K.K. Wagh Institute of Engineering Education and Research, Nashik

Department of Electrical Engineering

S.Y. B.Tech
Electrical Engineering

Curriculum

W.e.f. AY: 2024-25

FY BTECH Electrical Engineering

SEM-I

Course Code	Course Type	Title of Course	Teaching Scheme			Evaluation Scheme and Marks						Credits			
			TH	TU	PR	INSEM	ENDSEM	CCE	TUT /TW	PR /OR	TOTAL	TH	TU	PR	TOTAL
2300101A	**BSC**	Linear Algebra	3	1	0	20	60	20	25	0	**125**	3	1	0	**4**
2300103A	**BSC**	Applied Physics	3	0	2	20	60	20	50	0	**150**	3	0	1	**4**
2300105A	**ESC**	Fundamentals of Electrical Engineering	3	0	2	20	60	20	50	0	**150**	3	0	1	**4**
2300110A	**ESC**	Engineering Drawing	1	0	2	20	30	0	50	0	**100**	1	0	1	**2**
2300112A	**AEC**	Communication Skills	1	0	2	0	0	25	50	0	**75**	1	0	1	**2**
2300117D	**VSEC**	Electrical Wiring System	1	0	2	0	0	25	25	0	**50**	1	0	1	**2**
2300115A	**CC**	Liberal Learning, Sports, Yoga, Art	0	2	0	0	0	0	50		**50**	0	2	0	**2**
Total			**12**	**3**	**10**	**80**	**210**	**110**	**300**	**0**	**700**	**12**	**3**	**5**	**20**

SEM-II

Course Code	Course Type	Title of Course	Teaching Scheme			Evaluation Scheme and Marks						Credits			
			TH	TU	PR	INSEM	ENDSEM	CCE	TUT /TW	PR /OR	TOTAL	TH	TU	PR	TOTAL
2300102A	**BSC**	Differential Calculus	3	1	0	20	60	20	25	0	**125**	3	1	0	**4**
2300104A	**BSC**	Applied Chemistry	3	0	2	20	60	20	50	0	**150**	3	0	1	**4**
2300107A	**ESC**	Fundamentals of Electronics Engineering	3	0	2	20	60	20	50	0	**150**	3	0	1	**4**
2300108A	**ESC**	Programming in C	1	0	2	20	30	0	50	0	**100**	1	0	1	**2**
2300118D	**PCC**	Power Generation Technologies	2	0	0	20	60	20	0	0	**100**	2	0	0	**2**
2300116A	**IKS**	Indian Knowledge System	0	2	0	0	0	0	50	0	**50**	0	2	0	**2**
2300111A	**VSEC**	Workshop Practices	1	0	2	0	0	25	25	0	**50**	1	0	1	**2**
2300136A	**CC**	Engineering Exploration	0	2	0	0	0	0	75	0	**75**	0	2	0	**2**
Total			**13**	**5**	**8**	**100**	**270**	**105**	**325**	**0**	**800**	**13**	**5**	**4**	**22**

Department-Specific Exit Courses (To award Certificate)															
Course Code	**Course Type**	**Title of Course**	**Teaching Scheme**			**Evaluation Scheme and Marks**						**Credits**			
			TH	**TU**	**PR**	**INSEM**	**ENDSEM**	**CCE**	**TUT /TW**	**PR /OR**	**TOTAL**	**TH**	**TU /TW**	**PR**	**TOTAL**
2300119A	**EXIT**	Internship*	0	0	0	0	0	0	100	0	**100**	0	2	0	**2**
2300126A	**EXIT**	Electrical Load Calculations and Design	2	0	2	20	30	0	50	0	**100**	2	1	0	**3**
2300127A	**EXIT**	Maintenance of Electrical Appliances	2	0	2	20	30	0	50	0	**100**	2	1	0	**3**
Total			**4**	**0**	**4**	**40**	**60**	**0**	**200**	**0**	**300**	**4**	**4**	**0**	**8**

*Internship in the industry for 2 weeks

SY BTECH Electrical Engineering

SEM-III

Course Code	Course Type	Title of Course	Teaching Scheme			Evaluation Scheme and Marks						Credits			
			TH	TU	PR	INSEM	ENDSEM	CCE	TUT /TW	PR /OR	TOTAL	TH	TU	PR	TOTAL
2300201E	BSC	Advanced Calculus and Transform Techniques	3	-	-	20	60	20			**100**	3	-	-	**3**
2306202	PCC	Measurement and Instrumentation	3	-	-	20	60	20			**100**	3	-	-	**3**
2306203	PCC	Transformers and Induction Machines	3	-	-	20	60	20			**100**	3	-	-	**3**
2306204	PCC	Measurement and Machines Lab	-	-	4				50	50	**100**	-	-	2	**2**
2306205	PCC	Electrical Engineering Materials Lab	-	-	2	-	-	-	25	25	**50**	-	-	1	**1**
2306206	MDM	Analog and Digital Circuits	3	-	-	20	60	20	-	-	**100**	3	-	-	**3**
2306207	MDM	Analog and Digital Circuits Lab	-	-	2	-	-	-	25	25	**50**	-	-	1	**1**
2306208	OE	Industrial and Technology Management	2	-	-	-	-	50	-	-	**50**	2	-	-	**2**
2306209	VEC	Universal Human Values	-	2	-	-	-	50	-	-	**50**	-	2	-	**2**
2306210	VSEC	Python Programming	-	1	2	-	-	-	TUT-25 TW-25	-	**50**	-	1	1	**2**
Total			**14**	**03**	**10**	**80**	**240**	**180**	**150**	**100**	**750**	**14**	**3**	**5**	**22**

EM-IV

Course Code	Course Type	Title of Course	Teaching Scheme			Evaluation Scheme and Marks						Credits			
			TH	TU	PR	INSEM	ENDSEM	CCE	TUT /TW	PR /OR	TOTAL	TH	TU	PR	TOTAL
2306211	PCC	Electrical Network Analysis	3	-	-	20	60	20			**100**	3	-	-	**3**
2306212	PCC	Electrical Network Analysis Lab	-	-	2	-	-	-	25	25	**50**	-	-	1	**1**
2306213	PCC	Power System Engineering	3	-	-	20	60	20			**100**	3	-	-	**3**
2306214	PCC	Power Electronics	3	-	-	20	60	20			**100**	3	-	-	**3**
2306215	PCC	Power Electronics & Power System Lab	-	-	4				50	50	**100**	-	-	2	**2**
2306216	MDM	Microcontroller and Embedded Systems	3	-	-	20	60	20	-	-	**100**	3	-	-	**3**
2306217	MDM	Microcontroller and Embedded Systems Lab	-	-	2	-	-	-	25	25	**50**	-	-	1	**1**
2306218	OE	Design Thinking	2	-	-	-	-	50	-	-	**50**	2	-	-	**2**
2306219	VEC	Democracy, Election & Governance	-	2	-	-	-	50	-	-	**50**	-	2	-	**2**
2306220	AEC	Technical Writing	-	1	2	-	-	-	TUT-25 TW-25	-	**50**	-	1	1	**2**
Total			**14**	**03**	**10**	**80**	**240**	**180**	**150**	**100**	**750**	**14**	**3**	**5**	**22**

Department Specific Exit Courses (To award Diploma)														
Course Code	**Course Type**	**Title of Course**	**Teaching Scheme**			**Evaluation Scheme and Marks**						**Credits**			
			TH	**TU**	**PR**	**INSEM**	**ENDSEM**	**CCE**	**TUT /TW**	**PR /OR**	**TOTAL**	**TH**	**TU /TW**	**PR**	**TOTAL**
2306221	EXIT	Internship	0	0	0	0	0	0	100	0	**100**	0	2	0	**2**
2306222	EXIT	AutoCAD for Electrical Engineers	2	0	2	20	30	0	50	0	**100**	2	1	0	**3**
2306223	EXIT	Installation and Commissioning of Electrical Systems	2	0	2	20	30	0	50	0	**100**	2	1	0	**3**
Total			**4**	**0**	**4**	**40**	**60**	**0**	**200**	**0**	**300**	**4**	**4**	**0**	**8**

TY BTECH Electrical Engineering

SEM-V

Course Code	Course Type	Title of Course	Teaching Scheme			Evaluation Scheme and Marks						Credits			
			TH	TU	PR	INSEM	ENDSEM	CCE	TUT /TW	PR /OR	TOTAL	TH	TU	PR	TOTAL
2306301	PCC	Control System Engineering	3	-	-	20	60	20	-	-	**100**	3	-	-	**3**
2306302	PCC	Control System Engineering Lab	-	-	2	-	-	-	25	25	**50**	-	-	1	**1**
2306303	PCC	Synchronous and Special Purpose Machines	3	-	-	20	60	20	-	-	**100**	3	-	-	**3**
2306304	PCC	Power System Analysis	3	-	-	20	60	20	-	-	**100**	3	-	-	**3**
2306305	PCC	Machines and Power Systems Lab	-	-	2	-	-	-	25	25	**50**	-	-	1	**1**
2306306	PEC	Program Elective Course I	3	-	-	20	60	20	-	-	**100**	3	-	-	**3**
2306307	PEC	Program Elective Course Lab I	-	-	2	-	-	-	25	25	**50**	-	-	1	**1**
2306308	OE	IPR and Patents	2	-	-	-	-	50	-	-	**50**	2	-	-	**2**
2306309	MDM	Digital Signal Processing	3	-	-	20	60	20	-	-	**100**	3	-	-	**3**
2306310	CEP	Education and Energy Awareness Program	-	1	2	-	-	-	TUT-25 TW-25	-	50	-	1	1	2
Total			**17**	**01**	**08**	**100**	**300**	**150**	**125**	**75**	**750**	**17**	**1**	**4**	**22**

EM VI

Course Code	Course Type	Title of Course	Teaching Scheme			Evaluation Scheme and Marks						Credits			
			TH	TU	PR	INSEM	ENDSEM	CCE	TUT /TW	PR /OR	TOTAL	TH	TU	PR	TOTAL
2306311	PCC	Computer-Aided Machine Design	3	-	-	20	60	20	-	-	**100**	3	-	-	**3**
2306312	PCC	Computer-Aided Machine Design Lab	-	-	2	-	-	-	25	25	**50**	-	-	1	**1**
2306313	PCC	Electrical Installation, Maintenance and Testing	3	-	-	20	60	20	-	-	**100**	3	-	-	**3**
2306314	PEC	Program Elective Course II	3	-	-	20	60	20	-	-	**100**	3	-	-	**3**
2306315	PEC	Program Elective Course Lab II	-	-	2	-	-	-	25	25	**50**	-	-	1	**1**
2306316	PEC	Program Elective Course III	3	-	-	20	60	20	-	-	**100**	3	-	-	**3**
2306317	MDM	Communication Systems	3	-	-	20	60	20	-	-	**100**	3	-	-	**3**
2306318	OE	Finance for Engineers	2	-	-	-	-	50	-	-	**50**	2	-	-	**2**
2306319	VSEC	Industry connect Lab	1	-	2	-	-	-	25	25	**50**	1	-	1	**2**
2306320	RM	Software for Research	-	-	2	-	-	-	50	-	**50**	-	-	1	**1**
Total			**18**	**00**	**08**	**100**	**300**	**150**	**125**	**75**	**750**	**18**	**0**	**4**	**22**

Department Elective Courses

Course Code	Course Type	Title of Course	Teaching Scheme			Evaluation Scheme and Marks						Credits			
			TH	TU	PR	INSEM	ENDSEM	CCE	TUT /TW	PR /OR	TOTAL	TH	TU	PR	TOTAL
Program Elective Course I (Sem-V) (Students have to choose any one of the following)															
2306306A	PEC	High Voltage Engineering	3	-	-	20	60	20	-	-	100	3	-	-	3
2306306B		Electrical Mobility													
Program Elective Course Lab I (Sem-V) (Students have to choose a lab based on selected Program Elective Course I)															
2306307A	PEC	High Voltage Engineering Lab	-	-	2	-	-	-	25	25	50	-	-	1	1
2306307B		Electrical Mobility Lab													
Program Elective Course II (Sem-VI) (Students have to choose any one of the following)															
2306314A	PEC	PLC and SCADA Automation	3	-	-	20	60	20	-	-	100	3	-	-	3
2306314B		Applications of Power Electronics in Power System													
Program Elective Course Lab II (Sem-VI) (Students have to choose a lab based on selected Program Elective Course II)															
2306315A	PEC	PLC and SCADA Automation Lab	-	-	2	-	-	-	25	25	50	-	-	1	1
2306315B		Applications of Power Electronics in Power System Lab													
Program Elective Course III (Sem-VI) (Students have to choose any one of the following)															
2306316A	PEC	Renewable Energy Systems	3	-	-	20	60	20	-	-	100	3	-	-	3
2306316B		Energy Audit and Management													

Department Specific Exit Courses (To B. Voc Degree)

Course Code	Course Type	Title of Course	Teaching Scheme			Evaluation Scheme and Marks						Credits			
			TH	TU	PR	INSEM	ENDSEM	CCE	TUT /TW	PR /OR	TOTAL	TH	TU /TW	PR	TOTAL
2306321	EXIT	Internship	0	0	0	0	0	0	100	0	100	0	2	0	2
2306322	EXIT	Electrical Control Panel Design	2	0	2	20	30	0	50	0	100	2	1	0	3
2306323	EXIT	Switchgear and Protection	2	0	2	20	30	0	50	0	100	2	1	0	3
Total			**4**	**0**	**4**	**40**	**60**	**0**	**200**	**0**	**300**	**4**	**4**	**0**	**8**

FINAL BTECH Electrical Engineering

SEM-VII

Course Code	Course Type	Title of Course	Teaching Scheme			Evaluation Scheme and Marks						Credits			
			TH	TU	PR	INSEM	ENDSEM	CCE	TUT /TW	PR /OR	TOTAL	TH	TU	PR	TOTAL
2306401	PCC*	Power System Operation and Control	3	-	-	-	100	-			**100**	3	-	-	**3**
2306402	PEC*	Program Elective Course IV	3	-	-	-	100	-	-	-	**100**	3	-	-	**3**
2306403	HSSM-EEM*	Leadership/Innovation /Entrepreneurship/Startup	2	-	-	-	-	50	-	-	**50**	2	-	-	**2**
2306404	OJT	Internship	-	-	24	-	-	-	300	200	**500**	-	-	12	**12**
Total			**8**	**00**	**24**	**-**	**200**	**50**	**300**	**200**	**750**	**8**	**-**	**12**	**20**

*** Considering an Internship of 6 months, these courses are to be offered in online mode.**

SEM VIII

Course Code	Course Type	Title of Course	Teaching Scheme			Evaluation Scheme and Marks						Credits			
			TH	TU	PR	INSEM	ENDSEM	CCE	TUT /TW	PR /OR	TOTAL	TH	TU	PR	TOTAL
2306411	PCC	Electrical Controlled Drives	3	-	-	20	60	20			**100**	3	-	-	**3**
2306412	PCC	Electrical Controlled DrivesLab	-	-	2	-	-	-	25	25	**50**	-	-	1	**1**
2306413	PCC	Switch Gear and Protection	3	-	-	20	60	20			**100**	3	-	-	**3**
2306414	PCC	Switch Gear and Protection Lab	-	-	2	-	-	-	25	25	**50**	-	-	1	**1**
2306415	PEC	Program Elective Course V	3	-	-	20	60	20	-	-	**100**	3	-	-	**3**
2306416	PEC	Program Elective Course VI	2	-	-	20	30	-	-	-	**50**	2	-	-	**2**
2306417	RM	Research Methodology	3	-	-	20	60	20	-	-	**100**	3	-	-	**3**
2306418	HSSM-EEM	Professional Ethical Practices	2	-	-	-	-	50	-	-	**50**	2	-	-	**2**
2306419	PROJ	Project	-	-	8	-	-	-	100	50	**150**	-	-	4	**4**
Total			**16**	**0**	**12**	**100**	**270**	**130**	**150**	**100**	**750**	**16**	**0**	**6**	**22**

Department Elective Courses

Course Code	Course Type	Title of Course	Teaching Scheme			Evaluation Scheme and Marks						Credits			
			TH	TU	PR	INSEM	ENDSEM	CCE	TUT /TW	PR /OR	TOTAL	TH	TU	PR	TOTAL
Program Elective Course IV (Sem-VII) (Students have to choose any one of the following)															
2306402A	PEC	Smart Grid	3	-	-	--	100	--	-	-	100	3	-	-	3
2306402B		Design Power Electronic Converter	3	-	-	--	100	--	-	-	100	3	-	-	3
Program Elective Course V (Sem-VIII) (Students have to choose any one of the following)															
2306415A	PEC	Power Quality Assessment and Mitigation	3	-	-	20	60	20	-	-	100	3	-	-	3
2306415B		Microgrid and Control													
Program Elective Course VI (Sem-VIII) (Students have to choose any one of the following)															
2306416A	PEC	AI and ML Applications in Electrical Engineering	3	-	-	20	60	20	-	-	100	3	-	-	3
2306416B		Advanced Control System													

Credit Distribution Table

Semester		I	II	III	IV	V	VI	VII	VIII	Total Credits
Basic Science Course (BSC)	**BSC/ ESC**	8	8	3	3	--	--	--	--	22+12=34
Engineering Science Courses (ESC)		6	6	--	--	--	--	--	--	
Program Core Course (PCC)	**Program Course**	--	2	9	9	11	7	3	8	49+19=68
Program Elective Courses (PEC)		--	--	--	--	4	7	3	5	
Multidisciplinary Minor (MDM)	**Multidisciplinary Courses**	--	--	4	4	3	3	--	--	14+8=22
Open Elective(OE) Courses other than a particular program		--	--	2	2	2	2	--	--	
Vocational and Skill Enhancement Course (VSEC)	**Skill Courses**	2	2	2	--	--	2	--	--	8
Ability Enhancement Course (AEC)	**Humanities, Social Science and Management**	2	--	--	2	--	--	2	2	4+2+2+2+4= 14
Indian Knowledge System (IKS)		--	2	--	--	--	--			
Value Education Courses (VEC)		--	--	2	2	--	--			
Research Methodology	**Experiential Learning Courses**	--	--	--	--	--	1	--	3	4
Common Engineering Project(CEP)/Field Project(FP)		--	--	--	--	2	--	--	--	2
Project (PROJ)		--	--	--	--	--	--	--	4	4
Internship (OJT)		--	--	--	--	--	--	12	--	12
Co-curricular courses (CC)	**Liberal Learning courses**	2	2	--	--	--	--	--	--	4
Total Credits (Major)		**20**	**22**	**22**	**22**	**22**	**22**	**20**	**22**	**172**

S. Y. B. Tech.
Pattern 2023 Semester: III (E&TC, Electrical)
Code 2300201E: Advanced Calculus and Transform Techniques

Teaching Scheme:	Credit Scheme:	Examination Scheme:
Theory :03hrs/week	**03**	**Continuous Comprehensive Evaluation: 20Marks** **InSem Exam: 20Marks** **EndSem Exam: 60Marks**

Prerequisite: - Linear Algebra, Vector algebra, Differential calculus and Integral calculus.

Course Objectives:
To familiarize students with concepts and techniques in Ordinary differential equations, Laplace transform, Fourier transform & Z-Transform and Vector Calculus. The aim is to equip them with the techniques to understand advanced-level mathematics and its applications that would enhance analytical thinking power, useful in their disciplines.

Course Outcomes: On completion of the course, students will be able to

	Course Outcomes	Bloom's Level
CO1	Define and understand basic concepts of LDE, Transforms, Fourier Series and vector calculus.	2-Understanding
CO2	Solve the problems on LDE, Transforms, Fourier Series and vector calculus using appropriate methods.	3- Apply
CO3	Apply the concept of transform techniques to continuous & discrete systems.	3- Apply
CO4	Analyze complex engineering problems by using concepts of advanced calculus and transform techniques.	4 -Analyze
CO5	Evaluate real-life problems by using concepts of advanced calculus and transform techniques.	5- Evaluate

COURSE CONTENTS

Unit I	Linear Differential Equations (LDE)and Applications	(09hrs)	COs Mapped -CO1, CO2, CO4, CO5

LDE of nth order with constant coefficients, Complementary Function, Particular Integral, General method, Short methods, Method of variation of parameters, Cauchy's and Legendre's DE

Simultaneous and Symmetric simultaneous DE. Modeling of Electrical circuits

Unit II	Vector Calculus	(09 hrs)	COs Mapped CO1, CO2, CO4, CO5

Vector Differentiation: Physical interpretation of Vector differentiation, Vector differential operator, Gradient, Divergence and Curl, Directional derivative, Solenoidal, Irrotational and Conservative fields, Scalar potential, Vector identities.
Vector Integration: Line, Surface and Volume integrals, Work-done, Green's Lemma, Gauss's Divergence theorem, Stoke's theorem. Applications to problems in the Electromagnetic field.

Unit III	Laplace Transform (LT)	(09 hrs)	COs Mapped CO1, CO2, CO3, CO4, CO5

Laplace Transform: Definition of LT, Inverse LT, Properties & theorems, LT of standard functions. Applications of LT for solving Linear differential equations.

Unit IV	Fourier Series & Fourier Transform(FT)	(09 hrs)	COs Mapped CO1, CO2, CO3, CO4, CO5

Fourier Series: Definition, Dirichlet's conditions, Full range Fourier series, Half range Fourier series, Harmonic analysis, Parseval's identity and Applications to problems in Engineering.
Fourier Transform (FT): Complex exponential form of Fourier series, Fourier integral theorem, Fourier Sine & Cosine integrals, Fourier transform, Fourier Sine and Cosine transforms and their inverses.

Unit V	Z -Transform (ZT)	(09 hrs)	COs Mapped CO1, CO2, CO3, CO4,CO5

Z -Transform (ZT): Introduction, Definition, Standard properties, ZT of standard sequences and their inverses. Solution of difference equations

Text Books

1. B.V. Ramana, "Higher Engineering Mathematics", Tata McGraw-Hill.
2. B. S. Grewal, " Higher Engineering Mathematics ", Khanna Publication, Delhi.
3. Erwin Kreyszig, "Advanced Engineering Mathematics", Wiley Eastern Ltd.

Reference Books

1. Advanced Engineering Mathematics,7e, by peter V.O. Neil(Thomson Learning)
2. P. N. Wartikar and J. N. Wartikar, "Applied Mathematics" (Volumes I and II), Pune VidyarthiGriha Prakashan, Pune.
3. Advanced Engineering Mathematics, 2e, by M. D. Greenberg (Pearson Education).
4. Advanced Engineering Mathematics with MATLAB, 2e, by Thomas L. Harman, James Dabney and Norman Richert (Brooks/Cole, Thomson Learning).

Guidelines for Continuous Comprehensive Evaluation of Theory Course

Sr. No.	Components for Continuous Comprehensive Evaluation	Marks Allotted
1	Tests on each unit using LMS (Each test for 15 M and the total will be converted out of 05 M)	05
2	Problem-solving through Computational Software	05
3	Tutorial (1 tutorial on each unit for 15 marks and the total will be converted out of 05 M)	05
4	Group presentation on real-life problem	05

Topics for Tutorial

Sr. No.	Title	CO Mapped
1	Examples on LDE of nth order with constant coefficients.	**CO1, CO2, CO4, CO5**
2	Examples on Vector Calculus.	**CO1, CO2, CO4, CO5**
3	Examples on Laplace Transforms.	**CO1, CO2, CO3, CO4, CO5**
4	Examples on Fourier series & Fourier Transforms.	**CO1, CO2, CO3, CO4, CO5**
5	Examples on Z-Transform	**CO1, CO2, CO3, CO4, CO5**

S. Y. B. Tech
Pattern 2023 Semester: III (Electrical Engineering)
2306202: Measurement and Instrumentation

Teaching Scheme	Credit Scheme	Examination Scheme:
Theory: 3hrs/week	**TH-3**	**Continuous Comprehensive Evaluation: 20Marks** **InSem Exam: 20 Marks** **EndSem Exam: 60 Marks**

Prerequisite Courses:- Fundamentals of Electrical Engineering, Fundamentals of Electronics Engineering

Course Objectives: The course objectives are to

1. Familiarize students with a variety of measurement instruments used in engineering applications, such as voltmeters, ammeters, wattmeters, multimeters, oscilloscopes, and signal analyzers.
2. Explore students to the technology behind sensors used in measurement systems, including types of sensors, their principles of operation, and applications.
3. Help students to understand the importance of measurement standards and calibration procedures in ensuring accurate and reliable measurements.

Course Outcomes: On completion of the course, students will be able to–

	Course Outcomes	Bloom's Level
CO1	Describe the working principles of various measuring instruments	1-Remember
CO2	Illustrate the construction and explain measuring instruments and transducers, including calibration.	2-Understand
CO3	Apply measurement techniques to calculate power, energy, and circuit parameters.	3-Apply
CO4	Analyze different measuring methods and transducers for electrical and physical quantity measurements	4-Analyze

COURSE CONTENTS

Unit I	Measuring Instruments and Instrument Transformer	(9hrs)	COs Mapped - CO1, CO2

Introduction, classification, static and dynamic characteristics of measuring instruments, deflecting, controlling and damping system, errors.
Measuring Instruments: Principle and construction of moving coil, moving iron, and dynamo meter-type instruments.
Instrument Transformer: Use of instrument transformers, ratios, basic constructional features of C.T. and P.T., ratio and phase angle errors, reduction of errors, and applications in measurement.

Unit II	Measurement of Power and Energy	(9hrs)	COs Mapped - CO1, CO2, CO3

Measurement of Power: Torque equation, errors and their compensation, advantages, and disadvantages of dynamometer type wattmeter, low power factor wattmeter, poly-phase wattmeter. Measurement of power by one, two & three-wattmeter methods.
Measurement of Energy: Construction, working principle, torque equation of single phase conventional (induction type) energy meter. TOD meter.

Unit III	Measurement of Resistance, Inductance, and Capacitance	(9hrs)	COs Mapped - CO2, CO4

Measurement of resistance: Wheatstone Bridge, Kelvin's Double Bridge, Ammeter-Voltmeter method, Earth Tester and Megger.
Measurement of inductance, Capacitance: Maxwell's Bridge, Anderson Bridge, Schering Bridge, Wien Bridge, Applications and Limitations.

Unit IV	Electronic Instruments	(9hrs)	COs Mapped - CO1, CO2, CO3

Signal Conditioning and Data Acquisition: Amplification, ADC and DAC, S/H Circuits, Data Acquisition: Single and Multi Chanel, Data Logging,
Electronic Instruments: Block diagram and operation of digital ammeter and voltmeter, Digital multimeters, Block diagram and operation of single phase and three phase static energy meter, Calibration of static energy meter. Digital Storage Oscilloscope

Unit V	**Instrumentation**	**(9hrs)**	**COs Mapped – CO2, CO3, CO4**

Instrumentation: Introduction, classification, types: resistive, inductive, capacitive transducers, basic requirements for transducers. Measurement of Temperature, Linear and Angular Displacement, Pressure, Flow, and Level Measurement.
Intelligent Sensors: General Structure of smart sensors and their components, Characteristics of smart sensors and applications.

Text Books

1. A. K. Sawhney, "A Course in Electrical and Electronic Measurements and Instrumentation", 17th Edition, DhanpatRai& Co.
2. B. C. Nakraand K. K. Chaudhari, "Instrumentation Measurement and Analysis", 4th Edition, McGraw Hill Education India Private Limited
3. Melville Bigham Stout, "Basic Electrical Measurements", 3rd Edition, Literary Licensing, LLC
4.D. Patranabhis, "Sensors and Transducers", 2nd Edition, PHI Publications

Reference Books

1. E. W. Golding and F. C. Widdies, "Electrical Measurements and Measuring Instruments", 5th Edition, Reem Publications.
2. Rajendra Prasad, "Electronic Measurements and Instrumentation", 2nd Edition, Khanna Publishers.
3. Arun K. Ghosh, "Introduction to Measurements and Instrumentation", 4th Edition, PHI Publication.
4. M. M. S. Anand, "Electronics Instruments and Instrumentation Technology", 3rd Edition, PHI
5. D. A. Bell, "Electronic Instrumentation and Measurements", 3rd Edition, Oxford University Press
6. S. Gupta, J. P. Gupta, "PC Interfacing for Data Acquisition and Process Control", 2nd Edition, Instrument Society of America

Guidelines for Continuous Comprehensive Evaluation of Theory Course		
Sr. No.	**Components for Continuous Comprehensive Evaluation**	**Marks Allotted**
1	Assignment 1 (Based on UnitsI and II) (Deadline: before Insem)	5
2	Assignment 2 (Based on Units III and IV) (Deadline: before Endsem)	5
3.	LMS Tests (Best 5 out of Minimum 10)	5
4.	Class test (Before Endsem)	5

S. Y. B. Tech
Pattern 2023 Semester: III (Electrical Engineering)
2306203: Transformers and Induction Machines

Teaching Scheme	Credit Scheme	Examination Scheme:
Theory: 3 hrs./week	TH: 3	Continuous Comprehensive Evaluation: 20 Marks InSem Exam: 20 Marks EndSem Exam: 60 Marks

Prerequisite Courses: Fundamentals of Electrical Engineering

Course Objectives: The objectives of the course are to

1. Provide a comprehensive understanding of the operating principles, constructions, types, and applications of transformer and induction machines.
2. Help students to learn how to analyze the performance characteristics of induction machines and transformers, using various test
3. Exposed to the methods used for starting and speed control of induction machines, including soft starters and variable frequency drives.

Course Outcomes: On completion of the course, students will be able to–

	Course Outcomes	Bloom's Level
CO1	Recall the construction and working principles of transformers and induction machines.	1-Remember
CO2	Illustrate and comprehend various characteristics of electrical machines, and demonstrate the torque-speed relations.	2-Understand
CO3	Apply modelling techniques to represent transformer and induction machines using equivalent parameters.	3-Apply
CO4	Analyze performance parameters to choose suitable machines for various applications, adhering to standards.	4-Analyze

COURSE CONTENTS

Unit I	**Single Phase Transformers:**	**10 hrs.**	**CO1, CO3, CO4**

Magnetizing current in transformers, Transformers on no-load and on–load, equivalent circuits. Tests to determine equivalent circuit parameters and phasor diagrams on no-load and on-load. Efficiency, maximum efficiency, Determination of voltage regulation.
Special Transformers: Auto Transformer, Welding Transformers, Converter Transformers, Transformer behavior on non-sinusoidal supply (K-rated transformer)

Unit II	**Three-Phase Transformers:**	**8hrs**	**CO1, CO3, CO4**

Phase conversion and parallel operation of Three Phase Transformers
Connections for three-phase operation – star/star delta/delta, star/delta, delta/star, zigzag/star, and vector groups, V/V connection, Scott connection for three-phase to two-phase conversion
Transformer Testing: Testing as per Indian Standards. Polarity Test, OC & SC test on the transformer.

Unit III	**Three-Phase Induction Motor: Part-A**	**10 hrs.**	**CO2, CO3, CO4**

Construction, the principle of working, losses and efficiency, phasor diagrams, equivalent circuit. Analysis of equivalent circuit, torque-slip and power-slip characteristics. Tests to determine the equivalent circuit parameters.

Unit IV	**Three-Phase Induction Motor: Part-B**	**8 hrs.**	**CO2, CO3, CO4**

Staring of Induction motor, speed control of IM. Induction generators. , Comparison between SCIM and SRIM, Selection of motors based on application based. (NEMA standard)

Unit V	**Single Phase Induction Motor**	**9 hrs.**	**CO2, CO3, CO4**

Construction of single phase induction motor, double field revolving theory. Equivalent circuit and torque-slip characteristics based on double-revolving field theory, Tests to determine the parameters of

equivalent circuit and calculation of performance characteristics of the motor. Methods of self-starting. Types of single-phase induction motors: Split-phase motors (Resistor split-phase motor, Capacitor-start motor, Capacitor start and capacitor run the motor, and permanent capacitor motor). Comparison of 1-phase induction motor with 3-phase induction motor.

Text Books

1. Dr. P.S. Bimbhra, "Electrical Machinery" Khanna Publications.
2. Dr. P.S. Bimbhra, "Generalized theory of Electrical Machinery" Khanna Publications.
3. Nagrath and Kothari, "Electrical Machines"2nd Ed. Tata McGraw Hill.
4. Chenn K Krishna Reddy, "Electrical Machines- I and II" SciTech Publications (India) Pvt. Ltd. Chenn.
5. Edward Hughes, "Electrical Technology" ELBS, Pearson Education.
6. Smarajit Ghosh, "Electrical Machines" Pearson Education, New Delhi.

Reference Books

1. M.G. Say, "Performance and Design of AC. Machines", CBS Publishers and Distributors.
2. Charles I Hubert, "Electrical Machines Theory, Application, and Control", Pearson Education, New Delhi, Second Edition.
3. A.E. Fitzgerald, Charles Kingsley, Stephen D. Umans, "Electrical Machines", Tata McGraw

Guidelines for Continuous Comprehensive Evaluation of Theory Course		
Sr. No.	**Components for Continuous Comprehensive Evaluation**	**Marks Allotted**
1	Assignment 1 (Based on Units I and II) (Deadline: before Insem)	5
2	Assignment 2 (Based on Units III and IV) (Deadline: before Endsem)	5
3.	LMS Tests (Best 5 out of Minimum 10)	5
4.	Class test (Before Endsem)	5

S. Y. B. Tech Pattern 2023 Semester: III (Electrical Engineering) 2306204: Measurement and Machines Lab		
Teaching Scheme	**Credit Scheme**	**Examination Scheme:**
Practical: 4hrs/week	**PR: 2**	**Termwork: 50Marks** **Practical: 50Mark**

Prerequisite Courses, if any: -Fundamentals of Electrical Engineering, Fundamentals of Electronics Engineering, Applied Physics

Course Objectives: The objectives of the course are to

1. Develop a deeper understanding of concepts in electrical measuring instruments and instrumentation.
2. Provide exposure to experimental skills in electrical and physical parameter measurement.
3. Provide exposure to experimental skills in operation and using transformer and induction motor.

Course Outcomes: On completion of the course, students will be able to–

	Course Outcomes	Bloom's Level
CO1	Elaborate construction, working, ideal characteristics of machines and measuring instruments	2-Understand
CO2	Apply measuring instruments, transducers, and various techniques to measure electrical and physical quantities	3-Apply
CO3	Conduct experiments individually or in groups, prepare detailed lab reports, and deliver effective presentations.	3-Apply
CO4	Analyze the performance parameters of transformers and induction motors through experimentation.	4-Analyse

Part A: Measurement Lab

Perform any eight experiments from 1 to 13. An industrial visit is compulsory.

List of Laboratory Experiments		
Sr. No.	**Laboratory Experiments**	**CO Mapped**
1	Measure current, voltage, and power using an instrument transformer (CT & PT).	CO1, CO2, CO3
2	Measure the Power and Power Factor of a three-phase circuit by the two-wattmeter method.	CO1, CO2, CO3
3	Measure reactive power by the one-wattmeter method with all possible connections of the current coil and pressure coil.	CO1, CO2, CO3
4	Calibrate a single / three-phase Energy Meter by comparing it with a Substandard meter.	CO1, CO2, CO3
5	Measure unknown inductance using Anderson Bridge.	CO1, CO2, CO3
6	Measure unknown capacitance using the Schering Bridge.	CO1, CO2, CO3
7	Measure the low resistance by using the Kelvin Double Bridge Method.	CO1, CO2, CO3
8	Study and plot the characteristics of LVDT.	CO1, CO2, CO3
9	Measure voltage, current, time period, frequency, and phase angle using CRO.	CO1, CO2, CO3
10	Measurement of soil resistivity using four pin Wenner method.	CO1, CO2, CO3
11	Study of programmable LCR meter; Measure L, C, R, Q, dissipation factor, and power factor of the given component.	CO1, CO2, CO3
12	Study of Digital Storage Oscilloscope: a) Different modes in DSO such as Roll, Average, and Peak detection. b) Capture transients.	CO1, CO2, CO3

	c) Various MATH operations.	
13	Study of online Energy Monitoring System, various parameters, EMS software capabilities, trending with IOT applications. Demonstration of EMS system by inviting experts.	CO1, CO2, CO3
14	Industrial Visit Report (Compulsory).	CO1, CO2, CO3

Part B: Machine Lab

Perform any eight experiments from 1 to 10. An industrial visit is compulsory.

List of Laboratory Experiments		
Sr. No.	**Laboratory Experiments**	**COs Mapped**
1	Perform O.C. and S.C. tests on single-phase Transformer. a. Determination of equivalent circuit parameters from the test data. b. Determination of voltage regulation and efficiency.	CO1, CO3, CO4
2	Perform Parallel operation of two single-phase transformers and study their load sharing under various conditions of voltage ratios and leakage impedance.	CO1, CO3, CO4
3	Find the Polarity of the single-phase / three-phase transformer.	CO1, CO3, CO4
4	Study of Back-to-Back Test (Sumpner Test) on single phase transformer.	CO1, CO3, CO4
5	Determine the phase conversion - Scott connection for three-phase to two-phase conversion.	CO1, CO3, CO4
6	Perform load test on a 3-phase induction motor.	CO1, CO3, CO4
7	Determine parameters of equivalent circuit and performance analyses of IM.	CO1, CO3, CO4
8	Study of Speed control of 3-phase IM by pole changing (SCIM).	CO1, CO3, CO4
9	Study of Speed control of 3-phase IM by rotor resistance(SRIM).	CO1, CO3, CO4
10	Determination of equivalent circuit parameters of single-phase IM.	CO1, CO3, CO4
11	Industrial Visit Report (Compulsory).	CO1, CO3, CO4

Guidelines for Laboratory Conduction

1. The teacher will brief the given experiment to students for its procedure, observations, calculations, and outcome.
2. Apparatus and equipment required for the allotted experiment will be provided by the lab technician using SOP.
3. Students will perform the allotted experiment in a group (2-3 students in each group) under the supervision of faculty and lab technician.
4. After performing the experiment students will check their readings and calculations from the teacher.
5. After checking they have to write the conclusion on the final results.
6. Minimum 4 sets of the experiment should be made ready for the conduction of a batch for hardware experiments

Guidelines for Student's Lab Journal

The write-up should include a title, aim and apparatus, circuit or block diagram, waveforms, brief theory, procedure, observations, graphs, calculations, conclusion, and questions, if any.

Guidelines for Termwork Assessment

Each experiment from the lab journal is assessed for thirty marks based on three rubrics.
Rubric R-1 for timely completion, R-2 for understanding, and R-3 for presentation/journal writing where each rubric carries ten marks.

S. Y. B. Tech Pattern 2023 Semester: III (Electrical Engineering) 2306205: Electrical Engineering Materials Lab		
Teaching Scheme:	**Credit Scheme:**	**Examination Scheme:**
Practical: 2 hrs/week	**PR-1**	**Termwork: 25Marks** **Oral: 25Marks**

Prerequisite Courses: Fundamentals of Electrical Engineering, Applied Physics, Applied Chemistry.

Course Objectives: The objectives of the course are to

1. Impart knowledge of the physical properties of Electrical Engineering Materials
2. Introduce the materials used in various electrical components

Course Outcomes: On completion of the course, students will be able to

	Course Outcomes	Bloom's Level
CO1	Apply IS standard procedures to perform testing of various electrical engineering materials.	3-Apply
CO2	Analyze and interpret the results obtained from material testing experiments.	4-Analyze
CO3	Collaborate in group experiments, prepare detailed lab reports, and deliver effective presentations	4- Apply

List of Laboratory Experiments
(All experiments are compulsory)

Sr. No.	Laboratory Experiments	COs Mapped
1.	To measure the dielectric strength of solid insulating materials.	CO1, CO2, CO3
2.	To measure the dielectric strength of liquid-insulating materials	CO1, CO2, CO3
3.	To measure the dielectric strength of gaseous insulating materials using Sphere Gap-Unit.	CO1, CO2, CO3
4.	To obtain the Hysteresis Loop of the Ferro-Magnetic Material.	CO1, CO2, CO3
5.	To understand the principle of thermocouples and to obtain characteristics of different thermocouples.	CO1, CO2, CO3
6.	To measure the Insulation Resistance and kVAr capacity of the power capacitor.	CO1, CO2, CO3
7.	To measure the Resistivity of High Resistive Alloys.	CO1, CO2, CO3
8.	Testing of resins and polymers.	CO1, CO2, CO3
9.	Industrial Visit (Compulsory)	CO1, CO2, CO3

Guidelines for Laboratory Conduction

1. The teacher will brief the given experiment to students for its procedure, observations, calculations, and outcome.
2. Apparatus and equipment required for the allotted experiment will be provided by the lab technician using SOP.
3. Students will perform the allotted experiment in a group (2-3 students in each group) under the supervision of faculty and lab technician.
4. After performing the experiment students will check their readings and calculations from the teacher.
5. After checking they have to write the conclusion on the final results.
6. Minimum 4 sets of the experiment should be made ready for the conduction of a batch for hardware experiments

Guidelines for Student's Lab Journal
The write-up should include a title, aim and apparatus, circuit or block diagram, waveforms, brief theory, procedure, observations, graphs, calculations, conclusion, and questions, if any.
Guidelines for Termwork Assessment
Each experiment from the lab journal is assessed for thirty marks based on three rubrics. Rubric R-1 for timely completion, R-2 for understanding, and R-3 for presentation/journal writing where each rubric carries ten marks.

S. Y. B. Tech
Pattern 2023 Semester: III (Electrical Engineering)
2306206: Analog and Digital Circuits

Teaching Scheme	Credit Scheme	Examination Scheme:
Theory:3hrs/week	Th-3	Continuous Comprehensive Evaluation: 20Marks InSem Exam: 20Marks EndSem Exam: 60Marks

Prerequisite Courses: Fundamentals of Electronics Engineering

Course Objectives: The objectives of the course are to
1. Provide a solid understanding of the basic principles and concepts of analog and digital electronics.
2. Help students to analyze and design digital circuits, including logic gates, flip-flops, and counters, using Boolean algebra and state machine techniques.
3. Empower students to understand the operation and characteristics of integrated circuits, including analog and digital ICs, and their role in electronic systems.
4. Informed students about the latest developments and trends in analog and digital electronics, and understand their implications for future electronic systems.

Course Outcomes: On completion of the course, students will be able to–

	Course Outcomes	Bloom's Level
CO1	Understand different digital memories and programmable logic families	2-Understand
CO2	Describe linear and nonlinear applications of OPAMP with derivations and related graphs	3-Apply
CO3	Design different combinational and sequential digital circuits using K-map.	6-Create
CO4	Design analog circuits based on OPAMP for a given problem statement.	6-Create

COURSE CONTENTS			COs mapped
Unit I	**Applications of OPAMP Part A**	**9 hrs.**	**CO2,CO4**
Ideal and Practical characteristics of OPAMP, Inverting and non-inverting amplifier, differential amplifier, integrator, differentiator, Zero crossing detector, Comparator, and Schmitt trigger.			
Unit II	**Applications of OPAMP Part B**	**9 hrs.**	**CO2,CO4**
V-I and I-V converters, Design of First Order Filters, Peak Detector, Instrumentation Amplifier, Oscillators (Wein bridge and Phase shift), Square, Triangular, and Saw Tooth Waveform Generator			
Unit III	**D/A and A/D converters**	**9 hrs.**	**CO2,CO4**
Digital to Analog converters: Weighted resistor/converter, R-2R Ladder D/A converter, examples of D/A converter, sample and hold circuit **Analog to Digital converter**: Dual slope A/D Conversion, Successive Approximation A/D Conversion, V to F, and F to V converter. Study of Integrated circuits for A/D and D/A converter			
Unit IV	**Design of combinational logic circuit**	**9 hrs.**	**CO3**
The standard representation of logic functions, Karnaugh map: structure for two, three, and four, SOP and POS form reduction of Boolean expressions by K-map. Design of combinational circuits using Boolean expressions and K-maps, encoders, decoders, and a digital comparator.			
Unit V	**Design of sequential circuit**	**9 hrs.**	**CO1,CO3**
Shift registers, Introduction to sequential circuit Design of asynchronous counters Up and down synchronous counters using K-map, N modulo counters, Digital memories: RAM, ROM, EPROM; digital logic families: PAL, PLA, FPGA			

Text Books
1. Jaico and Charles H. Roth, "Fundamentals of Logic Design," Jr. Fourth Edition, Jaico Publishing House. 2. James, "Operational Amplifier and Linear Integrated Circuits Theory and Application," Jaico Publishing House.
Reference Books
1. Thomas Floyd and R.P. Jain, "Digital Fundamentals", 8th edition, Pearson Education. 2. P. Jain, "Modern Digital Electronics", 5th edition, Tata McGraw Hill, New Delhi. 3. Gaikwad R., "Operational Amplifier", 4th Edition, PHI New Delhi.

Guidelines for Continuous Comprehensive Evaluation of Theory Course		
Sr. No.	**Components for Continuous Comprehensive Evaluation**	**Marks Allotted**
1	Assignment 1 (Based on Units I and II) (Deadline: before Insem)	5
2	Assignment 2 (Based on Units III and IV) (Deadline: before Endsem)	5
3.	LMS Tests (Best 5 out of Minimum 10)	5
4.	Mini project	5

S. Y. B. Tech Pattern 2023 Semester: III (Electrical Engineering) 2306207: Analog and Digital Circuits Lab		
Teaching Scheme	**Credit Scheme**	**Examination Scheme**
Practical: 2 hrs/week	**PR-1**	**Termwork: 25Marks** **Practical: 25Mark**
Prerequisite Courses: Fundamental of Electronics Engineering Lab		
Course Objectives: The objectives of the course are to 1. Empower students to apply concepts learned in lectures to design, build, and test analog and digital electronic circuits in a laboratory setting. 2. Empower students to design and implement various analog and digital circuits, such as amplifiers, filters, logic gates, and counters, to meet specified requirements. 3. Guide students to use simulation software to simulate and validate circuit designs before implementation, enhancing understanding.		
Course Outcomes: On completion of the course, students will be able to–		

	Course Outcomes	**Bloom's Level**
CO1	Analyze applications of OPAMP in a closed and open loop configuration.	4-Analyze
CO2	Collaborate in group experiments, prepare comprehensive lab reports, and deliver effective presentations.	3-Apply
CO3	Design and implement combinational and sequential circuits.	5-Create
CO4	Design uncontrolled rectifiers with given specifications	5-Create

List of Laboratory Experiments		
Sr. No.	**Laboratory Experiments** (Perform any three from 1 to 5, perform any three from 8 to 11, 6 and 7 are compulsory)	**COs Mapped**
1.	Find the phase angle difference between the same frequency signal using ZCD and AND gate. (Hardware)	CO1, CO2
2.	Design of comparator for given reference voltage. (Hardware)	CO1, CO2
3.	Design sine, and triangular wave generator. (Hardware)	CO1, CO2
4.	Design first-order high pass and low pass filters using OPAMP in any open-source software for given specifications. (Software)	CO1, CO2
5.	Measure CMRR of 3 OPAMP Instrumentation amplifiers. (Hardware)	CO1, CO2
6.	Design of single phase bridge rectifier with output voltage and specified ripple. (this lab should be designed for each student to perform in simulation and demonstrate with hardware in the laboratory with design documents) (Software and Hardware)	CO2, CO4
7.	Implementation of A/D and D/A Converters	CO1, CO2
8.	Design of logical circuit for the display of decimal numbers on a seven-segment display. (Hardware)	CO2, CO3
9.	Design a three-bit full adder using any open-source software. (Software)	CO2, CO3
10.	Design a logical circuit to convert code from one numbering system to another (Software/Hardware)	CO2, CO3
11.	Design a digital clock or stopwatch using a decade counter.(IC74192) (Hardware)	CO2, CO3

Guidelines for Laboratory Conduction
1. The teacher will brief the given experiment to students for its procedure, observations, calculations, and outcome. 2. Apparatus and equipment required for the allotted experiment will be provided by the lab technician using SOP. 3. Students will perform the allotted experiment in a group (2-3 students in each group) under the supervision of faculty and lab technician. 4. After performing the experiment students will check their readings and calculations from the teacher. 5. After checking they have to write the conclusion on the final results. 6. Minimum 4 sets of the experiment should be made ready for the conduction of a batch for hardware experiments
Guidelines for Student's Lab Journal
The write-up should include a title, aim and apparatus, circuit or block diagram, waveforms, brief theory, procedure, observations, graphs, calculations, conclusion, and questions, if any.
Guidelines for TermWork Assessment
Each experiment from the lab journal is assessed for thirty marks based on three rubrics. Rubric R-1 for timely completion, R-2 for understanding, and R-3 for presentation/journal writing where each rubric carries ten marks.

S. Y. B. Tech.
Pattern 2023 Semester: III (Electrical Engineering)
2306208: Industrial and Technology Management

Teaching Scheme:	Credits:	Examination Scheme:
TH: 2 hrs/week	TH:2	Continuous Comprehensive Evaluation: 50Marks

Prerequisite Courses: NA

Course Objectives: The objectives of the course are to

1. Introduce the fundamentals of industrial economics and types of business organization
2. Present the importance of Motivation, Group dynamics, Teamwork, leadership skills and entrepreneurship.
3. Explain the fundamentals of Human Resource Management.
4. Explain the importance of Intellectual property rights and understand the concept of patents, copy rights and trademarks.

Course Outcomes: On completion of the course, students will be able to–

	Course Outcomes	Bloom's Level
CO1	Understand different types of business organizations and discuss the fundamentals of economics.	1-Remember
CO2	Explain the importance of technology management and quality management	2-Understand
CO3	Discuss the qualities of a good leader and the road map to entrepreneurship	2-Understand 3-Apply
CO4	Explain the importance of IPR and the role of Human Resource Management.	3-Apply
CO5	Describe the characteristics of marketing and its types and overview of financial Management.	3- Apply

COURSE CONTENTS

Unit I	**Industrial Economics and Business Organization**	**(06hrs)**	**CO1**

A) Industrial Economics: Definition of economics, Demand and Supply concept, Demand Analysis. Types of Demand, Determinants of Demand, Law of demand and supply, Elasticity of demand and supply, Law of Diminishing Marginal utility, Demand forecasting: Meaning and methods.
B) Business Organizations: Line organization, Staff organization and Functional Organization, (Project, Matrix, Committee Organization.)
C) Business Ownership and its Types: Types of business ownership, Sole proprietorship, Partnership (Act 1934), LLP (Limited Liability Partnership) (Act 2008). The one-person company, Joint Stock Company: Public Limited and Private Limited, Public Sector Undertaking (PSU).

Unit II	**Technology Management**	**(05 hrs)**	**CO2**

A) Technology Management: Definition of technology Management and its relation with society, development, application and scope.
B) Classification of Technology Management: Classification of technology management at various levels- its importance on the National Economy, Ethics in technology management, Critical factors in Technology management.

Unit III	**Motivational Theory and Entrepreneurship**	**(06hrs)**	**CO3**

A) Motivation: Introduction to Motivation, theories of work motivation, Content Theories: Maslow's Hierarchy of Needs, Herzberg's Two-factor theory, McClelland's Three Needs Theory, McGregor's Theory X and Theory Y.
B) Leadership: Importance of Leadership, Types of Leadership: Autocratic, Democratic and Laissez Faire Leadership, qualities of a good Leader. Group dynamics: Types and interactions of groups, stages of group dynamics: Norming, Storming, Forming, Performing and Adjourning.
C) Entrepreneurship: Importance and limitations of rational decision making, Decision-making under certainty, uncertainty and risk. Incentives for small business development

Unit IV	Intellectual Property Rights (IPR) & Human Resource Management (HRM)	(06hrs)	CO4

A) Introduction to Intellectual Property Rights (IPR): Meaning of IPR, Different forms of IPR, Patents, Criteria for securing Patents. Patent format and structure, Copy rights and trademark (Descriptive treatment only).
B) Human Resource Management: Introduction, importance, scope, HR planning, Recruitment, selection, training and development, Performance management.

Unit V	Marketing and Financial Management	(07hrs)	CO5

A) Marketing Management: Meaning of Market, Marketing strategy, motives, market characteristics and its types, Perfect Competition, Monopoly, Monopolistic completion and Oligopoly. New product development, Product life cycle, Marketing and selling, methods of selling, and marketing planning. Market survey and market research, Online Marketing (Digital Marketing).
B) Financial Management: Definition of financial management, cost Concept, Types of costs (Fixed, Variable, average, marginal, and total cost) and methods of costing price, and capital. Debit, credit, Profit and loss statement, Balance sheet, Depreciation Analysis, cause and significance, methods of calculation of depreciation, Taxation system, and type of taxes.

Text Books

1. O. P. Khanna, industrial engineering and management, Dhanpat Rai and sons, New Delhi.
2. Management Accounting and financial management by M. Y.Khan and P.K. Jain, Tata Mcgraw Hill-Tata-ISBN.

Reference Books

1. C. B. Mamoria and V. S. P. Rao- Personnel Management, Himalaya Publishing House, 30th Edition 2014
2.Harold Koonlz and OD'onnel–Management. Tata McGraw Hill Publication1980

Guidelines for Continuous Comprehensive Evaluation of Theory Course		
Sr. No.	**Components for Continuous Comprehensive Evaluation**	**Marks Allotted**
1	Assignment 1 (Based on Units I and II)(Deadline: before Insem)	5
2	Assignment 2 (Based on Units III and IV)(Deadline: before Endsem)	5
3	LearniCo (Best5sessionsoutofMinimum10sessions)	5
4	Class Test (Before Endsem on Units III, IV, V)	5

S. Y. B. Tech.
Pattern 2023 Semester: III (Electrical Engineering)
2306209: Universal Human Values

Teaching Scheme:	Credit Scheme:	Examination Scheme:
Tutorial : 02hrs/week	02	Continuous Comprehensive Evaluation: 50 Marks Total: 50 Marks

Prerequisite Courses, if any: -NA

Course Objectives: The objectives of the course are

- To help the students appreciate the essential complementarity between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity which are the core aspirations of all human beings.
- To facilitate the development of a Holistic perspective among students towards life and profession as well as towards happiness and prosperity based on a correct understanding of Human reality and the rest of existence. Such a holistic perspective forms the basis of Universal Human values and movement towards value-based living in a natural way.
- To highlight plausible implications of such a Holistic understanding in terms of ethical human conduct, trustful and mutually fulfilling human behavior and mutually enriching interaction with Nature.

Thus, this course is intended to provide a much-needed orientation input in value education to the young enquiring minds.

Course Outcomes: On completion of the course, students will be able to–

	Course Outcomes	Bloom's Level
CO1	**Evaluate** the significance of value inputs in formal education and start applying them in their life and profession	5
CO2	**Distinguish** between values and skills, happiness and accumulation of physical facilities, the Self and the Body, Intention and Competence of an individual.	4
CO3	**Analyze** the value of harmonious relationships based on trust and respect in their life and profession	4
CO4	**Examine** the role of a human being in ensuring harmony in society and nature.	4
CO5	**Apply** the understanding of ethical conduct to formulate the strategy for ethical life and profession.	3

COURSE CONTENTS

Unit I	**Introduction-Basic Human Aspiration, its fulfillment through All-encompassing Resolution**	**(06 hrs)**	**COs Mapped - 1**

The basic human aspirations and their fulfillment through Right understanding and Resolution, Right understanding and Resolution as the activities of the Self, Self-being central to Human Existence; All-encompassing Resolution for a Human Being, its details and solution of problems in the light of Resolution

Unit II	**Right Understanding (Knowing)- Knower, Known & the Process**	**(06 hrs)**	**COs Mapped –2**

The domain of right understanding starting from understanding the human being (the knower, the experiencer and the doer) and extending up to understanding nature/ existence–its interconnectedness and co-existence; and finally understanding the role of human beings in existence (human conduct).

Unit III	**Understanding Human Being**	**(06 hrs)**	**COs Mapped – 3**

Understanding the human being comprehensively as the first step and the core theme of this course;

the human being as a co-existence of the self and the body; the activities and potentialities of the self; the Basis for harmony/contradiction in the self			
Unit IV	**Understanding Nature and Existence**	**(06 hrs)**	**COs Mapped – 4**
A comprehensive understanding (knowledge) about the existence, Nature being included; the need and process of inner evolution (through self-exploration, self-awareness and self-evaluation), particularly awakening to activities of the Self: Realization, Understanding and Contemplation in the Self (Realization of Co-Existence, Understanding of Harmony in Nature and Contemplation of Participation of Human in this harmony/ order leading to comprehensive knowledge about the existence).			
Unit V	**Understanding Human Conduct, All-encompassing Resolution & Holistic Way of Living**	**(06 hrs)**	**COs Mapped – 5**
Understanding Human Conduct, different aspects of All-encompassing Resolution (understanding, wisdom, science, etc.), Holistic way of living for Human Beings with All-encompassing Resolution covering all four dimensions of human endeavor viz., realization, thought, behavior and work (participation in the larger order) leading to harmony at all levels from Self to Nature and entire Existence			

Text Books

1. R R Gaur, R Asthana, G P Bagaria, 2019 (2nd Revised Edition), A Foundation Course in Human Values and Professional Ethics.ISBN978-93-87034-47-1, Excel Books, NewDelhi.

Reference Books

1. IvanIllich,1974, Energy & Equity, The Trinity Press, Worcester, and Harper Collins, USA
2. E.F.Schumacher,1973, Small is Beautiful: a study of economics as if people mattered, Blond & Briggs, Britain.
3. SussanGeorge,1976, How the Other Half Dies, Penguin Press. Reprinted 1986,1991
4. Donella H. Meadows, Dennis L. Meadows, Jorgen Randers, William W.BehrensIII,1972, Limits to Growth –Club of Rome's report, Universe Books.
5. ANagraj,1998,JeevanVidyaEkParichay,DivyaPathSansthan,Amarkantak.
6. PLDhar, RRGaur,1990, Science and Humanism, Commonwealth Publishers.
7. ANTripathy,2003, Human Values, New Age International Publishers.
8. SubhasPalekar, 2000, How to practice Natural Farming, Pracheen (Vaidik) Krishi Tantra Shodh, Amravati.
9. E G Seebauer& Robert L. Berry, 2000, Fundamentals of Ethics for Scientists &Engineers, Oxford University Press

Mode of Evaluation

Based on the participation of the student in classroom discussions/Self-assessment/ Peer assessment/Assignments/Seminar/ContinuousAssessmentTest/SemesterEndExam SociallyrelevantProject/GroupActivities/Assignmentsmaybegivenimportanceinthiscourse

Guidelines for Continuous Assessment of Theory Course		
Sr. No.	**Components for Continuous Comprehensive Evaluation**	**Marks Allotted**
1	Assignment on Units I, II	**30**
2	Group presentations on Unit III	**10**
3	LMS Tests on each unit	**10**
	Total	**50**

S. Y. B. Tech. Pattern 2023 Semester: III (Electrical Engineering) 2306210: Python Programming		
Teaching Scheme:	**Credit Scheme:**	**Examination Scheme:**
Tutorial: 1hr/week **Practical: 2 hrs/week**	**TUT-1** **TW-1**	**Tutorial: 25M** **Term work: 25 Marks**
Prerequisite Courses: Differential Equation and Calculus, Linear algebra		
Course Objectives: The objectives of the course are to 1) Develop analytical skills using numerical methods. 2) Develop critical thinking to solve a complex engineering problem 3) Inculcate programming skills using Python language.		
Course Outcomes: On completion of the course, students will be able to–		

	Course Outcomes	Bloom's Level
CO1	Choose the correct numerical method depending on the problem definition.	2-Understand
CO2	Solve the given complex problem using selected numerical methods.	3-Analyze
CO3	Develop an algorithm and flow chart for numerical methods.	4. Apply
CO4	Write programs for numerical methods using Python with graphical representation.	5. Create

COURSE CONTENTS			COs mapped
Unit I	**Python Basics and Numerical Methods**	**7 hrs.**	**CO4**
Variable, Data Types, Operators, Conditional Statements Loops, Functions, Libraries. Birge-Vieta method, Bisection/Regula falsi /Newton-Raphson method, curve fitting using a least square approximation, Newton's forward/backward interpolation method, Newton's divided difference/Lagrange's interpolation method			
Unit II	**Numerical Methods**	**8 hrs.**	**CO1,CO2,CO3**
trapezoidal/ Simpson (1/3)rd rule for integration, Gauss elimination/Jordan method, Gauss Jacobi/Seidel for the solution of simultaneous equations, Modified Euler's/4th order RK method for the solution of ordinary differential equations.			

Guidelines for Tutorial (Any 8 Tutorial)		
Sr. No.	**Components for CCE**	**CO Mapped**
1	Numerical on the solution on a polynomial equation using the Birge Vieta method	CO1, CO2
2	Numerical on solution on a transcendental equation using Regula Falsi/Newton Raphson method	CO1, CO2
3	Numerical on solution on interpolation using appropriate techniques for equal-spaced data.	CO1, CO2
4	Numerical on solution on interpolation using appropriate techniques for unequal-spaced data.	CO1, CO2
5	Numerical on Numerical integration using the trapezoidal rule	CO1, CO2
6	Numerical on Numerical integration using Simpson's (1/3)rd or (3/8)th rule	CO1, CO2
7	Numerical on solution of the simultaneous equation using Gauss Jordon	CO1, CO2

	method	
8	Numerical on solution of the simultaneous equation using the Gauss-Seidel method	CO1, CO2
9	Numerical on solution of ODE using modified Euler's method	CO1, CO2
10	Numerical on solution of ODE using 4th order RK method.	CO1, CO2
List of Laboratory Experiments		
Sr. No.	**Laboratory Experiments**	**COs Mapped**
1	Develop an algorithm, draw a flow chart, and write a program to implement the following: (a) for loop and while loop-- application in Descarte's rule of the sign. (b) if-else and functions-- application in Intermediate value theorem. (c) 2DArray formation-- application in matrix data entry, transposition, and printing matrix.	CO1, CO2, CO3, CO4
2	Develop an algorithm, draw a flow chart, and write a program to implement the Birge-Vieta method.	CO1, CO2, CO3, CO4
3	Develop an algorithm, draw a flow chart, and write a program to implement the Bisection/Regulafalsi /Newton-Raphson method (single variable) in the following applications (formulate problem statement in any one of the following areas (but not limited to)) (a) Finding critical clearing angle in power system stability (give equation directly) (b) Relation between voltage and current in solar PV.	CO1, CO2, CO3, CO4
4	Develop an algorithm, draw a flow chart, and write a program to implement curve fitting using a least square approximation in the following applications (formulate problem statement in any one of the following areas (but not limited to)) (a) Voltage across capacitor during charging. (b) Relate temperature and resistance in the thermocouple. (c) Current through inductor during excitation.	CO1, CO2, CO3, CO4
5	Develop an algorithm, draw a flow chart, and write a program to apply Newton's forward/backward interpolation method in the following applications (formulate problem statement in any one of the following areas (but not limited to)) (a) Voltage across capacitor during charging (b) Relation of speed and armature voltage in DC motor. (c) Relation of breakdown voltage and thickness of insulation	CO1, CO2, CO3, CO4
6	Develop an algorithm, draw a flow chart, and write a program to apply Newton's divided difference/Lagrange's interpolation method in the following applications (formulate problem statement in any one of the following areas (but not limited to)) (a) Power transfer equation to find power at a particular angle (b) Transformer efficiency at particular loading (data of % loading and efficiency is known at a particular power factor) (c) Growth of electricity consumption in India (year Vs vs. per capita electrical consumption).	CO1, CO2, CO3, CO4
7	Develop an algorithm, draw a flow chart, and write a program to implement the trapezoidal/ Simpson (1/3)rd rule in the following applications (formulate problem statement in any one of the following areas (but not limited to))	CO1, CO2, CO3, CO4

	(a) RMS/Average value of given waveform. (b) Finding current through first-order circuit (RL series) (c) kWh consumption from the load curve (d) Magnetic field intensity in overhead transmission line	
8	Develop an algorithm, draw a flow chart, and write a program to implement Gauss elimination/Jordan in the following applications (formulate problem statement in any one of the following areas (but not limited to)) (a) Electrical network using KVL (b) Electrical Network using KCL	CO1, CO2, CO3, a CO4
9	Develop an algorithm, draw a flow chart, and write a program to implement Gauss Jacobi/Seidel in the following applications (formulate problem statement in any one of the following areas (but not limited to)) (a) Electrical network using KVL (b) Electrical Network using KCL	CO1, CO2, CO3, CO4
10	Develop an algorithm, draw a flow chart, and write a program to implement Modified Euler's/4th order RK method in the following applications (formulate problem statement in any one of the following areas (but not limited to) (a) Response of RC series circuit with DC (b) Response of RL circuit with DC (c) Deflection angle in MI-type instrument	CO1, CO2, CO3, CO4

Guidelines for Laboratory Conduction

The Instructor Manual should contain the following related to every program

- Theory related to the method
- Algorithm and Flowchart of the method
- Three to four different sets of problem statements for the numerical method
- Solve numerical using the appropriate method
- Ten questions based on method and related Python commands
- Expected Output

Guidelines for Student's Lab Journal

The student's Lab Journal should contain the following related to every experiment:

- Theory related to the method
- Algorithm and Flowchart of the method
- Three to four different sets of problem statements for the numerical method
- Solve numerical using the appropriate method
- Ten questions based on method and related Python commands

Guidelines for Tutorial and Termwork Assessment

1. Each experiment from the lab journal is assessed for thirty marks based on three rubrics.
2. Rubric R-1 for timely completion, R-2 for understanding, and R-3 for presentation/journal writing where each rubric carries ten marks.

S. Y. B. Tech
Pattern 2023 Semester: IV (Electrical Engineering)
2306211: Electrical Network Analysis

Teaching Scheme	Credit Scheme	Examination Scheme:
Theory:3hrs/week	**TH-3**	**Continuous Comprehensive Evaluation: 20 Marks** **InSem Exam: 20 Marks** **EndSem Exam: 60 Marks**

Prerequisite Courses: Fundamentals of Electrical Engineering, Advanced Calculus and Transform Techniques

Course Objectives: The objectives of the course are to
1. Impart the mathematical skills applied to Electrical networks.
2. Provide an overview of the behavior of the steady state and transient states in RLC circuits.
3. Develop an ability to design concepts for different filters.

Course Outcomes: On completion of the course, students will be able to–

	Course Outcomes	Bloom's Level
CO1	Define different laws and theorems related to electrical networks.	1-Remember
CO2	Apply theorems and Laplace transform for solving electrical network problems.	3-Apply
CO3	Analyze transient response and steady state of AC/DC electrical circuits in time and Laplace domain.	4-Analyze
CO4	Evaluate the different parameters in two-port networks.	5-Evaluate
CO5	Design the low-pass and high-pass filters based on the given specifications.	6- Create

COURSE CONTENTS

Unit I	**Basis Circuit Analysis**	**(9hrs)**	**CO1,CO2**

Types of sources, the concept of source transformation, voltage and current divider, mesh and super mesh-analysis in AC and DC circuit, nodal and super nodal analysis AC and DC circuit. Concept of dot convention, magnetic coupled circuit, and duality of networks.

Unit II	**Network Theorem for AC and DC Networks**	**(9hrs)**	**CO1,CO2**

Superposition, Thevenin, Norton, Maximum Power Transfer, Reciprocity Theorems. Graph Theory: Incidence, tie set, and cut set matrix.

Unit III	**Transients in Electrical Networks**	**(9hrs)**	**CO3**

Concept of the transient and steady-state response of passive element, transient response of R-L, R-C, and R-L-C network in the time domain, with source and source free responses, time constants steady state and transient state response.

Unit IV	**Transient Analysis in S-domain and Filters**	**(9hrs)**	**CO5**

Laplace transform representation of R, L, C in S-domain, application of Laplace Transform to solve series and parallel R-L, R-C, and R-L-C circuits (Source free, Source driven). Filters: First order high pass and low pass filters, design of filters.

Unit V	**Two Port Network**	**(9hrs)**	**CO4**

Two port networks, various two-port network parameters, and their interrelationships. Network Functions & Responses: Concept of complex frequency, driving point, and transfer functions for one port and two port network, poles &zeros of network functions, Restriction on Pole and Zerolocations of network function. Impulse response and complete response.Time domain behavior from the pole-zero plot.

Text Books

1. M. E. Van Valkenburg, “Network Analysis”, Third Edition, Prentice Hall of India Publication.
2. W. H. Hayt. Jr. and J. E. Kemmerly, “Engineering Circuit Analysis”, Fifth Edition, Tata-McGraw Hill Edition.
3. Desoer and Kuh, “Basic circuit theory”, Tata McGraw Hill Edition.
4. Joseph A Edminster, “Theory and Problems of Electric Circuits”, Shaum Series.
5. G. K. Mittal, “Network Analysis and Synthesis”, Khanna Publication.

Reference Books

1. D. Roy Choudhury, “Networks and systems” New Age International Publishers.
2. A Sudhakar and Shaymmohan S Palli, “Circuit & Network Analysis and Synthesis”, TMH Publication.
3. Abhijit Chakraborty, “Circuit Theory”, DhanpatRai and Company.
4. Ravish R Singh, “Network Analysis and synthesis”, McGraw Hill Education (India).

Guidelines for Continuous Comprehensive Evaluation of Theory Course		
Sr. No.	**Components for Continuous Comprehensive Evaluation**	**Marks Allotted**
1	Assignment 1 (Based on Units I and II) (Deadline: before Insem)	5
2	Assignment 2 (Based on Units III and IV) (Deadline: before Endsem)	5
3.	LMS Tests (Best 5 out of Minimum 10)	5
4.	Class test based on units III to V (before EndSem)	5

S. Y. B. Tech Pattern 2023 Semester: IV (Electrical Engineering) 2306212: Electrical Network Analysis Lab		
Teaching Scheme	**Credit Scheme**	**Examination Scheme:**
Practical: 2 hrs/week	**PR-1**	**Teamwork: 25 Marks** **Oral: 25 Marks**

Prerequisite Courses: Fundamentals of Electrical Engineering, Advanced Calculus and Transform Techniques

Course Objectives: The objectives of the course are to

1. Provide hands-on experience in circuit design to students.
2. Enable students to apply network theorems to electrical circuits.
3. Impart skills in software simulation and hardware design.

Course Outcomes: On completion of the course, students will be able to–

	Course Outcomes	Bloom's Level
CO1	Verify electrical network theorems through experiments.	3-Apply
CO2	Perform experiments in the group, write a lab report, and present it effectively.	3 -Apply
CO3	Find electrical network parameters and evaluate them for different circuits.	4- Analyze
CO4	Design different filters for given specifications.	6- Create

List of Laboratory Experiments (Perform any 8 of the following)

Sr. No.	Experiments Title	COs Mapped
1	Verification of superposition theorem in A.C. circuits. (Hardware)	CO1,CO2
2	Verification of Thevenin's theorem in A.C. circuits. (Hardware)	CO1,CO2
3	Verification of reciprocity theorem in A.C. circuits. (Hardware)	CO1,CO2
4	Verification of Norton's theorem in A.C. circuits. (Hardware)	CO1,CO2
5	Verification of Maximum Power Transfer theorem in A.C. circuits. (Hardware)	CO1,CO2
6	Determination of time response of R-C circuit to a step D.C. voltage input. (Charging and discharging of a capacitor through a resistor) (Hardware)	CO2, CO3
7	Determination of time response of R-L circuit to a step D.C. voltage input. (Rise and decay of current in an inductive circuit) (Hardware)	CO2, CO3
8	Determination of time response of R-L-C series circuit to a step D.C. voltage input using simulation.	CO2, CO3
9	Design of Low-Pass Filter and High-Pass Filter. (Software)	CO2,CO4
10	Determination of parameters of Two Port Network. (Hardware)	CO2, CO3

Guidelines for Laboratory Conduction

1. The teacher will brief the given experiment to students for its procedure, observations, calculations, and outcome.
2. Apparatus and equipment required for the allotted experiment will be provided by the lab technician using SOP.
3. Students will perform the allotted experiment in a group (2-3 students in each group) under

the supervision of faculty and lab technician. 4. After performing the experiment students will check their readings and calculations from the teacher. 5. After checking they have to write the conclusion on the final results. 6. Minimum 4 sets of the experiment should be made ready for the conduction of a batch for hardware experiments
Guidelines for Student's Lab Journal
The write-up should include a title, aim and apparatus, circuit or block diagram, waveforms, brief theory, procedure, observations, graphs, calculations, conclusion, and questions, if any.
Guidelines for Termwork Assessment
1. Each experiment from the lab journal is assessed for thirty marks based on three rubrics. 2. Rubric R-1 for timely completion, R-2 for understanding, and R-3 for presentation/journal writing where each rubric carries ten marks.

S. Y. B. Tech
Pattern 2023 Semester: IV (Electrical Engineering)
2306213: Power System Engineering

Teaching Scheme	Credit Scheme	Examination Scheme:
Theory:3 hrs./week	TH-03	Continuous Comprehensive Evaluation: 20Marks InSem Exam: 20Marks EndSem Exam: 60Marks

Prerequisite Courses: Power Generation Technology

Course Objectives: The objectives of the course are to

1. Enable students to learn the basic structure of electrical power systems, various electrical terms related to the power system, and tariffs.
2. Help students understand the specifications and applications of various major electrical equipment present in power plants.
3. Provide knowledge of the mechanical and electrical design of overhead and underground transmission systems.

Course Outcomes: On completion of the course, students will be able to–

	Course Outcomes	Bloom's Level
CO1	Define various terminologies related to load curve, tariff, economical load dispatch, and transmission system.	1. Remember
CO2	Elaborate tariff and allocation of generating units on an economical basis.	2- Understand
CO3	Calculate electrical and mechanical parameters and factors in the power station and transmission system.	3- Apply
CO4	Model and analyze the performance of the overhead transmission line	3- Analyze
CO5	Evaluate different types of tariffs and methods of economical load dispatch and unit commitment.	5 -Evaluate

COURSE CONTENTS

Unit I	Structure of Power System and Tariff	08hrs	CO1, CO2, CO3, CO5

Structure of Electrical Power Systems: Structure of electrical power system, Different factors associated with generating stations and Load curve, Load duration curve, Concept of base load and peak load stations (04hrs)

Tariff: Introduction of Tariff, objectives, desirable characteristic, various consumer categories, two-part tariff, three-part tariff, Time of day tariff for H.T and L.T industrial and commercial consumers, Introduction to Availability based tariff (ABT), kVAh tariff (4 hrs)

Unit II	Economical Load Dispatch and Unit Commitment	9hrs	CO1, CO2, CO3, CO5

Economic load dispatch: Cost curve of thermal and hydro plant, equal incremental cost method, method of Lagrange multiplier (neglecting transmission losses), Bmn coefficient, economic scheduling of thermal plant considering the effect of transmission losses, penalty factor (05 hrs)

Unit commitment: Concept of unit commitment, constraints on unit commitment – spinning reserve, thermal and hydro constraints, methods of unit commitment – priority list and dynamic programming, (04hrs)

Unit III	Mechanical Design of Transmission System	10hrs	CO1, CO3

Overhead Line Insulators: Types of insulators, its construction, and their applications such as Pin type, Suspension type, Strain type, Shackle type, Post insulators, and bushing. Potential distribution over suspension insulators, String efficiency and Methods of improving string efficiency (04hrs)

Sag Calculations: Main components of overhead lines, Various types of line supports, Conductor spacing, Length of span, Calculation of sag for equal and unequal supports, and effect of ice and wind loading. (03hrs)

Underground Cables: Construction of Cables, Classification of cables, XLPE cables, Capacitance of single core and three core cables, Dielectric stresses in single core cable, Grading of cables, inter sheath grading, capacitance grading. (03 hrs)

Unit IV	Electrical Design of Transmission System	10hrs	CO1, CO3

Resistance of Line: Resistance of transmission line, Skin effect, and proximity effect, Factors responsible for the production of these effects,

Inductance and capacitance calculations: Internal and external flux linkages of single conductor, Electric potential at a single charged conductor, Potential at the conductor in a group of charged conductors, Inductance and capacitance of single phase two wire line, the necessity of transposition, inductance, and capacitance of three-phase line with symmetrical and unsymmetrical spacing with transposition (Based on GMD and GMR Approach), Inductance of bundled conductors.

Unit V	Modeling of Transmission System	08 hrs	CO1, CO4

Classification of lines based on length and voltage levels, modeling of short, medium, and long transmission lines, generalized constant of transmission line, the concept of complex power, and power flow equations using a generalized constant.

TextBooks

1. V.K.Meheta, Rohit Mehta, "Principles of Power System", 2022 Color Edition, S. Chand Publication.
2. J.B. Gupta, “Transmission and Distribution", 2018-Edition, S.K. Kataria and Sons, New Delhi.
3. A Chakraborty, M.L.Soni, P.V. Gupta, U.S.Bhatnagar, "A text book on Power System Engineering",2009 Edition, Dhanpatrai& Co, Delhi.

Reference Books

1. W.D.Stevenson, "Power System Analysis", 2nd Edition, Tata McGraw Hill Publications.
2. M.V. Deshpande," Elements of Power Station Design", PHI Publication.
3. I.J. Nagrath and D.P.Kothari," Modern Power System Analysis", 4th Edition Tata McGraw Hill
4. D. Das," Electrical Power System", New Age Publication
5. Hadi Sadat, “Power System Analysis”, McGraw Hill

Guidelines for Continuous Comprehensive Evaluation of Theory Course		
Sr. No.	**Components for Continuous Comprehensive Evaluation**	**Marks Allotted**
1	Assignment 01 (Based on Units I and II) (Deadline: before Insem)	4
2	Assignment 02 (Based on Units III and IV) (Deadline: before Endsem)	4
3.	LMS Tests (Best 5 out of Minimum 10)	4
4.	Class test (Before Endsem) Based on Units III to V	4
5.	Industrial Visit assessment	4

S. Y. B. Tech
Pattern 2023 Semester: IV (Electrical Engineering)
2306214: Power Electronics

Teaching Scheme	Credit Scheme	Examination Scheme:
Theory:3hrs/week	**TH-3**	**Continuous Comprehensive Evaluation: 20Marks** **InSem Exam: 20Marks** **EndSem Exam: 60Marks**

Prerequisite Courses: Analog and Digital Circuits

Course Objectives: The objectives of the course are to
1. Introduce different power semiconductor devices
2. Introduce different converter topologies, their operation, and applications.

Course Outcomes: On completion of the course, students will be able to–

	Course Outcomes	Bloom's Level
CO1	Select switching devices for a given power converter	2-Understand
CO2	Draw circuit diagrams and waveforms for converter circuits with different loads	3- Apply
CO3	Analyze the operation and performance of power electronics converters	4- Analyze
CO4	Design simple power electronics converter circuits	6- Create

COURSE CONTENTS

Unit I	**Power Semiconductor Devices**	**(9 hrs.)**	**CO1, CO2**

Thyristor Devices: Concept of power electronics, scope, and applications, types of power converters, power semiconductor switches, SCRs, TRIAC, GTO, Thyristor ratings, protection, gate drive circuits
Transistor Devices: power MOSFETs, IGBTs-Principles of operation, characteristics,

Unit II	**AC-DC Converter**	**(9 hrs.)**	**CO1,CO2, CO3, CO4**

Introduction to the uncontrolled and controlled rectifier, Principles of single-phase fully-controlled converter with R, RL, and RLE load, Principles of single-phase half-controlled converter with R, RL and RLE load, Principles of three-phase fully-controlled converter operation with R load, Effect of load and source inductances, Introduction to dual converters.

Unit III	**DC-DC Converters**	**(9 hrs.)**	**CO1,CO2, CO3, CO4**

Step-down and step-up chopper, control strategy, Introduction to types of choppers-A, B, C, D, and E, Switched mode regulators- Buck, Boost, Buck-Boost regulator, Introduction to Resonant Converters.

Unit IV	**DC-AC converters**	**(9 hrs.)**	**CO1,CO2, CO3, CO4**

Single-phase and three-phase voltage source inverters (both 180 and 120 degrees conduction mode), Voltage and harmonicControl, PWM techniques: Multiple PWM, Sinusoidal PWM, modified sinusoidal PWM, Introduction to Multilevel Converter, Current source inverter.

Unit V	**AC-AC converters**	**(9 hrs.)**	**CO1,CO2, CO3, CO4**

Single and three-phase controllers, phase control, PWM AC voltage controller, Principle of ON-OFF control and cyclo-converters, Introduction to Matrix converters.

Text Books

1. Muhammad H. Rashid, “Power Electronics - Circuits, Devices and Applications”, Pearson, 4th Edition, 2018.
2. Ned Mohan, Tore M. Undeland, William P. Robbins, “Power Electronics”, John Wiley & Sons Publications, 3rd Edition, 2006.

Reference Books

1. P.S.Bimbhra, “Power Electronics”, Khanna Publishers, 6th Edition, 2016
2. Vedam Subramaniam, “Power Electronics”, New Age International (P) Ltd Publishers, 2001.

Guidelines for Continuous Comprehensive Evaluation of Theory Course		
Sr. No.	**Components for Continuous Comprehensive Evaluation**	**Marks Allotted**
1	Assignment 01 (Based on Units I and II) (Deadline: before Insem)	5
2	Assignment 02 (Based on Units III and IV) (Deadline: before Endsem)	5
3.	LMS Tests (Best 5 out of Minimum 10)	5
4.	Simulation of IEEE/SCI paper for power electronic applications (Before Endsem)	5

S. Y. B. Tech Pattern 2023 Semester: IV (Electrical Engineering) 2306215: Power Electronics and Power Systems Lab		
Teaching Scheme:	**Credit Scheme:**	**Examination Scheme:**
Practical: 4hrs/week	**PR- 2**	**Termwork: 50Marks** **Practical: 50 Mark**

Prerequisite Courses: Analog and Digital Circuits, Advanced Calculus and Transform Techniques

Course Objectives: The objectives of the course are to
1. Enable students to develop hands-on experience in analyzing, designing, and carrying out experiments on power electronic circuits.
2. Introduce the switching devices, power converters, and their applications in various systems for power control.

Course Outcomes: On completion of the course, students will be able to–

	Course Outcomes	Bloom's Level
CO1	Simulate and analyze various power electronic converters with different control techniques	3- Apply
CO2	Perform experiments in the group, write a lab report, and present it effectively	3-Apply
CO3	Find the R, L and C of the transmission line and represent its model using software	3-Analyze
CO4	Evaluate the performance of different power electronic converters and transmission lines.	5-Evaluate
CO5	Design the magnetic circuit, power circuit, and control circuit of various power electronic converters.	6-Create

Software and Hardware Lab		
Sr. No.	**Laboratory Experiments** Perform any 4 (Software) based experiments out of Sr. No. 01 to 07 Perform any 6 (Hardware) based experiment out of Sr. No. 08 to 16 Compulsory experiment is Sr. No. 17	**COs Mapped**
1	Simulation of the fully controlled converter with R and RLE load.	CO1, CO2
2	Simulation of the half-controlled converter with R and RLE load.	CO1, CO2
3	Simulation of a buck converter using MOSFET/IGBT.	CO1, CO2
4	Simulation of boost converter using MOSFET/IGBT.	CO1, CO2
5	Programming to find L and C of a given transmission line configuration.	CO3, CO2
6	Simulation of PI and T model of medium transmission line and calculate performance analysis.	CO3, CO2
7	Simulation of a three-phase inverter in the 120-degree and 180-degree mode of operation	CO1, CO2
8	Study VI characteristic of any two of the following devices 1) SCR 2) TRIAC 3) IGBT 4) MOSFET	CO4, CO2
9	Study the output voltage control using half controlled converter with R, RLE and RLE-FD load	CO4, CO2
10	Study the output voltage control using a fully controlled converter with R, RLE and RLE-FD load	CO4, CO2
11	Study the PWM-based three-phase inverter.	CO4, CO2

12	Study the DC to DC conversion using a buck-boost converter.	CO4, CO2
13	Study GATE triggering circuit for SCR.	CO4, CO2
14	Study single-phase AC voltage regulator using SCR/TRAIC.	CO4, CO2
15	Calculate ABCD parameters of medium transmission line	CO4, CO2
16	Calculate ABCD parameters of long transmission line	CO4, CO2
17	Design of any converter/gate driving circuit by the student as a mini project. (Group of five students). The mini-project should include (1) a Problem Statement (2) a Learning outcome (3) Software simulation and results(4) Component selection (5) Hardware design and results (6) Applications and (7) a Conclusion	CO5, CO2

Guidelines for Laboratory Conduction

1. The teacher will brief the given experiment to students for its procedure, observations, calculations, and outcome.
2. Apparatus and equipment required for the allotted experiment will be provided by the lab technician using SOP.
3. Students will perform the allotted experiment in a group (2-3 students in each group) under the supervision of faculty and lab technician.
4. After performing the experiment students will check their readings and calculations from the teacher.
5. After checking they have to write the conclusion on the final results.
6. Minimum 4 sets of the experiment should be made ready for the conduction of a batch for hardware experiments

Guidelines for Student's Lab Journal

The write-up should include a title, aim and apparatus, circuit or block diagram, waveforms, brief theory, procedure, observations, graphs, calculations, conclusion, and questions, if any.

Guidelines for Termwork Assessment

1. Each experiment from the lab journal is assessed for thirty marks based on three rubrics.
2. Rubric R-1 for timely completion, R-2 for understanding, and R-3 for presentation/journal writing where each rubric carries ten marks.

S. Y. B. Tech
Pattern 2023 Semester: IV (Electrical Engineering)
2306216: Microcontroller and Embedded Systems

Teaching Scheme	Credit Scheme	Examination Scheme:
Theory:3hrs/week	TH: 3	Continuous Comprehensive Evaluation: 20Marks InSem Exam: 20Marks EndSem Exam: 60Marks

Prerequisite Courses: Analog and Digital Circuits

Course Objectives: The objectives of the course are to

1. Provide a comprehensive understanding of microcontroller architecture, including CPU, memory, I/O ports, and peripherals.
2. Exposed to the principles of embedded systems design, including real-time operating systems, interrupt handling, and memory management.
3. Develop skills in programming microcontrollers using high-level languages such as C and assembly language, including interfacing with peripherals and sensors.
4. Guide to design and implement embedded systems for various applications, considering constraints such as cost, power, and size.

Course Outcomes: On completion of the course, students will be able to–

	Course Outcomes	Bloom's Level
CO1	Describe the type of computing systems and computer memory.	2-Understand
CO2	Explain the role of different components of 8051	2-Understand
CO3	Implement the knowledge of instructions to develop the assembly-level program (ALP).	3- Apply
CO4	Explain the role of different components of the ARM processor	2-Understand

COURSE CONTENTS

Unit I	Fundamentals of number system and computing	7hrs	CO1

Basics of sequential circuits; Number system: Binary, hexadecimal number system - Interrelationship and operations; Basics of computing; Evolution of computing systems: Microprocessors, Microcontrollers and embedded systems; Comparison of Microprocessors, Microcontrollers and embedded systems; Overview of computer memory; RISC and CISC architectures; Overview of Programming languages

Unit II	Basics of microcontroller 8051	10hrs	CO2, CO3

Architecture; Pin diagram; Memory organization; External memory interfacing; Addressing modes; Jump instruction in 8051; Introduction to ALP for performing different arithmetic and logical operations using local registers

Unit III	Special Function Registers in 8051	10hrs	CO2, CO3

Overview of SFRs; Timers; Serial communication; Interrupts; ALP for generating square wave, serial data transfer, Interrupts.

Unit IV	Interaction of 8051 with the real world	9hrs	CO2, CO3

Overview and interfacing of displays; keyboard; relay; sensors; and serial communication.

Unit V	Basics of Embedded Systems	9hrs	CO4

Introduction to embedded systems; Design consideration; Architecture and instruction set of ARM processors

Text Books
1. Mohammad Ali Mazidi, Janice GillispieMazidi, "The 8051 Microcontroller and Embedded, Pearson Education India Publisher, 2nd Edition, 2006. 2. Kenneth J. Ayla, “The 8051 Microcontroller", Thomson learning, 3rd edition, 2010. 3. Shibu K V, “Introduction to Embedded Systems”, Tata McGraw Hill Education Private Limited, 2nd Edition, 2016.
Reference Books
1. Andrew N Sloss, Dominic Symes, Chris Wright, "ARM System Developer's Guide, Morgan Kaufmann Publishers, 1st Edition, 2004. 2. D KarunaSagar, “Microcontroller 8051”, Oxford: Alpha Science, 2011. 3. P.V Guruprasad, “Arm Architecture System on Chip and More", Apress, 2013.

Guidelines for Continuous Comprehensive Evaluation of Theory Course		
Sr. No.	**Components for Continuous Comprehensive Evaluation**	**Marks Allotted**
1	Assignment 1 (Based on Units I and II) (Deadline: before Insem)	5
2	Assignment 2 (Based on Units III and IV) (Deadline: before Endsem)	5
3.	LMS Tests (Best 5 out of Minimum 10)	5
4.	Mini project	5

S. Y. B. Tech Pattern 2023 Semester: IV (Electrical Engineering) 2306217: Microcontroller and Embedded Systems Lab		
Teaching Scheme	**Credit Scheme**	**Examination Scheme:**
Practical: 2 hrs/week	**PR: 1**	**Termwork: 25 Marks;** **Oral: 25 Marks**

Prerequisite Courses: Analog and Digital Circuits

Course Objectives: The objectives of the course are to

1. Empower students to design and implement embedded systems using microcontrollers, considering real-time constraints and system requirements.
2. Help students to gain hands-on experience with development tools such as compilers, assemblers, debuggers, and simulators for microcontroller programming and debugging.
3. Demonstrate Interfacing of microcontrollers with external devices such as sensors, actuators, and displays, using appropriate communication protocols.

Course Outcomes: On completion of the course, students will be able to–

	Course Outcomes	Bloom's Level
CO1	Perform experiments in the group, write a lab report, and present it effectively	1-Understanding
CO2	Write the program for 8051 in assembly language for the given operations	3 –Apply
CO3	Write the program for interfacing different devices.	3 –Apply
CO4	Write the program for the ARM processor to perform the given operations	3 –Apply

List of Laboratory Experiments		
Sr. No.	**Laboratory Experiments**	**COs Mapped**
1	Identify various blocks of the 8051 microcontroller development board.	CO1
2	Write an assembly language program (ALP) to perform arithmetic operations: addition, subtraction, multiplication, and division.	CO1,CO2
3	Write an ALP to find the smallest/largest number from the given data bytes stored in internal/external data memory locations	CO1,CO2
4	Write an ALP for sending a character using serial communication	CO1,CO2
5	Interface LED with microcontroller and turn it ON with microcontroller interrupt.	CO1,CO2, CO3
6	Interface any sensor with an 8051 microcontroller.	CO1,CO2, CO3
7	Write a program to perform arithmetic operations: addition, subtraction, multiplication, and division using an ARM processor.	CO1,CO4
8	Interface relay with ARM processor and turn it ON and OFF.	CO1, CO3, CO4
9	Interface any sensor with an ARM processor.	CO1, CO3,CO4
10	Industrial Visit with visit report.	CO1
Guidelines for Laboratory Conduction		
• The teacher will brief the given experiment to students for its procedure, observations, calculations, and outcome.		

- Apparatus and equipment required for the allotted experiment will be provided by the lab technician using SOP.
- Students will perform the allotted experiment in a group (2-3 students in each group) under the supervision of faculty and lab technician.
- After performing the experiment students will check their readings and calculations from the teacher.
- After checking they have to write the conclusion on the final results.
- Minimum 4 sets of the experiment should be made ready for the conduction of a batch for hardware experiments

Guidelines for Student's Lab Journal

The student's Lab Journal should contain the following things related to every experiment:

- Title of the program
- Related Theory
- Algorithm and Flowchart
- Pin Diagram for the connection
- Result

Guidelines for Termwork Assessment

Each experiment from the lab journal is assessed for thirty marks based on three rubrics.
Rubric R-1 for timely completion, R-2 for understanding, and R-3 for presentation/journal writing where each rubric carries ten marks.

S.Y. B. Tech.
Pattern 2023 Semester: IV (Electrical Engineering)
2306218: Design Thinking

Teaching Scheme:	Credit Scheme:	Examination Scheme:
Theory: 2hrs/week	TH: 2	Continuous Comprehensive Evaluation: 50 Marks

Course Objectives: The objectives of the course are to
1. Highlight the significance of the academic project in acquiring employability skills
2. Make aware of the design thinking strategy in the project topic finalization
3. Introduce good practices in project planning and execution

Course Outcomes: On completion of the course, students will be able to–

	Course Outcomes	Bloom's Level
CO1	Select the topic for the academic project, define the project problem statement, scope, and objectives	2-Understand
CO2	Develop a system block diagram and outline important steps in project planning, execution, and completion	3- Apply
CO3	Apply design thinking strategy in project execution	3- Apply
CO4	Prepare and present project poster, presentation, and report	3-Apply

COURSE CONTENTS

Unit I	Design Thinking	6hrs	COs Mapped –CO3

Introduction to design thinking, importance, the impact of design thinking, design innovation, desirable, feasible, viable, human-centred design, double diamond approach, five phases of design thinking (Activity I)

Unit II	Five Phases of Design Thinking	6 hrs	COs Mapped – CO3, CO1

Empathize, Define, Ideate, Prototype and Test, different ways of achieving the five stages with the case study, developing a project through these steps (Activity II)

Unit III	Project Definition	6 hrs	COs Mapped –CO1

Introduction to project, the importance of the project, characteristics of the project, project failure, project management, selecting project topic, selecting team members, Defining project problem statement, project objectives and scope (Activity III)

Unit IV	Project Planning	6 hrs	COs Mapped – CO2

Searching and reading a research paper, summarizing the research paper, Literature survey, developing system/process/project block diagram, methodology, developing project plan
Types of modeling: Mathematical, software, hardware modeling, the need of modeling, procedure of modeling, detailed design, and development of the project, (Activity IV)

Unit V	Project Presentation	6 hrs	COs Mapped – CO4

Preparation for various competitions and hackathons, making project presentations, delivering Presentations, and Project Proposal writing. (Activity V)

Text Books

1. Tim Brown Change by Design How Design Thinking Transforms Organizations and Inspires Innovation, HarperCollins Publications

Reference Books

1. Andrew Shea, Bryan Boyer, Jennifer May, Mariana Amatullo, “Design for Social Innovation Case Studies from Around the World,” Taylor & Francis, 2021
2. Jason Westland, “The Project Management Life CycleA Complete Step-By-Step Methodology for Initiating, Planning, Executing & Closing a Project Success” Kogan Page Publication, 2007

Guidelines for Continuous Comprehensive Evaluation of Theory Course		
Sr. No.	**Components for Continuous Comprehensive Evaluation**	**Marks Allotted**
1	Activity I	10
2	Activity II	10
3	Activity III	10
4	Activity IV	10
5	Activity V	10

S.Y. B. Tech.
Pattern 2023 Semester: IV (Electrical Engineering)
2306219: Democracy, Election and Governance

Teaching Scheme:	Credit Scheme:	Examination Scheme:
Tutorial: 2 hrs/week	02	Continuous Comprehensive Evaluation: 50 Marks Total: 50 Marks

Prerequisite Courses, if any: - Basic term of democracy, Importance of Election and governance

Course Objectives:

- This module also aims to make the individual understand the different aspects of democracy and its implications for the overall development of the state.
- The syllabus is introduced from the point of view that all students upon entering into the college, enrol themselves as voters and encourage and enthuse other members of the society to participate not only in the election process but also electoral and political process in general.

Course Outcomes: On completion of the course, students will be able to–

	Course Outcomes	Bloom's Level
CO1	Understand and practice key principles of Democracy	2-Understand
CO2	Identify how different rights are protected in Democratic systems	2-Understand
CO3	Understand various approaches to Governance	2-Understand
CO4	Reflect on the various threats and challenges to Democracy	3-Apply

COURSE CONTENTS

Unit I	Democracy- Foundation and Dimensions	(08 hrs)	COs Mapped - CO1, CO2, CO4

Constitution of India, Evolution of Democracy- Different Models, Dimensions of Democracy- Social, Economic, and Political

Unit II	Decentralization	(08 hrs)	COs Mapped - CO1, CO2, CO3, CO4

The Indian tradition of decentralization, the History of the Panchayat Raj institution in the post-independence period 73rd and 74thamendments, Challenges of caste, gender, class, democracy and ethnicity

Unit III	Governance	(08 hrs)	COs Mapped – CO2, CO3, CO4

Meaning and concepts, Government and governance, Inclusion and exclusion

Text Books

2. Introduction to the Constitution of India, D. D. Basu, Lexis Nexis, 22nd Edition
3. Essays on contemporary India, Bipan Chandra, Har-Anand Publications.

Guidelines for Continuous Comprehensive Evaluation of Theory Course		
Sr. No.	**Components for Continuous Comprehensive Evaluation**	**Marks Allotted**
1	Three Assignments on unit-I, Unit-II, Unit-III & IV	30
2	Group Presentation on Unit-V	10
3	LMS Test on Each Unit	10
	Total	**50**

S.Y. B. Tech.
Pattern 2023 Semester: IV (Electrical Engineering)
2306220: Technical Writing

Teaching Scheme:	Credit Scheme:	Examination Scheme:
TU: 1 hrs/week PR: 2hrs/Week	TU: 1 PR: 1	Tutorial: 25 Marks Termwork: 25 Marks

Prerequisite Courses: NA

Course Objectives: The objective of this course is to make the student aware of the importance of writing skills and the significance of documentation related to the work carried out by any engineering professional.

Course Outcomes: On completion of the course, students will be able to–

	Course Outcomes	Bloom's Level
CO1	Discuss the various components of the thesis	2-Understand
CO2	Describe the significance of word processors in technical writing	2-Understand
CO3	Use word processors for academic and research writing	3- Apply

COURSE CONTENTS

Unit I	Academic writing	12 hrs	CO1, C03

Importance of report writing in academics and research; Different types of academic and research activities; Necessity of report writing for achievement of academic and research goals; Different types of reports/presentations; Characteristics of academic and research reports/presentations.
Structure of a thesis; Scope of the work; Literature review; Experimental/computational details; Preliminary studies; Results and Discussions; Figures and Tables preparation; Conclusions and future works; Bibliography; Appendices

Unit II	Tools and techniques for research writing	18 hrs	CO2, CO3

Types of research papers; Structure of research papers; Research paper formats; Abstract writing; Methodology; Results and discussions; Different formats for referencing; Ways of communicating a research paper Handling MS Word and Latex processors; Development of an effective power point presentation; Plagiarism and its handling through plagiarism detection tools

Text Books

1. C P Ravikumar, "On Writing a Thesis",. IETE Journal of Education, 2000.
2. K. V. Laan, J. T. Hackos, "The Insider's Guide to Technical Writing", 2nd Edition, 2022.

Reference Books

1. M. D. Desai, "Technical communication". Available (online): https://www.gtuelibrary.edu.in/publication/Technical%20communication%205th%20June'09.pdf
2. SWAYAM course on "Academic & Research Report Writing" by Dr. Samir Roy, NITTTR Kolkata. https://onlinecourses.swayam2.ac.in/ntr20_ed30/preview

Guidelines for Continuous Comprehensive Evaluation of Theory Course

Sr. No.	Components for Continuous Comprehensive Evaluation	Marks Allotted
1	Writing a Research paper in LaTeX having at least two tables, two figures and 5 equations.	25
2	Writing project report in LaTeX	25

S. Y. B. Tech
Department Specific Exit Courses (To award Diploma)
(Electrical Engineering)
2306221: Internship

Teaching Scheme:	**Credit Scheme:**	**Examination Scheme:**
Theory: NA	**02**	**Term work: 100 Marks**

Course Objectives: The objectives of the course are to

1. Encourage and provide opportunities for the students to acquire professional learning experiences.
2. Provide exposure to handling and using various tools, measuring instruments, meters, and technologies used in industries.
3. Enable students to develop professional and employability skills and expand their professional network.

Course Outcomes: On completion of the course, students will be able to–

	Course Outcomes	**Bloom's Level**
CO1	Operate various meters, measuring instruments, and tools used in industry efficiently and develop technical competence.	1-Remember 2-Understand
CO2	Understand the working culture and environment of the Industry and get familiar with various departments and practices in the industry.	4-Analyze 5-Evaluate
CO3	Apply internship learning in engineering project work, i.e. topic finalization, project planning, hardware development, result interpretations, report writing, etc.	3-Apply
CO4	Create a professional network and learn about ethical, safety measures, and legal practices.	1-Remember 2-Understand

Internship Guidelines for the Students

A. Before Joining the Internship

1. Look for internships in the industries provided by the department.
2. The internship duration should be 4 weeks.
3. Ask for the internship request letter from the respective class coordinator. He will appoint a guide for you.
4. Mentoring of the internship activity will be done through your Guide. You are informed to report to your guide from time to time.

B. During Internship

1. Keep the internship record book with you.
2. Note down all the details date-wise in the internship record book. Take the signature of your industry mentor daily.
3. The internship record book will help you to write your final internship report. Simultaneously you can start writing internship reports.
4. Maintain an institutional culture while working in the industry.

C. After Internship

1. Submit the Internship Record book and Internship report. Both are in hard copy.
2. Submit all your details within 15 days of completion of the Internship.
3. After the internship, the presentation schedule will be displayed.
4. The internship course will be assumed to be completed only after the final presentation. The date of presentation will be declared at least 10-15 days before the actual date.

Evaluation and Assessment of Internship			
Sr. No.	**Evaluation Parameter**	**Marks**	**Remarks**
1	Internship Record Book	25	Maintain all the records. This should be handwritten and submitted in hard copy. It will be evaluated based on 1. Proper and timely documented entries 2. Adequacy and quality of information 3. Data, observations, and discussions recorded 4. Thought process and recording techniques used 5. Organization of the information
2	Internship Report	25	Submit your report as per the guidelines. It should have **1. Starting pages:** Certificates, declaration, abstract, table of contents, figures, tables, etc. **2. Chapter 1:** Introduction: Brief about the company, industry or organization, objectives, motivation, and organization of the report **3. Chapter 2:** Problem Identification/Problem statement/objectives and scope/expected outcomes **4. Chapter 3:** Methodological details **5. Chapter 4:** Results / Analysis /inferences and conclusion **6. Chapter 5:** Suggestions/Recommendations for improvement to the industry, if any **7. End Pages:** Acknowledgement and references
3	Post-Internship Evaluation	50	Evaluation will be done by both industry and department mentors, based on the presentation criteria given below 1. Internship Identification and Selection 2. The Problem Studied with objectives and expected outcomes 3. Consideration of environmental/ Social /Ethical/ Safety measures/Legal aspects. 4. Methodology/System/Procedure Q&A 5. Block diagram, flow-chart, algorithm, system description Q&A 6. Final results, discussions, suggestions, comments, etc. Q&A 7. Presentation and Communication
Total Marks		**100**	**Timely completion of activities is essential for all above**

S. Y. B. Tech
Department Specific Exit Courses (To award Diploma)
(Electrical Engineering)
2306222: AutoCAD for Electrical Engineers

Teaching Scheme	Credit Scheme	examination scheme
Theory: 02 hrs/week	**TH: 02** **TW:01**	In SemExam: 20Marks End SemExam: 30Marks Term work: 50 Marks

Course Objectives: The objectives of the course are to

5. Understand the concepts of AutoCAD Electrical engineering.
6. Study AutoCAD Electrical engineering for creating projects and drawings.
7. Develop a hands-on experience with AutoCAD Electrical.

Course Outcomes: On completion of the course, students will be able to–

	Course Outcomes	Bloom's Level
CO1	Understand the applications of AutoCAD Electrical engineering.	2-Understand
CO2	Use AutoCAD Electrical Engineering for creating electrical engineering projects and drawings.	3-Apply

COURSE CONTENTS

Unit I	**Basics of AutoCAD** Lines and Polylines, Drawing a Polygon, Circles and Arcs, Move, Copy and Offset Commands, Rotate, Scale and Mirror Commands, Arrays, Hatch and Explode, Trim and Extend, Layers and dimensions, Distance, Area, and List Commands.	**(04 hrs)**	**CO1, CO2**
Unit II	**Basics of Electrical Lighting** Types of Lamps, Fluorescent and CFL, Sodium Lamps, Mercury and Metal Halide Lamps, LED Lighting, Luminaires, Color Rendering Index (CRI), Utilization and Maintenance Factors, IP or Ingress Protection for Luminaries, Lux Required from Electrical Code, Lighting System Design	**(06 hrs)**	**CO1, CO2**
Unit II	**Electrical System Design Procedure** Wiring of luminaries using AutoCAD, Types of wiring accessories, Adding and wiring of sockets in Autocad, Panel Schedule for Power and Lighting Circuits, Circuit Breakers and Cable Selections, SLD of Industrial Area and Riser of the Residential Building	**(08 hrs)**	**CO1, CO2**
Unit IV	**Cables** Classification of Cables According to Voltage, Frequency, Conductor Type, Insulation Level, Types of Armouring in Cables, Derating Factor of Cables, Selection of Neutral Conductor & Earthing Cross-Sectional Areas, Cable Design – Selection of Cables	**(06 hrs)**	**CO1, CO2**
Unit V	**Earthling System Design** Effect of Current on Human Body, Types of Electric Hazards, Classification of Earthing Systems, Components of Earthing System, Design of Earthing System, Earthing Conductors, Measurement of Earth Resistance by Megger and Three Point	**(06 hrs)**	**CO1, CO2**

	Method,		

Textbooks

1. Bhattacharya S. K., Electrical Engineering Drawing, New Age International publishers, second edition 1998, reprint2005.
2. A S Pabla, Electrical power distribution, 6th edition, Tata McGraw-Hill.
3. Bhatt, N.D., Engineering Drawing: Plane and Solid Geometry, 53rd edition, Charotar Publishing House Pvt. Limited, 2019
4. K. R. Gopalakrishna, & Sudhir Gopalakrishna: Textbook Of Computer Aided Engineering Drawing, 39thEdition, Subash Stores, Bangalore,2017

Reference Books

1. S. L. Uppal - Electrical Power - Khanna Publishers Delhi.
2. Raina K.B. and Bhattacharya S.K., Electrical Design, Estimating and Costing, Tata McGraw Hill, New Delhi

Any eight experiments are compulsory

List of Laboratory Experiments

Sr. No.	Laboratory Experiments	COs Mapped
1	Study of electrical wiring accessories and their symbols	CO1
2	Draw electrical and electronic symbols using CAD and take the print out	CO2
3	Design of residential wiring using AutoCAD	CO2
4	Design of commercial wiring using AutoCAD	CO2
5	Design of earthing system using AutoCAD	CO2
6	Draw D.C. and A.C machine parts using CAD and take print out	CO2
7	Draw a winding diagram for the given DC machine using CAD and take print out of (a)Lap winding and (b)Wave winding	CO2
8	Develop wiring diagrams for residential and commercial buildings using AutoCAD	CO2
9	Develop earthing system diagram using AutoCAD	CO2

Guidelines for Laboratory Conduction

- The teacher will brief the given experiment to students for its procedure, observations, calculations, and outcome.
- Apparatus and equipment required for the allotted experiment will be provided by the lab technician using SOP.
- Students will perform the allotted experiment in a group (2-3 students in each group) under the supervision of faculty and lab technician.
- After performing the experiment students will check their readings and calculations from the teacher.
- After checking they have to write the conclusion on the final results.
- Minimum 4 sets of the experiment should be made ready for the conduction of a batch for hardware experiments

Guidelines for Student's Lab Journal

• The write-up should include a title, aim and apparatus, circuit or block diagram, waveforms, brief theory, procedure, observations, graphs, calculations, conclusion, and questions, if any.
Guidelines for Term Work Assessment
Each experiment from the lab journal is assessed for thirty marks based on three rubrics. Rubric R-1 for timely completion, R-2 for understanding, and R-3 for presentation/journal writing where each rubric carries ten marks.

S. Y. B. Tech.
Pattern 2023 Department-Specific Exit Courses (To award Diploma)
(Electrical Engineering)
2306223: Installation and Commissioning of Electrical Systems

Teaching Scheme:	Credit Scheme:	Examination Scheme:
Theory: 02 Hrs/week Practical: 02hr/week	TH: 02 TW:01	In SemExam: 20 Marks End SemExam: 30Marks Tutorial/Term work: 50 Marks

Prerequisite Courses:-Transformer and Induction Machines, Power System Engineering

Course Objectives: The objectives of the course are to
1. Demonstrate the importance and necessity of maintenance.
2. Explain different condition monitoring methods.

Course Outcomes: On completion of the course, students will be able to–

	Course Outcomes	Bloom's Level
CO1	Apply electrical safety procedures	1-Remember
CO2	Compare and classify Earthing systems.	2-Understand
CO4	Demonstrate, analyze and test different condition monitoring methods.	4-Analyze
CO3	Classify different types of distribution supply systems and determine the economics of the distribution system.	3-Apply
CO5	Carry out Estimation and costing of internal wiring for residential and commercial installations.	5-Evaluate

COURSE CONTENTS

Unit I	**Electrical Safety** Contents of first aid box, treatment for cuts, burns and electrical shock. Procedures for first aid (e.g. removing casualty from contact with live wire and administering artificial respiration). Various statutory regulations (Electricity supply regulations, factory acts and Indian electricity rules of Central Electricity Authority (CEA), Classification of hazardous areas. (Introduction to OSHA) Safety regulations & measures, Indian Electricity Supply Act 1948-1956, Factory Act 1948, Fire extinguishers – types & its operations, fixed installation & portable devices.	**(04 hrs)**	**CO1**
UnitII	**Earthing** The necessity of earthing, system earthing: advantage of neutral earthing of generator in power station, equipment earthing: objective, types of earth electrodes, earthing in extra high voltage & underground cable, earthing resistance – factors affecting, determination of maximum permissible resistance of earthing system, measurement of earth resistance: voltmeter-ammeter method, earth tester method, ohm meter method & earth loop tester method, comparison between equipment earthing& system grounding. Tolerable step and touch voltages, Steps involved in the design of substation Earthing grid as per IEEE standard 80-2013.	**(06 hrs)**	**CO2**
Unit III	**Maintenance, Condition Monitoring and Testing** **Maintenance:** Importance and necessity of maintenance, different	**(08 hrs)**	**CO4**

	maintenance strategies like breakdown maintenance, planned/preventive maintenance and condition-based maintenance. Planned and preventive maintenance of transformer, Induction motor and Alternators. Condition Monitoring: Advanced tools and techniques of condition monitoring and thermography. dissolved gas analysis, Induction motor fault diagnostic methods – Vibration Signature Analysis, Motor Current Signature Analysis. Testing: Understanding CAT Ratings & Using CAT rated Instrument, Electrical Installation Testing Procedures- Insulation resistance test between installation and earth, Insulation resistance test between conductors (use of GUARD Terminal in IR test & Application) (methods used for IR Testing)		
UnitIV	**Economics of Distribution Systems:** Classification of supply systems (State Only) (i) DC, 2-wire system, (ii) Single phase two wire AC system, (iii) Three phase three wire AC supply system, iv) Three phase four wire AC supply system. Comparison between overhead and underground systems (For the above-mentioned systems) based on volume requirement for the conductor. AC Distribution System: Types of primary and secondary distribution systems, calculation of voltage drops in AC distributors (Uniform and Non Uniform Loading) (Numerical). Economics of power transmission: Economic choice of conductor (Kelvin's law) (Derivation and Numerical). Distribution Feeders: Design considerations of distribution feeders; radial and ring types of primary feeder's voltage levels, energy losses in feeders.	**(06 hrs)**	**CO3**
Unit V	**Installation and estimation of the distribution system** Electrical installations, domestic, industrial, Wiring Systems, Internal distribution of Electrical Energy. Methods of wiring, systems of wiring, wire and cable, conductor materials used in cables, insulating materials mechanical protection. Types of cables used in internal wiring, multi-stranded cables, voltage grinding of cables, and general specifications of cables. **ACCESSORIES:** Main switch and distribution boards, conduits, conduit accessories and fittings, lighting accessories and fittings, fuses, important definitions, determination of the size of fuse–-wire, fuse units. Earthing conductor, earthing, IS specifications regarding earthing of electrical installations, points to be earthed. Determination of the size of the earth wire and earth plate for domestic and industrial installations. Material required for GI pipe earthing.	**(06 hrs)**	**CO5**

Textbooks

1. B. R. Gupta- Power System Analysis and Design, 3rd edition, Wheeler's publication.
2. S. Rao, Testing Commissioning Operation and Maintenance of Electrical Equipment, Khanna publishers.
3. S. L. Uppal - Electrical Power - Khanna Publishers Delhi.
4. Handbook of condition monitoring by B. K. N. Rao, Elsevier Advance Tech., Oxford (UK).
5. S. K. Shastri – Preventive Maintenance of Electrical Apparatus – Katson Publication House.
6. B. V. S. Rao – Operation and Maintenance of Electrical Equipment – Asia Publication.
7. Handbook on Electrical Safety

Reference Books

1. P.S. Pabla –Electric Power Distribution, 5th edition, Tata McGraw Hill.
2. S. L. Uppal, Electrical Wiring and Costing Estimation, Khanna Publishers, New Delhi.
3. Surjit Singh, Electrical wiring, Estimation and Costing, DhanpatRai and Company, New Delhi.
4. Raina K.B. and Bhattacharya S.K., Electrical Design, Estimating and Costing, Tata McGraw Hill, New Delhi
5. B.D. Arora-Electrical Wiring, Estimation and Costing, - New Heights, New Delhi.
6. M.V. Deshpande, Elements of Power Station design and practice, Wheelers Publication.
7. S. Sivanagaraju and S. Satyanarayana, Electric Power Transmission and Distribution, Pearson Publication.
8. Power Equipment Maintenance and Testing (Power Engineering Book 32) by Paul Gill

Perform any eight experiments. An industrial visit is compulsory.

List of Laboratory Experiments		
Sr. No.	Laboratory Experiments	COs Mapped
1	Prepare layouts of wiring for installation of a given machine with specifications.	CO5
2	Prepare test reports of an electrical machine after commissioning.	CO3
3	Measure insulation resistance of winding/cables/wiring installation.	CO4
4	Prepare maintenance schedule of power transformer & induction motor.	CO3
5	Troubleshooting of ceiling fan & fluorescent tube light.	CO3
6	Prepare plate/pipe earthing as per IS.	CO2
7	Know & interpret IE rules pertaining to safety.	CO1
8	Show & demonstrate the action to be taken when a person comes in contact with a live wire.	CO1
9	Undertake drill operations for using fire extinguishers for safety against fire.	CO1
10	Study of thermograph images and analysis based on these images.	CO4
11	The practice of Earthing and Measurement of Earth resistance of Campus premises by using 4 Pole, 3 Pole, new technology practising in industry clamp-on method.	CO2
12	Assignment on the design of Earthing grid for 132/220 kV substation.	CO2
13	Design and estimation of light and power circuits of labs/industry.	CO5
14	Design and estimation of light and power circuits of residential wiring.	CO5
15	Estimation and costing for 11 kV feeders and substation. (voltage drop calculation, SLD, substation layout)	CO5
16	Study of troubleshooting of electrical equipment based on an actual visit to a repair workshop (Anyone). i) Three-phase induction motor ii) Transformer iii) Power Cable	CO4
17	Troubleshooting of household equipment – Construction, working and troubleshooting of any two households Electrical equipment (Fan, Mixer, Electric Iron, Washing Machines, Electric Oven, Microwave - Limited to electrical faults)	CO3

	(Here we perform Practical by using PAT Testers)	
18	Design, Estimation and costing of Earthing pit and Earthing connection for computer lab and electrical Machines Lab.	CO2 ,CO5
19	Activity: Interview of Electrical maintenance personnel/Technician/Electrician.	CO4
20	Activity: Safety awareness for housing societies/schools/Junior colleges.	CO1

Guidelines for Laboratory Conduction
• The teacher will brief the given experiment to students for its procedure, observations, calculations, and outcome. • Apparatus and equipment required for the allotted experiment will be provided by the lab technician using SOP. • Students will perform the allotted experiment in a group (2-3 students in each group) under the supervision of faculty and lab technician. • After performing the experiment students will check their readings and calculations from the teacher. • After checking they have to write the conclusion on the final results. • Minimum 4 sets of the experiment should be made ready for the conduction of a batch for hardware experiments
Guidelines for Student's Lab Journal
• The write-up should include a title, aim and apparatus, circuit or block diagram, waveforms, brief theory, procedure, observations, graphs, calculations, conclusion, and questions, if any.
Guidelines for Term Work Assessment
Each experiment from the lab journal is assessed for thirty marks based on three rubrics. Rubric R-1 for timely completion, R-2 for understanding, and R-3 for presentation/journal writing where each rubric carries ten marks.