Format. Looping and Counting, Software Counters with Time Delays. Simple Programs using Instruction Set of 8085 like Program for Addition/ Subtraction/ Multiplication and Division of Unsigned Binary Numbers **UNIT III** **The 8051 Architecture:** 8051 Microcontroller hardware, The 8051 oscillator and clock, program counter, data pointer, A and B CPU registers, Flags and program status word, Internal Memory, Internal RAM, the stack and the stack pointer, special function registers, Internal ROM, Input/output pins, ports and circuits, external memory, connecting external memory. **UNIT IV**				

	Instruction Set and Programming of 8051 Addressing modes: Introduction, Instruction syntax, Data types, Subroutines Immediate addressing, Register addressing, Direct addressing, Indirect addressing, Relative addressing, Indexed addressing, Bit inherent addressing, bit direct addressing. 8051 Instruction set, Instruction timings. Data transfer instructions, Arithmetic instructions, Logical instructions, Branch instructions, Subroutine instructions, Bit manipulation instruction. Assembly language programs. **UNIT V** **TIMERS, SERIAL COMMUNICATION** Timers/ counters of 8051 and programming in Assembly language, Serial Data Input/output and programming in Assembly language.
Course Outcomes	**At the end of this course student will be able to:** • Understand the basic architecture of Microprocessor 8085 Microcontroller 8051. • Understand various instructions and their application in programming. • Understand memory organization and mapping
Text Books	1. Microprocessor Architecture, Programming, and Applications with the 8085 5/e, R. S. Gaonkar, Penram International Publishing. 2. The 8051 Microcontroller Architecture, Programming And Applications Kenneth J Ayala West Publishing company 3. The 8051 Micro Controller and Embedded Systems Using Assembly and C, Second Edition, Muhammad Ali Mazidi Janice Gillispie Mazidi Rolin D. McKinlay
Reference Books	1. The8051Microcontroller,V.Udayashankar and MalikarjunaSwamy, TMH, 2009. 2. Microcontrollers: Architecture, Programming, Interfacing, and System Design, Raj Kamal, Pearson Education, 2005

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<table>
<tr><td>Course Title</td><td colspan="5">Estimation And Costing</td></tr>
<tr><td>Course Code</td><td colspan="5">DENEE502T</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">Applied mathematics & basic electrical Engineering</td></tr>
<tr><td>Course Objectives</td><td colspan="5">• Identify and differentiate between the two types of estimate.
• Define a unit cost estimate.
• Draw up a check list for estimate control.</td></tr>
<tr><td>Course Contents</td><td colspan="5">UNIT-I
Elements of estimating and costing :
Types of estimation and estimation tools,Overhead and service charges,Purchase procedure
Domestic and Industrial Wiring :
Layout and wiring diagram for residential building,Layout and wiring diagram for industrial wiring,Selection of number of circuit for project as per IE rules,
Estimation for residential wiring and industrial wiring,IE rules observed for above wiring.
UNIT-II
Domestic and Industrial Service Connection :
Survey work for domestic and industrial service connection,Wiring diagram of domestic and industrial service connections,Specifications of materials and accessories for service connection,Estimation of service connection for domestic and industrial (1phase and 3 phase) service connections.
UNIT-III
Overhead and Underground Distribution System
Planning and layout of overhead electrical distribution,Specifications of materials and accessories for overhead project,Planning and layout of underground electrical distribution,Specifications of materials and accessories for underground project,Drawings of overhead and underground service connection,IE rules pertaining to above project.
UNIT-IV
Estimating and Costing of Electrical Product
Market survey for cost of given product like D.O.L. starter, small motor, MCBs, etc.,Market survey for availability of required materials, their cost and other, requirements,Vf cost schedule.
Maintenance of Electrical Equipment
Estimation of repairs, servicing and testing cost including labour cost (service charge),Tools used for repairs & testing work, Detailed estimation and preparation of cost schedule for repair and maintenance of electric fan, automatic electric iron, single-phase transformer, mixer, D.O.L. starter etc.</td></tr>
</table>

	UNIT-V **Principles of Contracting** Terms, conditions and types of contract system,Types of tenders, tendering procedure and preparation of single tender,Terms and conditions of tender, procedure for inviting and scrutinizing of tender,Importance of earnest money deposit, security deposit and S.O.R.
Course Outcomes	**At the end of this course student will be able to:** • Perform and evaluate present worth, future worth and annual worth analyses on one of more economic alternatives. • understand various types of materials required for wiring • understand different systems of illumination • Comprehend the estimation of industrial installations.
Text Books	1. Electrical estimating and costing Bajpai, M.N., Saroj Publication, New Delhi.
Reference Books	1. Electrical wiring, estimating and costing Uppal, S.L., Khanna Publisher, New Delhi 2. I.E. rules Central Law Agency, Allahabad.S.O.R P.W.D. Govt. Deptt.

<table>
<tr><td>Course Title</td><td colspan="5">Power Electronics</td></tr>
<tr><td>Course Code</td><td colspan="5">DENEE503T</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">Basic electronics</td></tr>
<tr><td>Course Objectives</td><td colspan="5">• To provide the students a deep insight in to the working of different switching devices with respect to their characteristics
• To analyze different converters and control with their applications.
• To study advanced converters and switching techniques implemented in recent technology</td></tr>
<tr><td>Course Contents</td><td colspan="5">UNIT– I
Power Rectification:
Need and advantages of poly phase rectification,3 Phase and 6 Phase H.W. and F.W. (bridge) rectifiers, Derivation of Irms, Idc, Ripple factor, P.I.V. and efficiency for 3 ph. H.W. and F.W. rectifiers. Different transformers – double star, zig zag and branched connections – working and advantages ,Transformer utility factor : PUF and SUF
Controlled Rectification
Power controlling devices such as S.CR, and Triac Diac UJT, Triggering circuits, – phase shift, UJT, Schmitt trigger circuits Single phase, three phase H.W. and bridge rectifiers- Derivation of Idc and Irms .Applications of controlled rectifiers Series and parallel combination of SCRs.
UNIT – II
Inverters :
Need of invertion, Invertor circuits using SCR in series and pareller mode,Circuit diagram of emergency tube light.
UNIT – III
Converters :
Need of converter , types of converter (DC to DC and AC to AC), Block diagram of chopper,Circuit diagrams of chopper using switching transistors and SCRs, Need of commutation, methods, Single phase and Three phase cycloconverter.
UNIT – IV
Regulated Power Supply :
Need of regulation, Zener regulated DC power supply and it’s limitations, Working of shunt and series regulated power supply using transistor, IC regulated power supplies (Circuit diagram), Block diagrams of (SMPS) switch mode power supply AC stabilizer using tap changer, Block diagram of servo stabilizer.
UNIT – V</td></tr>
</table>

	Speed Control of Motors : Advantages of speed control, Separately excited DC motor by single and three phase controlled rectifiers,Methods of speed regulation , field failure protection, armature current limiter (block diagrams),Dual rectifier for reversal of rotation Speed control by chopper (block diagram), Circuit diagram of speed control of single phase and three phase induction motor by cycloconverter (Slip ring).
Course Outcomes	**At the end of this course student will be able to:** • Articulate the basics of power electronic devices • Design of power electronic converters in power control applications • Ability design AC voltage controller and Cyclo Converter. • Ability to design Chopper circuits.
Text Books	1. Industrial Power Electronics: P.S.Bhimra sixth edition
Reference Books	1. “Industrial Power Electronics” – M.H.Rashid

<table>
<tr><td>Course Title</td><td colspan="5">Electrical Machines – II</td></tr>
<tr><td>Course Code</td><td colspan="5">DENEE505T</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 machine-I</td></tr>
<tr><td>Course Objectives</td><td colspan="5">• To acquire the basic knowledge of construction, working and operation of transformer and induction motor.
• To know about the insulation of the machines and to choose good insulator for better performance and efficiency.
• Can design the speed controlling techniques for the induction motor.</td></tr>
<tr><td>Course Contents</td><td colspan="5">UNIT-I
Introduction to A.C. Machines :
Overview of AC machines, Difference between A.C. & D.C. Machines, Basic features of AC machines, Parts of A.C. Machine & their functions, Stator & rotor windings.
UNIT-II
Synchronous Motor:
General characteristics, Principal of operation, method of starting, motor on load with constant excitation, power flow, equivalent circuit, synchronous motor with different excitations, effect of excitation on armature current and power factor.
UNIT- III
Alternators :
Types of alternators, Principle & emf equation, Winding factors & its effect on, induced emf, Effect of frequency on induced emf, Effect of speed & excitation on induced emf, Excitation system used in modern, alternators, Concept of leakage, armature & synchronous reactance, Principle of working of brushless alternators, Applications.
UNIT- IV
Three Phase Induction Motors:
Stator & rotor parts, functions, windings, Concept of rotating magnetic fields, Stator & rotor current equations, Effect of frequency on slip, Torque equations, Condition for maximum torque, Torque speed curves, Circle diagram, Necessity of induction motor starters and different types, Methods of speed control of induction motors, Different types of induction motors.
UNIT- V
FHP Motors :
Construction of Fractional Horse Power (FHP) motors, Starting methods of FHP Motors, Principle of working of FHP motor, Application of Fhp</td></tr>
</table>

	Motors.
Course Outcomes	**At the end of this course student will be able to:** • Understand the working principles of Transformer and Induction Motor. • Identify different speed controlling techniques of Induction motor for the given application. • Calculate the Performance of both transformer and induction motor.
Text Books	1. Electrical Machines Bimbhra, P.S.; Khanna Publishers, New Delhi
Reference Books	1 Electrical Machines V.K.Mehta. fifth edition 2 Electrical Technology, Vol II, BL Thareja 3 Electrical Machines, Nagrath Kothari, IJ Nagrath, TMH

<table>
<tr><td>Course Title</td><td colspan="5">Power System Operation and Control</td></tr>
<tr><td>Course Code</td><td colspan="5">DENEE504TA</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">Generation transmission & distribution</td></tr>
<tr><td>Course Objectives</td><td colspan="5">• To augment the students' capacity in pursuing research in emerging areas of power system.
• To know the importance of compensation in power system and study the different compensating techniques.</td></tr>
<tr><td>Course Contents</td><td colspan="5">UNIT–I
Introduction to power system :
Growth of power system, Various elements of power system,Necessity and advantages of interconnection
Representation of power system
Single line diagram with standard symbol, Definition and advantages of Per Unit system, Conversion of PU values from one base value to other base value, Generalized ABCD constants and their characteristics, Values of constants in terms of circuit parameters, Proof of (AD-BC)=1,Relation of Zso, Zss, Zro, Zrs
UNIT–II
Symmetrical Components :
Operator a and j, Resolution of unbalanced three phase system in to balanced three phase system, Relation between Symmetrical and unsymmetrical components ,Phase sequence impedance and network, Analysis of L-G, L-L, L-L-G and L-L-L and their calculation
UNIT–III
Power System Stability And Reliability :
Meaning & Necessity of stability, Types of stability & Factors affecting stability, Stability limit & Methods of improving stability, Elementary two M/C system, Power angle cycles, Equal area criterion, Swing equation, Reliability & factors affecting reliability, Methods of improving reliability.
UNIT–IV
Circle Diagram :
Importance of circle diagram, Receiving end & Sending end circle diagram, Methods of voltage control- Regulating transformer & Static VAR Compensation.

Economic Operation of Power System :
Incremental fuel cost, Optimum Loading on two units in a plants, Transmission loss as a function of plant generation, Unit commitments, Beta – loss coefficients</td></tr>
</table>

	& numerical practice. **UNIT–V** **Load Flow Study:** Objectives of load flow, Bus classification, Qualitative interpretation of SLFE & its solution **HVDC/HVAC System** Merits & Demerits, Types of DC links, Controlled Rectification & Filters, Reactive Power requirements, Controlled characteristics.
Course Outcomes	**At the end of this course student will be able to:** • Identify and explain the different methods of generation, distribution, control and compensation involved in the operation of power systems. • Specify the equivalent electrical parameters of transmission line to prepare and analyze models to predict the range and ratings of the equipments to be used, the protection required against line transients and determine the appropriate methods of compensation required for operational stability
Text Books	1. Electric Power System Ashfaq Husain
Reference Books	1. Electrical Power System Mehta, V.K., Khanna Publishers, New Delhi 2. ABS Course in Electrical Power J. B. Gupta , Kalson Pub. ,Ludhiana

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<table>
<tr><td>Course Title</td><td colspan="5">Smart Grid Technology</td></tr>
<tr><td>Course Code</td><td colspan="5">DENEE504TB</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">Generation transmission & distribution</td></tr>
<tr><td>Course Objectives</td><td colspan="5">• Introduce various aspects of the smart grid including, Technologies, Components, Architectures and Applications.
• Explain communication infrastructure of smart grid.
• Explain various integration aspects of conventional and non-conventional energy sources</td></tr>
<tr><td>Course Contents</td><td colspan="5">UNIT - I
Introduction to Smart Grid
Evolution of Electric Grid, Concept of Smart Grid, Definitions, Need of Smart Grid, Functions of Smart Grid, Opportunities & Barriers of Smart Grid, Difference between conventional & smart grid, Concept of Resilient & Self Healing Grid, Present development & International policies in Smart Grid.Case study of Smart Grid.CDM opportunities in Smart Grid.
UNIT-II
Smart Grid Technologies: Part 1
Introduction to Smart Meters, Real Time Prizing, Smart Appliances, Automatic Meter Reading(AMR), Outage Management System(OMS), Plug in Hybrid Electric Vehicles(PHEV), Vehicle to Grid, Smart Sensors, Home & Building Automation, Phase Shifting Transformers.
UNIT-III
Smart Grid Technologies: Part 2
Smart Substations, Substation Automation, Feeder Automation. Geographic Information System(GIS), Intelligent Electronic Devices(IED) & their application for monitoring & protection, Smart storage like Battery, SMES, Pumped Hydro, Compressed Air Energy Storage, Wide Area Measurement System(WAMS), Phase Measurement Unit(PMU).
UNIT-IV
Microgrids and Distributed Energy Resources
Concept of microgrid, need & applications of microgrid, formation of microgrid, Issues of interconnection, protection & control of microgrid. Plastic & Organic solar cells,Thin film solar cells, Variable speed wind generators, fuelcells, microturbines, Captive power plants, Integration of renewable energy sources.</td></tr>
</table>

	UNIT-V **Power Quality Management in Smart Grid** Power Quality & EMC in Smart Grid, Power Quality issues of Grid connected Renewable Energy Sources, Power Quality Conditioners for Smart Grid, Web based Power Quality monitoring, Power Quality Audit.
Course Outcomes	**At the end of this course student will be able to:** • Understand the smart grid components and architectures • Describe different measuring methods and sensors used in the smart grid • Understand and describe the efficient energy management systems • Understand and describe the different microgrids and smart grid technologies • Understand and describe the diffident communication protocols and technologies used for smartgrids
Text Books	1. Ali Keyhani, Mohammad N. Marwali, Min Dai "Integration of Green and Renewable Energy in Electric Power Systems", Wiley 2. Clark W. Gellings, "The Smart Grid: Enabling Energy Efficiency and Demand Response", CRC Press
Reference Books	1. James Northcote, Green, Robert G. Wilson "Control and Automation of Electric Power Distribution Systems (Power Engineering)", CRC Press 2. Mladen Kezunovic, Mark G. Adamiak, Alexander P. Apostolov, Jeffrey George Gilbert "Substation Automation (Power Electronics and Power Systems)", Springer 3. Janaka Ekanayake, Nick Jenkins, Kithsiri Liyanage, Jianzhong Wu, Akihiko Yokoyama, "Smart Grid: Technology and Applications", Wiley 4. Jean Claude Sabonnadière, Nouredine Hadjsaïd, "Smart Grids", Wiley Blackwell 19 5. Stuart Borlase, "Smart Grids (Power Engineering)", CRC Press

<table>
<tr><td>Course Title</td><td colspan="5">Power Apparatus System</td></tr>
<tr><td>Course Code</td><td colspan="5">DENEE504TC</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">Generation transmission & distribution</td></tr>
<tr><td>Course Objectives</td><td colspan="5">• Impart theoretical knowledge of design of electrical transmission line, different types of substation, bus-bar arrangement.
• Introduce the concept of Different types of earthing system.
• To provide the theoretical insights overvoltage production and protection from these.
• Deliberate & discuss the concept of reliability of transmission line.</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 Apparatus</td></tr>
</table>

	Insulation. **UNIT-V** **Reliability of T&D 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 Models, Numerical Problems related to reliability of transmission and distribution system.
Course Outcomes	• To facilitate students understand the practical application of different types of apparatus used in power stations. • Graduates opting for C.S.E.B., NHPC, NTPC, and other industry as a career are likely to come across substations and shall be able to deliver more efficiently with their prior knowledge & by co-relating the concepts of substation, bus-bar scheme, earthing, protection introduced to them during engineering. • Students will gain the knowledge of different substation , mechanism of lightning, reliability of transmission line. This shall also impart them the understanding & importance of conducting these tests in real-life situations. • Apart from gaining the knowledge of above topics, students would develop analytical ability to understand the system dynamics and become capable of applying analytical approach to engineering challenges ahead.
Text Books	1. “Power System Analysis & Design”, BR Gupta S.Chand Publications 2. “Substation Design & Equipment” Gupta &Sation – DhanpatRai.Publications
Reference Books	1. Transmission & Distribution” – Westinghouse 2.“Electrical Power System Design” – M V Deshpande (TMH)

<table>
<tr><td>Course Title</td><td colspan="5">Digital Control System</td></tr>
<tr><td>Course Code</td><td colspan="5">DENEE504TD</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">Control System Engineering</td></tr>
<tr><td>Course Objectives</td><td colspan="5">• Appreciate the advantages of digital control over analog control
• Understand and apply the digital controller design techniques for given specifications.</td></tr>
<tr><td>Course Contents</td><td colspan="5">Unit 1
Z transform:
Z transform, Relationship between the s-plane and the z-plane, Inverse ztransform, Properties of Z transform, applications of z-transform, Delayed z-transform, Modified ztransform, Design of digital control systems using Z transform, Characteristic equation of closed loop systems
Unit 2
State-space analysis:
Analysis of sampled data systems, State equations of discrete data systems, Eigen values, Eigenvectors, State transition matrix, State diagram of discrete-data systems with zero order hold; Controllability, Observability.
Unit 3
Sampling Techniques:
Sampling: Types of sampling, instantaneous sampling, natural sampling, flat top sampling, Sample and hold circuits, Reconstruction of signals, Sampling rate, Nyquist criteria for sampling, Aperture effect, Applications.
Unit 4
Control System Design:
Design using state-space techniques, Stability tests using Bilinear transformation, Jury’s stability test, Second method of Lyapunov, Root loci for digital control systems, design of discrete PID, PD and PI controllers, Effect of adding poles and zeros, Pole placement design techniques.
Unit 5
Optimum control system:
Parametric optimization problem using second method of Lyapunov, Quardric optimal control problem, Performance indices, Linear Quadratic Regulator design.</td></tr>
<tr><td>Course</td><td colspan="5">• Apply z transform to convert analog filter into digital filter.</td></tr>
</table>

Outcomes	• Analyze the performance of filters. • Apply sampling techniques used in the communication. • Design digital filters and control their performance. • the optimization problem in control system
Text Books	1. D. C. Kuo, Digital Control Systems, Oxford University Press, 2/e, Indian Edition, 2007. 2. K. Ogota, Discrete Time Control Systems, Prentice Hall, 2/e, 1995. 3. Madan Gopal, Digital Control and State Variable Methods.
Reference Books	1. "Modern control engineering", Roy Choudhary, PHI. 2. "Control System Analysis and Design",K K Agarwal. 3. "Control Engineering Theory and Practice",M N Bandhopadhyay, PHI. 4. "Introduction to Control Engg. Model, Analysis and Design", Ajit K Mandal, New Age International Publishers. 5. I J Nagrath and M Gopal; New Age international Publishers, Forth Edition

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<table>
<tr><td>Course Title</td><td colspan="5">Modern Instrumentation & Microcontroller</td></tr>
<tr><td>Course Code</td><td colspan="5">DENEE501P</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>-</td><td>-</td><td>2</td><td>1</td><td></td></tr>
<tr><td>Prerequisites</td><td colspan="5">Digital Electronics</td></tr>
<tr><td>Course Objectives</td><td colspan="5">• The objective of this course is to provide knowledge about the fundamentals of Microprocessors & Micro Controller and their evolution internal architecture and construction.
• This course is also useful to provide the knowledge of various supporting chips provided with the Microprocessor 8085 and Microcontroller 8051.
• The aim of this course is to give the knowledge of various instructions, basic programming with Microprocessors 8085 and Microcontroller 8051.
• The aim of this course is to give the knowledge of data transfer schemes, Instruction format and addressing modes.</td></tr>
<tr><td>Course Contents</td><td colspan="5">List of experiments:
1 To add content of two memory locations and store result in another memory locations.
2. To find 2’s complement of 8 bit number.
3. To transfer block of 10 data bytes from one memory location to another.
4. To multiply two 8 bit numbers.
5. To add contents of a block of 10 data bytes.
6. To find largest/smallest among the 10 given data bytes
7. To arrange given data bytes in ascending order.
8. 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.
9. Write a microcontroller 8051 program to add two 16 Bit unsigned numbers. Operands are two RAM variables. Results to be in R1-R0 pair.
10. 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.
11. Write a microcontroller 8051 program to add two unsigned 32-bit numbers. Operands are two RAM variables. Results to be in R1-R0 pair.
12. Write a microcontroller 8051 program to add two 16 Bit signed numbers.
13. Write a microcontroller 8051 program to convert a binary number to equivalent BCD.</td></tr>
</table>

	14. Write a microcontroller 8051 program to convert a packed BCD number to two ASCII numbers and place them in R5 and R6. 15. Write a microcontroller 8051 program that generates 2kHz square wave on pin P1.0, 2.5 kHz on pin P1.2
Course Outcomes	**At the end of this course student will be able to:** • Understand the basic architecture of Microprocessor 8085 Microcontroller 8051. • Understand various instructions and their application in programming. • Understand memory organization and mapping
Text Books	1. Microprocessor Architecture, Programming, and Applications with the 8085 5/e, R. S. Gaonkar, Penram International Publishing. 2. The 8051 Micro Controller and Embedded Systems Using Assembly and C, Second Edition, Muhammad Ali Mazidi Janice Gillispie Mazidi Rolin D. McKinlay

<table>
<tr><td>Course Title</td><td colspan="5">Power Electronics</td></tr>
<tr><td>Course Code</td><td colspan="5">DENEE503P</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>-</td><td>-</td><td>2</td><td>1</td><td></td></tr>
<tr><td>Prerequisites</td><td colspan="5">Basic electronics</td></tr>
<tr><td>Course Objectives</td><td colspan="5">• To study and analyze V-I characteristics of SCR and DIAC.
• To study and analyze various waveforms across different circuit elements in Full and Half wave rectifier using UJT Firing circuit.
• To study and analyze Voltage (Impulse) commutated chopper</td></tr>
<tr><td>Course Contents</td><td colspan="5">List of Experiments:
1. Study of poly phase rectifiers; 3 phase, 6 phase , 3 phase bridge, tracing of wave forms, measurement of peak, r.m.s. average values and ripple frequency and ripple r.m.s. values, using CRO
2. Study of series regulated D.C. power supply find its load regulation.
3. Speed control of single phase induction motor wing triac.
4. Speed control of DC shunt motor using controlled rectifier.
5. Study of AC stabilizer / servo stabilizer.
6. Study of microprocessor and micro controller.
7. Implementation of microprocessor and I/Os on bread board .</td></tr>
<tr><td>Course Outcomes</td><td colspan="5">At the end of this course student will be able to:
• Ability to simulate characteristics of SCR, MOSFET, IGBT.
• Ability to simulate Cyclo-converter circuit & calculate harmonics.
• Ability to simulate Rectifiers, Choppers, AC voltage controller, Inverter circuits and on hardware kits.</td></tr>
<tr><td>Text Books</td><td colspan="5">1. Industrial Electronics PS Bhimra S Chand and Company</td></tr>
</table>

SHRI RAWATPURA SARKAR UNIVERSITY, RAIPUR, CHHATTISGARH
FACULTY OF ENGINEERING

<table>
<tr><td>Course Title</td><td colspan="5">Electrical Machines – II</td></tr>
<tr><td>Course Code</td><td colspan="5">DENEE505P</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>-</td><td>-</td><td>2</td><td>1</td><td></td></tr>
<tr><td>Prerequisites</td><td colspan="5">Electrical machine-ii</td></tr>
<tr><td>Course Objectives</td><td colspan="5">• To prepare the students to have a basic knowledge of induction motors.
• To prepare the students to have a basic knowledge of alternators.
• To know about an induction generator.</td></tr>
<tr><td>Course Contents</td><td colspan="5">List of experiments:

1. Performance of three-phase alternator.
2. Effect of speed & field current on induced emf.
3. Effect of unbalanced loading.
4. Measurement of slip by different methods
5. Performance of three phase induction motor (no load test and load test)
6. Control of three phase induction motor (speed & direction of rotation)
7. Determine Torque speed curves of three phase induction motor
8. Performance of single phase induction motor (no load test and load test)
9. Control of single phase induction motor (speed & direction of rotation)
10. Performance of FHP motors (no load test and load test)
11. Control of FHP motors (speed & direction of rotation)</td></tr>
<tr><td>Course Outcomes</td><td colspan="5">At the end of this course student will be able to:
• Conduct experiments on Ac Machines to find the characteristics.
• Calculate torque and speed of given Machine.
• Perform test on synchronous Machine to find Direct and quadrature axis reactance.</td></tr>
<tr><td>Text Books</td><td colspan="5">1. Electrical Machines Bimbhra, P.S.; Khanna Publishers, New Delhi</td></tr>
</table>

<table>
<tr><td>Course Title</td><td colspan="5">Industrial Training/Report Writing, Seminar</td></tr>
<tr><td>Course Code</td><td colspan="5">DENEE506P</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>-</td><td>-</td><td>2</td><td>1</td><td></td></tr>
<tr><td>Prerequisites</td><td colspan="5">Basic electrical engineering</td></tr>
<tr><td>Course Objectives</td><td colspan="5">• Train students to be independent in finding the EIT placement that will prepare them to join the workforce in the future.
• Expose the students to the actual working environment including rules, regulations and safety practices.
• Develop the students in terms of ability, competence and interpersonal relationship.</td></tr>
<tr><td>Course Contents</td><td colspan="5">To be focused on industry:
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 in house (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 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.</td></tr>
<tr><td>Course Outcomes</td><td colspan="5">At the end of this course student will be able to:
• Generate a report based on the experiences and projects carried out with the ability to apply knowledge of Mathematics, Science, and Engineering Fundamentals.
• Demonstrate competency in relevant engineering fields through problem identification, formulation and solution.</td></tr>
</table>

	• Master the professional and ethical responsibilities of an engineer.
Text Books	1. Experiments in basic electrical engineering, S.K.Bhattacharya. 2. Basic shop practical, Mehta & Gupta 3. Practical in electrical engineering, Dr. N.K.Jain