

B. Tech. Electrical and Electronics Engineering
KURUKSHETRA UNIVERSITY, KURUKSHETRA

SEMESTER-V

(Scheme of Examinations w.e.f. 2026-27 onwards)

S. No.	Course No./ Code	Subject	L:T:P	Hours/ Week	Credits	Examination Schedule (Marks)				Duration of exam (Hours)
						End Semester Exam	Internal Assessment	Practical Exam	Total	
1	B24-EE-301	Control System	3:0:0	3	3	70	30	--	100	3
2	B24-EE-303	Electrical Drives	3:0:0	3	3	70	30	--	100	3
3	B24-EE-305	Electrical Energy Conservation and Auditing	3:0:0	3	3	70	30	--	100	3
4	B24-EE-307	Microprocessor and Microcontroller	3:0:0	3	3	70	30	--	100	3
5	B24-EE-309	Power System-I	3:0:0	3	3	70	30	--	100	3
6	B24-HSM-202	Innovation, Startups and Entrepreneurship	3:0:0	3	3	70	30	--	100	3
7	B24-EE-313	Control System Lab	0:0:2	2	1	--	40	60	100	3
8	B24-EE-315	Microprocessor and Microcontroller Lab	0:0:2	2	1	--	40	60	100	3
9	B24-EE-317	Power System-I Lab	0:0:2	2	1	--	40	60	100	3
10	B24-EE-319	Industrial Training-I	0:0:2	2	1	--	100	--	100	3
11**	B24-VAC-302/ B24-VAC-304/ B24-VAC-306/ B24-VAC-308/ B24-VAC-310	Hindi Language Skills / Sanskrit Language Skills/ German Language Skills/ Japanese Language Skills/ French Language Skills	2:0:0	2	1	--	100	--	100	3
TOTAL				28	23	420	500	180	1100	

****B24-VAC** Courses are value-added courses, and the approved content may be offered to the students through the concerned departments (UTDs) or institutes (within the university campus) or the MOOC platform.

B. Tech. Electrical and Electronics Engineering
KURUKSHETRA UNIVERSITY, KURUKSHETRA
SEMESTER-VI

(Scheme of Examinations/w.e.f. 2026-27 onwards)

S. No.	Course No./ Code	Subject	L:T:P	Hours/ Week	Credits	Examination Schedule(Marks)				Duration of Exam (Hours)
						End Semester Exam	Internal Assessment	Practical Exam	Total	
1	B24-EEE-302	Biomedical Signal & Image Processing	3:0:0	3	3	70	30	--	100	3
2	B24-EEE-304	Digital Signal Processing	3:0:0	3	3	70	30	--	100	3
3*	B24-EE-304	Power Electronics	3:0:0	3	3	70	30	--	100	3
4*	B24-EE-306	Power System-II	3:0:0	3	3	70	30	--	100	3
5*	--	Program Elective-I	3:0:0	3	3	70	30	--	100	3
6*	--	Program Elective-II	3:0:0	3	3	70	30	--	100	3
7*	B24-EE-310	Power Electronics Lab	0:0:2	2	1	--	40	60	100	3
8*	B24-EE-312	Power System-II Lab	0:0:2	2	1	--	40	60	100	3
9*	B24-EE-314	Project-I	0:0:4	4	2	--	40	60	100	3
10*	B24-MAC-301	Constitution of India	2:0:0	2	1	--	100	--	100	3
TOTAL				28	23	420	400	180	1000	

*The subject is common with B. Tech. Electrical Engineering

Note:

- The course of both Program Elective and Open Elective will be offered at 1/3rd strength or 20 students (whichever is smaller) of the section.
- All students have to undertake the industrial training for 6 to 8 weeks after the 6th semester, which will be evaluated in the 7th semester.

Program Elective-I		Program Elective-II	
B24-EEP-302	Electrical Machine Design	B24-EEP-310	Computer Networks
B24-EEP-304	Power Management	B24-EEP-312	Electromagnetic Theory
B24-EEP-306	Signals and Systems	B24-EEP-314	High Voltage Engineering and FACTS Devices
B24-EEP-308	Soft Computing	B24-EEP-316	VLSI Circuits

B24-EE-301		Control System					
Lecture	Tutorial	Practical	Credit	End Semester Exam	Internal Assessment	Total	Duration of Exam
3	-	-	3	70	30	100	3Hrs.
Purpose: Students will grasp fundamental concepts of Control systems and will be able to analyze transient, frequency response of these systems and also will be able to tell about the stability of the control systems							
Course Outcomes (CO)							
CO1	To understand the basics of open loop and closed loop feedback systems.						
CO2	To find steady state time response and stability analysis of a simple control system.						
CO3	To plot Root Locus, Bode Plot, Nyquist Plot and to find stability as well error in response.						
CO4	To determine the controller or compensator configuration.						

UNIT-I

Introduction to control systems: Introduction, classification of control systems, open and closed loop systems. Mathematical models of physical systems, Transfer functions for different types of systems, block diagrams; Signal flow graphs.

Signal flow graphs: Signal flow graphs, basic properties of signal flow graph, signal flow graph algebra, signal flow graph for control systems and Mason's gain formula.

UNIT-II

Time Domain Analysis: Time domain performance criterion, time response of first order systems and second order systems, steady state errors and error constants, types of control systems.

Stability analysis: BIBO stability, Necessary conditions for stability, Routh's stability criterion, difficulties in formulation of Routh's table, application of Routh's stability criterion to linear feedback systems, relative stability analysis, root-loci and root contours, sensitivity analysis.

UNIT-III

Frequency Response analysis: Co-relation between time and frequency response – 2nd order systems only.

Bode plots & Nyquist plot: Nyquist plots, Bode Plots, Nyquist stability criterion, Gain margin and Phase margin, relative stability using Nyquist Criterion, frequency response specifications.

UNIT – IV

Design of Control Systems: Introduction, Design with the PD Controller, PI Controller and PID Controller, Design with Phase-Lead Controller, Phase- Lag Controller, and Lead-Lag Controller. Concept of state, state variable and state model, state models for linear continuous time systems, concept of controllability and observability.

Text Book: Control System Engg.: I. J. Nagrath & M. Gopal ; New Age India.

Reference Books:

1. Automatic Control Systems: B.C. Kuo; 8th Ed., Wiley India.
2. Modern Control Engg: K. Ogata; 5th Ed., Pearson Education.
3. Control Systems: Principles & Designing: Madan Gopal; TMH.

Note: The paper setter will set the paper as per the question paper templates provided.

B24- EE-303		Electrical Drives					
Lecture	Tutorial	Practical	Credit	End Semester Exam	Internal Assessment	Total	Duration of Exam
3	0	0	3	70	30	100	3 Hrs
Program Objective (PO)	The main objective of the course is to impart the students with the knowledge of designing of various electrical machine						
Course Outcomes(CO)							
After completion of course students will be able to							
CO1	Understand the characteristics of dc motors and induction motors.						
CO2	Understand the principles of speed-control of dc motors and induction motors						
CO3	Understand the power electronic converters used for dc motor and induction motor speed control						
CO4	Understand the concept of DC drive						

UNIT-I

Introduction: Review of emf and torque equations of DC machine, review of torque-speed characteristics of separately excited dc motor, change in torque-speed curve with armature voltage, example load torque-speed characteristics.

Review of dc chopper and duty ratio control, chopper fed dc motor for speed control, steady state operation of a chopper fed drive, armature current waveform and ripple, calculation of losses in dc motor

UNIT-II

Multi-quadrant DC drive: Review of motoring and generating modes operation of a separately excited dc machine, four quadrant operation of dc machine; single-quadrant, two-quadrant and four-quadrant choppers; steady-state operation of multi-quadrant chopper fed dc drive, regenerative braking. Control structure of DC drive, inner current loop and outer speed loop.

UNIT-III

Review of induction motor equivalent circuit and torque-speed characteristic, variation of torque-speed curve with (i) applied voltage, (ii) applied frequency and (iii) applied voltage and frequency, typical torque-speed curves of fan and pump loads, operating point, constant flux operation, flux weakening operation.

UNIT-IV

Impact of rotor resistance of the induction motor torque-speed curve, operation of slip-ring induction motor with external rotor resistance, starting torque, power electronic based rotor side control of slip ring motor, slip power recovery.

Reference Books:

1. G.K.Dubey, "Power Semiconductor Controlled Drives", Prentice Hall, 1989.
2. R.Krishnan, "Electric Motor Drives: Modeling, Analysis and Control", Prentice Hall, 2001.
3. G.K.Dubey, "Fundamentals of Electrical Drives", CRC Press, 2002.
4. W.Leonhard, "Control of Electric Drives", Springer Science & Business Media, 2001.

Note: The paper setter will set the paper as per the question paper templates provided.

B24-EE-305	Electrical Energy Conservation and Auditing						
Lecture	Tutorial	Practical	Credit	End Semester Exam	Internal Assessment	Total	Duration of Exam
3	0	0	3	70	30	100	3 Hrs
Purpose	The main objective of the course is to impart the students with the knowledge of energy conservation act, tariff and energy auditing.						
Course Outcomes (CO)							
After completion of course students will be able to							
CO1	Study the different energy conservation act						
CO2	Understand the various tariff and load management						
CO3	Understand the different types of energy auditing						
CO4	Study various types of motors and cooling Tower & Energy conservation opportunities in them.						

UNIT-I

Commercial and Non-commercial energy, primary energy resources, commercial energy production, final energy consumption, energy needs of growing economy, energy and environment, energy security, energy conservation and its importance, restructuring of the energy supply sector, energy strategy for the future, air pollution, climate change. Energy Conservation Act-2001 and its features.

UNIT-II

Electricity tariff, load management and maximum demand control, power factor improvement, selection & location of capacitors, Thermal Basics-fuels, thermal energy contents of fuel, temperature & pressure, heat capacity.

UNIT-III

Definition, energy audit, need, types of energy audit. Energy management (audit) approach- understanding energy costs, bench marking, energy performance, matching energy use to requirement. Electrical system: Electricity billing, electrical load management and maximum demand control, power factor improvement and its benefit.

UNIT-IV

Electric motors: Types, losses in induction motors, motor efficiency, factors affecting motor performance, Cooling Tower: Types and performance evaluation, efficient system operation, flow control strategies and energy saving opportunities, assessment of cooling towers.

Reference Books:

1. Albert: Plant Engineers & Managers Guide to Energy Conservation.
2. Wayne C. Turner Energy management handbook, John Wiley and Sons.
3. Guide to Energy Management, Cape Hart, Turner and Kennedy
4. Cleaner Production – Energy Efficiency Manual for GERIAP, UNEP, Bangkok prepared by National Productivity Council
5. M.K. Lahiri: Saving of Electricity by System Management. M.K. Lahiri Publication
6. Guide books for National Certification Examination for Energy Manager / Energy Auditors Book-1, General Aspects (available online)

Note: The paper setter will set the paper as per the question paper templates provided.

B24-EE-307		Microprocessor and Microcontroller					
Lecture	Tutorial	Practical	Credit	End Semester Exam	Internal Assessment	Total	Duration of Exam
3	-	-	3	70	30	100	3Hrs.
Purpose: Students will grasp the structure, working and application of 8086 Microprocessor and 8051 Microcontroller							
Course Outcomes (CO)							
CO1	To learn the architecture 8086 Microprocessor.						
CO2	To learn the instruction set of 8086 Microprocessor and assembly language programming of 8086 Microprocessor.						
CO3	To learn about 8051 Microcontroller and interfacing of 8086 with different types of Memories.						
CO4	To learn about interfacing of interrupts, basic I/O Interfacing with 8086 Microprocessor.						

UNIT-I

8086 CPU ARCHITECTURE: 8086 Block diagram; description of data registers, address registers; pointer and index registers, PSW, Queue, BIU and EU. 8086 Pin diagram descriptions. Generating 8086 CLK and reset signals using 8284. Microprocessor BUS types and buffering techniques, 8086 minimum mode and maximum mode CPU module.

UNIT-II

8086 INSTRUCTION SET: Instruction formats, addressing modes, Data transfer instructions, string instructions, logical instructions, arithmetic instructions, transfer of control instructions; process control instructions; Assembler directives.

8086 PROGRAMMING TECHNIQUES: Writing assembly Language programs for logical processing, arithmetic processing, timing delays; loops, data conversions.

UNIT-III

8051 Microcontroller MAIN MEMORY SYSTEM DESIGN: 8051 Architecture- Registers, Pin diagram, I/O ports functions, Internal Memory organization. Memory devices, 8086 CPU Read/Write timing diagrams in minimum mode and maximum mode. Address decoding techniques. Interfacing SRAMS; ROMS / PROMS.

UNIT-IV

BASIC I/O INTERFACE: Intel's 8255 - description and interfacing with 8086. ADCs and DACs, - types, operation and interfacing with 8086. 8086 Interrupt mechanism; interrupt types and interrupt vector table. Applications of interrupts, Intel's 8259.

Text Books:

1. D.V. Hall, Microprocessors and interfacing: programming and hardware, McGraw Hill 3rd ed.
2. A. K. Ray and K.M. Bhurchandi, "Advanced Microprocessors and Peripherals", TMH.
3. Liu, Gibson, "Microcomputer Systems: The 8086/88 Family", 2nd Edition, PHI.
4. Barry B. Brey, "The Intel Microprocessors-Architecture, Programming and Interfacing", 8th Edition, PHI
5. Kenneth Ayala, "The 8086 Microprocessor: Programming & Interfacing the PC", Cengage Learning, Indian Edition, 2008.
6. "The 8051 Microcontroller and Embedded Systems – using assembly and C ", Muhammad Ali Mazidi and Janice Gillespie Mazidi and Rollin D. McKinlay; PHI, 2006 / Pearson, 2006.
7. "The 8051 Microcontroller", Kenneth J. Ayala, 3rd Edition, Thomson/Cengage Learning.

Reference Books:

1. Kip Irvine, "Assembly language for IBM PC", PHI, 2nd Edition, 1993
2. Uffenback, "The 8086 Family Design" PHI, 2nd Edition.

Note: The paper setter will set the paper as per the question paper templates provided.

B24-EE-309		Power System – I					
Lecture	Tutorial	Practical	Credit	End Semester Exam	Internal Assessment	Total	Duration of Exam
3	-	-	3	70	30	100	3Hrs.

Purpose: To enable students to analyze power system networks, network parameters, modeling of transmission lines

Course Outcomes (CO)

CO1	Understand the concepts of power systems.
CO2	Understand the various power system components.
CO3	Understand various transmission line modeling.
CO4	Understand various line insulators and line supports.

UNIT- I

Evolution of Power Systems: Typical power system. Underground and Overhead system, AC and DC transmission system, Effects of increase in Voltage on transmission line efficiency, Comparisons of the cost of the conductor in the overhead system. Conductor size and Kelvin's Law, Growth of power systems, Indian overview. Brief overview of Radial and ring main system.

UNIT- II

Overhead Transmission Lines: Inductance and capacitance calculation of single-phase and three-phase overhead line, Corona loss, Factors affecting Corona loss, Bundled conductors, Skin effects, Proximity effect.

Underground Cables: General Overview, its composition and grading.

UNIT- III

Transmission line modelling: Short transmission line, Medium transmission line: Nominal-T and Nominal pi model, Generalized circuit constant, Ferranti Effect, Long transmission line, Surge impedance, Surge impedance loading, Power flow through a transmission line.

UNIT IV

Overhead Line Insulator: Introduction, Properties of insulator material, types of Insulators, String efficiency, Methods of improving string efficiency.

Mechanical Design of Overhead Line: Main components of overhead line, Line supports, conductor material, cross arm, Guys and Stays, Tension and Sag, Vibrations and vibration damper.

Text Books / References:

1. Power System analysis and Stability by S.S. Vadhwa.
2. Electrical Power System by C.L. Wadhwa.
3. Electrical Power System by Ashfaq Hussain.
4. Elements of Power System Analysis by W.D. Stevenson.
5. Electric Power System by B.M. Weddy.
6. The transmission and Distribution of Electric energy by H. Cotton.
7. Modern Power System Analysis by I.J. Nagrath and D.P. Kothari.

Note: The paper setter will set the paper as per the question paper templates provided.

B24-HSM-202		Innovation, Startups and Entrepreneurship					
Lecture	Tutorial	Practical	Credit	End Semester Exam	Internal Assessment	Total	Duration of Exam
3	-	-	3	70	30	100	3 Hours
Purpose	The objective of this Course is to inspire students and help them imbibe an entrepreneurial mindset.						
Course Outcomes (CO)							
CO 1	Understanding the essence of innovation and features of innovative processes, models and methods of innovative entrepreneurship, and the role of innovation as a major factor in creating the value of companies.						
CO 2	Understanding the dynamic role of entrepreneurship and small businesses, types of business structure, organising and managing a Small Business.						
CO 3	Understanding the concept of start-ups, Control Strategic Marketing Planning, concept of incubation and prototype, new Product Development, Business Plan Creation.						
CO 4	Understanding risk analysis in business, financing methods, role of government in supporting entrepreneurship.						

UNIT -I

Introduction to Innovation and Entrepreneurial Idea Generation and Identifying Business Opportunities, Management Skills for Entrepreneurs, Innovations and their forms, Innovation - features and characteristics, Factors initiating innovations, Innovation process and its stages, Statistical measurement of innovation, Model of innovation, Source of innovation, Technological transfer, Information technology to support innovation, difference between technological and non-technological innovation

UNIT-II

Introduction to Entrepreneurship and Start – Ups - Definitions, Traits of an entrepreneur, Intrapreneurship, Entrepreneurial Motivation, Functions of Entrepreneur, Concept, Growth of Entrepreneurship in India, Types of Business Structures, Similarities /differences between entrepreneurs and managers, Business Ideas and their implementation, Discovering ideas and visualizing the business, Activity map, Types of startups, role of entrepreneurs in economic development, future of entrepreneurs, entrepreneurial process

UNIT -III

Start ups - Initial idea generation and planning stages, and incubation referring to the development process of identifying and developing new ideas for products, services, or processes, and creating a working model or prototype to test the feasibility of the concept.

Market Analysis – Identifying the target market, Competition evaluation and Strategy Development, Five Cs of Opportunity Identification, Market Opportunity Identification in emerging technology companies, Process of creating and growing a new business venture, Business plan of the innovation project.

UNIT -IV

Risk Analysis: Risk management in venture projects, Financing and Protection of Ideas- Financing methods available for start-ups in India, Communication of Ideas to potential investors – Investor Pitch, Patenting and Licenses, Exit strategies for entrepreneurs, bankruptcy, and succession and harvesting strategy, venture capital, angel investment, and crowdfunding.

Government support- programs and initiatives aimed at supporting the development of new ideas, innovations, and startups, funding and mentorship, IPR - legal protection of a person's or organization's rights to their invention, brand, or creative work

Suggested Readings:

1. Shrutin N Shetty, (2018), Design the Future: Simplifying Design Thinking to Help You, Notion Press
2. "Entrepreneurship development small business enterprises", Pearson, Poornima M Charantimath, 2013.
3. Roy Rajiv, "Entrepreneurship", Oxford University Press, 2011.
4. "Innovation and Entrepreneurship", Harper Business- Drucker, F. Peter, 2006.

5. "Entrepreneurship", Tata McGraw-Hill Publishing Co., Ltd. New Delhi- Robert D. Hisrich, Mathew J. Manimala, Michael P Peters and Dean A. Shepherd, 8th Edition, 2012.

Note: The paper setter will set the paper as per the question paper templates provided.

B24-EE-313	Control Systems Lab						
Lecture	Tutorial	Practical	Credit	Practical	Internal Assessment	Total	Time(Hrs)
0	0	2	1	60	40	100	3
Purpose:	The main objective of the course is to impart the students with the knowledge of various controller and compensation technique.						
Course Outcomes (CO)							
After completion of course students will be able to							
CO1	To understand the various simulator						
CO2	To study the various compensation technique						
CO3	To study the speed control of dc motor						
CO4	To study the various error detector.						

LIST OF EXPERIMENTS:

1. Experiment to study linear system simulator.
2. To study the stroboscope & measure the shaft speed
3. Experiment to study light intensity control using P & PI controller with provision for and transient speed control.
4. Experiment to study D.C motor speed control.
5. Experiment to study the stepper motor characteristics and its control through microprocessor kit.
6. Experiment to study Temperature control system.
7. Experiment to study Compensation design.
8. Experiment to study Digital control system.
9. Experiment to study Synchros.
10. Experiment to study AC Position control system.
11. Experiment to study Potential Metric Error detector.

NOTE: At least eight (8) experiments from the above list are mandatory to perform for the students.

B24-EE-315		Microprocessor and Microcontroller Lab					
Lecture	Tutorial	Practical	Credit	Practical Exam	Internal Assessment	Total	Duration of Exam
-	-	2	1	60	40	100	3 Hrs.

Purpose: Write the efficient Assembly Language Program for different problem statements and implement different system interfacing.

Course Outcomes (CO)

CO1	Understand the architecture of the 8086 Microprocessor.
CO2	Learn the instruction set and assembly language programming for the 8086.
CO3	To be able to write program using different implementations for the same problem.
CO4	Use of programming language constructs in program implementation.

LIST OF EXPERIMENTS

1. a) Familiarization with 8086 Trainer Kit.
b) Familiarization with Turbo Assembler and Debugger S/Ws.
2. Perform addition, subtraction, multiplication, and division using 8086 instructions.
3. Write a program that takes any two numbers as Input from the user through the input device (Keyboard) & Prints their sum on the standard output device (Screen) by giving appropriate messages to the user
4. Write a program to find out any power of number such that $Z = X^N$. Where N is programmable and X is unsigned number.
5. Write a program to Generate the Fibonacci series up to 'n' terms.
6. Write a program to Move data between registers, memory, and ports using MOV, PUSH, POP, etc.
7. Write a program to arrange block of data in (i) Ascending and (ii) Descending order.
8. Write a program to Implement AND, OR, XOR, NOT, and shift/rotate operations.
9. Write a program to Convert between BCD and binary formats.
10. Write a program to generate a delay using loops.
11. Write a program to Search for an element in an array and return its position.
12. Write a program to Take a string input and reverse it.
13. Write a program to Convert letters in a string between uppercase and lowercase.
14. Write a program to Convert a decimal number to its hexadecimal equivalent.
15. Write a program to Convert a hexadecimal string to a decimal number.
16. Write a programmable delay routine to cause a minimum delay = 2mS and a maximum delay = 20 minutes in the increments of 2mS.

NOTE: At least eight (8) experiments from the above list are mandatory to perform for the students.

B24-EE-317		Power System-I Lab					
Lecture	Tutorial	Practical	Credit	Practical Exam	Internal Assessment	Total	Duration of Exam
-	-	2	1	60	40	100	3 Hrs.

Purpose: The main objective of the course is to impart the students with the knowledge of various relays, insulators and transmission line modeling.

Course Outcomes (CO)

CO1	To understand various types of relays.
CO2	To study the parallel operation of the alternator.
CO3	To understand the concept of various insulators.
CO4	To understand the concept of transmission line modelling.

LIST OF EXPERIMENTS

1. Experiment to find out the dielectric strength of transformer oil.
2. Experiment to find zero sequence component of three phase line.
3. Draw the characteristics of thermal overload relay.
4. Experiment to study an IDMT over current relay & plot, it's characteristic curves i.e. graph between current & time.
5. Experiment to study differential relay characteristics.
6. Experiment to measure the ABCD parameters of a given transmission line, also study Ferranti effect.
7. Experiment to study Parallel operation of two alternators.
8. Experiment to plot the power angle characteristics of given transmission line.
9. Experiment to find the string efficiency of a string insulator with/without guard rings.
10. Experiment to study the characteristics of transmission line for t-network & pie- network.
11. Testing of a current transformer & find Ratio Error & Phase angle error for various burdens.
12. To study various types of distance relay.
13. Experiment to study fault current using sequence impedance network.

NOTE: At least eight (8) experiments from the above list are mandatory to perform for the students.

B24-EE-319		Industrial Training-I					
Lecture	Tutorial	Practical	Credit	End Semester Exam	Internal Assessment	Total	Duration of Exam
-	-	2	1	--	100	100	-

It is a course in which the students will be evaluated for the industrial training undergone during the semester break after the 4th semester examination, and students will be required to get passing marks to qualify.

B24-VAC-302	Hindi Language Skills						
Lecture	Tutorial	Practical	Credit	End Semester Exam	Internal Assessment	Total	Time
2	-	-	1	--	100	100	3

This course will be offered through NPTEL/MOOC online courses with the following link -

https://onlinecourses.nptel.ac.in/noc23_hs125/preview.

The syllabus of NPTEL/MOOC platform will be acceptable. Students can also learn online from videos and internal assessment can be made in the Institute by taking an internal exam of 100 marks.

B24-VAC-304		Sanskrit Language Skills					
Lecture	Tutorial	Practical	Credit	End Semester Exam	Internal Assessment	Total	Time
2	-	-	1	--	100	100	3 Hrs
Course Outcomes (CO) At the end of this course, student will							
CO 1	Learn behavioural science from Bhagwat Gita						
CO 2	Learn self awareness and spirituality from Bhagwat Gita						
CO 3	Learn mind management from Bhagwat Gita						
CO 4	Learn responsible behaviour from Bhagwat Gita						

SYLLABUS FOR SANSKRIT STUDIES

Unit 1	<u>BEHAVIOURAL SCIENCE</u> ● Learning different personality types from Gita. BG 14.6-8 ● Dealing with stress, depression and self-destructive urges. BG 2.14 ● Overcoming procrastination and hyperactivity. BG 18.35-36 ● Developing <i>sattva</i> - platform of controlled action. BG 18.33 ● Balancing physical, mental and emotional health. BG 6.16-17, 6.5 ● Increasing productivity in activity through spirituality. BG 2.47 ● Mind Intelligence mechanism. BG 3.42-43 ● Tapping the power of meditation. BG 6.10-15
Unit 2	<u>SELF-AWARENESS</u> ● Understanding Different Layers of Self - Physical, Mental and Spiritual – BG 2.13 ● Becoming Sensitive Towards Other Beings and Nature at Large – BG 5.18, 6.29-32 ● Cultivating Culture of Respect – BG 13.8-12 ● Dealing with Grief – BG 2.11, 2.27 ● Holistic Wellbeing Through Self-Awareness – BG 6.5, 6.7 ● Recognizing the Impermanence of the Body – BG 2.14 ● Cultivating Detachment for True Self-Awareness – BG 2.71, 5.29 ● Connecting with the Higher Self Through Meditation – BG 6.10 ● Transcending Ego for Inner Peace – BG 3.27 ● Self-Reflection for Personal Growth – BG 6.5 ● Overcoming False Identification with the Body – BG 2.30 ● Seeing the Divine in All Beings – BG 9.22
Unit 3	<u>MIND MANAGEMENT - ART OF MIND CONTROL</u> ● The Root of Frustration & Anger – BG 2.62-63 ● Discover the Real Reason Behind Lack of Motivation – BG 3.36, 3.41 ● Controlling the Uncontrolled Mind – BG 6.26 ● Understanding the Mind & Its Power – BG 6.6, 3.42 ● Mind Like a Boat in Stormy Waters – BG 2.67 ● Learn to Stay Calm Under Pressure – BG 2.14, 2.56 ● The Peaceful Mind of a Wise Person – BG 2.70, 2.56 ● Freedom from Attachment = Peace – BG 2.71, 5.26 ● Peace Through Detachment – BG 2.71, 5.20

Unit 4**RESPONSIBLE ACTION**

- Understanding Intricacies of Action and Reaction - Karma, Vikarma & Akarma – BG 4.17
- Principles of Forbearance and Tolerance – BG 2.14, 12.13-14
- Coping with Adversities and Reversals in Life – BG 2.14-15, 18.11
- Becoming Responsible in Action - Karma Yogi – BG 3.7, 3.19, 3.30, 5.10
- Performing Actions Without Attachment to Results – BG 2.47, 3.19
- Acting in Accordance with Dharma – BG 3.35
- Surrendering the Fruits of Actions to God – BG 9.22, 18.66
- Selflessness in Actions – BG 18.9
- Discerning Between Right and Wrong Actions – BG 18.63
- Balanced Approach to Work and Rest – BG 6.17
- Purifying Intentions Behind Actions – BG 18.11
- Taking Responsibility for One's Actions and Their Impact – BG 3.16

B24-VAC-306		German Language Skills					
Lecture	Tutorial	Practical	Credit	End semester Exam	Internal assessment	Total	Duration of exam (Hours)
2	0	0	1	-	100	100	3 Hrs
Purpose	To learn about German Language Skills						
Course Outcomes (CO)							
CO1	Introduce students to basic German language.						
CO2	Enable basic communication in German (self-introduction, daily routine, etc.).						
CO3	Develop foundational skills in vocabulary and grammar.						
CO4	Develop foundational skills in reading, writing, listening, and speaking.						

Unit 1: Introduction & Basics

- German alphabet and pronunciation
- Greetings and farewells
- Introducing oneself and others
- Numbers (0–100)
- Days, months, seasons

Unit 2: Vocabulary Building I

- Family and relationships
- Professions and nationalities
- Countries and cities
- Colors and clothing
- Weather

Unit 3: Grammar I

- Nouns: gender, singular/plural
- Articles: definite (der/die/das), indefinite (ein/eine)
- Personal pronouns (ich, du, er, etc.)
- Verb conjugation (regular verbs in Präsens)
- Sentence structure: main clause word order

Grammar II

- Verbs: haben, sein, modal verbs (möchten, können)
- Question words (wer, was, wo, etc.)
- Negation (nicht, kein)
- Possessive pronouns (mein, dein, etc.)
- Accusative case basics

Unit 4: Vocabulary Building II

- Food and drink
- Daily routine
- Time and date
- House and furniture
- Hobbies and leisure

Communication Practice

- Simple dialogues (in café, at university, at home)
- Role plays (shopping, asking directions, introductions)
- Listening practice (audio exercises)
- Writing practice (short texts, filling forms)

Assessment (Optional/Recommended)

- Vocabulary quizzes
- Short written assignments
- Oral presentation or role-play
- Final test (basic grammar and vocabulary)

B24-VAC-308		Japanese Language Skills					
Lecture	Tutorial	Practical	Credit	End semester Exam	Internal assessment	Total	Duration of exam (Hours)
2	0	0	1	-	100	100	3 Hrs
Purpose	In about Japanese Language Skills						
Course Outcomes (CO)							
CO1	Introduce students to basic Japanese language.						
CO2	Enable basic communication in Japanese (self-introduction, daily routine, etc.).						
CO3	Develop foundational skills in vocabulary and grammar.						
CO4	Develop foundational skills in reading, writing, listening, and speaking.						

Unit 1: Introduction & Basics

- Alphabet and pronunciation
- Greetings and farewells
- Introducing oneself and others
- Numbers (0–100)
- Days, months, seasons

Unit 2: Vocabulary Building I

- Family and relationships
- Professions and nationalities
- Countries and cities
- Colors and clothing
- Weather

Unit 3: Grammar I

- Nouns: gender, singular/plural
- Articles: definite and indefinite
- Personal pronouns
- Verb conjugation (regular verbs in present tense)
- Sentence structure: main clause word order

Grammar II

- Common verbs (e.g., to be, to have, modal verbs)
- Question words
- Negation
- Possessive pronouns
- Basic cases or particles (as applicable)

Unit 4: Vocabulary Building II

- Food and drink
- Daily routine
- Time and date
- House and furniture
- Hobbies and leisure

Communication Practice

- Simple dialogues (e.g., in café, at university, at home)
- Role plays (shopping, asking directions, introductions)
- Listening practice (audio exercises)
- Writing practice (short texts, filling forms)

Assessment (Optional/Recommended)

- Vocabulary quizzes
- Short written assignments
- Oral presentation or role-play
- Final test (basic grammar and vocabulary)

B24-VAC-310	French Language Skills						
Lecture	Tutorial	Practical	Credit	End semester Examination	Internal assessment	Total	Duration of exam (Hours)
2	0	0	1	-	100	100	3 Hrs
Purpose	To learn about French Language Skills						
Course Outcomes (CO)							
CO1	Introduce students to basic French language.						
CO2	Enable basic communication in French (self-introduction, daily routine, etc.).						
CO3	Develop foundational skills in vocabulary and grammar.						
CO4	Develop foundational skills in reading, writing, listening, and speaking						

Unit 1: Introduction & Basics

- Alphabet and pronunciation
- Greetings and farewells
- Introducing oneself and others
- Numbers (0–100)
- Days, months, seasons

Unit 2: Vocabulary Building I

- Family and relationships
- Professions and nationalities
- Countries and cities
- Colors and clothing
- Weather

Unit 3: Grammar I

- Nouns: gender, singular/plural
- Articles: definite and indefinite
- Personal pronouns
- Verb conjugation (regular verbs in present tense)
- Sentence structure: main clause word order

Grammar II

- Common verbs (e.g., to be, to have, modal verbs)
- Question words
- Negation
- Possessive pronouns
- Basic cases or particles (as applicable)

Unit 4: Vocabulary Building II

- Food and drink
- Daily routine
- Time and date
- House and furniture
- Hobbies and leisure

Communication Practice

- Simple dialogues (e.g., in café, at university, at home)
- Role plays (shopping, asking directions, introductions)
- Listening practice (audio exercises)
- Writing practice (short texts, filling forms)

Assessment (Optional/Recommended)

- Vocabulary quizzes
- Short written assignments
- Oral presentation or role-play
- Final test (basic grammar and vocabulary)

B24-EEE-302	Biomedical Signal & Image Processing						
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Total	Time(Hrs)
3	0	0	3	70	30	100	3
Purpose:	To make students aware about the fundamentals and various techniques of biomedical image processing and to develop the algorithms for image analysis and diagnosis in medical imaging						
Course Outcomes (CO)							
After completion of course students will be able to							
CO1	To understand image fundamentals and acquisition techniques						
CO2	To learn Image Enhancement in Spatial and Frequency domain						
CO3	To learn Morphological Image Processing and Image Segmentation.						
CO4	To learn image compression and representation.						

UNIT-I

Fundamentals of Digital Image: Image formation, visual perception, CCD & CMOS Image sensor, Image sampling: Two dimensional Sampling theory, Nonrectangular grid and Hexagonal sampling, Optimal sampling, Image quantization, Non uniform Quantization, Image formats. Types of pixel Operations, Types of neighborhoods, adjacency, connectivity, boundaries, regions, 2D- convolution, Color models.

UNIT-II

Image Enhancement in Spatial and Frequency domain: Basic gray level transformations, histogram processing, Smoothing operations, Edge Detection-derivative based operation, filtering in frequency domain, 2D-DFT, Smoothing frequency domain filters, Sharpening frequency domain filters, Homomorphic filtering.

UNIT-III

Morphological Image Processing: Dilation and Erosion, Opening and Closing, Hit-or-Miss transformation, Boundary Extraction, Region filling, Extraction of Connected Components, Convex Hull, Thinning, Thickening, Skeletons, Pruning.

Image Segmentation: Detection of discontinuities, Point-line- edge detection, Linear and Circular Hough Transform, Basic Global and Adaptive Thresholding, Region Based segmentation, K-Means Clustering

UNIT-IV

Image Compression: Fundamentals of Image compression models, Lossless compression: variable length coding, LZW coding, Arithmetic coding, Lossy compression: Wavelet and DCT coding, Predictive coding.

Representation and Description: Image features, Feature extraction, Chain code, Moments

Text/Reference Books:

1. Digital Image Processing, Gonzalez and Woods- Pearson Education
2. Digital Image Processing, S. Sridhar – Oxford University Press.
3. Fundamentals of Digital Image Processing, A.K. Jain .P.H.I.
4. Digital Image Processing, William Pratt- John Wiley.
5. Feature Extraction and Image Processing, Mark S. Nixon and Alberto S. Aguado.
6. Digital Image Processing and Analysis, Chanda Majumder- Printice Hall India.
7. Medical image processing, Geoff Dougherty editor, springer

B24-EEE-304	Digital Signal Processing						
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Total	Time(Hrs)
3	0	0	3	70	30	100	3
Purpose:	The main objective of the course is to impart the students with the knowledge of discrete time signals and digital filters .						
Course Outcomes (CO)							
After completion of course students will be able to							
CO1	Represent signals mathematically in continuous and discrete-time, and in the frequency domain.						
CO2	Analyse discrete-time systems using z-transform						
CO3	Understand the Discrete-Fourier Transform (DFT) and the FFT algorithms.						
CO4	Design digital filters for various applications						

UNIT-1

Discrete-time signals and systems

Discrete time signals and systems: Sequences; representation of signals on orthogonal basis; Representation of discrete systems using difference equations, Sampling and reconstruction of signals - aliasing; Sampling theorem and Nyquist rate.

UNIT-2

Z-transform

Z Transform, Region of Convergence, Analysis of Linear Shift Invariant systems using z transform, Properties of z-transform for causal signals, Interpretation of stability in z-domain, Inverse z-transforms.

UNIT-3

Discrete Fourier Transform

Frequency Domain Analysis, Discrete Fourier Transform (DFT), Properties of DFT, Convolution of signals, Fast Fourier Transform Algorithm, Parseval's Identity, Implementation of Discrete Time Systems.

UNIT-4

Design of Digital filters

Design of FIR Digital filters: Window method, Park-McClellan's method. Design of IIR Digital Filters: Butterworth, Chebyshev and Elliptic Approximations; Low-pass, Band-pass, Band- stop and High-pass filters.

Text/Reference Books:

1. S. K. Mitra, "Digital Signal Processing: A computer based approach", McGraw Hill, 2011.
2. A.V. Oppenheim and R. W. Schaffer, "Discrete Time Signal Processing", Prentice Hall, 1989.
3. J. G. Proakis and D.G. Manolakis, "Digital Signal Processing: Principles, Algorithms And Applications", Prentice Hall, 1997.
4. L. R. Rabiner and B. Gold, "Theory and Application of Digital Signal Processing", Prentice Hall, 1992.
5. J. R. Johnson, "Introduction to Digital Signal Processing", Prentice Hall, 1992

B24-EE-304		Power Electronics					
Lecture	Tutorial	Practical	Credit	End Semester Exam	Internal Assessment	Total	Duration of Exam
3	-	-	3	70	30	100	3Hrs.
Purpose: To familiarize the students with the Converter and Power switching device.							
Course Outcomes (CO)							
CO1	Introduction to Power Electronics and Thyristor Rectifiers will be acquainted.						
CO2	Various converters will be acquainted.						
CO3	Inverters Voltage control in 1-phase inverters will be acquainted.						
CO4	Basic voltage source inverter						

UNIT-I

Power switching devices :

Diode, Thyristor, MOSFET, IGBT: I-V Characteristics; Firing circuit for thyristor; Voltage and current commutation of a thyristor; Gate drive circuits for MOSFET and IGBT.

UNIT-II

Thyristor rectifiers

Single-phase half-wave and full-wave rectifiers, Single-phase full-bridge thyristor rectifier with Rload and highly inductive load; Three-phase full-bridge thyristor rectifier with R-load and highly inductive load; Input current wave shape and power factor.

UNIT-III

DC-DC buck converter:

Elementary chopper with an active switch and diode, concepts of duty ratio and average voltage, power circuit of a buck converter, analysis and waveforms at steady state, duty ratio control of output voltage.

DC-DC boost converter:

Power circuit of a boost converter, analysis and waveforms at steady state, relation between duty ratio and average output voltage.

UNIT-IV

Single-phase voltage source:

Power circuit of single-phase voltage source inverter, switch states and instantaneous output voltage, square wave operation of the inverter, concept of average voltage over a switching cycle, bipolar sinusoidal modulation and unipolar sinusoidal modulation, modulation index and output voltage.

References/Text:

1. Power Electronics, Dr. P.S. Bimbhra, Khanna Pub.
2. Fundamentals of Power Electronics" by Erickson and Maksimovic.
3. Power Electronics: Circuits, Devices, and ApplicationsBy Muhammad H. Rashid.
4. Electric Motor Drives Modeling, Analysis, and Control, Ramu Krishnan
5. Basics of Electrical Drives, S K Pillai, New Academic Science Limited

Note: The paper setter will set the paper as per the question paper templates provided.

B24-EE-306		Power System-II					
Lecture	Tutorial	Practical	Credit	End Semester Exam	Internal Assessment	Total	Duration of Exam
3	-	-	3	70	30	100	3Hrs.
Purpose: To enable students to analyze power system networks, faults in power systems, transient and bus impedance algorithm.							
Course Outcomes (CO)							
CO1	Understand the concepts of per UNIT system.						
CO2	Understand the various faults in the power system.						
CO3	Understand the stability in the power system.						
CO4	Determine methods of impedance matrix calculation.						

UNIT-I

Introduction: Characteristics & representation of components of a power system, synchronous machines, transformers, lines cables & loads. Single line diagram of a power system, zero sequence impedance diagrams of power system with different types of connections of three phase transformers.

Per UNIT system: Per UNIT method of representing quantities, Advantages and disadvantages of per UNIT system, determination of base impedance, Per UNIT impedance of two winding transformers.

UNIT-II

Symmetrical faults: calculation of fault currents, use of current limiting reactors.

Unsymmetrical faults: symmetrical components transformation, sequence impedance of power system elements, Sequence network of power system, analysis of unsymmetrical faults- Single line to ground fault, Line –Line fault and Double line to ground fault.

UNIT-III

Power System Stability:- Steady state stability, methods of improving steady state stability, Transient stability, methods of improving transient stability, Swing equation, power flow in line, Power angle diagram.

UNIT-IV

Power Flow Studies: - Bus classification, Bus admittance matrix, Power flow equation, Load flow solution using Gauss-Seidel and Newton Raphson method, Decoupled and Fast decoupled methods, Comparison of load flow methods

Reference Books:

1. Elements of Power System Analysis by W.D. Stevenson.
2. Electric Power System by B.M. Weddy.
3. The transmission & Distribution of Electric Energy by H. Cotton.
4. Power System & Protection by S.S. VADHERA

Note: The paper setter will set the paper as per the question paper templates provided.

B24-EE-310		Power Electronics Lab					
Lecture	Tutorial	Practical	Credit	Practical Exam	Internal Assessment	Total	Duration of Exam
-	-	2	1	60	40	100	3 Hrs.

Purpose: The main objective of the course is to enable students to analyze the characteristics and operation of power semiconductor devices and power electronic converters.

Course Outcomes (CO)

CO1	To study and analyze the characteristics and operating parameters of power semiconductor devices such as SCR, UJT, TRIAC, and FET.
CO2	To investigate the operation and performance of UJT relaxation oscillators and DC-DC chopper circuits.
CO3	To study and evaluate the characteristics and operation of single-phase and three-phase controlled rectifier circuits.
CO4	To analyze the performance and applications of inverter and cyclo-converter circuits used for AC power conversion and control.

LIST OF EXPERIMENTS:

1. To Plot the firing characteristics of given silicon control rectifier.
 - a. By varying the gate current I_g keeping forward voltage V_{ak} fixed.
 - b. By varying forward voltage V_{ak} keeping gate current fixed.
2. To study the V-I characteristics of given UJT. To plot graph between V_e and I_e . To find negative resistance from the graph.
3. To plot V-I characteristics of given Triac in I and III quadrant.
4. To plot the drain characteristics of given F.E.T & to evaluate the parameter r_d , I_{dss} .
5. To study the UJT based relaxation oscillator & to evaluate the dynamic resistance.
6. To study & draw the characteristics of DC-DC chopper power circuit
7. To study the characteristics of single phase fully controlled converter circuit.
8. To study the characteristics of 3-phase fully controlled converter power circuit.
9. To study single phase Mc Murray Inverter power circuit.
10. To study single phase cyclo-converter circuit.

Note: At least eight (8) experiments from the above list are mandatory to perform for the students.

B24-EE-312		Power System-II Lab					
Lecture	Tutorial	Practical	Credit	Practical Exam	Internal Assessment	Total	Duration of Exam
-	-	2	1	60	40	100	3 Hrs.

Purpose: The main objective of the course is to impart the students with the knowledge of programming in power system.

Course Outcomes (CO)

CO1	To develop the program for Y-bus and Z-bus.
CO2	To develop the program load flow analysis.
CO3	To develop the program for different mathematical operations.
CO4	To develop the program for Gauss Seidel method.

List of Experiments

1. Develop a program to do the following mathematical operations:
 - i) Transpose of a matrix
 - ii) Multiplication of two matrices
 - iii) Addition & subtraction of two matrices
2. Write a program to formulate Y-Bus by non- singular transformation $Y_{Bus} = [A]$, $T = y [A]$.
3. Develop a program to solve a set of 4 simultaneous linear equations using Gaussian Elimination method.
4. Develop a program to calculate Z bus of a given network using building algorithm. Assume that no mutual coupling is involved in between the different elements.
5. The Gauss Seidel method to find the solution of following equations

$$X_1 + X_1 X_2 + X_3 = 10$$

$$X_1 + X_2 + X_3 = 6$$

$$X_1 X_2 - X_3 = 2$$
6. You have given with a 6 bus system. Apply load flow technique using Gauss Seidel method to solve up to two iterations.
7. Develop a program to find Eigen Values for given Matrix.
8. Develop a program to determine the bus impedance matrices for the given power system network.
9. Develop a program to determine the admittance matrices for the given power system network.
10. To conduct the load flow analysis of power system networks (not more than 6 bus) on any dedicated using Newton-Raphson method.

Note: At least eight (8) experiments from the above list are mandatory to perform for the students.

B24-EE- 314		Project-I					
Lecture	Tutorial	Practical	Credit	Practical Exam	Internal Assessment	Total	Duration of Exam
-	-	4	2	60	40	100	3 Hrs.
Purpose: To develop teamwork, plan and implement the project, write a comprehensive report and develop effective presentation skills.							
Course Outcomes (CO): Upon completion of the course, students will be able to							
CO1	Identify and define a problem statement from the requirements raised from the literature survey /need analysis						
CO2	Build and Test circuits,/models /prototypes/hardware/software for developing real-life small applications						
CO3	Work in teams, write a comprehensive report and an effective presentation of the project work.						
CO4	Rapid prototyping, which will lead them towards entrepreneurship.						

Project-I Guidelines:

The Project-I is a team activity having 3-5 students in a team. This is circuit building and testing for developing small applications. The project may be a complete hardware or a hardware with a software aspect. It should encompass components, machines, automation and control, power system devices, analogue or digital ICs, microcontroller, software, etc. Based on a comprehensive literature survey/ need analysis, the student shall identify the title and define the aim and objectives of Project-I.

B24-MAC-301		Constitution of India					
Lecture	Tutorial	Practical	Credit	End semester exam	Internal Assessment	Total	Duration of Exam
2	-	-	1	-	100	100	3 Hrs.
Purpose: This course introduces students to the basic Philosophy of Indian Constitution.							
Course Outcomes (CO)							
CO1	To explain the basic structure of Indian Constitution.						
CO2	To understand the structure of Indian Union.						
CO3	To write down roles and powers of Governor.						
CO4	To explain the election process under Indian Constitution.						

UNIT-I

The Constitution - Introduction, The History of the Making of the Indian Constitution, Preamble and the Basic Structure, and its interpretation, Fundamental Rights and Duties, and a Brief overview of the Directive Principles of State Policy.

UNIT-II

Union Government, Structure of the Indian Union, President – Role and Power, Prime Minister and Council of Ministers, Brief overview of Lok Sabha and Rajya Sabha.

UNIT-III

State Government, Governor – Role and Power, Chief Minister and Council of Ministers, State Secretariat, distribution of powers between the state and the centre under the Indian Constitution.

UNIT-IV

Local Administration, District Administration, Municipal Corporation, Zila Panchayat.
Election Commission a. Role and Functioning b. Chief Election Commissioner c. State Election Commission

Suggested Learning Resources:

1. Ethics and Politics of the Indian Constitution Rajeev Bhargava Oxford University Press, New Delhi, 2008
- 2 The Constitution of India B.L. Fadia Sahitya Bhawan; New edition (2017)
- 3 Introduction to the Constitution of India DD Basu Lexis Nexis; Twenty-Third 2018 edition Suggested Software/Learning Websites:
1. <https://www.constitution.org/cons/india/const.html>
2. <http://www.legislative.gov.in/constitution-of-india>
3. <https://www.sci.gov.in/constitution>
4. <https://www.toppr.com/guides/civics/the-indian-constitution/the-constitution-ofindia/>

Note: The paper setter will set the paper as per the question paper templates provided.

B24-EEP-302	Electrical Machine Design						
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Total	Time(Hrs)
3	0	0	3	70	30	100	3
Purpose:	The main objective of the course is to impart the students with the knowledge of designing of various electrical machine						
Course Outcomes (CO)							
After completion of course students will be able to							
CO1	Understand the construction and performance characteristics of electrical machines.						
CO2	Understand the various factors which influence the design: electrical, magnetic and thermal loading of electrical machines						
CO3	Understand the principles of electrical machine design and carry out a basic design of an ac machine						
CO4	Use software tools to do design calculations						

UNIT 1

Introduction

Major considerations in electrical machine design, electrical engineering materials, space factor, choice of specific electrical and magnetic loadings, thermal considerations, heat flow, temperature rise, rating of machines.

UNIT 2

Transformers

Sizing of a transformer, main dimensions, output equation for single- and three-phase transformers, window space factor, overall dimensions, operating characteristics, regulation, no load current, temperature rise in transformers, design of cooling tank, methods for cooling of transformers.

UNIT 3

Induction Motors

Sizing of an induction motor, main dimensions, length of air gap, rules for selecting rotor slots of squirrel cage machines, design of rotor bars & slots, design of end rings, design of wound rotor, magnetic leakage calculations, leakage reactance of polyphase machines, magnetizing current, short circuit current.

UNIT 4

DC MACHINES: Output equation, choice of specific loadings, choice of poles and speed, Design of core length, armature diameter, depth of armature core, air gap length, cross section of armature conductors, armature slots.

COMPUTER AIDED DESIGN: Computerization of design procedures, development of computer programs & performance predictions, optimization techniques & their application to design problems.

Text / References:

1. A. K. Sawhney, "A Course in Electrical Machine Design", Dhanpat Rai and Sons, 1970.
2. M.G. Say, "Theory & Performance & Design of A.C. Machines", ELBS London.
3. S. K. Sen, "Principles of Electrical Machine Design with computer programmes", Oxford and

B24-EEP-304	Power Management						
Lecture	Tutorial	Practical	Credit	End Semester Exam	Internal Assessment	Total	Duration of Exam
3	0	0	3	70	30	100	3
Program Objective (PO)	The main objective of the course is to impart the students with the knowledge of management of different power sectors						
Course Outcomes(CO)							
After completion of course students will be able to							
CO1	To know about the present power scenario.						
CO2	Understand the concept to power sources and project management						
CO3	Knowledge of Engineering and general layout of equipment's						
CO4	Understand the structure of power sector						

UNIT-I

Introduction: Powerscenario;powerdevelopment;planning;powerresources;environment-powermatters plan; pre-feasibility and feasibility studies; state relations for power etc; electricity industry structure and safety regulations bill-state and central power boards/power corporations.

UNIT-II

Resources; geophysical study; Seismic considerations; environmental restraints; resettlement and rehabilitation. Procurement: Contracting and procurement; consulting services; types of contracts; project management; organization and economy management; organizational planning and time scheduling; project cost control.

UNIT-III

Engineering and general layout of equipments; generator; transformer and switch gear and control equipment; construction methods; operation and maintenance principle; maintenance organization and planning; availability; life cycle cost and future development; visits to sites.

UNIT-IV

Power Sector: Power sector structure in different states; regulatory regime in those states; power utilities in Haryana; grid management; power financing ;visit to sites.

Power Station: Management of fuel; water resource electricity dividend scenario; storage and handling; pricing; contract etc.; human resource management; visit to sites.

Reference Books:

1. Subramanyam, B. "PowerPlantEngineering", Dhanpat Rai Pub., 1995
2. Sharma P.C., "PowerPlantEngineering", Dhanpat Rai Pub., 1997
3. Decenzo, David A., Robbins, Stephen P., "HumanResourceManagement", Prentice Hall of India, 2004.
4. Nag, P.K., "PowerPlantEngg". Tata McGraw Hill, 2003.
5. Gill, A.B., "Power Plant Performance Management", British Electricity Authority, 1984.

Note: The paper setter will set the paper as per the question paper templates provided.

B24-EEP-306		Signals and Systems					
Lecture	Tutorial	Practical	Credit	End Semester Exam	Internal Assessment	Total	Duration of Exam
3	-	-	3	70	30	100	3Hrs.
Purpose: To introduce the students to signal characteristics and analysis, theory related to systems and its analysis.							
Course Outcomes (CO)							
CO1	To understand the basic properties of signal & systems.						
CO2	To know the methods of characterization of LTI systems in time domain						
CO3	To analyse continuous time signals and system in the Fourier and Laplace domain						
CO4	To analyse discrete time signals and system in the Z transform domain						

UNIT-I

Introduction and Classification of signals: Definition of signal and systems, communication and control system as examples Classification of signals, Basic Operations on signals: Amplitude scaling, addition, multiplication, differentiation, integration, time scaling, time shift and time reversal. Exponential, sinusoidal, step, impulse and ramp functions.

System Classification and properties: Linear-nonlinear, Time variant-invariant, causal-noncausal, static-dynamic, stable-unstable, invertible.

UNIT-II

LTI system Properties: Properties of linear, time – invariant systems, convolution, interconnection of LTI systems, Time domain representation of LTI System, zero- input response, zero state response, impulse response, and stability, systems represented by differential and difference equations.

UNIT-III

Fourier Representation of Continuous and Discrete time Signals: Introduction to Fourier Transform & DTFT, Definition and basic problems. Properties of Fourier Transform: Linearity, Time shift, Frequency shift, Scaling, Differentiation and Integration, Convolution and Modulation, Parseval's theorem.

Sampling, discrete – time signals, models, operations, discrete – time systems, stability, discrete – time Fourier series, discrete – time Fourier transform.

UNIT – IV

Laplace Transform: Introduction to Laplace transform, Region of convergence for Laplace transform, Inverse Laplace transform, Properties of Laplace transform, Analysis and characterization of LTI systems using Laplace transform.

The Z-Transforms: Z transform, properties of the region of convergence, properties of the Z-transform, Inverse Z-transform, Causality and stability, Transform analysis of LTI systems. Applications: Modulation, types, benefits, window functions, Filtering, digital filters.

Text Book:

Alan V. Oppenheim, Alan S. Willsky, S. Hamid Nawab, Signals and Systems, Prentice Hall India,

Reference Books:

1. Signals and Systems: Tarun Kumar Rawat, Oxford University Press.
2. Signals and Systems: Haykin S., Veen B.V., John Wiley.

Note: The paper setter will set the paper as per the question paper templates provided.

B24-EEP-308		Soft Computing					
Lecture	Tutorial	Practical	Credit	End Semester Exam	Internal Assessment	Total	Duration of Exam
3	-	-	3	70	30	100	3Hrs.
Purpose: The main objective of the Soft Computing Techniques to Improve Data Analysis Solutions is to strengthen the dialogue between the statistics and soft computing research communities in order to cross-pollinate both fields and generate mutual improvement activities.							
Course Outcomes (CO)							
CO1	To learn the basic concepts of Soft Computing.						
CO2	Learn the Neural Networks, architecture, functions and various algorithms involved.						
CO3	Implementation of the Fuzzy Logic, Various fuzzy systems and their functions.						
CO4	Learn the implementation of Genetic algorithms, its applications and advances.						

UNIT-I

Soft Computing: Conventional AI to Computational Intelligence; Soft Computing Constituents and Applications.

Introduction to Non-traditional Meta-heuristic Optimization Techniques: Random Optimization, Simulated Annealing, Tabu Search, Ant Colony Optimization, Particle Swarm Optimization, Harmony Search, Memetic Algorithms, Other Evolutionary Algorithms such as Firefly Algorithm, Bee Algorithm, Shuffled Frog Leap algorithm, Bat algorithm etc.

Data Clustering Algorithms: K-Means, Fuzzy C-Means, Mountain Clustering, Subtractive Clustering.

UNIT-II

Fuzzy Set Theory: Fuzzy Sets & Classical Sets; Operations on Fuzzy Sets, Fuzzy Relations, Linguistic Variables.

Membership Functions: Introduction, Features, & Fuzzification, Methods of Membership Value Assignment; Defuzzification.

Fuzzy Systems: Crisp Logic, Predicate Logic, Fuzzy Logic; Fuzzy Rule Base and Approximate Reasoning, Fuzzy Quantifiers; Fuzzy Inference Systems, Fuzzy Decision Making, Fuzzy Logic Control System; Fuzzy Expert Systems.

UNIT-III

Neural Networks: Fundamental Concepts, Basic Models and Architecture; Machine Learning Using Neural Networks; Associative Memory Networks and their Applications.

Supervised Learning Neural Networks: Perceptron Networks, Radial Basis Function Networks; Back Propagation Neural Network: Architecture, Learning, Applications, & Research Directions; The Boltzman Machine.

Unsupervised Learning Networks: Competitive Learning networks; Kohonen Self-Organizing Networks; Hebbian learning; The Hopfield Network; Counter propagation Networks; Adaptive Resonance Theory: Introduction, Architecture, & Applications; Feed forward Networks; Reinforcement Learning.

UNIT-IV

Genetic Algorithms: Introduction to Genetic Algorithms (GA) and their Terminology; Traditional Optimization and Search Techniques vs. Genetic Algorithm; Operators in Genetic Algorithms; Problem Solving using Genetic Algorithm; Classification of Genetic Algorithms; Holland's Classifier Systems; Genetic Programming; Advantages and Limitations of Genetic Algorithm; Applications of Genetic Algorithm; Applications of GA in Machine Learning.

Text Books:

1. S.N. Sivanandam & S.N. Deepa, Principles of Soft Computing, Wiley Publications, 2nd Edition, 2011.
2. S. Rajasekaran & G.A. Vijayalakshmi Pai, Neural Networks, Fuzzy Logic & Genetic Algorithms, Synthesis & applications, PHI Publication, 2009.
3. N. K. Bose, Ping Liang, Neural Network fundamental with Graph, Algorithms & Applications, TMH, 1998.
4. Bart Kosko, Neural Network & Fuzzy System, PHI Publication, 1st Edition, 2009.
5. Rich E. Knight K, Artificial Intelligence, TMH, 3rd Edition, 2012.
6. George J Klir, Bo Yuan, Fuzzy sets & Fuzzy Logic, Theory & Applications, PHI Publication, 2009.
7. Martin T Hagen, Neural Network Design, Nelson Candad, 2008, Addison Wesley.

Note: The paper setter will set the paper as per the question paper templates provided.

B24-EEP-310		Computer Networks					
Lecture	Tutorial	Practical	Credit	End Semester Exam	Internal Assessment	Total	Duration of Exam
3	-	-	3	70	30	100	3Hrs.
Purpose: The main objective of the course is to introduce the architecture and layers of computer networks, and protocols used at different layers.							
Course Outcomes (CO)							
CO1	To introduce the basic concept of networking, types, networking topologies and layered architecture.						
CO2	To introduce the Data Link layer and its protocols, MAC and LAN protocols.						
CO3	To introduce the packet switching networks, routing algorithms and congestion control techniques.						
CO4	To introduce the concept of TCP/IP, its architecture and protocols.						

UNIT-I

Introduction: Networking goals, Applications of networking: web, ftp and email, Network Topologies analysis and comparison, Network types, Wireless network architecture, Switching approaches, Transmission media and their performance comparison, ISDN and B-ISDN.

Layered Architectures: Need for a layered architecture, OSI Reference model, TCP/IP architecture, layer protocols.

UNIT-II

Data Link layer: Peer to peer mechanism, Flow and Error control, Flow control mechanism: Stop and Wait, Sliding Window, Error control mechanism: Stop and Wait ARQ, Go Back-N ARQ and Selective repeat, Error detection and correction, Example of Data Link Protocols: PPP, HDLC protocol.

MAC and LAN Protocols: Multiple access protocols: ALOHA- pure and slotted ALOHA, CSMA, CSMA/CD, Channelization protocols: FDMA, TDMA, CDMA. Token ring, Ethernet, LAN standards 802.11, LAN Interconnected devices: Switch/Hub, Bridges, Router, Gateways.

UNIT-III

Packet Switching Networks: Packet Network topology, Methods: Datagrams and Virtual Circuits, Types of virtual circuits: X.25, Frame Relay, ATM. Routing Algorithms (distance vector, link state packet routing), Traffic Management and QoS – FIFO, Priority Queues, Fair Queuing, Congestion control techniques(choke packets, leaky bucket, token bucket).

UNIT-IV

TCP/IP: Architecture, Internet Protocols – IP packet, addressing, Subnet Addressing, IP routing, CIDR, ARP, RARP, ICMP, Reassembly, IPv6, UDP, Transmission Control Protocol – TCP, Reliable Stream Service, Operation Protocol, DHCP, Mobile IP, Internet Routing Protocols, Multicast Routing.

TEXT BOOK:

1. S. Tanenbaum (2003), Computer Networks, 4th edition, Pearson Education/ PHI, New Delhi, India.

REFERENCE BOOKS:

1. Behrouz A. Forouzan (2006), Data Communication and Networking, 4th Edition, McGraw-Hill, India.
2. Kurose, Ross (2010), Computer Networking: A top-down approach, Pearson Education, India.

Note: The paper setter will set the paper as per the question paper templates provided.

B24-EEP-312		Electromagnetic Theory					
Lecture	Tutorial	Practical	Credit	End Semester Exam	Internal Assessment	Total	Duration of Exam
3	-	-	3	70	30	100	3Hrs.
Purpose: To familiarize the students with the introductory concepts of Electric and Magnetic Fields and make them understand the phenomenon of propagation of electromagnetic waves and transmission lines.							
Course Outcomes (CO)							
CO1	Review and basics of electrostatics will be covered.						
CO2	Review and basics of Magneto-statics and Maxwell's equations will be covered.						
CO3	Fundamentals of uniform plane waves and their propagation in different mediums will be covered.						
CO4	Fundamentals of Transmission Lines and analysis.						

UNIT-I (With computational methods)

Electrostatics: Relevant Primer: Electrostatics fundamentals, Comparison of Cartesian, Cylindrical & Spherical Coordinate Systems, introductory multivariable calculus.

Divergence, curl and gradient, solenoidal and irrotational fields, basic idea of Stokes' Theorem, Gauss's Theorem and its Applications, Capacitance, Current Density and Continuity Equation.

UNIT-II (Qualitative analysis only)

Magnetic Field: Relevant Primer: Magnetostatics, Biot-Savart's Law, Ampere's circuital Law, Faraday's Law, Ampere's Force Law, Magnetic Circuits, magnetic materials and properties.

Maxwell Equations: Magnetic Vector Potentials, Differential Current Element, Maxwell's Equations in Point and Integral form, their physical interpretation and relation with circuit theory, Retarded Potentials.

UNIT-III (Qualitative analysis only)

The Uniform Plane Wave: Plane Wave, Deduction of Uniform plane wave equation & its Properties, Wave equations from Maxwell's equations, various media, Wave Equation for Free Space and Conducting Medium, Propagation. The Poynting Vector and its theorem. Skin Effect, reflection of Uniform Plane Waves.

UNIT-IV (With computational methods)

Transmission Lines: The Transmission Line Parameters and Equations, Primary & Secondary Constants, Propagation Constant, Phase and Group Velocities.

SC and OC Lines, Input Impedance Relations, Reflection Coefficient, VSWR, Smith Chart –its Configuration and Applications.

Text/Reference Books:

1. David K. Cheng, Field and Wave Electromagnetics, Addison Wesley.
2. K.D. Prasad, Antenna and Wave Propagation, Satya Prakashan.
3. Sadiku, Elements of Electromagnetics, 6th ed., Oxford Press.(Asian Edition).
4. J.D. Kraus, Electromagnetics, McGraw Hill Publications.

Note: The paper setter will set the paper as per the question paper templates provided.

B24-EEP-314		High Voltage Engineering and FACTS Devices					
Lecture	Tutorial	Practical	Credit	End Semester Exam	Internal Assessment	Total	Duration of Exam
3	-	-	3	70	30	100	3Hrs.
Purpose: The main objective of the course is to impart the knowledge of HVE, HVDC & FACTS devices.							
Course Outcomes (CO)							
CO1	To impart knowledge about Conduction and Break Down in Gases, liquid dielectrics and solid dielectrics.						
CO2	To impart knowledge about Generation of High Voltages and Currents.						
CO3	To acquaint students with the HVDC Transmission.						
CO4	To impart knowledge to students about facts devices.						

UNIT-I

Conduction and Break Down in Gases: Ionization processes, Townsend's criterion, breakdown in electronegative gases, time lags for breakdown, streamer theory, Paschen's law.

Break Down in Liquid Dielectrics: Conduction and breakdown in pure liquid and commercial liquid.

Break Down in Solid Dielectrics: Intrinsic breakdown, electromechanical break down, breakdown of solid, dielectric and composite dielectrics.

UNIT-II

Generation of High Voltages and Currents: Generation of high direct current voltages, generation of high alternating voltages, generation of impulse voltages, generation of impulse currents, tripping and control of impulse generators.

UNIT-III

HVDC Transmission: Development of HVDC Technology, Selection of converter configuration. Rectifier and Inverter operation. Control of HVDC converters and Systems. Harmonics in HVDC Systems, Harmonic elimination, AC and DC filters.

UNIT-IV

Introduction of Facts Concepts: Basic of flexible alternating current transmission system (FACTS) controllers, shunt, series, combined and other controllers, HVDC or FACTS, static VAR compensator (SVC) and static synchronous compensator (STATCOM), Static Synchronous Series Compensator (SSSC), Thyristor Controlled Series, Capacitor (TCSC). Solid State Contactors (SSC) and TSSC.

Suggested Books:

1. M. S. Naidu and V. Kamaraju, "High Voltage Engineering, Tata Mc-Graw Hill.
2. C. L. Wadhwa, "High Voltage Engineering", Wiley Eastern Ltd.
3. E. Kuffel and W. S. Zaengal, "High Voltage Engineering", Pergamon Press.
4. Hingorani N.G, "Understanding FACTS (Concepts and Technology of Flexible AC Transmission System)", Standard Publishers.
5. Song Y.H. and Johns A.T., "Flexible AC Transmission Systems", IEEE Press.
6. Ghosh A. and Ledwich G., "Power Quality Enhancement using Custom Power Devices", Kluwer Academic Publishers.
7. Mathur and Verma, "Thyristor-based FACTS controllers for Electrical Transmission Systems", IEEE Press.
8. Bollen M.H.J., "Understanding Power Quality and Voltage Sag", IEEE Press.
9. Padiyar K.R., "FACTS Controllers in Power Transmission and Distribution", New Age International Publisher.
10. Miller T.J.E., "Reactive Power Control in Electric Systems", John Wiley.
11. Kamakshiah S, Kamaraju V, "HVDC Transmission", McGraw Hill Education.

Note: The paper setter will set the paper as per the question paper templates provided.

B24-EEP-316	VLSI Circuits						
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Total	Time(Hrs)
3	0	0	3	70	30	100	3
Purpose:	To make students aware about the CMOS logic design						
Course Outcomes (CO)							
After completion of course students will be able to							
CO1	To understand Transistor-Level CMOS Logic Design.						
CO2	To learn Estimation and Optimization of combinational circuits using RC delay models and logical efforts						
CO3	To design models of moderately sized CMOS circuits that realize specified digital functions.						
CO4	To make an understanding of the characteristics of CMOs circuit construction.						

UNIT-I

Introduction to MOS Transistor Theory: nMOS, pMOS Enhancement Transistor, MOSFET as a Switch, Threshold voltage, Body effect. MOS Device Design Equations, Basic DC equations, Short Channel Effects and Device Models – Scaling Theory, Threshold Voltage Variation, Mobility Degradation with Vertical Field, Velocity Saturation, Hot Carrier Effects, Output Impedance Variation with Drain- Source Voltage, MOS Device Models, Small Signal AC Characteristics and Modeling of MOS Transistors using SPICE.

UNIT-II

Introduction, Voltage Transfer Characteristic (VTC), Noise Immunity and Noise margins, Resistive-Load Inverter, Inverters with n-Type MOSFET Load and CMOS Inverter, DC Characteristics of CMOS Inverter, Calculation of VIL, VIH, VOL, VOH and Vth, Design of CMOS Inverters, Supply Voltage Scaling in CMOS Inverters, Power and Area considerations.

UNIT-III

Switching Characteristics of CMOS Inverter- Delay-Time Definitions, CMOS Propagation Delay, Calculation of Delay times, Estimation of Interconnect parasitic- Interconnect Capacitance Estimation, Interconnect Resistance Estimation, Layout of an Inverter, Calculation of Interconnect Delay- RC Delay Models, The Elmore Delay, Buffer Chains, Low Swing Drivers, Power Dissipation-Switching, Short-Circuit and Leakage Components of Energy and Power, Power-Delay Product, Power Distribution and Performance Optimization of Digital Circuits by Logical Effort Sizing; CMOS Ring Oscillator Circuit.

UNIT-IV

COMBINATIONAL MOS LOGIC CIRCUITS- CMOS Logic Circuits (NAND, NOR and Complex Logic Gates, Multiplexers etc.), CMOS Transmission Gates (Pass Gates), Pseudo nMOS logic, Dynamic CMOS logic, Clocked CMOS logic and CMOS Domino logic. Sequential MOS logic circuits-Behavior of Bistable Elements, The SR Latch Circuit, Clocked Latch and Flip-Flop Circuits, CMOS D-Latch and Edge-Triggered Flip-Flop.

Subsystem design process- design of 4-bit shifter, arithmetic building blocks like adders, multipliers and ALU.

Text / Reference Books:

1. Sung-Mo Kang & Yusuf Leblebici, "CMOS Digital Integrated Circuits – Analysis and Design", 3rd Edition, Tata McGraw-Hill, New Delhi, 2003.
2. Jan M. Rabaey, Anantha Chandrakasan and Borivoje Nikolic, "Digital Integrated Circuits: a design perspective", 2nd Edition, Pearson Education, 2003.
3. David A. Hodges, Horace G. Jackson, Resve A. Saleh, "Analysis and Design of Digital Integrated Circuits: In Deep Submicron Technology", McGraw, 2003.
4. David A. Johns and Ken Martin, "Analog Integrated Circuit Design" John Wiley and Sons Inc., 1997.
5. Neil Weste and David Harris, "CMOS VLSI Design: A Circuits and Systems Perspective", 4th Edition, Addison-Wesley, 2010

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