KURUKSHETRA UNIVERSITY, KURUKSHETRA

(ESTABLISHED BY THE STATE LEGISLATURE ACT XII OF 1956)
('A+' GRADE NAAC ACCREDITED)

Scheme & Syllabus
of
B.Tech. Degree
in
Electrical and Computer Engineering (ECO)

(w.e.f. session 2023-24 onwards)

Table of Contents

GENERAL COURSE STRUCTURE

&

CREDIT DISTRIBUTION

GENERALCOURSESTRUCTURE&THEME

A. Definition of Credit*:

1Hr. Lecture(L) per week	1Credit
1Hr.Tutorial(T)per week	1Credit
1Hr.Practical(P)per week	0.5Credit
2HoursPractical(P)per week	1Credit

*Except for the Manufacturing process workshop, mandatory and value-added courses

B. Range of Credits: The total number of credits proposed for the four-year B.Tech. degree in Electrical and Computer Engineering (ECO) is kept as 175. In addition, for a B.Tech. with Honors & specialization/minor degree, the student must acquire an additional 18-20 credits through MOOC courses offered at the SWAYAM/NPTEL portal.

C. Structure of UG Program in Electrical and Computer Engineering (ECO)**:** The structure of UG program in Electrical and Computer Engineering (ECO) has essentially the following categories of courses with the breakup of credits as given:

Sr. No.	Category	Credit Breakup for CSE
1	Humanities and Social Sciences including Management courses	16.5
2	Basic Science courses	24
3	Engineering Science courses including workshop, drawing, basics of electronics/ electrical/mechanical/computer etc.	13.5
4	Professional core courses	78
5	Program Elective courses relevant to chosen specialization/branch	15
6	Open subjects–Electives from other technical and/or emerging subjects	03
7	Project work, seminar and internship in industry or else where	17
8	Mandatory and Audit Courses [IDEA Workshop, IDEA Workshop Lab, Personality Development and Soft Skills, Environmental Studies, Induction Program, Constitution of India, Essence of Indian Knowledge Tradition, NCC/NSS/Sports/ Yoga/ Technical or Cultural Club/ Society Activities]	08
	Total	**175**

D. Course code and definition:

Course code	Definitions
L:T:P	Lecture: Tutorial: Practical
BSC	Basic Science Courses
ESC	Engineering Science Courses
HSC/HSM	Humanities and Social Sciences including Management courses
ECO	Program Core Courses
EEP	Program Elective Courses
EEO	Open Elective Courses
VAC	Value Added Courses
MAC	Mandatory Courses

- **Category-wise Courses**

HUMANITIES & SOCIAL SCIENCES COURSES [HSC/HSM]

S.No	Course No./ Code	Subject	Semester	Hrs/week			Credits
				Lecture	Tutorial	Practical	
1	B23-HSC-101	English for Technical Writing	II	2	0	2	3
2	B23-HSC-102	Design Thinking	I	0	0	3	1.5
3	B23-HSM-101	Universal Human Values-II: Understanding Harmony And Ethical Human Conduct	I	3	0	0	3
4	B23-HSM-202	Innovation, Start ups and Entrepreneurship	V	3	0	0	3
5	B23-HSM-201	Organizational Behaviour	III	3	0	0	3
6	B23-HSM-302	Humanities–II Intellectual Property Rights (IPR) and Regulatory	IV	3	0	0	3
Total Credits							**16.5**

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BASIC SCIENCE COURSES [BSC]

S. No	Course No./ Code	Subject	Semester	Hrs/week			Credits
				Lecture	Tutorial	Practical	
1	B23-BSC-101	Semiconductor Physics	I	3	1	2	5
2	B23-BSC-107	Mathematics-I	I	3	1	0	4
3	B23-BSC-104	Engineering Chemistry	II	3	0	2	4
4	B23-BSC-108	Mathematics-II	II	3	1	0	4
5	B23-BSC-106	Biology	II	3	0	0	3
6	B23-BSC-203	Mathematics-III	IV	3	1	0	4
Total Credits							**24**

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ENGINEERING SCIENCE COURSE[ESC]

S. No	Course No./ Code	Subject	Semester	Hrs/week			Credits
				Lecture	Tutorial	Practical	
1	B23-ESC-102	Engineering Graphics and Design	I	1	0	4	3
2	B23-ESC-104	Basic Electrical Engineering	I	3	1	2	5
3	B23-ESC-101	Programming for Problem Solving	II	3	0	2	4
4	B23-ESC-107	Manufacturing Practices Workshop	II	0	0	3	1.5
Total Credits							**13.5**

PROGRAM CORE COURSES [ECO]

S. No.	Course No./ Code	Subject	Semester	Hrs/Week L:T:P	Credits
1	B23-ECO-201	Analog and Digital Electronics	III	3:0:2	4
2	B23-ECO-203	Computer Organization and Architecture	III	3:0:0	3
3	B23-ECO-205	Data Structure and Algorithms	III	3:0:2	4
4	B23-ECO-207	Electrical Machine-I	III	3:0:2	4
5	B23-ECO-209	Electric Power Generation	III	3:0:0	3
6	B23-ECO-202	Electrical Measurement and Instrumentation	IV	3:0:2	4
7	B23-ECO-204	Electrical Machine-II	IV	3:0:2	4
8	B23-ECO-206	Network Analysis and Synthesis	IV	4:0:0	4
9	B23-ECO-208	Object Oriented Programming	IV	3:0:2	4
10	B23-ECO-301	Control System	V	3:0:2	4
11	B23-ECO-303	Data Base Management System	V	3:0:2	4
12	B23-ECO-305	Electromagnetic Theory	V	3:0:0	3
13	B23-ECO-307	Operating System	V	3:0:0	3
14	B23-ECO-309	Power System-I	V	3:0:2	4
15	B23-ECO-302	Renewable Energy Resources	VI	3:0:0	3
16	B23-ECO-304	Power System-II	VI	3:0:2	4
17	B23-ECO-306	Python Programming	VI	3:0:2	4
18	B23-ECO-308	Signals and Systems	VI	3:0:2	4
19	B23-ECO-401	AIML	VII	3:0:2	4
20	B23-ECO-403	Big Data Analytics	VII	3:0:2	4
21	B23-ECO-405	Power System Protection and Relaying	VII	3:0:0	3
Total					**78**

SKILL ENHANCEMENT-BASED PROJECT WORK, SEMINAR AND INTERNSHIP

S. No.	Course No./ Code	Subject	Semester	Hrs/Week L:T:P	Credits
1	B23-ECO-316	Project-1	VI	0:0:4	2
2	B23-ECO-411	Project-II	VII	0:0:6	3
3	B23-ECO-402	Project-III / Internship/ Startups/ Research Lab	VIII	0:0:24	10
4	B23-ECO-317	Industrial Training-I	V	0:0:2	1
5	B23-ECO-413	Industrial Training-II	VII	0:0:2	1
Total					**17**

LIST OF PROGRAMME ELECTIVE COURSES [EEP]

S. No.	Course No./ Code	Subject	Semester	Hrs/Week L:T:P	Credits
1	B23-EEP-302	Power Electronics and Drives	VI	3:0:0	3
2	B23-EEP-304	Transducer and Sensors	VI	3:0:0	3
3	B23-EEP-306	Soft Computing	VI	3:0:0	3
4	B23-EEP-308	Software Engineering	VI	3:0:0	3
5	B23-EEP-310	High Voltage Engineering and Facts Devices	VI	3:0:0	3
6	B23-EEP-312	Computer Added Power System Analysis	VI	3:0:0	3
7	B23-EEP-314	Internet Technology and Management	VI	3:0:0	3
8	B23-EEP-316	Computer Network	VI	3:0:0	3
9	B23-EEP-401	Digital Signal Processing	VII	3:0:0	3
10	B23-EEP-403	Microprocessor and Microcontroller	VII	3:0:0	3
11	B23-EEP-405	Industrial Automation	VII	3:0:0	3
12	B23-EEP-407	Software Verification, Validation and Testing	VII	3:0:0	3
13	B23-EEP-402	Electric Vehicle Technology	VIII	3:0:0	3
14	B23-EEP-404	Power System Restructuring and Deregulation	VIII	3:0:0	3
15	B23-EEP-406	Robotics and Automation	VIII	3:0:0	3
16	B23-EEP-408	Block Chain Technology	VIII	3:0:0	3
17	B23-EEP-410	Energy Audit and Conservation	VIII	3:0:0	3
18	B23-EEP-412	Smart Grid	VIII	3:0:0	3
19	B23-EEP-414	Data Mining	VIII	3:0:0	3
20	B23-EEP-416	Mobile App Development	VIII	3:0:0	3

LIST OF OPEN ELECTIVE COURSES [EEO]

S. No.	Course No./ Code	Subject	Semester	Hrs/Week L:T:P	Credits
1	B23-EEO-401	Biomedical Signal Processing	VII	3:0:0	3
2	B23-EEO-403	International and Corporate Law	VII	3:0:0	3
3	B23-EEO-405	Internet of Things	VII	3:0:0	3
4	B23-EEO-407	Digital Image Processing	VII	3:0:0	3

VALUE ADDED AND MANDATORY COURSES [VAC/MAC]

S. No.	Course No./ Code	Subject	Semester	Hrs/Week L:T:P	Credits
1	B23-VAC-101	Personality Development and Soft Skills	II	2:0:0	1
2	B23-VAC-110	IDEA Workshop	I	2:0:0	1
3	B23-VAC-112	IDEA Project Workshop	I	0:0:2	1
4	B23-VAC-302/304/306/308/310	Hindi Language Skills/ Sanskrit Language Skills/ German Language Skills/ Japanese Language Skills/ French Language Skills	V	2:0:0	1
5	B23-VAC-401/403/405/407/409/411	NCC/NSS/Sports/ Yoga/ Technical or Cultural Club/Society activities	VII	0:0:2	1
6	B23-MAC-201	Environmental Studies	IV	3:0:0	1
7	B23-MAC-202	Essence of Indian Traditional Knowledge	III	2:0:0	1
8	B23-MAC-301	Constitution of India	VI	2:0:0	1
Total					**8**

SEMESTER WISE STRUCTURE

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SEMESTER-III

(w.e.f. 2024-25)

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	B23-ECO-201	Analog and Digital Electronics	3:0:0	3	3	70	30	--	100	3
2	B23- ECO -203	Computer Organization and Architecture	3:0:0	3	3	70	30	--	100	3
3	B23-ECO-205	Data Structure and Algorithms	3:0:0	3	3	70	30	--	100	3
4	B23-ECO-207	Electrical Machine-I	3:0:0	3	3	70	30	--	100	3
5	B23-ECO-209	Electric Power Generation	3:0:0	3	3	70	30	--	100	3
6	B23-HSM-201	Organizational Behaviour	3:0:0	3	3	70	30	--	100	3
7	B23-ECO-211	Analog and Digital Electronics Lab	0:0:2	2	1	--	40	60	100	3
8	B23-ECO-213	Data Structure and Algorithms Lab	0:0:2	2	1	--	40	60	100	3
9	B23-ECO-215	Electrical Machine Lab-I	0:0:2	2	1	--	40	60	100	3
10	B23-MAC-202	Essence of Indian Traditional Knowledge	2:0:0	2	1	--	100	--	100	3
TOTAL				**26**	**22**	**420**	**400**	**180**	**1000**	

Note:

- **NCC/NSS/Sports/Yoga/Technical or Cultural Club/society activities will be joined by students in the second year also and will be evaluated in the 7th semester by the institute based upon a continuous evaluation model as per guidelines.**

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SEMESTER-IV

(w.e.f. 2024-25)

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	B23-BSC-203	Mathematics-III	3:1:0	4	4	70	30	--	100	3
2	B23-ECO-202	Electrical Measurement and Instrumentation	3:0:0	3	3	70	30	--	100	3
3	B23-ECO-204	Electrical Machine-II	3:0:0	3	3	70	30	--	100	3
4	B23-ECO-206	Network Analysis and Synthesis	4:0:0	4	4	70	30	--	100	4
6	B23-ECO-208	Object Oriented Programming	3:0:0	3	3	70	30	--	100	3
7	B23-HSM-302	Intellectual Property Rights (IPR) and Regulatory	3:0:0	3	3	70	30	--	100	3
8	B23-ECO-210	Electrical Measurement and Instrumentation Lab	0:0:2	2	1	--	40	60	100	3
9	B23-ECO-212	Electrical Machine Lab-II	0:0:2	2	1	--	40	60	100	3
10	B23-ECO-214	Object Oriented Programming Lab	0:0:2	2	1	--	40	60	100	3
11	B23-MAC-201	Environmental Studies	3:0:0	3	1	70	30	--	100	3
TOTAL				**29**	**24**	**490**	**330**	**180**	**1000**	

Note:

- All students have to undertake the industrial training for 4 to 6 weeks after the 4th semester, which will be evaluated in the 5th semester.

B.Tech. Electrical and Computer Engineering (ECO)

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SEMESTER-V

(w.e.f. 2025-26)

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	B23-ECO-301	Control System	3:0:0	3	3	70	30	--	100	3
2	B23-ECO-303	Data Base Management System	3:0:0	3	3	70	30	--	100	3
3	B23-ECO-305	Electromagnetic Theory	3:0:0	3	3	70	30	--	100	3
4	B23-ECO-307	Operating System	3:0:0	3	3	70	30	--	100	3
5	B23-ECO-309	Power System-I	3:0:0	3	3	70	30	--	100	3
6	B23-HSM-202	Innovation, Startups and Entrepreneurship	3:0:0	3	3	70	30	--	100	3
7	B23-ECO-311	Control System Lab	0:0:2	2	1	--	40	60	100	3
8	B23-ECO-313	DBMS Lab	0:0:2	2	1	--	40	60	100	3
9	B23-ECO-315	Power System-I lab	0:0:2	2	1	--	40	60	100	3
10	B23-ECO-317	Industrial Training-I	0:0:2	2	1	--	100	--	100	3
11	B23-VAC-302/304/306/308/310	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**	

B.Tech. Electrical and Computer Engineering (ECO)
KURUKSHETRA UNIVERSITY, KURUKSHETRA
SEMESTER-VI
(w.e.f. 2025-26)

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	B23-ECO-302	Renewable Energy Resources	3:0:0	3	3	70	30	--	100	3
2	B23-ECO-304	Power System-II	3:0:0	3	3	70	30	--	100	3
3	B23-ECO-306	Python Programming	3:0:0	3	3	70	30	--	100	3
4	B23-ECO-308	Signals and Systems	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	B23-ECO-310	Power System-II Lab	0:0:2	2	1	--	40	60	100	3
8	B23-ECO-312	Python Programming Lab	0:0:2	2	1	--	40	60	100	3
9	B23-ECO-314	Signals and Systems Lab	0:0:2	2	1	--	40	60	100	3
10	B23-ECO-316	Project-I	0:0:4	4	2	--	100	--	100	3
11	B23-MAC-301	Constitution of India	2:0:0	2	1	--	100	--	100	3
TOTAL				**30**	**24**	**420**	**500**	**180**	**1100**	

Note:

- ThecourseofbothProgramElectiveandOpenElectivewillbeofferedat1/3rd 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	
B23-EEP-302	Power Electronics and Drives	B23-EEP-310	High Voltage Engineering and Facts Devices
B23-EEP-304	Transducer and Sensors	B23-EEP-312	Computer Added Power System Analysis
B23-EEP-306	Soft Computing	B23-EEP-314	Internet Technology and Management
B23-EEP-308	Software Engineering	B23-EEP-316	Computer Network

B.Tech. Electrical and Computer Engineering (ECO)

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SEMESTER-VII

(w.e.f. 2026-27)

S. No.	Course No./ Code	Subject	L:T:P	Hours / Week	Credits	Examination Schedule (Marks)				Duration of Exam (Hours)
						End Semester	Internal Assessment	Practical Exam	Total	
1	B23-ECO-401	AIML	3:0:0	3	3	70	30	--	100	3
2	B23-ECO-403	Big Data Analytics	3:0:0	3	3	70	30	--	100	3
3	B23-ECO-405	Power System Protection and Relaying	3:0:0	3	3	70	30	--	100	3
4	--	Program Elective-III	3:0:0	3	3	70	30	--	100	3
5	--	Open Elective-I	3:0:0	3	3	70	30	--	100	3
6	B23-ECO-407	Data Analytics Lab	0:0:2	2	1	--	40	60	100	3
7	B23-ECO-409	AIML Lab	0:0:2	2	1	--	40	60	100	3
8	B23-ECO-411	Project-II	0:0:6	6	3	--	40	60	100	3
9	B23-ECO-413	Industrial Training-II	0:0:2	2	1	--	100	--	100	3
10	B23-VAC-401/403/405/407/409/411	NCC/NSS/Sports/ Yoga/ Technical or Cultural Club/Society activities	0:0:2	2	1	--	100	--	100	--
TOTAL				**29**	**22**	**350**	**470**	**180**	**1000**	

Note:

- **The** course of both Program Elective and Open Elective will be offered at1/3rd strength or 20 students (whichever is smaller) of the section.
- B23-VAC-401/403/405/407/409/411 are single credit value added courses in which NCC/NSS/Sports/Yoga/Technical or Cultural Club/Society activities will be joined by students in first year and will be evaluated in 7th semester by the institute based upon continuous evaluation model as per guidelines**.**

Program Elective-III		**Open Elective-I**	
B23-EEP-401	Digital Signal Processing	B23-EEO-401	Biomedical Signal Processing
B23-EEP-403	Microprocessor and Microcontroller	B23-EEO-403	International and Corporate Law
B23-EEP-405	Industrial Automation	B23-EEO-405	Internet of Things
B23-EEP-407	Software Verification, Validation and Testing	B23-EEO-407	Digital Image Processing

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SEMESTER-VIII

(w.e.f. 2026-27)

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	--	Program Elective-IV	3:0:0	3	3	70	30	--	100	3
2	--	Program Elective-V	3:0:0	3	3	70	30	--	100	3
3	B23-ECO-402	Project-III / Internship/ Startups/ Research Lab	0:0:20	20	10	--	200	200	400	3
TOTAL				**26**	**16**	**140**	**260**	**200**	**600**	

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.
- In case of semester-long project work done in industry/external institute, the Program Elective- IV and Open Elective-IV may be offered in online mode through MOOC courses offered by SWAYAM/NPTEL portal. These courses may be done from 3rd semester till completion of the degree.

Program Elective -IV		Program Elective -V	
B23-EEP-402	Electric Vehicle Technology	B23-EEP-410	Energy Audit and Conservation
B23-EEP-404	Power System Restructuring and Deregulation	B23-EEP-412	Smart Grid
B23-EEP-406	Robotics and Automation	B23-EEP-414	Data Mining
B23-EEP-408	Block Chain Technology	B23-EEP-416	Mobile App Development

B.Tech. Electrical and Computer Engineering (ECO)
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Students of Electrical and Computer Engineering are offered to earn **ADDITIONAL 18-20 CREDITS** through MOOCs/SWAYAM courses as per the 'Guidelines to implement the SWAYAM/MOOCs/ other authorized online courses (OAOC) of Kurukshetra University, Kurukshetra' in any of the emerging areas mentioned below for the award of the degree of:

1. B.Tech. (Hons.) Electrical and Computer Engineering with Specialization in Electric Vehicles
2. B.Tech. (Hons.) Electrical and Computer Engineering with Specialization in Energy Engineering
3. B.Tech. (Hons.) Electrical and Computer Engineering with Specialization in Artificial Intelligence and Machine Learning
4. B.Tech. (Hons.) Electrical and Computer Engineering with Specialization in Data Science
5. B.Tech. Electrical and Computer Engineering with a Minor Degree in Mechatronics
6. B.Tech. Electrical and Computer Engineering with a Minor Degree in VLSI Design
7. B.Tech. Electrical and Computer Engineering with a Minor Degree in Internet of Things (IoT)
8. B.Tech. Electrical and Computer Engineering with a Minor Degree in Cyber Security

B23-ECO-201		Analog and Digital Electronics					
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 analog and digital electronics.	
Course Outcomes (CO)	
CO1	To understand the concept of carrier transport phenomena in semiconductors and diodes such as p-n Junction diode and tunnel diode.
CO2	To understand the detailed operation of BJT and the calculation of its parameters using transistor models.
CO3	Students will be able to understand the basic logic gates and will be able to apply minimization techniques for reducing a function up to four variables.
CO4	Students will be able to design combinational & Sequential circuits and their analysis.

UNIT-I

Charge Carriers Transport: Energy bands in intrinsic and extrinsic silicon; Carrier transport: diffusion current, drift current, mobility, and resistivity; Generation and recombination of carriers; Continuity equation, PN Junction: Basic Structure, small signal equivalent circuit of p-n diode, derivation of barrier potential and diode current equation, Simple diode circuits: clipping, clamping and rectifiers, Zener diode and its application as voltage regulator.

UNIT-II

Bipolar Junction Transistor: Basic principle of operation, Current gains: derivation of α, β, ϒ and their relationship. Various modes of operation of BJT, Base Width Modulation, Transistor hybrid model, h-parameter equivalent circuit of transistor, Analysis of transistor amplifier using h-parameters, calculation of input impedance, output impedance and voltage gain.

UNIT-III

Number Systems: Decimal, binary, octal, hexadecimal number system and conversion, binary weighted codes, signed numbers, 1s and 2s complement codes, Binary arithmetic

Boolean Algebra: Binary logic functions, Boolean laws, truth tables, associative and distributive properties, De-Morgans theorems, realization of switching functions using logic gates.

UNIT – IV

Combinational Logic: Switching equations, canonical logic forms, sum of product & amp; product of sums, Karnaugh maps, two, three and four variable K-maps, simplification of expressions.

Analysis & design of Combinational Logic: Introduction to combinational circuits, Adder and Subtractor circuits (half & amp; full adder & amp; subtractor, Encoder, Decoder, Comparator, Multiplexer, De-Multiplexer and Parity Generator

Sequential circuits: A 1-bit memory, clocked SR flip flop, J- K, T and D types flip flops

Text Books:

1. Millman & amp; Halkias: Integrated Electronics, TMH.
2. Boylestad & Nashelsky: Electronic Devices & Circuit Theory, PHI.
3. M. M. Mano, & quot; Digital design & quot;, Pearson Education India, 2016.
4. Donald P. Leach and Albert Paul Malvino, Digital Principles and Applications, 8th Edition, TMH, 2003

Reference Books:

1. B.G. Streetman, Solid State Electronic Devices, Prentice Hall of India, New Delhi, 1995.
2. E S. Yang, Microelectronic Devices, McGraw Hill, Singapore, 1988.
3. S. Salivahanan and Naresh Kumar, Electronics devices and circuits, McGraw Hill,1998.

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

B23-ECO-203		Computer Organization and Architecture					
Lecture	**Tutorial**	**Practical**	**Credit**	**End Semester Exam**	**Internal Assessment**	**Total**	**Duration of Exam**
3	**-**	**-**	**3**	**70**	**30**	**100**	**3Hrs.**

Purpose: Students will grasp fundamental computer architecture concepts and learn essential skills for building cost-effective computer systems.

Course Outcomes (CO)	
CO1	Be familiar with the internal organization and operations of a computer.
CO2	Be familiar with the design tradeoffs in designing and constructing a computer processor.
CO3	Be aware of the CPU design, including the RISC/CISC architectures.
CO4	Be acquainted with the basic knowledge of I/O devices and select the appropriate interfacing standards for I/O devices.

UNIT- I

Data representation and Computer arithmetic: Introduction to Computer Systems, Organization and architecture, Von Neumann Architecture, evolution and computer generations.

Memory Organization: Memory Hierarchy, Main Memory, Auxiliary Memory, Associative Memory, Cache Memory, Virtual Memory.

UNIT-II

Basic Computer organization and Design: Instruction codes, computer registers and common bus system, computer instructions, timing and control, instruction cycle: Fetch and Decode, Register reference instructions; Memory reference instructions. Input, output and Interrupt: Instructions, Program interrupt, Interrupt cycle, Control Memory, address sequencing, Micro program Example, micro instruction format, Horizontal Vs Vertical micro-programming, design of control Unit, microprogram sequencer, Hardwired v/s Micro-programmed Control.

UNIT-III

Central Processing Unit: General register organization, stack organization, instruction formats (Zero, One, Two and Three Address Instruction), addressing modes.

CISC and RISC: features and comparison. Pipeline and vector Processing, Parallel Processing, Flynn's taxonomy, Pipelining, Instruction Pipeline, Basics of vector processing and Array Processors.

UNIT-IV

Input-output organization: I/O interface. I/O Bus and interface modules, I/O versus Memory Bus. Asynchronous data transfer: Strobe control, Handshaking, Asynchronous serial transfer. Modes of Transfer: Programmed I/O, Interrupt-driven I/O. Direct memory Access, DMA controller and transfer.

Suggested Books:

1. William Stallings, "Computer Organization and Architecture – Designing for Performance", Sixth
2. Edition, Pearson Education, 2003.
3. Morris Mano, M., "Computer System Architecture," 3/e, Pearson Education, 2005.
4. John P. Hayes, "Computer Architecture and Organization," 3/e, TMH, 1998.
5. David A. Patterson and John L. Hennessy, "Computer Organization and Design: The
6. Hardware/Software interface", Third Edition, Elsevier, 2005.
7. V.P. Heuring, H.F. Jordan, "Computer Systems Design and Architecture", Second Edition, Pearson
8. Education, 2004.
9. Carl Hamacher, Zvonko Vranesic and Safwat Zaky, "Computer Organization", Fifth Edition, Tata
10. McGraw Hill, 2002

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

B23-ECO-205		Data Structure and Algorithms					
Lecture	**Tutorial**	**Practical**	**Credit**	**End Semester Exam**	**Internal Assessment**	**Total**	**Duration of Exam**
3	**-**	**-**	**3**	**70**	**30**	**100**	**3 Hrs.**
Purpose: To introduce Data Structure principles for software system design and implementation							
Course Outcomes							
CO 1	To elaborate elementary data organizations and identify different data structure operations such as insertion, deletion, and traversal.						
CO 2	To examine various operations of Stack and Queue.						
CO 3	To identify the role of link lists in data structure and discuss various types of linked lists.						
CO 4	To explore Terminologies of trees and graphs.						

UNIT-I

Introduction: Basic Terminologies: Elementary Data Organizations, Data Structure Operations: Insertion, Deletion, Traversal, etc. Analysis of an Algorithm, Asymptotic Notations, and Time-Space Trade-Off. Searching: Linear Search and Binary Search Techniques and Their Complexity Analysis.

Sorting: Objectives and properties of different sorting algorithms: selection sort, bubble sort, insertion sort, quick Sort, and merge sort.

UNIT-II

Stacks and Queues: Describes the stack and its operations. Queue, Types of Queues: Simple queue, circular queue, priority queue; operations on each type of queue.

UNIT-III

Linked Lists: Linked lists and their types: Representation in memory: algorithms of several operations: traversing, searching, insertion, and deletion.

UNIT-IV

Trees: Basic Tree Terminologies, Different Types of Trees: Binary Tree, Binary Search Tree, and AVL Tree: tree operations on each of the trees.

Graph: Basic Terminologies and Representations, Graph Search, and Traversal.

TEXTBOOKS:

1. Fundamentals of Data Structures, Illustrated Edition by Ellis Horowitz, Sartaj Sahni, Computer Science Press.
2. Data Structures, Revised 1st Edition by Seymour Lipschutz, Scaum's Outline Series McGraw Hill

REFERENCE BOOKS:

1. Algorithms, Data Structures, and Problem Solving with C++", Illustrated Edition by Mark Allen Weiss, Addison Wesley Publishing Company
2. How to Solve it by Computer, 2nd Impression by R. G. Dromey, Pearson Education.

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

B23-ECO-207	Electrical Machine-I						
Lecture	**Tutorial**	**Practical**	**Credit**	**End Semester Exam**	**Internal Assessment**	**Total**	**Duration of Exam**
3	**-**	**-**	**3**	**70**	**30**	**100**	**3 Hrs.**
Purpose: To familiarize the students with electric machines and transformers.							
Course Outcomes							
CO1	To understand the concept, working, operation, and maintenance of single-phase transformer						
CO 2	To understand the concept, working, operation, maintenance of the phase transformer & conversion from three-phase to multiple phases						
CO 3	To understand the construction, working, and operation of D.C. Generator						
CO 4	To understand the concept, working, operation, and testing of D.C. Motor						

UNIT – I

TRANSFORMERS: Principle, construction of core, EMF equation, winding & tank, cooling, operation, testing of single-phase transformer, equivalent circuit, phasor diagram, parameters determination, P.U representation of parameters, regulation, losses & efficiency, separation of iron losses, parallel operation, all-day efficiency, Sumpner's test, specifications of transformer, maintenance of transformer, difference between power transformer and distribution transformer.

UNIT – II

Three phase transformers: Types and their comparative features.
Auto-Transformer: Principle, construction, comparison with two winding transformers, applications.
Nature of magnetizing current: plotting of magnetizing current from B-H curve, Inrush current.
Phase-Conversion: Three to two phases, three to six phases, and three to twelve phases of conversions. Introduction to three windings transformer, tap-changing & phase-shifting transformers.

UNIT – III

D.C. Generator- Principle & construction of D.C. generator, simplex lap, wave winding, E.M.F. equation, types, voltage build-up, armature reaction, compensating winding, the function of the commutator, methods of improving commutation, load characteristics, parallel operation.

UNIT- IV

D.C. Motor- Principle of DC motors, function of commutator in DC motors, torque and output power equations, load characteristics, losses, starting, starters, speed control, braking, testing, Swinburne test, Hopkinson test, Ward Leonard Method, efficiency & applications.

Suggested Books:

1. A. E. Fitzgerald and C. Kingsley, "Electric Machinery", New York, McGraw Hill Education, 2013.
2. A. E. Clayton and N. N. Hancock, "Performance and design of DC machines", CBS Publishers, 2004.
3. M. G. Say, "Performance and design of AC machines", CBS Publishers, 2002.
4. P. S. Bimbhra, "Electrical Machinery", Khanna Publishers, 2011.
5. I. J. Nagrath and D. P. Kothari, "Electric Machines", McGraw Hill Education, 2010.

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

B23-ECO-209		Electrical Power Generation					
Lecture	**Tutorial**	**Practical**	**Credit**	**End Semester Exam**	**Internal Assessment**	**Total**	**Duration of Exam**
3	**-**	**-**	**3**	**70**	**30**	**100**	**3 Hrs.**
Purpose: Students will familiarize with power plants economics, cost factors, and overview of conventional power plants.							
Course Outcomes							
CO 1	To study, Load and loading forecasting, Power plant economics, Tariffs and power factor improvement used in power generation						
CO 2	To understand tariffs, importance of power factor and working of Thermal power plants.						
CO 3	To understand working of Thermal power plants.						
CO 4	To understand working of Nuclear power plants, Diesel power plants & Combined working of thermal & hydel plants.						

UNIT-I

Load and Load Forecasting: Load curves, maximum demand, load factor, diversity factor, capacity factor, utilization factor, types of load, load forecasting, base load and peak load.

Power Plant Economics: Choice of type of generation, size of generator and number of units, cost of electrical energy, depreciation of plant, effect of load factor on cost of Electrical Energy.

UNIT-II

Tariffs and Power Factor Improvement: Different types of tariffs and methods of power factor improvement.

Hydro power plants: Choice of site, classification of hydro electric plants, main parts and working of plants and their layouts, characteristics of hydro electric generators. Speed governing—Purpose, hydraulic type governor functioning

UNIT-III

Thermal Power Plants: Working of power plants and their layout, Main parts and working of stations-thermodynamic cycles, fuel handling, combustion and combustion equipment, problem of ash disposal, circulating water schemes and supply of makeup water, economizer, air pre-heater feed water heaters and dust collection.

UNIT-IV

Nuclear power plants: Choice of site, classification of plants, main parts, layout and their working, associated problems. Diesel Power Plants: Diesel plant equipments, diesel plant layout and their working, application of diesel plants.

Combined working of plants: Advantages of combined operation plant requirements of base load and peak load operation. Combined working of run-off river plant and steam plant**.**

REFERENCES:

1. C.L. Wadhwa, ―Electric Power System‖ (Willey Eastern Ltd).
2. I. J. Nagnath and D.P. Kothari ―Power System Engineering‖ TMGH.
3. Power Genreation by B.R Gupta, S.Chand.
4. Power System Engg. By R.K Rajput, Luxmi Publication.

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

B23-HSM-201	Organizational Behavior						
Lecture	**Tutorial**	**Practical**	**Credit**	**End Semester Exam**	**Internal Assessment**	**Total**	**Duration of Exam**
3	**0**	**-**	**3**	**70**	**30**	**100**	**3 Hrs.**
Purpose: The objective of this course is to help students converse with the basic concepts of organizational behaviour to nurture managerial skills.							
Course Outcomes							
CO1	An overview of organizational behaviour as a discipline and understanding the concept of individual behaviour.						
CO2	Understand the concept and importance of personality and emotions and their importance in decision-making and effective leadership.						
CO3	Enabling the students to know about the importance of effective motivation and its contribution in group dynamics and resolving conflicts.						
CO4	Understand how to overcome organizational stress by maintaining proper organizational culture and effective communication.						

UNIT- I

Introduction to organizational behavior: Concept and importance of organizational behavior, role of Managers in OB, challenges and opportunities for OB.

Foundation of individual behavior: Biographical characteristics, concept and types of abilities, concept of values and attitude, types of attitude, attitude and workforce diversity.

UNIT- II

Introduction to personality and emotions: Definition and Meaning of Personality, Determinants of Personality, Personality Traits Influencing OB, Nature and Meaning of Emotions, Emotions dimensions, concept of Emotional intelligence.

Perception and individual decision making: meaning of perception, factors influencing perception, rational decision-making process, the concept of bounded rationality. Leadership-trait approaches, behavioural approaches, situational approaches, and emerging approaches to leadership.

UNIT-III

Motivation: Concept and theories of motivation, theories of motivation-Maslow, two-factor theory, theory X and Y, ERG Theory, McClelland's theory of needs, goal setting theory, application of theories in the organizational scenario, the linkage between MBO and goal setting theory.

Foundations of group behaviour and conflict management: Defining and classifying of groups, stages of group development, Informal and formal groups- group dynamics, managing conflict and negotiation, causes of group conflicts, managing intergroup conflict through resolution.

UNIT-IV

Introduction to Organizational Communication: Meaning and importance of communication process, importance of effective communication, organizational stress: definition and meaning sources and types of stress, impact of stress on organizations, stress management techniques.

Introduction to Organization Culture: Meaning and nature of organization culture, types of culture, managing cultural diversity, managing change and innovation-change at work, resistance to change, a model for managing organizational change.

Text Books:

1. Colquitt, Jason A., Jeffery A. LePine, and Michael Wesson. Organizational Behavior: Improving Performance and Commitment in the Workplace. 5th ed. New York: McGraw-Hill Education, 2017.
2. Hitt, Michael A., Miller, and Adrienne Colella. Organizational Behavior. 4th ed. Hoboken, NJ: John Wiley, 2015.
3. Robbins, Stephen P., and Judge. Organizational Behavior. 17th ed. Harlow, UK: Pearson Education, 2017.

Reference Books:

1. Schermerhorn, Hunt and Osborn, Organisational behavior, John Wiley.
2. Udai Pareek, Understanding Organisational Behaviour, Oxford Higher Education.
3. Mc Shane & Von Glinov, Organisational Behaviour, Tata Mc Graw Hill.
4. Aswathappa, K., Organisational Behaviour– Text and Problem, Himalaya Publication.

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

B23-ECO-211	Analog and Digital Electronics Lab						
Lecture	**Tutorial**	**Practical**	**Credit**	**Practical Exam**	**Internal Assessment**	**Total**	**Duration of Exam**
-	**-**	**2**	**1**	**60**	**40**	**100**	**3 Hrs.**

Purpose: The students will familiarize themselves with digital and analogue devices.

Course Outcomes (CO)

CO1	To teach the students how to experimentally plot the VI characteristics of various diodes such as p-n diode, Zener diode etc. find the threshold voltage and Zener breakdown voltage from the VI curve.
CO2	To teach the students how to experimentally find the values of various parameters of Transistor such as voltage gain, current gain etc.
CO3	To verify truth tables of basic logic gates and design various gates using universal gates.
CO4	To design various Combinational & Sequential circuits and verify their operation

List of Experiments

1. To study the VI characteristics of p-n diode in forward and reverse bias and find the threshold voltage from the VI curve.
2. To study the operation of Zener diode as a voltage regulator.
3. To study the operation of half-wave and full wave rectifiers and calculate their ripple factor values.
4. To study the operation of series and parallel Clippers using P-N junction diodes.
5. To study the operation of clampers using P-N junction diodes.
6. To experimentally plot the input and output characteristics of a given BJT transistor in CE configuration and calculate its various parameters.
7. To experimentally Plot the input and output characteristics of a given BJT transistor in CB configuration and calculate its various parameters.
8. Familiarization with Digital Trainer Kit and associated equipment.
9. Study of TTL gates AND, OR, NOT, NAND, NOR, EX-OR, EX-NOR.
10. Design and realize a given function using K-Maps and verify its performance.
11. To verify the operation of Multiplexer and De-multiplexer.
12. To verify the operation of Comparator.
13. To verify the truth table of S-R, J-K, T, D Flip-flops.

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

B23-ECO-213	Data Structure and Algorithms Lab						
Lecture	**Tutorial**	**Practical**	**Credit**	**Practical Exam**	**Internal Assessment**	**Total**	**Duration of Exam**
-	**-**	**2**	**1**	**60**	**40**	**100**	**3 Hrs.**

Purpose: To Introduce Data Structures principles and paradigms for designing and implementing software.	
Course Outcomes (CO)	
CO1	To introduce the basic concepts of Data structure, basic data types, searching and sorting based on array data types.
CO2	To introduce the structured data types like Stacks and Queue and its basic operation's implementation.
CO3	To introduce implementation of linked list.
CO4	To introduce the concepts of Tree.

List of Experiments

1. Write a program to implement array operations.
2. Write a program to implement memory allocation and de-allocation in array.
3. Write a program for search methods.
4. Write a program for insertion sort
5. Write a program for selection sort
6. Write a program for bubble sort.
7. Write a program to implement Stack and its operation.
8. Write a program to implement Queue and its operation.
9. Write a program to implement singly linked list for the following operations: Create, Display, searching, traversing and deletion.
10. Write a program to implement insertion, deletion and traversing in B tree.

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

B23-ECO-215	Electrical Machines Lab-I						
Lecture	**Tutorial**	**Practical**	**Credit**	**Practical Exam**	**Internal Assessment**	**Total**	**Duration of Exam**
-	**-**	**2**	**1**	**60**	**40**	**100**	**3 Hrs.**
Purpose: The students will do various experiments on the Transformer and DC machine.							
Course Outcomes (CO)							
CO1	To teach the students how to experimentally find various parameters and losses of the single-phase transformer.						
CO2	Experimental analysis of parallel operation and Scott connection.						
CO3	To perform various tests on DC machines to analyse various parameters.						
CO4	To analyze various characteristics of DC machines and transformers.						

LIST OF EXPERIMENTS

1. To find turns ratio, polarity & mark dot convention of a 1-phase transformer.
2. To perform open & short circuit tests on a 1-phase transformer& find parameters.
3. To perform Sumpner's Back-to-Back test on 1-phase transformer& find parameters.
4. Parallel operation of two 1-phase transformers and observe load sharing.
5. To convert three phase supply to 2-phase by Scott-connection, compare line Currents theoretically & practically for unbalanced load.
6. To perform load test on DC shunt generator & find efficiency& observe speed at Different load.
7. Speed control of DC shunt motor by armature & field control method, draw graph Between speed & field current.
8. To perform Swinburne's test of DC shunts motor and find efficiency.
9. To perform Hopkinson's test of DC shunts M/Cs.
10. To perform Ward Leonard method for speed control DC shunts motor.
11. To make various types of three phase connections, using three single phase Transformers, study relevant features
12. Characteristics for compound, series shunt generators.

Note: At least eight experiments should be performed from above list.

B23-MAC-202	Essence of Indian Traditional Knowledge						
Lecture	**Tutorial**	**Practical**	**Credit**	**Internal Assessment**	**End Semester Exam**	**Total**	**Duration of Exam**
2	**-**	**-**	**1**	**100**	**-**	**100**	**3 Hrs.**

Purpose: To facilitate the students with the concepts of Indian traditional knowledge and to make them understand the importance of the roots of the knowledge system, analyze and apply to their day-to-day life.

Course Outcomes

CO1	The students will be able to understand, connect and explain the basics of Indian traditional knowledge from a modern scientific perspective.
CO2	The students will be able to understand Holistic Health using the Indian Knowledge System.
CO3	The students will be able to Manage their thoughts and Emotions and will learn positivity, self-regulation, and control.
CO4	The students will be able to Achieve Consciousness through Indian Knowledge System.

UNIT 1

Introduction to Indian Traditional knowledge: Define traditional knowledge, importance, kinds of traditional knowledge. Philosophical systems, Basics of Rajyoga and Karam yoga, Benefits of Rajyoga and Karamyoga.

UNIT 2

Holistic Health using Indian Knowledge System: Basic principles of natural life style, Benefits through five elements. Healing through food, Chakras and Mudras. Physical, Mental, Emotional and Spiritual health using traditional knowledge.

UNIT 3

Positivity: Traditional approaches. Happiness: objective and subjective measures of wellbeing, life satisfaction. Resilience, Self-regulation and self-control, optimism, self-esteem. Managing thoughts and Emotions with the help of Rajyoga. Achieving Powers for Self-Mastery.

UNIT 4

Achieving Consciousness through Indian Knowledge System: Emotional intelligence, Indian approach to Psychology. Consciousness; levels, body-mind relationship, self-motivation, Self and Identity in modern Psychology and Indian thought., Spirituality and well-being.

Reference and Text Books:

Mahadevan, M., Bhat, V.R. & Pavana N. (2022). Introduction to Indian Knowledge System: Concepts and Applications. PHI Learning

Baumgardner, SR & Crothers, MK (2009). Positive Psychology. Prentice Hall/Pearson Education.

Cornelissen, R.M., Misra G. & Varma S. (2014). Foundations & Applications of Indian Psychology. Pearson Education.

Rajyoga Education and Consciousness Improvement Programme for Educators, Rajyoga Education and Research Foundation.

Rajyoga Meditation Course, Thoughkart, Jaipur(Rajasthan), India.

Prakartik Swasthya Shastra, Publisher Natural Lifestyle

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

B23-BSC-203	MATHEMATICS-III [For Mechanical, (Electrical & Comp. Engg.) students only]						
Lecture	**Tutorial**	**Practical**	**Credit**	**Internal Assessment**	**End Semester Exam**	**Total**	**Duration of Exam**
3	**1**	**-**	**4**	**70**	**30**	**100**	**3 Hrs.**

Purpose: To familiarize the prospective students with Laplace Transform to solve differential equations and how to apply the principles of probability & statistics to model and analyze various phenomena in fields like finance, economics, and engineering, aiding in making informed decisions and predicting outcomes.

Course Outcomes	
CO1	Introduction about the concept of Laplace transform and how it is useful in solving definite integrals and initial value problems.
CO 2	To introduce the fundamental concepts of probability to analyze and predict outcomes in real-life situations.
CO 3	Probability theory provides models of probability distributions (theoretical models of the observable reality involving chance effects) to be tested by statistical methods which has various engineering applications.
CO4	To make the students familiar with basic statistics, including measures of central tendency, measures of dispersion, correlation, and regression.

UNIT-I (08Hrs)

Laplace Transform: Introduction, Laplace Transform of Elementary Functions, Basic properties of Laplace transform, Laplace transform of periodic functions, finding inverse Laplace transform by different methods, Convolution theorem, solving ordinary differential equations by Laplace Transform method.

UNIT-II (10Hrs)

Basic Probability: Introduction, additive law of probability, Conditional Probability, Independent Events, Bayes' Theorem. Random Variables: Discrete random variables, probability distribution, Probability mass function and distribution function, Expectation, Moments, Variance and standard deviation of discrete random variables.

UNIT-III (10 hrs)

Continuous Probability distribution: Continuous random variables, probability distribution, Probability density function and distribution function, Expectation, Moments, Variance and standard deviation of Continuous random variables. Probability distributions: Binomial, Poisson and Normal - evaluation of statistical parameters for these three distributions.

UNIT-IV (12hrs)

Basic Statistics: Measures of Central tendency: Mean, median, quartiles, mode, Geometric mean, Harmonic mean, Measures of dispersion: Range, Quartile deviation, mean deviation, standard deviation, coefficient of variation, Moments, Skewness and Kurtosis, Correlation, Coefficient of correlation, methods of calculations, Lines of regression.

Suggested Books:

1. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons,2006.
2. P. G. Hoel, S. C. Port and C. J. Stone, Introduction to Probability Theory, Universal Book Stall, 2003
3. S. Ross, A First Course in Probability, 6th Ed., Pearson Education India, 2002.
4. W. Feller, An Introduction to Probability Theory and its Applications, Vol. 1, 3rd Ed.,Wiley, 1968.
5. N.P. Bali and and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2010.
6. Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint, 2010.
7. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010.
8. Veerarajan T., Engineering Mathematics (for semester III), Tata McGraw-Hill, New Delhi, 2010.

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

B23-ECO-202	Electrical Measurement and Instrumentation						
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): To provide knowledge of Measurement of Electrical and Electronics Instruments to the students.

Course Outcomes (CO)

CO1	To understand the concept of units, errors, and measuring system fundamentals.
CO2	To understand the concept of measuring instruments
CO3	To understand the concept of low & high resistance measurements, A.C. bridges
CO4	To understand the concept of watt meters, energy meters& transducers

UNIT–I

UNITS, STANDARDS & ERRORS: S.I. units, Absolute standards (International, Primary, Secondary & Working Standards).True Value, Errors (Gross Systematic Random): Static characteristics of Instruments (Accuracy, precision, Sensitivity ,Resolution & threshold).

MEASURINGSYSTEMFUNDAMENTALS: Classification of instruments (Absolute & Secondary Instruments: indicating, recording &integrating instruments: based upon Principle of operation). Generalized instrument (Block diagram, description of blocks). Three forces in electromechanical indicating instrument (Deflecting, controlling &damping forces).

UNIT–II

MEASURING INSTRUMENTS: Construction, operating principle, Torque equation, shape of scale, use as Ammeter or as Voltmeter (Extension of Ranges). Use on AC/DC or both. Advantages & disadvantages, errors (both on AC/DC) of PMMC types, electrodynamics type, moving iron type (attraction, repulsion & combined types). Induction type, electrostatic type instruments. Introduction of Q meter, VTVM.

UNIT–III

LOW & HIGH RESISTANCE MEASUREMENTS: Wheat stone bridge; Kelvin's double bridge method, Difficulties in high resistance measurements, Measurement of high resistance by direct deflection, loss of charge method, Megaohm Bridge & meggar.

A.C. BRIDGES: General balance, Ckt. & Phasor diagram, applications, advantages/disadvantages of: Maxwell's inductance, inductance-capacitance, Hays, Anderson, Owens, De-Sauty's, and Schering & Weins Bridges. Shielding & earthling

UNIT–IV

TRANSDUCERS & THEIR APPLICATIONS: Types of Transducers, Classifications, Measurement of Displacement, pressure, force, temperature& light

WATTMETERS & ENERGY METERS: Construction, operating principle, torque equation, shape of scale, errors, Advantages & disadvantages of Electrodynamics & induction type watt meters; single phase induction type Energy meter.

REFERENCES:

A Course in Elect. & Electronics Measurement & Instrumentation by A.K. Sawhney; Khanna Pub.
Electronics & Electrical Measurement & Instrumentation by J.B. Gupta, Kataria & Sons.
Electronics Instrumentation & Measurement technique, W.D. Copper & A.dHelfrick.
Measuring Systems by E.O. Doeblin; TMH.

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

B23-ECO-204	Electrical Machines-II						
Lecture	**Tutorial**	**Practical**	**Credit**	**End Semester Exam**	**Internal Assessment**	**Total**	**Duration of Exam**
3	**-**	**-**	**3**	**70**	**30**	**100**	**3 Hrs.**
Purpose: To familiarize the students with the basics of Electrical Machines							
Course Outcomes							
CO1	Understand the concepts of rotating magnetic fields and three phase Induction machine.						
CO 2	Understand the operation of single-phase induction motors.						
CO 3	To Analyze performance characteristics of synchronous machines.						
CO 4	To study the concepts and operation of various special-purpose machines.						

UNIT-I

Induction Machines:

Basic concept of Induction machines: winding factors, generated e.m.f. and m.m.f distribution, a.c. winding, rotating magnetic field.

3-phase Induction Motor: Construction, features, production of torque, phasor diagram, equivalent circuit, performance analysis, torque–slip characteristics, running, light and blocked rotor test, load test on 3-ph I.M.

UNIT-II

Starting of 3-ph I.M. Starting methods of squirrel cage and wound rotor induction motor.

Induction Generator-Operation, applications, advantages.

Single-phase induction motors: -

Constructional features & double-revolving field theory, equivalent circuit, determination of parameters. Split phase, starting methods, types& applications.

UNIT-III

Three Phase Synchronous Generators: Principle, construction, EMF equation, armature winding, armature reaction, equivalent circuit, voltage regulation, Output power equation, power angle curve, two reactance theory, slip test, Transient and sub transient reactance, synchronization, parallel operation.

Three Phase Synchronous Motor: Construction, Principle of operation, Equivalent circuit, torque, power developed, starting, V-curve, Hunting-causes, effects & reduction, synchronous condenser applications.

Comparison between induction motor and synchronous motor.

UNIT-IV

Special Purpose Motors: Universal motor, Repulsion motor, Single-phase series motor, Single-phase Synchronous motor, Stepper Motor, Linear Induction motor, Reluctance motor, Servo motor, Hysteresis motor, Brushless DC motor, Permanent Magnet DC (PMDC) motor, Schrage motor.

Suggested Books:

1. A. E. Fitzgerald and C. Kingsley, “Electric Machinery”, McGraw Hill Education, 2013.
2. M. G. Say, “Performance and design of AC machines”, CBS Publishers, 2002.
3. P. S. Bimbhra, “Electrical Machinery”, Khanna Publishers, 2011.
4. I. J. Nagrath and D. P. Kothari, “Electric Machines”, McGraw Hill Education, 2010.
5. A. S. Langsdorf, “Alternating current machines”, McGraw Hill Education, 1984.

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

B23-ECO-206	Network Analysis and Synthesis						
Lecture	**Tutorial**	**Practical**	**Credit**	**End Semester Exam**	**Internal Assessment**	**Total**	**Duration of Exam**
4	**0**	**0**	**4**	**70**	**30**	**100**	**3 Hrs.**
Purpose	To familiarize the students with the concepts of topology, transient analysis, network modelling, filters and methods of network analysis and synthesis for solving simple and complex circuits.						
Course Outcomes							
CO1	To understand the time domain analysis of first and Second-order linear circuits.						
CO2	To understand the concept of N/W topologies and network analysis using graph theory.						
CO3	To understand various parameters of two-port networks & their relationship.						
CO4	To understand the concept of synthesis of one port network.						

UNIT-I

TIME DOMAIN ANALYSIS: Transients in First and Second-order linear circuits-RL, RC and RLC. First-order differential equation and solution, Time constant, Second-order homogeneous differential equation and solution, RL, and RC sinusoidal transient.

UNIT-II

NETWORK FUNCTIONS & GRAPH THEORY: Basic Laplace and Inverse Laplace transformation rules, Laplace of Unit step, Ramp, Impulse waveforms, Initial and Final value theorem, Step response of RL, RC and RLC using Laplace transforms, Terminal pairs or Ports, Network functions for one-port and two-port networks, the concept of poles and zeros in Network functions, Restrictions on pole and zero. Locations for driving point functions and transfer functions. Principles of network topology, graph matrices, and network analysis using graph theory.

UNIT-III

TWO PORT NETWORKS: Characteristics and Parameters of two-port networks**,** Network Configurations**,** short circuit Admittance parameters, open-circuit impedance parameters, Transmission parameters, hybrid parameters, conditions for reciprocity & symmetry of two-port networks in different parameters representations. Inter-relationships between parameters of two-port network sets, Expression of input & output impedances in terms of two port parameters, Inter-connection of two port networks.

UNIT-IV

NETWORK SYNTHESIS: Hurwitz polynomials**,** Properties of Hurwitz polynomials**,** Positive real functions, procedure of testing of PR functions, concept and procedure of network synthesis, properties of expressions of driving point immitances of LC networks. LC Network synthesis: Foster's I & II Form, Cauer's I & II form, RC & RL Network.

REFERENCES:

1. Network Theory Analysis & Synthesis: Smarajit Ghosh; PHI.
2. Network Analysis & Synthesis: F.F. Kuo; John Wiley & Sons Inc.
3. Circuit Theory, A. Chakarbarti, Dhanpat Rai
4. Introduction to modern Network Synthesis: Van Valkenburg; John Wiley.
5. Network Analysis: Van Valkenburg; PHI.
6. Networks and Systems: D.Roy Choudhury; New Age International.

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

B23-ECO- 208		Object Oriented Programming					
Lecture	**Tutorial**	**Practical**	**Credit**	**End Semester Exam**	**Internal Assessment**	**Total**	**Duration of Exam**
3	**-**	**-**	**3**	**70**	**30**	**100**	**3 Hrs.**

Purpose: To introduce the principles and paradigms of Object-Oriented Programming Language for design and implement the Object-Oriented System.

Course Outcomes

CO 1	To elaborate the basic concepts of object-oriented programming language And the representation.
CO 2	To allocate dynamic memory, access private members of class and the behaviour of inheritance and its implementation.
CO 3	To explore polymorphism, interface design and overloading of operator.
CO 4	To examine general purpose template and handling of raised exception during programming.

UNITI

Object Oriented Concepts, Introduction to Objects and Object-Oriented Programming, Encapsulation, Polymorphism, Overloading, Inheritance, Abstract Classes, Accessifier (public/ protected/ private), Class Scope and Accessing Class.

UNIT-II

Friend Function and Friend Classes, This Pointer, Dynamic Memory Allocation and Deallocation (New and Delete), Static Class Members, Constructors, parameter Constructors and Copy Constructors, Deconstructors, Introduction of inheritance, Types of Inheritance.

UNIT-III

Polymorphism, Virtual Functions, Pure Virtual Function, Abstract Base Classes, Static and Dynamic Binding. Fundamentals of Operator Overloading, Rules for Operators Overloading.

UNIT-IV

Basics of C++ Exception Handling, Try, Throw, Catch, multiple catch, Re-throwing an Exception, Exception specifications.

Fundamentals of Templates: Function Templates, Overloading Template Functions.

Suggested Books:

1. The complete reference C ++ by Herbert 30hield Tata McGraw Hill.
2. Object Oriented Programming in Turbo C++ by Robert Lafore, 1994, The WAITE Group Press.
3. Shukla, Object Oriented Programming in c++, Wiley India.
4. C++ How to Program by H M Deitel and P J Deitel, 1998, Prentice Hall.
5. Programming with C++ By D Ravichandran, 2003, T.M.H.

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

B23-HSM-302	Intellectual Property Rights (IPR) and Regulatory						
Lecture	**Tutorial**	**Practical**	**Credit**	**End Semester Exam**	**Internal Assessment**	**Total**	**Duration of Exam**
3	**-**	**-**	**3**	**70**	**30**	**100**	**3 Hrs.**
Purpose: The course is designed to provide comprehensive knowledge to the students regarding the general principles of IPR, Concepts and Theories, and international regimes relating to IPR.							
Course Outcomes							
CO1	Students will be familiarized with the introduction to the patent concept and legal implications.						
CO2	Students will be able to understand the concept of copyright in detail.						
CO3	Students will be able to understand trademarks and the laws associated with them.						
CO4	Students will be able to learn about geographical Indications, industrial design and IPR in Information Technology.						

UNIT-I

Indian patent law: The Patents Act, 1970, amendments to the patents act, patentable subject matter, patentability criteria, procedure for filing patent applications, patent granting procedure, revocation, patent infringement and remedies, relevant provisions of the biological diversity act, 2002, access and benefit sharing issues, objectives, rights, patent act 1970 and its amendments. The procedure of obtaining patents, working of patents. Infringement.

UNIT-II

Copyrights: Introduction, works protected under copyright law, infringement. Introduction to copyright, international protection of copyright and related rights- an overview Indian copyright act, 1957 with its amendments, copyright works, ownership, transfer and duration of copyright, renewal and termination of copyright Industrial.

Designs: Need for protection of industrial designs, subject matter of protection and requirements, the designs act, 2000, procedure for obtaining design protection, revocation, infringement and remedies.

UNIT-III

Trademarks: Objectives, types, rights, protection of goodwill, infringement, passing off, need for protection of trademark, kinds of trademark , Indian trademarks law, procedural requirements of protection of trademarks, content of the rights, exhaustion of rights, procedural requirements of protection of trademarks, content of the rights, exhaustion of rights, assignment under licensing, infringement, right of goodwill, passing off, domain names and effects of new technology (internet).

UNIT-IV

Geographical Indications: Objectives, Justification, International Position, Multilateral Treaties, National Level, Indian Position. Industrial Designs: Objectives, Rights, Assignments, Infringements, Information Technology Related Intellectual Property Rights, Computer Software and Intellectual Property, Database and Data Protection, Protection of Semiconductor chips, Domain Name Protection, Implications of intellectual property rights on the commercialization of Biotechnology products.

References:

1. N.S. Gopalakrishnan & T.G. Agitha, Principles of Intellectual Property (2009), Eastern Book Company, Lucknow
David I. Bainbridge, Intellectual Property, Longman, 9th Edition, 2012
2. Susan K Sell, Private Power, Public Law: The Globalization of Intellectual Property Rights, Cambridge Univ. Press, 2003
3. N.S. Gopalakrishnan & T.G. Ajitha, Principles of Intellectual Property, Eastern Book Company,2nd Edition, 2014
4. Jayashree Watal, Intellectual Property Rights in the WTO and Developing Countries, Oxford University Press, 2001
5. Lionel Bently & Brad Sherman, Intellectual Property Law, Oxford University Press, 3rd Edition, 2008
6. Duggal Pavan, Legal Framework on Electronic Commerce & Intellectual
7. Property Rights, Universal Publishing House, 2014
8. Paul Torremans, Intellectual Property and Human Rights, Kluwer Law International, 2008
9. Anderman, Interface Between Intellectual Property Rights and Competition Policy, Cambridge University Press, 2007.
10. Philippe Cullet, Intellectual Property Protection and Sustainable Development, Lexis Nexis, 2005.

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

B23-ECO-210	Electrical Measurements and Instrumentation Lab						
Lecture	**Tutorial**	**Practical**	**Credit**	**Practical Exam**	**Internal Assessment**	**Total**	**Duration of Exam**
0	**0**	**2**	**1**	**60**	**40**	**100**	**3 Hrs.**

Program Objective (PO): The main objective of the course is to impart the students with the knowledge of various types of instruments and measurement of resistance, inductance and capacitance, displacement, pressure & temperature by bridges and transducers

Course Outcomes (CO)	
CO1	To understand the different types of meters.
CO2	To measure the low and high resistance
CO3	To calculate the inductance, capacitance and frequency using bridge.
CO4	To measure the displacement, pressure & temperature by transducers.

LIST OF EXPERIMENTS

1. To convert & calibrate a D'Arsonnal type galvanometer into a voltmeter & an ammeter.
2. To calibrate an energy meter with the help of a standard wattmeter & stop watch.
3. To measure capacitance by Schering bridge.
4. To measure inductance by Maxwell's bridge.
5. To measure inductance by Hay's bridge.
6. To measure frequency by Wien's bridge.
7. To measure low resistance by Kelvin's Double bridge.
8. To measure high resistance by loss of charge method.
9. To measurer R, L, C, by Q meter.
10. To measure displacement by LVDT Transducer.
11. To measure displacement by Capacitance Transducer.
12. To measure pressure by Strain Gauge Transducer.
13. To measure temperature by RTD Transducer.

Note: At least Eight experiments should be performed from above list.

B23-ECO- 212	Electrical Machines Lab-II						
Lecture	**Tutorial**	**Practical**	**Credit**	**Practical Exam**	**Internal Assessment**	**Total**	**Duration of Exam**
-	**-**	**2**	**1**	**60**	**40**	**100**	**3 Hrs.**
Purpose: To get acquaintance with the experiments of motors.							
Course Outcomes							
CO1	To perform load test and find out various parameters of three-phase induction motor.						
CO2	To understand effects of variation in different parameters on the operation of induction machine.						
CO3	To perform various tests on synchronous machine.						
CO4	To analyze various characteristics of synchronous machine.						

LIST OF EXPERIMENTS

1. To perform load test on a 3-phase induction motor / DC generator set and to determine the efficiency of induction motor.
2. Determine mechanical losses by light running of a 3-phase induction motor.
3. Study and starting of 1-phase induction motor. To perform light running and block rotor test and to determine the parameters of the equivalent circuit.
4. To perform the open circuit test and block rotor test on 3-phase induction motor and draw the circle diagram.
5. To perform & study effect of rotor resistance on a poly phase slip ring induction motor.
6. To calculate regulation by synchronous impedance method: -
   a. Conduct open and short circuit test on a three-phase alternator.
   b. Determine and plot variation of synchronous impedance with If
   c. Determine SCR
   d. Determine regulations for 0.8 lagging power factor, 0.8 leading power factor and unity PF.
7. To plot V curves of a synchronous machine.
   a. Determination of Xo of a synchronous machine.
   b. Measurement Xd & Xq (Direct axis and Quadrature axis reactance) by slip test
8. To measure Xq of synchronous machine (negative sequence reactance).
9. To calculate regulation by ZPF method.
10. To perform and study parallel operation of synchronous generators.

Note: At least eight experiments should be performed from above list.

B23-ECO- 214	Object Oriented Programming Lab						
Lecture	**Tutorial**	**Practical**	**Credit**	**Practical Exam**	**Internal Assessment**	**Total**	**Duration of Exam**
-	**-**	**2**	**1**	**60**	**40**	**100**	**3 Hrs.**
Purpose: Introduce Object-Oriented Programming principles and paradigms to design and implement Object-Oriented Systems.							
Course Outcomes							
CO1	To introduce the basic concepts of object-oriented programming language and its representation.						
CO2	To allocate dynamic memory, access private members of class and the behaviour of inheritance and its implementation.						
CO3	To introduce polymorphism, interface design and overloading of operator.						
CO4	To explore exception handling.						

LIST OF EXPERIMENTS

1. WAP to find the sum of individual digits of a positive integer.
2. WAP to generate the first n terms of the sequence.
3. WAP to implement class with encapsulation.
4. WAP to implement access specifiers.
5. WAP to illustrate New and Delete Keywords for dynamic memory allocation
6. WAP to implement default constructor, parameterized constructor and copy constructors.
7. WAP to implement operator overloading.
8. WAP to implement inheritance.
9. WAP to implement types of inheritance.
10. WAP to implement abstract class.
11. WAP to implement virtual function.
12. WAP to implement function overriding.
13. WAP to implement exception handling.
14. WAP to implement templates.

Note: At least Eight experiments should be performed from the above list.

B23-MAC-201	Environmental Studies						
Lecture	**Tutorial**	**Practical**	**Credit**	**Internal Assessment**	**End Semester Exam**	**Total**	**Duration of Exam**
2	**--**	**--**	**1**	**30**	**70**	**100**	**3 Hrs.**
Purpose: The students will familiarize themselves with natural resources, ecosystems, factors affecting environments and human relationship with nature.							
Course Outcomes (CO)							
CO1	Students will be able to understand the importance of natural resources.						
CO2	Students will understand the concept of an ecosystem, its structure, and its functions.						
CO3	The students will be able to understand the causes and impacts of various environmental pollution.						
CO4	Students will be able to understand the relationship between the human population and the environment.						

UNIT-1

Introduction to Environmental studies: The Multidisciplinary nature of environmental studies Definition; Scope and importance, Need for public awareness.

Natural Resources: Forest resources: Use and Over-exploitation, deforestation. Timber extraction, mining, dams, and their effects, Water resources: Use and over-utilization of surface and groundwater, conflicts over water, dams benefits and problems, Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, Food resources: changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, Energy resources: renewable and non-renewable energy sources, Land resources: land degradation, soil erosion, and desertification.

UNIT-II

Ecosystems: Concept of an ecosystem, Structure and function of an ecosystem, Energy flow in the ecosystem, Ecological succession, Food chains, food webs, and ecological pyramids. Major types of ecosystem-Forest ecosystem, Grassland ecosystem, Desert ecosystem, Aquatic ecosystem.

Biodiversity and its Conservation: Introduction-Definition: genetic, species, and ecosystem diversity. Biogeographical classification of India, Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values, India as a mega-diversity nation, Hot-spots of biodiversity, Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts, Endangered and endemic species of India, Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

UNIT-III

Environmental pollution: Causes, effects, and control measures of: - Air pollution, Water pollution, Soil pollution, Marine pollution, Noise pollution, Nuclear hazards, and Solid waste Management: Causes, effects, and control measures of urban and industrial wastes, Disaster management: floods, earthquake, cyclone and landslides.

Social Issues and the Environment: Sustainable development, Water conservation, rainwater harvesting, Resettlement and rehabilitation of people; its problems and concerns. Environmental ethics: Issues and possible solutions, Climate change, global warming, acid rain, ozone layer depletion, and wasteland reclamation. Environment Protection Act, Air (Prevention and Control of Pollution) Act, Water (Prevention and Control of Pollution) Act, Wildlife Protection Act., and Forest Conservation Act.

UNIT-IV

Human population and the Environment: Population growth, Population Explosion-Family welfare Programme, Environment and human health. Human Rights, Value Education, HIV/AIDS, Women and Child Welfare, Role of Information Technology in Environment and human health, Drugs and their effects; Useful and harmful drugs; Use and abuse of drugs; Stimulant and depressant drugs. Concept of drug de-addiction. Legal position on drugs and laws related to drugs.

Field Work (Practical)-

- Visit to a local area to document environmental assets -river/forest/grassland/ hill/mountain.
- Visit to a local polluted site- Urban/Rural/Industrial/Agricultural.
- Study of common plants, insects, and birds.
- Study of simple ecosystems- pond, river, hill slopes, etc.

Suggested readings:

1. Agarwal, K.C. 2001 Environmental Biology, Nidi Publ. Ltd. Bikaner.
2. Kaushik, Anubha and Kaushik, C.P. (2004 Perspectives in Environmental Studies, New age International Publishers.
3. Bharucha Erach, The Biodiversity of India, Mapin Publishing Pvt. Ltd., Ahmedabad -380013, India, Email: mapin@icenet. net (R).
4. Brunner R.C., 1989, Hazardous Waste Incineration, McGraw Hill Inc. 480p.
5. Clerk B.S., Marine Pollution, Clanderson Pross Oxford (TB).
6. Cunningham, W.P.Cooper, T.H. Gorhani, E & Hepworth, M.T.2001, Environmental Encyclopedia, Jaico Publ. House, Mumbai, 1196p.
7. De A.K., Environmental Chemistry, Wiley Eastern Ltd.
8. Down to Earth, Centre for Science and Environment (R).

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