Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur 440033

Scheme and Syllabus for

Bachelor of Technology (Electrical Engineering)

Submitted by

Board of Studies in Electrical Engineering

FYUG Engineering Curriculum: NEP-Electrical Engineering

20/3/25 20/3/25 20/3/25 20/3/25

Vision

To provide quality professional education to aspiring students to produce globally competent technocrats, who can address challenges of industry and society to achieve sustainable socio-economicdevelopment.

Mission

To produce graduates possessing sound fundamental knowledge of Electrical Engineering

To provide technical manpower for industry to solve problems with multidisciplinary approach.

To encourage students for scholarly research in emerging areas of electrical engineering

To inculcate ethical and social values.

Program Outcomes (PO'S)

PO1	Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals ,and an engineering specialization to the solution of complex engineering problems.
PO2	Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3	Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4	Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5	Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PO6	The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO7	Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO8	Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9	Individual and teamwork: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10	Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO11	Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO12	Life-long learning: Recognize the need for and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific Outcomes (PSO)

PSO1	Interpret, identify, analyze, and evaluate problems in power system operation, control and design.
PSO2	Demonstrate knowledge to develop, control and assess electrical and electronic systems.

Program Educational Objectives (PEOs)

PEO1	Electrical engineer graduate shall be ready for modern technologies of electrical power system, energy industry and non-conventional energy sources.
PEO2	Electrical engineer graduate shall be able to enhanced analytical skill to solve industrial problem and work as a entrepreneur
PEO2	Electrical engineer graduate shall be able promote the awareness of green technologies by considering environmental aspects.

SCHEME OF TEACHING & EXAMINATION (I – VIII SEMESTER)

B.Tech.Sem –I (Electrical Engineering –Major)

SN	Course Category	Course Code	Name of Course	BoS	Teaching Scheme (hrs)			Total Credit	Examination Scheme						
									Theory				Practical		
					TH	TU	P		Exam Hrs	SEE	CIE	Min.	SEE	CIE	Min.
1	BSC - I	BEL1T01	Engineering Mathematics-I	ASH	3	-	-	3	3	70	30	45	-	-	-
2	BSC - II	BEL1T02	Applied Physics	ASH	2	-	-	2	3	70	30	45	-	-	-
3	BSC - II	BEL1P02	Applied Physics Lab	ASH	-	-	2	1	-	-	-	-	25	25	25
4	ESC – I	BEL1T03	Basics of Electrical & Electronics Engineering	EE	3	-	-	3	3	70	30	45	-	-	-
5	ESC – I	BEL1P03	Basics Electrical & Electronics Engineering Lab	EE	-	-	2	1	-	-	-	-	25	25	25
6	ESC – II	BEL1T04	Engineering Graphics	ME	3	-	-	3	3	70	30	45	-	-	-
7	ESC – II	BEL1P04	Engineering Graphics Lab	ME	-	-	2	1	-	-	-	-	-	50	25
8	AEC-I	BAE1T01	Communication Skills	ASH	1	0	0	1	2	35	15	23			
9	AEC-I	BAE1P01	Communication Skills	ASH	0	0	2	1	`--	`--	`--	--	25	25	25
9a	VSC – I	BVS1P01	Basics of Solar PV Plant Installation	EE	-	-	4	2	-	-	-	-	50	50	50
10	CC-I	BCC1P01	Refer CC Basket	ASH	-	-	4	2	-	-	-	-	-	100	50
			Total		**12**	**0**	**16**	**20**		**315**	**135**		**125**	**275**	

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Semester wise Credit Distribution Structure for Four Year UG Electrical Engineering (Major) and Minor in Multidisciplinary

Semester	Category	I	II	III	IV	V	VI	VII	VIII	Credits
Basic Science Course	BSC	3 * 2 = 6	4 * 2 = 8	--	--	--	--	--	--	14
Engineering Science Course	ESC	4 * 2 = 8	4	--	--	--	--	--	--	12
Programme Core Course (PCC)	Program Courses	--	2	4 * 2 = 8	4 * 2 = 8	(4 * 2)+ 2 = 10	(4 * 2) + 1= 9	0	4 +4=8	45
Programme Elective Course (PEC)	Program Courses	--	--	--	--	4	(4 * 2) - 1= 7	2	3 * 2 = 6	19
Multidisciplinary Minor (MDM)	Multidisciplinary Courses	--	--	2	2	4	2	2	2	14
Open Elective (OE) Other than a particular program	OE	--	--	4	2	2	--	--	--	8
Vocational and Skill Enhancement Course (VSEC)	Skill Courses	2	2	--	2	--	2	--	--	8
Ability Enhancement Course (AEC -01, AEC-02)	Humanities Social Science and Management (HSSM)	2	--	--	2	--	--	--	--	4
Entrepreneurship/Economics/Management Courses	(HSSM)	--	--	2	2	--	--	--	--	4
Indian Knowledge System (IKS)	(HSSM)	--	2	--	--	--	--	--	--	2
Value Education Course (VEC)	(HSSM)	--	--	2	2	--	--	--	--	4
Research Methodology	Experiential Learning Courses	--	--	--	--	--	--	4	0	4
Comm. Engg. Project (CEP)/Field Project (FP)	ELC	--	--	2	--	--	--	--	--	2
Project	ELC	--	--	--	--	--	--	--	4	4
Internship/ OJT	ELC	--	--	--	--	--	--	12	--	12
Co-curricular Courses (CC)	Liberal Learning Courses	2	2	--	--	--	--	--	--	4
Total Credits (Major)		**20**	**20**	**20**	**20**	**20**	**20**	**20**	**20**	**160**

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B.Tech.Sem –II (Electrical Engineering –Major)

SN	Course Category	Course Code	Name of Course	BoS	Teaching Scheme (hrs)			Total Credit	Examination Scheme						
									Theory				Practical		
					TH	TU	P		Exam Hrs	SEE	CIE	Min.	SEE	CIE	Min.
1	BSC - III	BEL2T05	Engineering Mathematics-II	ASH	3	-	-	3	3	70	30	45	-	-	-
2	BSC - IV	BEL2T06	Applied Chemistry	ASH	3	-	-	3	3	70	30	45	-	-	-
3	BSC - IV	BEL2P06	Applied Chemistry Lab	ASH	-	-	2	1	-	-	-	-	-	50	25
4	ESC – III	BEL2T07	Engineering Mechanics	CV	3	-	-	3	3	70	30	45	-	-	-
5	ESC – III	BEL2P07	Engineering Mechanics Lab	CV	-	-	2	1	-	-	-	-	25	25	25
6	PCC – I	BEL2T08	Elements of Electrical Engineering & Measurements	EE	2	-	-	2	3	70	30	45	-	-	-
7	PCC – I	BEL2P08	Elements of Electrical Engineering & Measurements	EE	-	-	2	1	-	-	-	-	25	25	25
8	SEC – I	BSE2P01	Refer SEC Basket	-	-	-	4	2	-	-	-	-	50	50	50
9	IKS-I	BIK2T01	Refer IKS Basket	ASH	2	-	-	2	3	70	30	45	-	-	-
10	CC-II	BCC2P01	Refer CC Basket	ASH	-	-	4	2	-	-	-	-	-	100	50
			Total		**13**	**0**	**14**	**20**		**350**	**150**		**100**	**250**	

Exit option : Award of UG Certificate in Major with 40 credits and an additional 8 credits in skill based courses , internship , mini project etc

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B.Tech. Sem –III (Electrical Engineering –Major)

SN	Course Category	Course Code	Name of Course	BoS	Teaching Scheme (hrs)			Total Credit	Examination Scheme						
									Theory				Practical		
					TH	TU	P		Exam Hrs	SEE	CIE	Min.	SEE	CIE	Min.
1	PCC – II	BEL3T09	Network Analysis	EE	3	-	-	3	3	70	30	45	-	-	-
2	PCC – II	BEL3P09	Network Analysis Lab	EE	-	-	2	1	-	-	-	-	25	25	25
3	PCC – III	BEL3T10	Renewable Energy Sources	EE	3	-	-	3	3	70	30	45	-	-	-
4	PCC – III	BEL3P10	Renewable Energy Sources Lab	EE	-	-	2	1	-	-	-	-	25	25	25
5	MDM-I	BMD3T11	Electronic Devices & Circuits	EE	2	-	-	2	3	70	30	45	-	-	-
6	OE-I	BOE3T01	Open Elective-I		3	-	-	3	3	70	30	45	-	-	-
7	OE-I	BOE3P01	Open Elective-I Lab		-	-	2	1	-	-	-	-	25	25	25
8	HSSM	BHM3T01	Entrepreneurship & Startups	ASH	2	-	-	2	2	35	15	23	-	-	-
9	VEC	BVE3T01	Constitution of India	ASH	2	-	-	2	2	35	15	23	-	-	-
10	CEP	BCE3P01	Community Engineering Project	EE	-	-	4	2	-	-	-	-	-	100	50
			Total		**15**	**0**	**10**	**20**		**350**	**150**		**75**	**175**	

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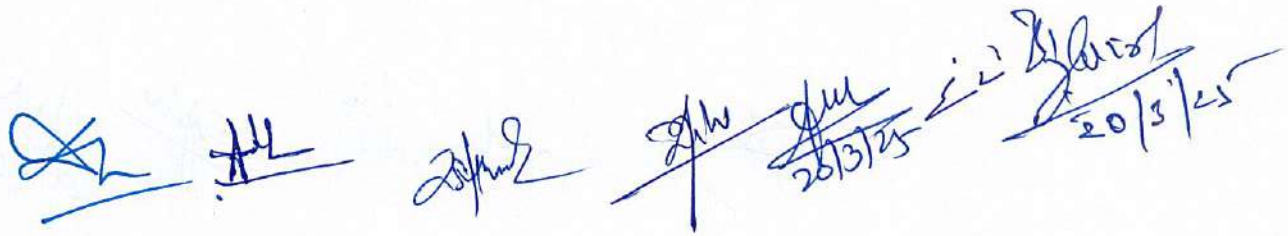
B.Tech. Sem –IV (Electrical Engineering –Major)

SN	Course Category	Course Code	Name of Course	BoS	Teaching Scheme (hrs)			Total Credit	Examination Scheme						
									Theory				Practical		
					TH	TU	P		Exam Hrs	SEE	CIE	Min.	SEE	CIE	Min.
1	PCC – IV	BEL4T11	Electrical Machines-I	EE	3	-	-	3	3	70	30	45	-	-	-
2	PCC – IV	BEL4P11	Electrical Machines-I Lab	EE	-	-	2	1	-	-	-	-	25	25	25
3	PCC – V	BEL4T12	Power Systems-I	EE	3	-	-	3	3	70	30	45	-	-	-
4	PCC – V	BEL4P12	Power Systems-I Lab	EE	-	-	2	1	-	-	-	-	25	25	25
5	MDM-II	BMD4T13	Elements of Electromagnetic	EE	2	-	-	2	3	70	30	45	-	-	-
6	OE-II	BOE4T02	Open Elective-II		2	-	-	2	3	70	30	45	-	-	-
7	AEC-II	BAE4P02	Technical Report Writing	EE	-	-	4	2	-	-	-	-	50	50	50
8	HSSM-II	BHM4T02	Digital Economy	ASH	2	-	-	2	2	35	15	23	-	-	-
9	VEC-II	BVE4T02	Universal Human Values	ASH	2	-	-	2	2	35	15	23	-	-	-
10	VSC-II	BVE4P02	Electrical Engineering Drawing	EE	-	-	4	2	-	-	-	-	50	50	50
			Total		**14**	**0**	**12**	**20**		**350**	**150**		**150**	**150**	

Exit option : Award of UG Diploma in Major with 80 credits and an additional 8 credits in skill based courses , internship , mini project etc



B.Tech. Sem –V (Electrical Engineering –Major)

SN	Course Category	Course Code	Name of Course	BoS	Teaching Scheme (hrs)			Total Credit	Examination Scheme						
									Theory				Practical		
					TH	TU	P		Exam Hrs	SEE	CIE	Min.	SEE	CIE	Min.
1	PCC – VI	BEL5T13	Electrical Machines-II	EE	3	-	-	3	3	70	30	45	-	-	-
2	PCC – VI	BEL5P13	Electrical Machines-II Lab	EE	-	-	2	1	-	-	-	-	25	25	25
3	PCC – VII	BEL5T14	Electrical Power Utilization	EE	2	-	-	2	2	70	30	45	-	-	-
4	PCC – VII	BEL5P14	Electrical Workshop Lab.	EE	-	-	2	1	-	-	-	-	50	50	50
5	PCC – VIII	BEL5T15	Power Systems-II	EE	3	-	-	3	3	70	30	45	-	-	-
6	PEC-I	BEL5T16	Program Elective-I **(Refer Program Elective Basket)**	EE	3	1	-	4	3	70	30	45	-	-	-
8	MDM-III	BMD5T17	Programming Techniques & Simulation	EE	3	-	-	3	3	70	30	45	-	-	-
9	MDM-III	BMD5P17	Programming Techniques & Simulation Lab	EE	-	-	2	1	-	-	-	-	25	25	25
10	OE-III	BOE5T03	Open Elective-III		2	-	-	2	3	70	30	45	-	-	-
			Total		**16**	**1**	**6**	**20**		**420**	**180**		**100**	**100**	

B.Tech. Sem –VI (Electrical Engineering –Major)

SN	Course Category	Course Code	Name of Course	BoS	Teaching Scheme (hrs)			Total Credit	Examination Scheme						
									Theory				Practical		
					TH	TU	P		Exam Hrs	SEE	CIE	Min.	SEE	CIE	Min.
1	PCC – IX	BEL6T18	Power Electronics	EE	3	-	-	3	3	70	30	45	-	-	-
2	PCC – IX	BEL6P18	Power Electronics Lab	EE	-	-	2	1	-	-	-	-	25	25	25
3	PCC – X	BEL6T19	Control System	EE	3	1	-	4	3	70	30	45	-	-	-
5	PCC – XI	BEL6T20	Control System Lab	EE	-	-	2	1	-	-	-	-	25	25	25
6	PEC-II	BEL6T21	Program Elective-II	EE	3	-	-	3	3	70	30	45	-	-	-
7	PEC-III	BEL6T22	Program Elective-III	EE	3	1	-	4	3	70	30	45	-	-	-
8	MDM-IV	BMD6T22	Microprocessor & Microcontroller	EE	2	-	-	2	2	70	30	45	-	-	-
9	SEC-II	BSE6P02	Electrical Installation Design lab	EE	-	-	4	2	-	-	-	-	50	50	50
			Total		**14**	**2**	**8**	**20**		**350**	**150**		**100**	**100**	

Exit option : Award of UG Degree B.Voc / B.Sc. in Major with 120 credits and an additional 8 credits in skill based courses , internship , mini project etc.

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B.Tech. Sem –VII (Electrical Engineering –Major)

SN	Course Category	Course Code	Name of Course	BoS	Teaching Scheme (hrs)			Total Credit	Examination Scheme						
									Theory				Practical		
					TH	TU	P		Exam Hrs	SEE	CIE	Min.	SEE	CIE	Min.
1	RM	BRM7T23	Research Methodology #	EE	3	-	-	3	3	70	30	45	-	-	-
2	RM	BRM7P23	Effective writing#	EE	1	-	-	1	-	35	15	23	-	-	-
3	PEC-IV	BEL7T24	Program Elective-IV #	EE	2	-	-	2	3	70	30	45	-	-	-
4	MDM-V	BMD7T25	Introduction to Artificial Intelligence & Machine Learning #	EE	2	-	-	2	3	70	30	45	-	-	-
5	OJT	BOJ7P01	Internship (12 Weeks)	EE	-	-	24	12	-	-	-	-	200	200	200
			Total		**8**	**0**	**24**	**20**		**245**	**105**		**200**	**200**	

 # Indicates that, Online Courses to be done from NPTEL. Examination will be conducted by NPTEL / RTMNU

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B.Tech. Sem –VIII (Electrical Engineering –Major)

SN	Course Category	Course Code	Name of Course	BoS	Teaching Scheme (hrs)			Total Credit	Examination Scheme						
									Theory				Practical		
					TH	TU	P		Exam Hrs	SEE	CIE	Min.	SEE	CIE	Min.
1	PCC – XII	BEL8T26	Power System Protection	EE	3	-	-	3	3	70	30	45	-	-	-
2	PCC – XII	BEL8P26	Power System Protection Lab	EE	-	-	2	1	-	-	-	-	25	25	25
3	PCC – XIII	BEL8T27	Computer Application in Power Systems	EE	3	-	-	3	3	70	30	45	-	-	-
4	PCC – XIII	BEL8P27	Computer Application in Power Systems Lab	EE	-	-	2	1	-	-	-	-	-	50	25
5	PEC-V	BEL8T28	Program Elective-V	EE	3	-	-	3	3	70	30	45	-	-	-
6	PEC-VI	BEL8T29	Program Elective-VI	EE	3	-	-	3	3	70	30	45	-	-	-
7	MDM-VI	BMD8T30	IoT Application in Electrical Engg.	EE	2	-	-	2	3	70	30	45	-	-	-
8	Project	BPR8P01	Project	EE	-	-	8	4	-	-	-	-	100	100	100
			Total		**14**	**0**	**12**	**20**		**350**	**150**		**125**	**175**	

4-Years Bachelor's Degree (B.Tech.) in Electrical Engineering with Multidisciplinary Minor

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Abbreviations

OE	**Generic/ Open Electives**
VSEC	**Vocational Skill and Skill Enhancement Courses**
VSC	**Vocational Skill Courses**
SEC	**Skill Enhancement Courses**
AEC	**Ability Enhancement Courses**
IKS	**Indian Knowledge System**
VEC	**Value Education Courses**
OJT	**On Job Training: Internship/ Apprenticeship.**
FP	**Field projects**
CEP	**Community engagement project**
CC	**Co-curricular Courses**
RM	**Research Methodology**
RP	**Research Project**
Lib. Learn	**Liberal Learning Course**
HSSM	**Courses on Humanities, Social Science, and Management**
SEE	**Semester End Examination**
CIE	**Continuous Internal Evaluation**

LIST OF PROGRAM ELECTIVE COURSES (PEC) ELECTRICAL ENGINEERING

S.N.	Semester	Category	Course code	Course name
1	5th	PEC-I	BEL5T16A	PLC and SCADA
2			BEL5T16B	Electrical Machine Design
3			BEL5T16C	Digital Electronics circuits
4	6th	PEC-II	BEL6T20A	Electrical Safety & Standards
5			BEL6T20B	Electric Drives & Control
6			BEL6T20C	Energy Management & Audit
7		PEC-III	BEL6T21A	Electric Vehicles
8			BEL6T21B	HV Engineering
9			BEL6T21C	Electrical Distribution Systems
10	7th	PEC-IV	BEL7T24A#	EHVAC & HVDC Transmission
11			BEL7T24B#	Advance Control System
12			BEL7T24C#	Power Semiconductor Based Drives
13	8th	PEC-V	BEL8T28A	Power Quality
14			BEL8T28B	Smart Grid System
15			BEL8T28C	Power Station Practice
16		PEC-VI	BEL8T29A	Flexible AC Transmission Systems
17			BEL8T29B	Solar Photovoltaic Systems
18			BEL8T29C	Battery Management System.

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#indicates that Online Courses to be done from NPTEL. Examination will be conducted by NPTEL/RTMNU.

LIST OF OPEN ELECTIVES (OE) OFFERED BY ELECTRICAL ENGINEERING BOS

(Students of Electrical Engineering will not be able to opt these OE courses)

S.N.	Semester	Course code	Course name
1	3rd SEM	BOE3T01	Fundamental of Electrical Engineering
2	4th SEM	BOE4T02	Introduction to Power Systems
3	5th SEM	BOE5T03	Power Plant Engineering

LIST OF INDIAN KNOWLEDGE SYSTEM COURSES (IKS) OFFEREDBYELECTRICAL ENGINEERINGBOS

(Offered by Applied Science Board and Humanities)

S.N.	Semester	Category	Course code	Course name
1	2ndsem	IKS-I	BCSE2T05A	Consciousness Studies
2			BCSE2T05B	Preserving Art, Culture and Tradition
3			BCSE2T05C	Wellness, traditional medicines and yoga
4			BCSE2T05D	Glimpses of ancient Science and Technology

LIST OF SKILL ENHANCEMENT COURSES (SEC) OFFERED BY ELECTRICAL ENGINEERING BOS

S.N.	Semester	Course Code	Course Name
1	2nd SEM	BSE2P01	Electric Wiring & Illumination System
2	6th SEM	BSE6P02	Electrical Installation Design

First Semester Syllabus

RASHTRASANT TUKADOJI MAHARAJ NAGPUR UNIVERSITY, NAGPUR
FACULTY OF SCIENCE & TECHNOLOGY
B.TECH. ELECTRICAL ENGINEERING

Sem: I	Total Hours Distribution per week	
Total Credit : 3	Lecture (L): 3 Hrs	Tutorial/Activity (T/A): 0 Hr.
Subject Code	BEL1TO1	Engineering Mathematics -1

Examination Scheme			
Internal Marks:	University Marks:	Minimum Passing Marks:	Examination Duration:
30 Marks	70 Marks	45 Marks	3 Hours

Course Objectives	
1	The topics covered will equip them the techniques to understand advanced level mathematics and its applications that would enhance analytical thinking power.
2	The aim is to inculcate and develop the basic mathematic skills of engineering students that are imperative for effective understanding of engineering subjects.

Course Outcomes	
After completion of syllabus, students would be able to	
1	Analyse real world scenarios to recognize when derivatives or integrals are appropriate, formulate problems about the scenarios, creatively model these scenarios (using technology, if appropriate) in order to solve the problems using multiple approaches, judge if the results are reasonable, and then interpret and clearly communicate the results.
2	Appreciate ODE and system of ODEs concepts that are encountered in the real world, understand and be able to communicate the underlying mathematics involved to help another person gain insight into the situation.
3	Apply knowledge of mathematics, physics and modern computing tools to scientific and engineering problems.
4	Develop an ability to identify, formulate and/or solve real world problems.
5	Understand the impact of scientific and engineering solutions in a global and societal context.

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SYLLABUS

Details of Topic	Allotment of Hours		Mapped with CO Number
	L	T/A	CO
Unit-1 : Differential Calculus			
Successive differentiation: Leibnitz's Rule, Taylor's and Maclaurin's series for function of one variable, Indeterminate forms and L'Hospital's Rule.	5		1
Unit 2: Multivariable Calculus (Differentiation)			
Functions of several variables, First and Higher order partial derivatives, Euler's theorem, Chain rule and Total differential coefficient, Jacobians, Lagrange's method of undetermined multipliers.	5		2
Unit 3: Matrices			
Rank of a matrix, Consistency of linear system of non-homogeneous equations, Linear dependence of vectors, Eigen values and Eigen vectors, Reduction to diagonal form, Cayley-Hamilton theorem.	4		3
Unit 4: First Order Ordinary Differential Equations			
Linear, Reducible to linear and Bernoulli's differential equations, Exact differential equations (Excluding the cases of integrating factors), Application of first order differential equation to simple electrical circuits.	5		4
Unit-5: Higher Order Ordinary Differential Equations			
Higher order ordinary linear differential equations with constant coefficients, Method of variation of parameters, Cauchy's and Legendre's homogeneous differential equations, Applications of higher order differential equations to simple electrical circuits.	5		5

Text/Reference Books:

(1) Erwin Krayzig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons,2006.

(2) Ramana B.V., Higher Engineering Mathematics, Tata Mc-Graw Hill, New Delhi, 11th Reprint, 2010.

(3) N.P. Bali and Manish Goyal, A textbook of Engineering Mathematics, Laxmi Publications, Reprint, 2008.

(4) B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010.

(5) P. N. Wartikar and J. N. Wartikar, Applied Mathematics, Volume I and II.

(6) H.K Dass, Rama Verma, RajnishVerma, V.J. Dagwal, Sajid Anwar and D.F. Shastrakar, Engineering Mathematics, Volume I and II, S. Chand.

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RASHTRASANT TUKADOJI MAHARAJ NAGPUR UNIVERSITY, NAGPUR
FACULTY OF SCIENCE & TECHNOLOGY
B.TECH. ELECTRICAL ENGINEERING

Sem: I	Total Hours Distribution per week	
Total Credit : 2	Lecture (L): 3 Hrs	Tutorial/Activity (T/A): 0 Hr.
Subject Code	BEL1TO2	Applied Physics

Examination Scheme			
Internal Marks:	University Marks:	Minimum Passing Marks:	Examination Duration:
30 Marks	70 Marks	45 Marks	3 Hours

Course Outcomes

After completion of syllabus, students would be able to	
1	Learn the basic concepts of the dual nature of matter and wave packet and apply them to analyze various relevant phenomena and to solve related numerical problems.
2	Apply concepts in interference and diffraction to solve relevant numerical problems and to relate to relevant engineering applications
3	Identify and explain different types of diodes, transistors, and its applications.
4	Learn and explain quantum transitions and apply them to the working of lasers.

SYLLABUS

Details of Topic	Allotment of Hours		Mapped with CO Number
	L	T/A	CO
Unit-1 :Quantum Mechanics			
Concept of wave-particle duality, De-Broglie Hypothesis, Matter Waves, Davisson-Germer Experiment; Bohr's Quantization condition. Concept of wave packets, Heisenberg Uncertainty Principle. Schrodinger wave equation (time dependent and time independent), Wave function Ψ and normalization condition, Application to one dimensional infinite potential well.	6		1
Unit 2: Wave optics			

Huygen's principle, superposition of waves and interference of light by wavefront splitting and amplitude splitting, Interference in thin films, Interference in Wedge-shaped thin film, Newton's rings, and Anti-reflection coating.	6		2
Unit 3: Semiconductor Devices			
Semiconductor, Classification, Pure and doped semiconductors. Types of Semiconductor diodes -P-N junction Diode, Tunnel Diode, Zener Diode, Light Emitting Diode (LED), Photodiode. Transistors, Hall Effect, Hall voltage, and Hall coefficient; its applications	6		3
Unit 4: Lasers			
Quantum Transitions: Absorption, Spontaneous emission & stimulated Emission, Metastable states, Principle of laser, Laser characteristics, Coherence length and coherence time, Pumping schemes: Three level and Four level. Optical Resonator, Construction & working of Ruby laser and He-Ne laser, Semiconductor diode laser, Applications of laser.	6		4

Suggested Text Books &Reference Books

1. P. M. Mathews and K. Venkatesan, A Textbook of Quantum Mechanics, Tata Mc Graw Hill (1977).
2. J. L. Powell and B. Crasemann, Quantum Mechanics, Narosa Publishing House (1993).
3. Charles Kittel, Introduction to Solid State Physics, Wiley Eastern, 5th edition, (1983).
4. A. J. Dekker, Solid State Physics, Prentice Hall of India (1971).
5. A Textbook of Engineering Physics, Dr. M. N. Avdhanulu, Dr. P. G. Kshirsagar, S. Chand Publication
6. Text book of Applied Physics, Dr. D. S. Hardas, Dr. D. S. Bhoumik, Dr.S. Shastri, Das Ganu Publication ISBN-978-93-84336-59-2 (2021)
7. Applied Physics, M. N. Avdhanulu, Shilpa A. Pande, Arti R. Golhar, Mohan Giriya, S. CHAND
8. A Text Book of Engineering Physics Dr. DevashreeHardas& Dr. Ashish Panat, Das Ganu Publication ISBN-978-81-921757-7-5 (2011)
9. Applied Physics, - Dr. (Mrs)S.P. Wankhede, Dr.ShrutiPatle, Dr.(Mrs.)S.U.Bhonsule and Dr.N. S. Ugemuge DNA Publication ISBN-978-81-945174-6-7 (2020)
10. Quantum Physics of Atoms, Molecules, Solids, Nuclei, and Particles by R. Eisberg and R. Resnick, Wiley and Sons
11. Engineering Physics, second edition, Sanjay Jain, G. Sahasrabudhe, University's Press(India) Pvt. Ltd.(2016)
12. D. J. Griffiths, Quantum mechanics, Prentice Hall of India Private Limited, New Delhi
13. L. I. Schiff, Quantum Mechanics, TMH Publications
14. Advanced Engineering Materials - Dr. Sangeeta G. Itankar, Dr. ManjushaDandekar, Dr. Tushar R. Shelke, Dr. Swati Fartode, Alliance & Co. ISBN 978-93-91322-12-0 (2023)
15. Applied Physics- Dr. Sangeeta G. Itankar, Dr. ManjushaDandekar, Dr. Tushar R. Shelke, Dr. Swati Fartode, Alliance &Co. ISBN 978-93-91322-97-7 (2023)
16. David Halliday, Robert Resnick, Jearl Walker, Principles of Physics, 10th Edition, John Wiley and Sons (2017)
17. Advanced physics - Dr.ShrutiPatle, Dr.(Mrs).S.U.Bhonsule, Dr.Ashish N. Bodhaye, Dr.ManoharD.Mehare DNA Publication (2019)
18. Engineering Physics - Dr.N. S. Ugemuge, Dr.(Mrs.)S.U.Bhonsule and Dr.ShrutiPatle DNA Publication(2019)

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RASHTRASANT TUKADOJI MAHARAJ NAGPUR UNIVERSITY, NAGPUR
FACULTY OF SCIENCE & TECHNOLOGY
B.TECH. ELECTRICAL ENGINEERING

Sem: I	Total Hours Distribution per week		
Total Credit :1	Practical (P): 2 Hrs.		
Subject Code	BEL1P02	Applied Physics Lab.	
Examination Scheme - Practical			
Internal Marks:	University Marks:	MinimumPassing Marks:	Examination Duration:
25 Marks	25 Marks	25 Marks	--

LIST OF PRACTICAL:

Pr. No.	List of Practical
1	Energy gap of semiconductor /thermistor.
2	Parameter extraction from V-I characteristics of PN junction diode.
3	Parameter extraction from V-I characteristics of Zener diode.
4	Parameter extraction from V-I characteristics of PNP/NPN transistor in CB and CE mode.
5	V-I Characteristics of Tunnel diode.
6	V-I Characteristics of Light Emitting Diodes/ Determination of Plank's constant by using LEDs.
7	Study of Diode rectification.
8	Study of Hall Effect and determination of Hall Voltage of a given sample.
9	Variation of Hall coefficient (RH) with temperature.
10	To study B-H curve and to find out the values of coercivity, retentivity, and saturation magnetization of the experimental material.
11	Determination of NA for optical fiber
12	Calibration of Time Base circuit of CRO and determination of AC, DC voltage & frequency of electrical signals using CRO.
13	To determine the number of lines per cm on a diffraction grating using a LASER beam.
14	Virtual Lab: Experiment on the determination of the thickness of a thin foil using an air wedge arrangement.
15	Virtual Lab: Experiment on the determination of the refractive indices of the material corresponding to ordinary and extra - ordinary rays.

Note: Performance of at least six experiments is compulsory in a semester.

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FACULTY OF SCIENCE & TECHNOLOGY
B.TECH. ELECTRICAL ENGINEERING

Sem: I	Total Hours Distribution per week	
Total Credit : 3	Lecture (L): 3 Hrs	Tutorial/Activity (T/A): 0 Hr.
Subject Code	BEL1TO3	Basics of Electrical & Electronics Engineering

Examination Scheme			
Internal Marks:	University Marks:	Minimum Passing Marks:	Examination Duration:
30 Marks	70 Marks	45 Marks	3 Hours

Course Objectives	
1	To learn basic concepts and principles of Electrical and Electronics Engineering.
2	To Understand basic operation and working of electrical machines.
3	To learn the concepts of electrical &electronic circuits .

Course Outcomes	
After completion of syllabus, students would be able to	
1	Understand basic properties of electrical components and electrical parameters
2	Analyse DC Electric & Magnetic Circuits
3	Learn and analyse AC circuits
4	Understand working principle of electrical machines
5	Know the electronic devices and their properties & use the various electronic devices for various applications.

SYLLABUS

Details of Topic	Allotment of Hours		Mapped with CO Number
	L	T/A	CO
Unit-1			
Circuit Elements and Parameters- Resistance, Inductance & Capacitance, Basic relations between voltage, current and resistance, classification of material according to conductivity, various effects current.	7		1

Unit 2:			
Electrical Circuit Fundamentals-DC Circuits: Types, Series, Parallel, Star, Delta and transformation Kirchhoff's Laws& Applications, Energy Sources and Circuit Reduction, Magnetic Circuits: Flux, MMF, Reluctance, Analogy with Electric Circuits. Simple Calculations for Composite Magnetic Circuits	5		2
Unit 3:			
AC Circuits & Fundamentals-Principle of Generation of Single Phase , Periodic Function, Average & R.M.S., Values, Steady State Behavior With Sinusoidal Excitation, Phasor Representation, Reactance & Impedance, Series & Parallel Circuit, Power Factor.	10		3
Unit 4:			
Introduction to Electrical Machines- Transformer: Basic Principles, Construction, Phasor Diagram for Transformer under no load and on load conditions, Voltage Regulation and Efficiency, DC Machines: Introduction and types, Working Principle, simple mathematical equations, Other types of machines: Induction Motor, Stepper Motors (Only Working Principle)	8		4
Unit-5:			
Introduction to Electronic Components- P-N Junction Diode, Bi-junction transistor, UJT, FET etc and their properties, Diode as a rectifier. **Fundamental Applications of Transistors-** Common emitter, common collector and common base configurations of BJT, Emitter follower, various Biasing circuits for BJT, BJT as a switch, BJT as an amplifier. Basic introduction to OP-AMP	9		5

Text & Reference Books:

1. D. C. Kulshrehtha, "Basic Electrical Engineering", Tata Mcgraw Hill, 2012
2. B.L.Theraja, "Electrical Technology", S.Chand
3. MillmanHalkias , "Electronic Devices and Circuits", Tata McGraw Hill, 2000

Online references:

1. Basic Electrical Engineering A Web course of NPTEL by Day, Bhattacharya & Roy, Available:- www. nptel.ac.in

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FACULTY OF SCIENCE & TECHNOLOGY
B.TECH. ELECTRICAL ENGINEERING

Sem: I	Total Hours Distribution per week	
Total Credit : 3	Lecture (L): 3 Hrs	Tutorial/Activity (T/A): 0 Hr.
Subject Code	BEL1TO4	Engineering Graphics

Examination Scheme			
Internal Marks:	University Marks:	Minimum Passing Marks:	Examination Duration:
30 Marks	70 Marks	45 Marks	3 Hours

Course Objectives	
1	To improve imagination skills.
2	Learn to sketch and take field dimensions.
3	Learn to take data and transform it into graphic drawings.
4	Learn basic engineering drawing formats.

Course Outcomes	
After completion of syllabus, students would be able to	
1	Get acquainted with the knowledge of various lines, geometrical constructions and construction of various kinds of scales, and Ellipse.
2	Improve their imagination skills by gaining knowledge about points, lines and planes.
3	Become proficient in drawing the projections of various solids.
4	Gain knowledge about orthographic and isometric projections.

SYLLABUS

Details of Topic	Allotment of Hours		Mapped with CO Number
	L	T/A	CO
Unit-1			

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Polygons-Construction of Regular Polygons using given length of a side; Ellipse-General method and Oblong Methods for Construction of ellipse; Scales-Plain ,Vernier and Diagonal Scales. Introduction to Orthographic Projections; Projections of Points; Projections of Straight Lines parallel to both planes; Projections of Straight Lines-Parallel to one and inclined to other plane.	7		1
Unit 2:			
Projections of Straight Lines inclined to both planes, determination of true lengths, angle of inclinations and traces.	5		2
Unit 3:			
Projections of Planes; Regular Planes Perpendicular / Parallel to one Reference Plane and inclined to other Reference Plane; inclined to both the Reference Planes.	10		3
Unit 4:			
Projections of Solids-Prisms, Pyramids, Cylinders and Cones with the axis inclined to one Plane.	8		4
Unit-5:			
Conversion of Isometric Views to Orthographic Views. Conversion of Orthographic Views to Isometric Projections and Views.	9		5

Text Book:

1.Engineering Drawing byN.D.Bhat,Chariotpublications

Reference Books:

1. Engineering Drawing by M.B. Shah and B.C. Rana, Pearson publishers
2. Engineering Drawing by Dhananjay A. Jolhe, Tata McGraw Hill Publishers
3. Engineering Graphics for Degree by K.C. John, PHI Publishers

RASHTRASANT TUKADOJI MAHARAJ NAGPUR UNIVERSITY, NAGPUR
FACULTY OF SCIENCE & TECHNOLOGY
B.TECH. ELECTRICAL ENGINEERING

Sem: I	Total Hours Distribution per week		
Total Credit :1	Practical (P): 2 Hrs.		
Subject Code	BEL1P04	Engineering Graphics Lab.	
Examination Scheme - Practical			
Internal Marks:	University Marks:	Minimum Passing Marks:	Examination Duration:
50 Marks	--	25 Marks	--

LIST OF PRACTICAL:

Based on the above syllabus (Project assign /Preparation of sheets)

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B.TECH. ELECTRICAL ENGINEERING

Sem: I	Total Hours Distribution per week		
Total Credit :1	Practical (P): 2 Hrs.		
Subject Code	BEL1P03	Basics of Electrical & Electronics Engineering Lab.	
Examination Scheme - Practical			
Internal Marks:	University Marks:	MinimumPassing Marks:	Examination Duration:
25 Marks	25 Marks	25 Marks	--

Practical Course Objectives	
1	To learn basics of Electrical and Magnetic Circuits
2	To learn the basic semiconductor Electronic devices and their applications

Practical Course Outcomes	
After completing the practical course, students will be able to	
1	Understand basic properties of electrical components and electrical parameters
2	Analyse DC Electric & Magnetic Circuits
3	Learn and analyse AC circuits
4	Know the electronic devices and their properties
5	Use the various electronic devices for various applications

LIST OF PRACTICAL:

Pr. No.	List of Practical
1	To study and verification of Kirchhoff's Laws applied to direct current circuit
2	To obtain the B/H curve of a magnetic material
3	To study AC series circuits
4	To Study AC parallel circuits
5	To study characteristics of P-N Junction diode
6	To study Half and Full wave rectifier
7	To study Transistor Characteristics
8	To study of BJT as amplifier

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FACULTY OF SCIENCE & TECHNOLOGY
B.TECH. ELECTRICAL ENGINEERING

Sem: I	Total Hours Distribution per week		
Total Credit : 1	Lecture (L): 1Hrs	Tutorial/Activity (T/A): 0 Hr.	
Subject Code	BAE1TO1	Communication Skills	
Examination Scheme			
Internal Marks:	University Marks:	Minimum Passing Marks:	Examination Duration:
15 Marks	35 Marks	23 Marks	2 Hours

Prerequisites: Basic knowledge of Communication Skills

Course Objectives	
1	Students would be able to enhance their communication skills.

Course Outcomes	
After completion of syllabus, students would be able to	
1	Construct grammatically correct sentences.
2	Identify and overcome barriers of communication.
3	Demonstrate good Listening and speaking skills.
4	Develop effective reading and writing skills.

SYLLABUS

Details of Topic	Allotment of Hours		Mapped with CO Number
	L	T/A	CO
Unit-1			
Grammar: Tenses and its types, sentences and its Types, Transformation of Sentences(Assertive, Affirmative, Negative, Interrogative, Exclamatory) Reported speech.	4		1
Unit-2			
Introduction to Communication, Importance of communication Types of communication -Verbal and non-verbal Communications: - Kinesics, Vocalics, Chronemics, Haptics,Proxemics), Barriers to communication and methods to overcome them.	3		2
Unit-3			

Introduction to LSRW Skills-, Listening Skills: Importance of listening, Types of listening, listening barriers and methods to overcome, Speaking Skills: Components of public speaking, Essential steps for public speaking, Overcoming stage fear in public speaking, Do's, and Don'ts of Public speaking	5		3
Unit-4			
Reading Skills: Importance of reading skills, Types of reading, comprehending passages, Writing Skills: Importance of effective writing, Paragraph writing, Email etiquettes.	4		4

Reference books:

1. Technical Communication by Meenakshi Raman and Sangeeta Sharma, OUP

2. Public Speaking and Influencing Men in Business by Dale Carnegie 3. Professional Communication Skills

by Bhatia and Sheikh, S. Chand Publications

3. Communication Skills by Sanjeev Kumar and Pushpalata, OUP

4. Communication Skills by LalitaBisen, Bhumika Agrawal, N. ThejoKalyani, Himalaya Publishing House

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B.TECH. ELECTRICAL ENGINEERING

Sem: I	Total Hours Distribution per week		
Total Credit :1	Practical (P): 1 Hrs.		
Subject Code	BAE1P01	Communication Skills	
Examination Scheme - Practical			
Internal Marks:	University Marks:	MinimumPassing Marks:	Examination Duration:
25 Marks	25 Marks	25 Marks	--

LIST OF PRACTICAL:

Pr. No.	List of Practical: (Perform any 6 – 8 Practical)
1	Barriers to Communication
2	Non-verbal Communication
3	Listening Skills
4	Reading Skills
5	Speaking Skills
6	Presentation Skills
7	Group Discussion
8	Interview Techniques
Pr. No.	**List of Practical: Beyond Syllabus**
1	Development of Word Power
2	Use of Figurative language

Suggested Textbooks /Reference Books/ Web page (URL)/Research paper, etc.

1 Technical Communication by Meenakshi Raman and Sangeeta Sharma, OUP
2 Public Speaking and Influencing Men in Business by Dale Carnegie
3 Professional Communication Skills by Bhatia and Sheikh, S. Chand Publications
4 Communication Skills by LalitaBisen, Bhumika Agrawal, N.ThejoKalyani, Himalaya

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FACULTY OF SCIENCE & TECHNOLOGY
B.TECH. ELECTRICAL ENGINEERING

Sem: I	Total Hours Distribution per week		
Total Credit :2	Practical (P): 4 Hrs.		
Subject Code	BVS1P03	Basics of Solar PV Plant Installation	
Examination Scheme - Practical			
Internal Marks:	University Marks:	Minimum Passing Marks:	Examination Duration:
50 Marks	50 Marks	50Marks	--

Practical Course Objectives	
1	To understand the Solar PV Technology
2	To learn the basics of Solar PV Panels
3	To prepare the design of Solar PV Plant
4	To install a small Solar PV Plant

Practical Course Outcomes	
After completing the practical course, students will be able to	
1	Compute the electricity generation from solar radiations
2	Carry out basic requirement of solar PV plants
3	Identify and use the tools used for Solar PV system installation
4	Install the Civil/Mechanical and Electrical components of a Solar PV system
5	Test and Commission Solar PV system

LIST OF PRACTICAL:

Pr. No.	List of Practical
1	To demonstrate the I-V and P-V Characteristics of PV module with varying radiation and temperature level
2	To demonstrate the I-V and P-V characteristics of series and parallel combination of PV modules
3	To determine the different electrical parameters of a mono-crystalline and poly-crystalline silicon solar panel
4	To study the effect of variation in tilt angle on PV module power
5	To draw the charging and discharging characteristics of battery
6	To study solar PV inverter
7	Observe the output waveform of the inverter in auto mode
8	Workout power flow calculations of standalone PV system of load with battery

Second Semester Syllabus

9	To study all the tools required for solar PV plant installation
10	To study the on-grid and off-grid Solar PV plant
11	To design a small Solar PV plant

Text & Reference Books:

1. Solar Photovoltaics: Fundamentals, Technologies and Applications by Chetan Singh Solanki, PHI
2. Install Your Own Solar Panels by Joseph Burdick, Philip Schmidt Storey Publishing
3. Solar PV Installer (Suryamitra) Published by RachanaSagar Pvt Ltd.

Online references:

1. The complete Solar Energy Course Beginner to Advanced level- https://www.udemy.com/course/the-complete-solar-energy-course-beginner-to-advanced-level/

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FACULTY OF SCIENCE & TECHNOLOGY
B.TECH. ELECTRICAL ENGINEERING

Sem: II	Total Hours Distribution per week	
Total Credit : 3	Lecture (L): 3 Hrs	Tutorial/Activity (T/A): 0 Hr.
Subject Code	BEL2TO5	Engineering Mathematics -II

Examination Scheme			
Internal Marks:	University Marks:	Minimum Passing Marks:	Examination Duration:
30 Marks	70 Marks	45 Marks	3 Hours

Course Objectives	
1	The objective of the course is to inculcate and strengthen analytic ability among the engineering students and to create zeal of working with higher mathematics and its applications in the extensive field of engineering.
2	The topics covered will serve as basic tools for specialized studies in many fields of engineering and technology.

Course Outcomes	
After completion of syllabus, students would be able to	
1	Analyse real world scenarios to recognize when integrals are appropriate, formulate problems about the scenarios, creatively model these scenarios (using technology, if appropriate) in order to solve the problems using multiple approaches, judge if the results are reasonable, and then interpret and clearly communicate the results.
2	Define and understand the geometry of vector differential operators and line and surface integrals.
3	Explain and apply principles of study design and data collection.
4	Develop an ability to identify, formulate and/or solve real world problems
5	Understand the impact of scientific and engineering solutions in a global and societal context.

SYLLABUS

Details of Topic	Allotment of Hours		Mapped with CO Number
	L	T/A	CO

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Unit-1 :Integral Calculus			
Evaluation of Definite and Improper Integrals: Beta and Gamma functions and their properties, Mean value, Mean square value and Root mean square value, Tracing of curves (Cartesian), Applications of definite integrals to find length of curve, area, volume.	10		1
Unit 2: Multivariable Calculus (Integration)			
Multiple Integration: Double integrals (Cartesian), Change of order of integration in double integrals, Change of variables (Cartesian to Polar). Applications on Area, Mass, Volume	10		2
Unit 3: Vector Calculus			
Vector Calculus: Vector triple product, Product of four vectors, Scalar point function, Vector point function, Vector differentiation, Gradient, Divergence and Curl, Directional derivatives, Solenoidal and Irrotational motions	8		3
Unit 4: Statistics			
Fitting of a Curve by Method of Least Squares: Straight line $y = a + b x$, Second degree parabola $y = a+bx+cx_2$ and curves of the type $y = ae^{bx}$, $y = ab^{x}$ and $y = ax^{b}$. Coefficient of correlation and Lines of regression, Rank correlation.	10		4
Unit-5: Numerical Methods:			
Error Analysis, Solution of Algebraic and Transcendental Equations: Method of False position, Newton–Raphson method and its convergence, Solution of system of simultaneous linear equations: Crout's method (LU decomposition Method), Gauss-Seidel method.	8		5

Text/Reference Books:

(1) Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons,2006.

(2) Ramana B.V., Higher Engineering Mathematics, Tata Mc-Graw Hill, New Delhi, 11th Reprint, 2010.

(3) N.P. Bali and Manish Goyal, A textbook of Engineering Mathematics, Laxmi Publications, Reprint, 2008.

(4) B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010.

(5) P. N. Wartikar and J. N. Wartikar, Applied Mathematics, Volume I and II.

(6) H.K Dass, Rama Verma, RajnishVerma, V.J. Dagwal, Sajid Anwar and D.F. Shastrakar, Engineering Mathematics, Volume I and II, S. Chand.

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FACULTY OF SCIENCE & TECHNOLOGY
B.TECH. ELECTRICAL ENGINEERING

Sem: II	Total Hours Distribution per week	
Total Credit : 3	Lecture (L): 3 Hrs	Tutorial/Activity (T/A): 0 Hr.
Subject Code	BEL2TO6	Applied Chemistry

Examination Scheme			
Internal Marks:	University Marks:	Minimum Passing Marks:	Examination Duration:
30 Marks	70 Marks	45 Marks	3 Hours

Course Outcomes

After completion of syllabus, students would be able to	
1	Students will be able to apply the basics concepts of electrochemistry& corrosion technology.
2	Students will know about fuels and lubricants and analyse the situation for their appropriate applications.
3	Students can analyse the various industrial problems arising due to water quality and their remediation.
4	Students will Develop the environmental awareness from the basics of green chemistry and its application.
5	Students will inculcate the use of instrumentation techniques and interpret its applications in material characterization.

SYLLABUS

Details of Topic	Allotment of Hours		Mapped with CO Number
	L	T/A	CO
Unit-1 :Electrochemistry and Corrosion Technology			
A] Electrochemistry: Electrochemical & Galvanic Series, Electrochemical & Electrolytic cell, Battery: Introduction, types, characteristics, components/materials, working and applications of Lithium-cobalt oxide and metal air batteries. Super capacitors: Introduction, types (EDLC, pseudo and asymmetric capacitor) with examples and applications. Energy conversion devices: Introduction, characteristics, materials, working and applications of H2-O2 fuel cells, amorphous Si and quantum dye sensitized solar cells.	7		1

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B] Corrosion: Theories of Corrosion (Dry, Wet and Differential Aeration), Pilling-Bedworth Rule & Numerical, Factors affecting corrosion, Types of Corrosion (Intergranular & Stress), Corrosion Protection- Design & Material Selection, Cathodic Protection (Galvanic & Impressed Current)			
Unit 2: Fuels & Lubricants			
A] Fuels: Introduction: Calorific value, Higher and lower calorific value; determination of calorific value by Bomb and Boy's calorimeter; numerical based on calorific value determination; Liquid fuels –fractional distillation of crude petroleum(boiling point wise separation only) use of gasoline and diesel in internal combustion engine: knocking and chemical constitution of fuel, Octane and Cetane number, doping agents, Introduction to propellants and its classification. Combustion calculations – Numericals based on combustion calculations for solid, liquid and gaseous fuels **B] Lubricants**: Lubrication, Mechanism of lubrication, types of lubricants and its properties (viscosity & viscosity index, flash & fire point, aniline point, saponification value, acid value), criterion for selection of lubricants.	7		2
Unit 3: Water Technology			
A] Water Purification Technology: Principles of coagulation and flocculation, Sterilization by using ozone and chlorine (Cl_2 gas & chloramine), Break point chlorination and its significance. Industrial Water Treatment: Softening of water-principle- reactions, advantages, limitations and comparison of Zeolite process, and De-mineralization process. Numerical based on Zeolite process. **B] Boiler Troubles–** Causes, effect on boiler operation and methods of prevention – Scales and sludges, Caustic embrittlement. Desalination of sea water- Principle, method and advantages of electro dialysis and reverse osmosis processes Waste Water Treatment (introduction and importance) –Water treatment from biological waste water to clean water production (Dissolved Air Floatation and Membrane bio reactors)	7		3
Unit 4: Green Chemistry			
A] Green Chemistry: Introduction, twelve principles of Green chemistry with examples, Numerical based on atom economy, Carbon sequestration & Carbon Credits **B] Green reagents**, Dimethyl carbonate and its applications, Supercritical carbon dioxide properties and applications Biopolymers: Classification based on type, properties and applications of collagen, chitosan, starch. Green Hydrogen Synthesis by photolysis of water, environmental benefits and applications	7		4

Unit-5: Material Characterization Techniques			
Principles and applications of – **A]** Electronic Spectroscopy (Beer-Lambert's law and its numerical), Infra-Red spectroscopy and Nuclear Magnetic Resonance spectroscopy. **B]** Thermal analysis (Thermogravimetry, Differential Thermal Analysis, Differential Scanning Calorimetry), Scanning Electron Microscopy, Transmission Electron Microscopy, Atomic Force Microscopy, Brunauer-Emmett-Teller (BET) surface area analysis, X-ray Diffraction Analysis, particle size analyser (Dynamic Light Scattering), High Performance Liquid Chromatography and Gas Chromatography	8		5

References/ Text Books

1. Engineering Chemistry, S S Dara, S Chand Publication
2. Engineering Chemistry, Jain & Jain, Dhanpat Rai Publication
3. Applied Chemistry, A V Bharati, Das Ganu Publication
4. Energy & Environment, A V Bharati, Das Ganu Publication
5. Spectroscopy, Y R Sharma, S Chand
6. Green Chemistry for Beginners, Anju Srivastava, Rakesh K. Sharma, Jenny Stanford Publishing
7. Instrumental Methods of Chemical Analysis, B. K. Sharma, Krishna Prakashan.

https://wiki.anton-paar.com/in-en/the-principles-of-dynamic-light-scattering/

8. Fundamentals of Solid Propellant Combustion, Kuo, K.K., Summerfield, M., Progress in Astronautics & Aeronautics, Vol. 90, AIAA. 1984 - https://onlinecourses.nptel.ac.in/noc24_ae09/preview

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B.TECH. ELECTRICAL ENGINEERING

Sem: II	Total Hours Distribution per week		
Total Credit :1	Practical (P): 2 Hrs.		
Subject Code	BEL2P06	Applied Chemistry Lab.	
Examination Scheme - Practical			
Internal Marks:	University Marks:	Minimum Passing Marks:	Examination Duration:
50 Marks	--	25 Marks	--

LIST OF PRACTICAL:

Pr. No.	List of Practical's (Any 6 performance based and 1 virtual lab experiment)
1	Proximate Analysis of coal
2	Estimation of viscosity of oil by Redwood Viscometer 1 or 2
3	Estimation of Flash point of lubricating oil by open/ closed cup apparatus
4	Estimation of Acid value of lubricant
5	Estimation of Consistency of grease by penetrometer
6	Estimation of Saponification value of lubricant
7	Estimation of Hardness of water (Total, Permanent & Temporary) by complexometry
8	Estimation of Alkalinity of water (Warder's Method)
9	Estimation of DO / free chlorine estimation
10	Estimation of Copper estimation (iodometrically)
11	Estimation of Ni by complexometry / gravimetry.
12	Fe(II)/ (III) estimation by redox titration.
13	Beer's Law verification by spectrophotometer.
14	Separation of copper nickel ions by paper chromatography.
15	Acid base titration by potentiometry
16	Acid base titration by conductometry
17	Virtual Lab: Experiment on Calorimetry
18	Virtual Lab: Experiment on Spectroscopy

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RASHTRASANTTUKADOJIMAHARAJNAGPURUNIVERSITY,NAGPUR FACULTY OF SCIENCE & TECHNOLOGY

B.TECH.-ELECTRICAL ENGINEERING

Sem: II	Total Hours Distribution per week		
Total Credit:3	Lecture(L):3Hrs	Tutorial/Activity(T/A): Hrs.	Practical(P): 2 Hrs.
Subject Code:	BEL2T07	Name of Subject: Engineering Mechanics	

Examination Scheme			
Internal Marks:	University Marks:	Maximum Passing Marks:	Examination Duration:
30 Marks	70 Marks	45 Marks	3 Hours

Course Objective	
1	To Understand the force systems and draw free body diagram to analyze rigid body equilibrium.
2	To Comprehend the principles of friction and solve engineering mechanics problems associated with frictional force.
3	To introduce the concept of centriod and moment of inertia of plane area.
4	To make student aware about the method of joint and method of section to analyse the truss.
5	To Understand the concept of motion of particles and rigid bodies.

List of Course Outcome	
After completion of syllabus student able to	
1	Analyse a given force system and apply the knowledge of force system and moment to determine resultant of various force system & apply the knowledge of equilibrium of force system.
2	To apply the basics of friction
3	Locate Centroid and compute area Moment of Inertia for standard shapes and composites areas.
4	Analyze simple determinate trusses
5	Analyzetheconnectedsystemofparticlesusingconceptofdynamicequilibrium

SYLLBUS

Details of Topic	Allotment of Hours		Mapped with CO Number
	L	T/A	CO
UNIT 1: Basics Concepts and equilibrium of force systems			
Introduction to Engineering Mechanics: Force Systems, Basic concepts, Rigid Body equilibrium;	3		1
System of Forces, Coplanar Concurrent Forces, Resultant Moment of 4 Forces and its Applications; Couples in 2D and 3D	4		

Equilibrium of System of Forces, Free body diagrams, Equations of Equilibrium of Coplanar Systems. Simple beams and support reactions. Diagram of Statically Determinate Beams	3		
UNIT 2: Friction			
Types of friction, Limiting friction, Laws of Friction, Static Friction; Motion of Bodies, wedge friction, ladder friction Belt friction	5		2
UNIT 3: Centroid and Moment of Inertia			
Centroid and Centre of Gravity, Centroid of standard shapes and application to composite plane shapes; Area moment of inertia: formula of area moment of inertia of standard shapes, parallel and perpendicular axis theorem, application to composite plane shapes	7		3
UNIT 4: Analysis of structures- Trusses			
Assumption and Analysis of simple trusses by method of joints & method of sections	5		4
UNIT 5: Kinetics of Particles			
Kinetics of particles D'Alemberts principle and its application in connected system of particles, Impulse Momentum, Collision of bodies, Work Energy Method.	5		5

References/ Text Books

1. Vector Mechanics for Engineers: Statics and Dynamics, Johnston. R.E., Beer. F., Eisenberg. E. R,& Mazurek. D., McGraw Hill
2. Engineering Mechanics: Principles of Statics and Dynamics, R. C. Hibbler, Pearson Press
3. Engineering Mechanics, S S Bhavikatti, Newage International publication

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RASHTRASANTTUKADOJIMAHARAJNAGPURUNIVERSITY,NAGPUR

FACULTY OF SCIENCE & TECHNOLOGY

B.TECH -ELECTRICAL ENGINEERING

Sem: II	Total Hours Distribution per week		
Total Credit:1	Practical (P):2Hrs.		
Subject Code	BEL2P07	Engineering Mechanics Lab.	
	Examination Scheme- Practical		
Internal Marks:	University Marks:	Minimum Passing Marks:	Examination Duration:
25Marks	25 Marks	25 Marks	--

List of Experiments: Performance of at least Any eight experiments is compulsory in a semester.

Exp. No.	List of Experiments
1	To verify law of polygonal of forces using Law of Polygon Apparatus
2	To determine the forces in the members of a Jib Crane Apparatus experimentally and graphically
3	Parallel Forces Apparatus
4	Law Of Moment
5	Rolling Friction Apparatus
6	Equilibrium Forces Apparatus
7	To find determine the support reactions of a Simply Supported Beam experimentally and analytically
8	To determine the coefficient of friction between two surfaces of different material on Plane Friction Apparatus.
9	To find the forces in the member of truss using graphical method and hand calculation
10	To find (1) Principle moment of inertia and (2) Moment of inertia and product of inertia about any inclined axis for a composite figure using Mohr's circle and hand calculation,
11	To determine the coefficient of friction of Coil Friction Apparatus.
12	Kinetics of particles (collision of bodies)
13	To find support reactions of a simply supported beam using graphical method and hand calculation

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B.TECH. ELECTRICAL ENGINEERING

Sem: II	Total Hours Distribution per week	
Total Credit : 2	Lecture (L): 2Hrs	Tutorial/Activity (T/A): 0 Hr.
Subject Code	BEL2T08	Elements of Electrical Engineering & Measurements

Examination Scheme			
Internal Marks:	University Marks:	Minimum Passing Marks:	Examination Duration:
30 Marks	70 Marks	45 Marks	3 Hours

Course Objectives	
1	To learn fundamentals of electrical circuits and analysis
2	To understand the basics of electrical machines
3	To learn the various electrical measuring instruments
4	To learn the concept of transducers

Course Outcomes	
After completion of syllabus, students would be able to	
1	Apply the concepts for analysis of single phase and three phase a.c. circuits
2	Understand the principle and working of electrical machines and their basic analysis
3	Learn the various a.c. bridges and their applications to measure R-L-C parameters
4	Understand the principle and working of electrical measuring instruments
5	Learn the concepts of transducers and their applications

SYLLABUS

Details of Topic	Allotment of Hours		Mapped with CO Number
	L	T/A	CO
Unit-1			
A.C Circuits: Periodic Function, Average & R.M.S., Values, Steady State Behavior With Sinusoidal Excitation, Phasor Representation, Reactance & Impedance, Series & Parallel Circuit, Phasor diagram Power Factor, Principle of Generation of Single Phase & Three Phase Voltages, Power in Balanced Three Phase AC System	5		1
Unit 2:			
Principle and working of single phase transformer, transformers losses, phasor diagram, d.c. machines construction and working, simple numerical analysis	5		2
Unit 3:			
Measurement of low, high and medium resistances, Principle and working of A. C. Bridge, Various types of bridges and applications for measurement of R-L-C parameters	5		3
Unit 4:			
Classification of measuring instruments, Construction and working principle of	5		4

moving coil, moving iron and dynamo meter type of instruments, measurement of power, energy, power factor			
Unit-5:			
Fundamentals of Sensors and transducers, classification of transducers, transducer applications for measurement of displacement, pressure, temperature etc	4		5

Text & Reference Books:

1. S.K. Bhattacharya , "Basic Electrical and Electronics Engineering", Pearson Education, 2012
2. D. C. Kulshrehtha, "Basic Electrical Engineering", Tata Mcgraw Hill, 2012
3. Kothari D.P. and Nagrath I.J., "Theory And Problems of Basic Electrical Engineering," Prentice Hall
4. A.K. Sawhney, "A course in Electrical & Electronics Measurement and Instrumentation", Dhanpat rai & Sons, 2015
5. Ernest O.Doebelin, "Measurement Systems Application and Design, International Student Edition", McGraw Hill Book Company, 1998

Online references:

1. Basic Electrical Engineering A Web course of NPTEL by Day, Bhattacharya & Roy, Available:- www. nptel.ac.in

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FACULTY OF SCIENCE & TECHNOLOGY
B.TECH. ELECTRICAL ENGINEERING

Sem: II	Total Hours Distribution per week		
Total Credit :1	Practical (P): 2 Hrs.		
Subject Code	BEL2P08	Elements of Electrical Engineering & Measurements Lab.	
Examination Scheme - Practical			
Internal Marks:	University Marks:	MinimumPassing Marks:	Examination Duration:
25 Marks	25 Marks	25Marks	--

	Practical Course Objectives
1	To analyze electrical a.c. circuits
2	To understand the operating principles of electrical machines
3	To learn the use of electrical measuring instruments for measuring various parameters
4	To understand the working of transducers and their applications

	Practical Course Outcomes
After completing the practical course, students will be able to	
1	To compute the various parameters of a.c. circuits
2	To perform the short circuit test and open circuit test for the transformer
3	To measure and compute the parameters of electrical machines
4	To understand the use of a.c. bridges for R-L-C measurements

LIST OF PRACTICAL:

Pr. No.	List of Practical
1	To study RLC series ac circuit
2	To study resonance in RLC series ac circuit
3	To study RLC parallel ac circuit
4	To study 3-phase circuits with load connected in star and delta
5	To determine Voltage regulation and efficiency of a single phase transformer by direct loading
6	Study of d.c. motors
7	Measurement of three phase power by Two Wattmeter method procedure
8	To study and plot the characteristics of LVDT
9	To analyse the characteristics of the Piezo electric sensor
10	To measure unknown values of given inductance and capacitance using appropriate a.c. bridge

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B.TECH. ELECTRICAL ENGINEERING

Sem: II	Total Hours Distribution per week		
Total Credit :2	Practical (P): 4 Hrs.		
Subject Code	BSE2P01	Electric Wiring & Illumination System	
Examination Scheme - Practical			
Internal Marks:	University Marks:	Minimum Passing Marks:	Examination Duration:
50 Marks	50 Marks	50 Marks	--

Practical Course Objectives	
1	To develop a foundational understanding of electric charge
2	To equip students with the skills to proficiently install various wiring types
3	To cultivate competence in diverse lighting systems
4	To enable students to apply their knowledge in integrating lighting with smart home platforms designing energy-efficient solutions, and implementing sustainable lighting practices and maintenance plans.

Practical Course Outcomes	
After completing the practical course, students will be able to	
1	Solve basic problems in electrical systems using fundamental electrical concepts
2	Interpret electrical wiring diagrams and troubleshoot electrical issues
3	Understand various lighting sources and smart lighting systems
4	Apply knowledge to integrate lighting with smart home platforms and design energy-efficient solutions.

LIST OF TOPICS AND EXPERIMENTS:

Pr. No.	List of Topics and Experiments
1	**Study of electrical systems fundamentals-** Introduction to Electricity, Basics of electric charge, voltage, resistance, current and Ohm's Law, Overview of circuit components (resistors, capacitors, inductors), Series and parallel circuits, Energy consumption in electrical systems, Common safety practices in electrical systems, Introduction to personal protective equipment (PPE)
2	**Study of electrical wiring systems-** Overview of wiring types (conduit, non-metallic sheathed cable, armored cable), Reading and interpreting electrical wiring diagrams, Common symbols and conventions in electrical wiring diagrams, Guidelines for installation of electrical wiring, Basic troubleshooting techniques in electrical systems
3	**Study of various Illumination Systems-** Overview of lighting sources (incandescent, fluorescent, LED), Factors influencing lighting design (purpose, aesthetics, energy efficiency), Introduction to manual and automated lighting controls. Smart lighting systems and their benefits, LED technology and its advantages.

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4	**Design of smart home integration and sustainable lighting practices-** Overview of home automation in the context of electrical systems and lighting, Integration with smart home platforms, Design of energy-efficient lighting systems, Routine maintenance practices for lighting systems, Development of lighting maintenance plan

Text & Reference Books:

1. Handbook of Electrical Installation Practice by Geoffrey Stokes
2. Electrical Wiring Residential by Ray C. Mullin
3. Illumination and Electrification of Buildings by M. Chaudhari

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B.TECH. ELECTRICAL ENGINEERING

Sem: II	Total Hours Distribution per week	
Total Credit : 2	Lecture (L): 2Hrs	Tutorial/Activity (T/A): 0 Hr.
Subject Code	BIK2T01A	Consciousness Studies

Examination Scheme			
Internal Marks:	University Marks:	Minimum Passing Marks:	Examination Duration:
30 Marks	70 Marks	45 Marks	3 Hours

Course Outcomes	
After completion of syllabus, students would be able to	
1	Analyze the basics of Psychology and its applications
2	Develop knowledge about the sensory processes and perception
3	Apply various theories of classical conditioning
4	Integrate the theories of memory and behavior of mind

SYLLABUS

Details of Topic	Allotment of Hours		Mapped with CO Number
	L	T/A	CO
Unit-1			
An introduction to Psychology Introduction to Psychology, Definition of psychology, history, methods in Psychology, Subfields of Psychology and its applications	10		1
Unit 2:			
Basic Cognitive Processes Sensory processes-general characteristics of senses, visual sense, auditory sense, other senses Perceptual organization-principles of perceptual organization, object perception and perceptual constancies, influences upon perception, extrasensory perception	10		2
Unit 3: Learning			
Classical conditioning, theories about classical conditioning, Reinforcement and Punishment	9		3
Unit 4: Memory			
Theories about memory, brain and memory, long term memory, forgetting	7		4

Reference Books:

1. Clifford T. Morgan, King, Weisz and Schopler, Introduction to Psychology, McGraw Hill Education (India) Private Limited
2. Hilgard, Atkinson and Atkinson(1977). Introduction to Psychology. Tata McGraw Hill
3. Kao H.S R.& Sinha D. (Eds)(1977). Asian perspectives on psychology. New Delhi: Sage

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B.TECH. ELECTRICAL ENGINEERING

Sem: II	Total Hours Distribution per week	
Total Credit : 2	Lecture (L): 2Hrs	Tutorial/Activity (T/A): 0 Hr.
Subject Code	BIK2T01B	Preserving Art, Culture and Tradition

Examination Scheme			
Internal Marks:	University Marks:	Minimum Passing Marks:	Examination Duration:
30 Marks	70 Marks	45 Marks	3 Hours

Course Objectives	
1	To provide overview of Indian Knowledge System (IKS) and sensitize thestudents to the contributions made by Indians in the field of philosophy, art and health.

Course Outcomes	
After completion of syllabus, students would be able to	
1	Interpret basics of Indian Knowledge system.
2	Integrate the teaching of Indian culture and civilization
3	Appreciate Indian artistic tradition.
4	Analyze Indian health and wellness system for healthy living

SYLLABUS

Details of Topic	Allotment of Hours		Mapped with CO Number
	L	T/A	CO
Unit-1			
Introduction to Indian Knowledge System Introduction and overview of Indian Knowledge system, The Vedic Corpus -Vedas, Types of Vedas, Upavedas, Types of Upavedas	9		1
Unit 2:			
Indian Culture and Civilization Indian culture and Civilization: its characteristics, Difference between Culture and Civilization, Indus valley civilization, Vedic civilization	9		2
Unit 3:			
Indian Artistic Tradition, Indian Artistic tradition: Chitrakala- Indian style painting (Madhubani, Warli, Phad,Kalamkari, Gond, Mandana),Nritya : Indian dance forms (Bharatnatyam, Kathak, Kathakali, Kuchipudi, Manipuri, Mohiniattyam) Sangeet- Carnatic music & Hindustani music	9		3
Unit 4:			
Health and Wellness Health and Wellness, Well being: Mental & Physical, Dimensions of Wellness, Concept of healthy living in Ayurveda, Tri-doshas –Relationship to Health	9		4

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Activity: Prepare PPTs/Posters/Videos on any two topics

Books Recommended:

1. Introduction to Indian Knowledge System by Mahadevan, B, Bhat, VinayakRajat,NagendraPavana R.N., Prentice Hall India Pvt., Limited, 2022.
2. Indian knowledge Systems, Kapil Kapoor, Avadhesh Kumar Singh, D.K, Printworld.
3. Traditional Knowledge System in India by Amit Jha, Atlantic Publishers, 2002
4. Exploring The Mysterious, By T.N. Dhar · Mittal Publications, 2004
5. Indian Art & Culture (E), By Anurag Kumar, Arihant Publication India Limited, 2016
6. A History of Indian Philosophy, Volume 2, By SurendranathDasgupta, DiamondPublishers, 2017
7. Sri Suresh Soni, Sources of our cultural heritage, PrabhatPrakashan, 2018.
8. A Beautiful Tree by Dharampal, RashtrotthanaSahitya, 2021

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B.TECH. ELECTRICAL ENGINEERING

Sem: II	Total Hours Distribution per week		
Total Credit : 2	Lecture (L): 2Hrs	Tutorial/Activity (T/A): 0 Hr.	
Subject Code	BIK2T01C	Wellness, traditional medicines and yoga	
Examination Scheme			
Internal Marks:	University Marks:	Minimum Passing Marks:	Examination Duration:
30 Marks	70 Marks	45 Marks	3 Hours

Course Objectives	
1	The course will enable engineering students to acquire the knowledge of richness of healthy lifestyle and strong heritage of yoga and Vedas in Indian traditional system.

Course Outcomes	
After completion of syllabus, students would be able to	
1	Understand the importance of a healthy lifestyle
2	Familiarize to manage stress and health consciousness about physicaland mental health.
3	Appreciate the benefits of yoga and medicinal plant.
4	Identify the social changes in Indian society.

SYLLABUS

Details of Topic	Allotment of Hours		Mapped with CO Number
	L	T/A	CO
Unit-1			
Importance of health and wellness, Essential components of balanced diet for healthy living, Processed foods and unhealthy eating habits.	9		1
Unit 2:			
Body systems and common diseases, Sedentary lifestyle and its risk of disease, Stress, anxiety, and depression, Factors affecting mental health.	9		2
Unit 3:			
Importance and benefits of yoga, Purpose of yoga, traditional knowledge of medicinal plant, use of home available herbs and spices.	9		3
Unit 4:			
Vedas and it types, Social change in Indian society, Social stratification and class conflicts.	9		4

Textbooks/References:

1. Sociology in India – Surendra Sharma, Rawat Publication.

2. Bradfird B, Strand and Others. Fitness Education Arizona GorsuchSeani; sbrickPublishers, 1997.

3. Scott K. Powers and Stephen L. Dodd. Total Fitness: Exercise, Nutrition and wellness,Boston: Allyn and Bacon, 1999.

4. Rigveda Samhita with Sayanabhasya, VaidikSamshodhan Mandal, Pune

5. Riksuktashati, H. D. Velankar, BharatiyaVidyaBhavan, Mumbai

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B.TECH. ELECTRICAL ENGINEERING

Sem: II	Total Hours Distribution per week	
Total Credit : 2	Lecture (L): 2Hrs	Tutorial/Activity (T/A): 0 Hr.
Subject Code	BIK2T01D	Glimpses of ancient Science and Technology

Examination Scheme			
Internal Marks:	University Marks:	Minimum Passing Marks:	Examination Duration:
30 Marks	70 Marks	45 Marks	3 Hours

Course Objectives	
1	To provide the students with scientific foundation of Ancient Indian Knowledge System
2	To create awareness about scientific heritage of the ancient civilization

Course Outcomes	
After completion of syllabus, students would be able to	
1	To provide information about great mathematicians and to help students to trace, identify, practice, and develop the significant Indian mathematics
2	To understand the concept of motion and its application in Indian ancient physics literature.
3	To understand the concepts of basic chemical & metallurgical process of ancient and medieval India.

SYLLABUS

Details of Topic	Allotment of Hours		Mapped with CO Number
	L	T/A	CO
Unit-1			
Mathematics in India: Introduction of inception of Mathematics from vedic periods. Great Mathematician and their contribution (e.g. Arytabhatta, Bhaskara, Brahmagupta, Ramanujan, Pingala, Bhaskara-II), Sulbhasutras (Pythagoras theorem), Square, Square root, Square root ofimperfect Squares, Magic Squares, Value of Pi.	12		1
Unit 2:			
Physics in India: Vaisheshikadarshan Atomic theory & law of motion, theory of Panchmahabhoota, BrihathShathaka (divisions of the time, unit of distance), Bhaskarachaya (Introduction to theory of Gravity, Suryasiddhanta & Sidhantashriomani), Lilavati (Gurutvakashan Shakti).	12		2
Unit 3:			
Chemistry in India: Vatsyayana, Nagarjuna, Vagbhaṭa –building of Theras-Shala(laboratory), working arrangements of Ras-Shala, material and equipment, Yaśodhara Bhaṭṭa- process of distillation, apparatus. Metallurgy in India: Survarṇa (gold) and its different types, properties, Rajata(silver), Tamra(copper), Loha(iron), Jasta(zinc), Naga /Sisa(lead), Pittala(brass).	12		3

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Reference Books Recommended:

1. Kapur K and Singh A.K (Eds) 2005). Indian Knowledge Systems, Vol. 1. Indian Institute of Advanced Study, Shimla. Tatvabodh of Sankaracharya, Central Chinmay Mission Trust, Bombay,1995
2. Dharmpal, Indian Science and Technology in the eighteen century, Rashtrottahanasahitya, 1983
3. S Biswal, B L Ray, Vedic Science and technology, DK Print world, 2009
4. A.K Bag, History of technology in Indian (Set 3 vol), Indian Nation Science Academy, 1997.
5. A Gosh, History of Science in India (Volume-I Part-II Astronomy), the national academy ofscience, India & the Ramkrishna mission institute of culture, 2014

Third Semester Syllabus

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B.TECH. ELECTRICAL ENGINEERING

Sem: III	Total Hours Distribution per week	
Total Credit : 3	Lecture (L): 3 Hrs	Tutorial/Activity (T/A): 0 Hr.
Subject Code	BEL3T09	Network Analysis

Examination Scheme			
Internal Marks:	University Marks:	Minimum Passing Marks:	Examination Duration:
30 Marks	70 Marks	45 Marks	3 Hours

Course Outcomes

After completion of syllabus, students would be able to

1	Understand and analyze basic circuit elements and their interconnections
2	Apply mesh current and node voltage methods to analyze electrical circuits.
3	Obtain transient and steady-state responses of electrical circuits.
4	Synthesize waveforms and apply Laplace transforms to analyze networks
5	Evaluate different Network Functions and understand two port network behavior

SYLLABUS

Details of Topic	Allotment of Hours		Mapped with CO Number
	L	T/A	CO
Unit I : Electric Circuit Elements			
Basic concepts: Ideal source, Practical source, dependent and independent source Voltage and Current sources, source transformation, concept of duality, Series and Parallel Combination of Inductors , Series and Parallel Combination of Capacitors.	7		1
Unit –II: Nodal and mesh Analysis			
Introduction, mesh analysis ,the super mesh, mesh basis equilibrium approach for simple networks of having mutual coupling. Nodal analysis, the super node, nodal vs mesh analysis	7		2
Unit –III: Network Theorems			
Superposition, Thevenin's, Norton's, Maximum Power transfer, Reciprocity theorems as applied to D C. & A.C	7		3
Unit –IV: Electric Circuit Analysis using Laplace Transforms			
Review of Laplace transform, waveform synthesis, Analysis of electrical circuits using Laplace transform for standard inputs, Solution of first and second order differential equations of different combinations of series and parallel RLC networks. analysis of networks with and without initial conditions using Laplace transforms.	7		4

Unit –V: Two port networks and Network functions			
Two port networks, relationship between two port variables, driving point and transfer functions, properties, concept of complex frequency, Poles and zeros. Two port network parameters: Impedance parameters, admittance parameters, transmission parameters and hybrid parameters, interconnection of two port networks	8		5

Text Books:

1. Van Valkenburg, "Network Analysis", Third Edition, 2009, Prentice Hall of India
2. Sudhakar, A, Shyammohan, "Circuits and Networks", Third Edition, 2006, Tata McGraw-Hill.
3. D. Roy Choudhary, "Networks and Systems", New Age International Publishers, 2nd Edition, 2012
4. Kelkar and Pandit, "Linear Network Theory", Pratibha Publications.

Reference Books:

1. Mahmood Nahvi, Joseph A Edminister, "Schaum's outline of Electric Circuits", 6th Edition, Tata McGraw-Hill, 6th Edition, 2013
2. W. H. Hayt and J. E. Kemmerly, "Engineering Circuit Analysis", McGraw Hill Education, 2013.
3. C. K. Alexander and M. N. O. Sadiku, "Electric Circuits", McGraw Hill Education, 2004.
4. K. V. V. Murthy and M. S. Kamath, "Basic Circuit Analysis", Jaico Publishers, 1999.
5. K. Sureshkumar, "Electric Circuits & Network", Pearson Publication
6. Del Toro, "Electrical circuit", Prentice Hall

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B.TECH. ELECTRICAL ENGINEERING

Sem : III	Total Hours Distribution per week		
Total Credit:1	Practical(P): 2Hrs.		
Subject Code	BEL3P09	Network Analysis Lab	
Examination Scheme- Practical			
Internal Marks:	University Marks:	Minimum Passing Marks:	Examination Duration:
Marks	Marks 25	Marks 25	--

	Practical Course Objectives
1	Understand and Apply Network Theorems
2	Analyze Resonance in Electrical Circuits
3	Evaluate Network Parameters
4	Enhance Circuit Analysis and Problem-Solving Skills
5	Bridge Theoretical Knowledge with Practical Applications

	Practical Course Outcomes
After completing the practical course, students will be able to	
1	Ability to Apply Network Theorems
2	Understanding of Resonance in RLC Circuits
3	Proficiency in Two-Port Network Parameter Analysis
4	Practical Skills in Electrical Circuit Design and Testing
5	Enhanced Problem-Solving and Analytical Skills

LIST OF PRACTICALS:

Pr. No.	List of Practical's
1	To study and verify the Superposition Theorem.
2	To study and verify the Thevenin's Theorem.
3	To study and verify the Reciprocity Theorem.
4	To study and verify the Maximum Power Transfer Theorem.
5	To study and verify the Nortons Theorem.
6	To study and verify the Tellegens Theorem.
7	To study the resonance in RLC Series Circuit and find its resonant frequency.
8	To study of the resonance in RLC Parallel Circuit and find its resonant frequency.
9	To determine Y-parameter for π network.
10	To determine Z-parameter for T network
11	To determine ABCD Parameter of a Passive Two Port Network.1)
12	To determine h-parameters for a two-port network.

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Sem: III	Total Hours Distribution per week	
Total Credit : 3	Lecture (L): 3 Hrs	Tutorial/Activity (T/A): 0 Hr.
Subject Code	BOE3T010	RENEWABLE ENERGY SOURCES

Examination Scheme			
Internal Marks:	University Marks:	Minimum Passing Marks:	Examination Duration:
30 Marks	70 Marks	45 Marks	3 Hours

Course Outcomes

After completion of syllabus, students would be able to

1	Memorize the fundamental of solar radiation geometry
2	Identify and analyze the process of power generation through solar photovoltaic
3	Highlighting the various applications of Solar Energy
4	Outline the site requirement criteria for wind farm & compare different types of wind generators.
5	Identifying non-conventional Energy sources such as Geothermal, MHD, Biomass, Fuel cell, Tidal, Ocean for generating Electricity

SYLLABUS

Details of Topic	Allotment of Hours		Mapped with CO Number
	L	T/A	CO
Unit 1: Solar Radiation & its Measurement			
Solar Radiation & its Measurement: Solar Constant, Solar radiation at earth's surface, solar radiation geometry, solar radiation measurement, estimation of average solar radiation, solar radiation on tilted surfaces	6		1
Unit 2: Solar Photovoltaic power generation			
Solar Photovoltaic power generation: Physics of solar cells, Characteristic of solar cell, series and parallel connection, types of solar cell, module manufacturing, partial shading, bypass and blocking diode, load calculation, different panel calculations and selection (Monocrystalline, Polycrystalline etc), Calculation of Solar rooftop setup (rating): stand alone PV system with battery and grid connected PV system with Net Metering, Introduction to MPPT	6		2
Unit 3: Application of Solar Energy			
Application of Solar Energy: Solar water heating, space heating, space cooling, solar thermal heat conversion, Solar Cooking, Solar pumping, Solar Water	6		3

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pumping for agriculture purposes, Calculation of solar setup required in solar water pumping, Solar Green Houses, Hydrogen production from Solar Energy			
Unit 4: Wind Energy			
Basic principles of wind energy conversion, wind energy conversion system, wind data & energy estimation, site selection consideration, basic components of wind energy conversion system (WECS), classification of WEC system, generating system, energy storage, application of wind energy. Stand-Alone and Grid Connected Wind-Electrical Power System	6		4
Unit 5: Other Nonconventional Energy Source			
Brief Introduction to operating principles only: MHD power generation, Fuel cell, Energy from Ocean, Ocean thermal electric conversion (OTEC), Claude & Anderson cycles, Hybrid cycle, Energy from Tides ,Estimation of Energy & Power in simple single basin ,Tidal system			

Suggested Text Books &Reference Books:

1Non Conventional Energy Sources G.D. Rai, Khanna publishers

2. Non Conventional Energy Resources B. H. Khan 2nd , The McGraw Hill Companies

3. Solar Energy: Principles of thermal collection and storage, S. P. Sukhatme 2nd edition, Tata McGraw Hill Publishing Company Ltd.

4. Solar Photovoltaics: Fundamental, Technologies and Applications, Chetan Singh Solanki ,

5. Non-Conventional Energy Sources and Utilization, R.K. Rajput, S. Chand Publications.

6. Non-Conventional Energy Resources, D S Chauhan, S K Srivastava, New Age International Publishers

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RASHTRASANT TUKADOJI MAHARAJ NAGPUR UNIVERSITY, NAGPUR
FACULTY OF SCIENCE & TECHNOLOGY
B.TECH. ELECTRICAL ENGINEERING

Sem:	Total Hours Distribution per week		
Total Credit:1	Practical(P):2 Hrs.		
Subject Code	BOE3P10	RENEWABLE ENERGY SOURCES LAB	
Examination Scheme- Practical			
Internal Marks:	University Marks:	Minimum Passing Marks:	Examination Duration:
Marks: 25	Marks 25	Marks 25	--

	Practical Course Objectives
1	To analyze the impact of shading on the output power of a photovoltaic (PV) system.
2	To demonstrate the working of bypass and blocking diodes in a photovoltaic system.
3	To calculate and analyze the power flow in a standalone PV system supplying DC and AC loads with a battery.
4	To study the performance of MPPT through varying resistive loads and DC-DC converter duty cycles.

	Practical Course Outcomes
After completing the practical course, students will be able to	
1	Students will be able to identify and describe the effects of shading on the output power of PV modules.
2	Students will demonstrate an understanding of the function of bypass and blocking diodes in PV systems.
3	Students will apply power flow calculations and analyze the operation of a standalone PV system providing DC and AC loads, integrating a battery.
4	Students will evaluate the performance of a PV system by studying MPPT techniques, comparing results obtained through varying resistive loads and DC-DC converter duty cycles.
5	Students will analyze the behavior of boost and buck converters and their role in power conversion within a PV system.

LIST OF PRACTICALs:

Pr. No.	List of Practical
1	To demonstrate the effect of shading on module output power.
2	To demonstrate the working of diode as Bypass diode and blocking diode.
3	Workout power flow calculations of standalone PV system of DC and AC load with battery.
4	Find the MPP manually by varying the resistive load across the PV panel.
5	Find the MPP by varying the duty cycle of DC-DC converter.
6	Observe the Vm, Im, Pm and duty cycle at which MPP occurs, with MPP algorithm
7	Observe the response of Pm in the plotter and compare with the Pm observed.
8	Study of various modes of Constant Voltage Charging technique.
9	Study of Boost converter
10	Study of Buck converter
11	Study of Boost converter
12	Study of Dusk to Dawn switch

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FACULTY OF SCIENCE & TECHNOLOGY
B.TECH. ELECTRICAL ENGINEERING

Sem: III	Total Hours Distribution per week	
Total Credit : 2	Lecture (L): 2 Hrs	Tutorial/Activity (T/A): 0 Hr.
Subject Code	BMD3T11	ELECTRONICS DEVICES & CIRCUITS

Examination Scheme			
Internal Marks:	University Marks:	Minimum Passing Marks:	Examination Duration:
30 Marks	70 Marks	45 Marks	3 Hours

Course Outcomes

After completion of syllabus, students would be able to	
1	Understand the characteristics of basic diodes and analyze rectifier circuits
2	Understand the characteristics and use of a transistor.
3	Apply the knowledge of transistor for the analysis of power amplifiers and oscillators.
4	Evaluate the characteristics of basic electronic devices and analyze emerging technologies in renewable energy systems and energy storage solutions.

SYLLABUS

Details of Topic	Allotment of Hours		Mapped with CO Number
	L	T/A	CO
Unit 1: Basic diode and its applications			
P-N junction diode, operation and characteristics; half-wave and full-wave rectifiers, Filters, Ripple factor, characteristics and applications of Zener diodes, Zener diode voltage regulator, photo diodes.	7		1
Unit 2: Basic transistor and its applications			
Operation and characteristics of a BJT. BJT as a switch. BJT as an amplifier: Biasing circuits, small-signal analysis of CE, CB and CC amplifiers and their Comparison, Transistor as a switch. Field effect transistors and MOSFETs- Principle of operation .and characteristics.	10		2
Unit 3: Power amplifiers			
Classification as A, B, AB, C, Push pull amplifiers, Cross over distortion, Positive and Negative amplifiers- classification, feedback amplifiers, advantages and applications. Differential amplifier circuits and their stages, current source, biasing, level Shifting techniques, Oscillators- Bark hausen's criterion, RC and Crystal oscillators	10		3

Unit 4: Applications of Op-Amp			
Inverting and non-inverting amplifier, integrator, active filter, voltage regulator, oscillators (Wein's bridge and phase shift). Analog to Digital Conversion. Hysteresis Comparator, Zero Crossing Detector, Square-wave and triangular-wave generators. Precision rectifier. Study of linear ICs: LM741, LM555, LM 7805	08		4

Suggested Text Books:

1. Millman and Halkias, "Electronic Devices and Circuits", McGraw Hill.

2. Millman and Halkias, "Integrated Electronics", McGraw Hill

3. J. V. Wait, L. P. Huelsman and G. A. Korn, "Introduction to Operational Amplifier theory and applications", McGraw Hill U. S., 1992.

4. R. Gaikwad, "Operational Amplifiers and applications"

Suggested Reference Books:

1. J. Millman and A. Grabel, "Microelectronics", McGraw Hill Education, 1988.

2. P. Horowitz and W. Hill, "The Art of Electronics", Cambridge University Press, 1989.

3. P. R. Gray, R. G. Meyer and S. Lewis, "Analysis and Design of Analog Integrated Circuits", John Wiley & Sons, 2000

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FACULTY OF SCIENCE & TECHNOLOGY
B.TECH. ELECTRICAL ENGINEERING

Sem: III	Total Hours Distribution per week	
Total Credit : 3	Lecture (L): 3 Hrs	Tutorial/Activity (T/A): 0 Hr.
Subject Code	BOE3T01	Fundamental of Electrical Engineering

Examination Scheme			
Internal Marks:	University Marks:	Minimum Passing Marks:	Examination Duration:
30 Marks	70 Marks	45 Marks	3 Hours

Course Outcomes

After completion of syllabus, students would be able to	
1	Analyze DC circuits using fundamental electrical concepts, Ohm's law and Kirchhoff's laws, and solve problems involving basic electrical components such as resistors, capacitors, and inductors.
2	Apply the principles of AC circuit analysis to calculate power factors, understand phasor representations, and evaluate the behavior of RLC circuits, including resonance conditions.
3	Explain the working principles of electrical machines and transformers, and evaluate their applications in power systems while considering energy efficiency aspects.
4	Evaluate the characteristics of basic electronic devices and analyze emerging technologies in renewable energy systems and energy storage solutions.

SYLLABUS

Details of Topic	Allotment of Hours		Mapped with CO Number
	L	T/A	CO
Unit 1: Basic Electrical Concepts and DC Circuits			
Introduction to electrical engineering and its applications, Electric charge, current, voltage, power, and energy, Electrical components: resistors, capacitors, inductors Ohm's law and Kirchhoff's laws, Series and parallel circuits, DC circuit analysis techniques	6		1
Unit 2: AC Circuits and Power Systems			
Alternating current fundamentals , Sinusoidal waveforms and phasors, RLC circuits and resonance ,Power in AC circuits: real, reactive, and apparent power* Power factor and power factor correction.	6		2
Unit 3: Electrical Machines and Transformers			
Magnetic circuits and electromagnetic principles , Transformers: principle, types, and applications, DC machines: motors and generators, AC machines: induction motors, synchronous machines, Speed control techniques, Introduction to electric drives	6		3

Energy efficiency in electrical machines			
Unit 4: Electronics devices and Emerging Technologies			
Semiconductor devices: diodes, transistors, Power electronic devices and basic circuits Operational amplifiers and their applications ,Renewable energy systems: solar, wind Energy storage technologies	6		4

Suggested Text Books &Reference Books

1. Fundamentals of Electrical Engineering and Electronics" by S.K. Sahdev , Dhanpat Rai & Co.
2. Basic Electrical Engineering" by V.N. Mittle and Arvind Mittal , Tata McGraw Hill
3. Basic Electrical and Electronics Engineering" by R.K. Rajput , Laxmi Publications
4. Fundamentals of Electrical Engineering" by B.L. Theraja and A.K. Theraja S. Chand Publishing
5. Basic Electrical Engineering" by D.P. Kothari and I.J. Nagrath , McGraw Hill Education

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B.TECH. ELECTRICAL ENGINEERING

Sem: III	Total Hours Distribution per week	
Total Credit : 1	Practical (P): 2 Hrs	
Subject Code	BOE3P01	Fundamental of Electrical Engineering LAB

Examination Scheme			
Internal Marks	University Marks	Minimum Passing	Examination Duration
25 Marks	25 Marks	25 Marks	---

	Practical Course Objectives
1	Analysis and Implementation of DC Circuits
2	Analyze AC Circuits and Power Measurement
3	Testing and Performance Analysis of Electrical Machines & Transformers
4	Understand Application of Semiconductor Devices and Technologies

	Practical Course Outcomes
After completing the practical course, students will be able to	
1	**Analyze DC Circuits** using Ohm's and Kirchhoff's laws, measuring voltage, current, and resistance.
2	Study AC Circuits by observing waveforms, determining resonance, and measuring power parameters.
3	Test Electrical Machines through transformer tests, motor load tests, and performance analysis.
4	Implement Electronic Circuits including rectifiers, op-amp applications, and renewable energy systems.

LIST OF PRACTICAL:

Pr. No.	List of Practical
1	To Study and verification of Kirchhoff's Voltage and Current Laws in a DC Circuit.
2	To Study and verification of Superposition theorem.
3	To Study of RLC Circuits and Determination of Resonance Frequency
4	To Study RLC series circuit and to plot Phasor Diagram for it.
5	To Study & plot B-H curve for given magnetic material.
6	To Study and perform Direct loading test on single phase transformer.
7	To Study Half and Full wave rectifier.
8	To Study Characteristics of P-N Junction Diode
9	To Study Transistor Characteristics.
10	To Study Performance Evaluation of a Solar Panel System Under Different Load Conditions

Rashtrasant Tukadoji Maharaj Nagpur University B.Tech (EP/CE/CS/IT/CIVIL/ET) III Semester			
Course Title	**Entrepreneurship and Startups**	**Course Code**	**BHM3T01**
Teaching Hours/ Week	**02 Th**	**Total Credits:**	**02**
CIE	**15 Marks**	**SEE**	**35 Marks**

Course Outcomes:	
After completing the course, students will be able to	
CO1	Understand a know-how on entrepreneurship development
CO2	Acquire the knowledge of various types of startups
CO3	Remember the concept of ideation
CO4	Apply the funding for startups

UNIT 1
Concept of entrepreneurship, characteristics of an Entrepreneur, types of Entrepreneurship, Functions of Entrepreneurs, Women entrepreneurship in India, Problems and challenges of women entrepreneurs, Government's support system to develop women entrepreneurship.

UNIT 2
Concept of startup, Types of startups: Scalable startup, small business startup, lifestyle startup, buyable startup, social startup, big business startup, Startup ecosystem

UNIT 3
Concept of ideation, ideation process, idea incubation, design thinking approach, ideation techniques (brainstorming, sketching, SCAMPER, and prototyping), success factors for ideation.

UNIT IV
Funding for startups, angel funding, venture funding, difference between angel and venture funding, private equity fund, ownership of startups, causes of startups failures, Startup success case studies: Instagram, Linkedin, Snapchat, Whatsapp

TEXT BOOK REFERENCE
1. Entrepreneurial Development By, S. S. Khanka S. Chand & Co. Ltd. New Delhi, 1999. 2. Entrepreneurial Development. By, S.Anil Kumar. New Age International. 3. Small- Scale Industries and Entrepreneurship, By, Dr. Vasant Desai, Himalaya Publication. 4. Industrial Economics and Entrepreneurship development by A.M. Sheikh, Nawaz Khan & M.A. Tongo, S chand Publication

Rashtrasant Tukadoji Maharaj Nagpur University
B.Tech (Common to all branches)
III Semester

Course Title	Constitution of India	Course Code	BVE3T01
Teaching Hours / Week	02 Th	Total Credits:	02
CIE	15 Marks	SEE	35 Marks

Course Outcomes :

After completing the course, students will be able to

CO1	Analyze the basic structure of Indian Constitution.
CO2	Remember the Fundamental rights and duties.
CO3	Know DPSP's and Nation's political structure.
CO4	Understand function of Parliament and Judiciary.

UNIT 1

Introduction to the Indian Constitution, Preamble of the Indian Constitution and key concepts, Salient features of the Indian Constitution, Role and objective of Constituent Assembly.

UNIT 2

Fundamental rights meaning, significance, restrictions and limitations Fundamental duties and its scope, difference between Fundamental rights and Fundamental duties

UNIT 3

Directive Principles of State Policy (DPSP's) and its present relevance in India, Union Executive- President, Prime Minister and Union cabinet.

UNIT IV

Parliament - role and function, Lok Sabha and Rajya Sabha, Judiciary system in India, Supreme Court of India and other courts.

TEXT BOOK REFERENCE

1. Introduction to the Constitution of India by D D Basu.
2. Outlines of Indian Legal and Constitutional History by M P Jain.
3. Constitution of India by P M Bakshi

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FACULTY OF SCIENCE & TECHNOLOGY
B.TECH. ELECTRICAL ENGINEERING

Sem: III	Total Hours Distribution per week		
Total Credit : 2	Lecture (L): NA	Practical /Activity (T/A): 4 Hr.	
Subject Code	BCE3P01	Community Engineering Project	
Examination Scheme			
Internal Marks:	University Marks:	Minimum Passing Marks:	Examination Duration:
100 Marks	N.A	50 Marks	---

Project Objectives

1. Address real community needs through electrical engineering solutions
2. Develop practical implementation skills
3. Promote sustainable and cost-effective solutions
4. Foster community engagement and social responsibility
5. Apply theoretical knowledge to solve real-world problems

Project Guidelines

Phase 1: Community Need Assessment

- Conduct community surveys and interviews
- Identify specific electrical/energy-related problems
- Document existing infrastructure and limitations
- Assess available resources and constraints
- Consider socio-economic factors

Phase 2: Project Planning

- Define clear project objectives and scope
- Create detailed technical specifications
- Develop budget and resource requirements
- Establish timeline and milestones
- Form community partnerships
- Consider safety regulations and standards

Phase 3: Implementation

- Create detailed design documentation
- Source materials and equipment

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- Execute project in phases
- Involve community members in implementation
- Document progress and challenges
- Conduct regular safety checks

Phase 4: Evaluation and Sustainability

- Measure project impact
- Gather community feedback
- Train community members for maintenance
- Document lessons learned
- Create maintenance schedules
- Prepare handover documentation

Sample Project Ideas

1. Solar-Powered Community Learning Center

Objective: Establish a reliable power supply for a rural community center

Components:
- Solar panel installation (1-2 kW system)
- Battery storage system
- LED lighting system
- Computer charging stations
- Basic electrical outlets

Expected Impact:
- Extended study hours for students
- Digital literacy programs
- Community gatherings after dark
- Emergency charging facility

2. Smart Street Lighting System

Objective: Implement energy-efficient street lighting in a residential area

Components:
- LED street lights with motion sensors
- Automatic timing controls
- Solar integration where possible
- Remote monitoring system
- Fault detection system

Expected Impact:
- Reduced energy consumption
- Improved street safety
- Lower maintenance costs
- Better lighting management

3. Micro-hydro Power Generation

Objective: Harness local water resources for power generation

Components:
- Small-scale turbine system
- Power distribution network
- Control and monitoring system
- Safety mechanisms
- Grid connection (optional)

Expected Impact:
- Clean energy generation
- Reduced power costs
- Local job creation
- Sustainable power source

4. Energy Audit and Efficiency Program

Objective: Improve energy efficiency in community buildings

Components:
- Energy monitoring systems
- LED lighting upgrades
- Power factor correction
- Smart metering
- Automated controls

Expected Impact:
- Reduced energy bills
- Better power quality
- Environmental benefits
- Community awareness

Documentation Requirements

Technical Documentation
1. Project proposal
2. Technical specifications
3. Circuit diagrams
4. Installation guides
5. Safety protocols
6. Maintenance manuals

Social Documentation
1. Community feedback forms
2. Impact assessment reports

3. Training materials
4. Sustainability plans
5. Photo and video documentation

Evaluation Criteria

Technical Aspects (40%)
- Design effectiveness
- Implementation quality
- Technical innovation
- Safety considerations
- Reliability

Social Impact (30%)
- Community benefit
- User adoption
- Sustainability
- Knowledge transfer
- Local capacity building

Project Management (30%)
- Planning and organization
- Resource utilization
- Timeline adherence
- Documentation quality
- Team collaboration

Tips for Success
1. Prioritize community involvement from the start
2. Use locally available materials when possible
3. Design for easy maintenance
4. Consider scalability and replication
5. Document everything thoroughly
6. Plan for long-term sustainability
7. Build strong community partnerships
8. Include training and capacity build.

Fourth Semester Syllabus

RASHTRASANT TUKADOJI MAHARAJ NAGPUR UNIVERSITY, NAGPUR
FACULTY OF SCIENCE & TECHNOLOGY
B.TECH. ELECTRICAL ENGINEERING

Sem: IV	Total Hours Distribution per week	
Total Credit : 3	Lecture (L): 3 Hrs	Tutorial/Activity (T/A): 0 Hr.
Subject Code	BEL4T11	Electrical Machine-I

Examination Scheme			
Internal Marks:	University Marks:	Minimum Passing Marks:	Examination Duration:
30 Marks	70 Marks	45 Marks	3 Hours

Course Outcomes

After completion of syllabus, students would be able to

1	Determine Equivalent Circuit parameter, Efficiency and Regulation of Single Phase Transformer and to Explain the Phasor groups of Three Phase Transformer.
2	Analyze different characteristics of D. C. Motor and Speed Control of D.C. Motor.
3	Explain different types of Three Phase Induction Motor and Analyze the characteristics at different Value of Slip.
4	Know Voltage Regulation of Three Phase Synchronous Generator and Behaviour of Synchronous Motor with Different Excitations
5	Understand Single Phase Machines and Special Machines.

SYLLABUS

Details of Topic	Allotment of Hours		Mapped with CO Number
	L	T/A	CO
Unit I: Single Phase Transformer			
Revision of Single-Phase Transformer, Phasor Diagram Under Different Load Conditions, Losses, Equivalent Circuit, Open Circuit and Short Circuit Test, Voltage Regulation, Efficiency, Condition of Maximum Efficiency, All Day Efficiency, Polarity Test. Single phase Autotransformer, Working, Merits and Demerits. Applications. **Three Phase Transformer:** -Principle and Operation, Connection and Phasor Groups, Polarity Test, Open Circuit and Short Circuit Test, Conditions of Parallel Operation.	8		1
Unit II: D.C. Machines			

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Construction Details, Types, Principle, Production of Torque, Torque Equation and Condition of Maximum and Starting Torque, Losses and Efficiency, Torque-Slip Characteristics, Behaviour for Different values of Slip. No Load Test and Blocked Rotor Test. Starting methods of Three Phase Induction Motor. Applications.	7		2
Unit III: Three Phase Induction Motor			
Construction Details, Types, Principle, Production of Torque, Torque Equation and Condition of Maximum and Starting Torque, Losses and Efficiency, Torque-Slip Characteristics, Behaviour for Different values of Slip. No Load Test and Blocked Rotor Test. Starting methods of Three Phase Induction Motor. Applications.	7		3
Unit IV: Synchronous Machines			
Three Phase Synchronous Generator : -Introduction, Constructional features of Salient Pole and Cylindrical Pole Rotor Machines, Introduction to Armature Winding and Field Winding, Winding Factors and EMF Equation, Armature Reaction, Phasor Diagram Under Load Condition, Regulation and Synchronous Impedance Method to Find Voltage Regulation. **Three Phase Synchronous Motor:** - Construction and Principle, Starting of Synchronous Motor, Motor on Load, Effect of Changing Field Excitation at Constant Load, V and Inverted-V Curves. Applications.	7		4
Unit V: Single Phase Machines			
Single Phase Induction Motor: - Principle and Operation, Double Field Revolving Theory. Principle and Working of Shaded Pole Induction Motor, Split Phase Induction Motor and Capacitor Start Capacitor Run Motor. Applications. **Principle, Working and Applications of Special Machines:** - Universal Motor, Hysteresis Motor, Brushless D. C. Motor, A.C. Series Motor.	7		5

Suggested Text books & Reference Books

Text Books

1. "Electrical Machines,", I. J. Nagrath, D.P. Kothari, Tata McGraw- Hill Publishing Company Ltd.
2. Electrical Machinery",P.S.Bhimbra,, Khanna Publishers.
3. "Electrical Machines", P.K. Mukherjee, S. Chakraborty, Dhanat Rai Publications.
4."Generalized Theory in Electrical Machines"P.S. Bhimbra, Khanna Publishers.
5. "Basic Electrical Engineering," D C Kulshreshtha, The McGraw Hill Higher Education Private Limited, New Delhi.
6. "Laboratory Courses in Electrical Engineering," S.G.Tarnekar, P.P. Kharbanda, S.B.Bodkhe, S.D. Naik , S. Chand & Company Ltd., New Delhi
7. Use ICT Tools

Reference Books

1. "Performance and Design of A.C. Machines," M.G.Say, CBS Publishers and Distributors Pvt. Ltd.
2. "Electrical Machinery", A.F. Fitzgerlad, Charles Kingdey, Jr. Stephan D. Umans, Fifth Edition in SI Units, McGraw Hill Book Company.
3., "Laboratory Manual for Electrical Machines, "D.P. Kothari, B.S.Umre, Second Edition , I.K. International Publishing House Pvt.Ltd., New Delhi.

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FACULTY OF SCIENCE & TECHNOLOGY
B.TECH. ELECTRICAL ENGINEERING

Sem: IV	Total Hours Distribution per week	
Total Credit : 1	Lecture (L): 0	Practical: 2 Hrs.
Subject Code	BEL4P11	Electrical Machine-I LAB

Examination Scheme			
Internal Marks:	University Marks:	Minimum Passing Marks:	Examination Duration:
25 Marks	25 Marks	25 Marks	-----

Course Objectives

1.	The basic principle of operation of 1- phase transformer, construction of 3-phase transformers, their classification, connections and phasor diagrams
2.	The basic principle, construction, operation, Performance characteristics, steady state analysis and applications of all types (AC and DC) electrical motors.

Course Outcomes

After completion of syllabus, students would be able to

1	Evaluation of performance indices, equivalent circuit parameters and variation of the performance on loading of single phase and three phase transformer, induction motors and DC shunt motors
2	Magnetizing characteristics of the DC Generator, Critical Field resistance and speed of the machine
3	Various methods of speed control of DC shunt motor and three phase wound rotor induction motor

Minimum Eight Practical's are to be performed out of the following:

Experiment No	Experiment Based on
1	To perform Open Circuit and Short Circuit tests on a 1-phase transformer to evaluate efficiency and voltage regulation.
2	To perform load test on 1-phase transformer to determine its efficiency and voltage regulation.
3	To study conversion of a 2-winding transformer into an autotransformer.
4	To study phasing out and polarity marking of a 1-phase transformer.

5	To study voltage and current relations in a 3-phase, Delta-Star connected transformer.
6	To perform Open Circuit and Short Circuit test on a 3-phase transformer.
7	To plot magnetization characteristic of a DC generator.
8	To study speed control of a DC shunt motor by varying – (a) field excitation and (b) armature voltage
9	To perform load test on a DC shunt motor.
10	To study control of a 3-phase slip-ring induction motor by – (a) variation of a rotor resistance and (b) varying supply voltage
11	To perform load test on a 3-phase induction motor by direct loading.
12	To perform load test on a 3-phase induction motor by indirect loading
13	To perform No-Load and Blocked rotor tests on a 3-phase induction motor
14	To Study starters used for starting AC and DC machines
15	Virtual Laboratory Experiments based on the above

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B.TECH. ELECTRICAL ENGINEERING

Sem: III	Total Hours Distribution per week	
Total Credit : 3	Lecture (L): 3 Hrs	Tutorial/Activity (T/A): 0 Hr.
Subject Code	BEL4T12	POWER SYSTEM-I

Examination Scheme			
Internal Marks:	University Marks:	Minimum Passing Marks:	Examination Duration:
30 Marks	70 Marks	45 Marks	3 Hours

Course Outcomes	
After completion of syllabus, students would be able to	
1	Understand the basic structure of power system, smart grid and micro grid.
2	Model and represent the power system components in it's per unit value.
3	Learn the parameters of transmission lines and cables.
4	Evaluate the performance of transmission lines.
5	Acquaint with the method of load flow analysis and the concept of voltage stability

SYLLABUS

Details of Topic	Allotment of Hours		Mapped with CO Number
	L	T/A	CO
Unit 1: Evolution of Structure of Power Systems			
Structure of power systems, brief exposure to generation, transmission and distribution aspects, Present-Day Scenario, Introduction to Smart Grids and Micro-grids, their components, Standardization of transmission voltages, Overhead and Underground transmission system, EHVAC verses HVDC transmission, HVDC Components, distribution connection scheme(radial ,ring main and interconnected), Feeders and distributors, Substation and its equipment's.	8		1
Unit 2: Per Unit Representation			

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Representation of power system elements, models and parameters of generator, transformer and transmission lines and load, voltage and frequency dependence of loads, single line impedance diagram, advantages of per unit representation.	6		2
Unit 3: Overhead Transmission Lines and Cables			
Components of overhead lines, choice of conductors, Skin effect, Proximity effect, Corona, Transposition of conductors ,Bundled conductor, Types of insulators, string efficiency, Method to improve string efficiency, Derivation for Inductance of a single phase line, concept of self GMD and mutual GMD, Derivation for Capacitance of a single phase line, Insulated Cables, Dielectric stress in single core cables, Grading of cables, XLPE cables	8		3
Unit 4: Performance of Transmission line			
Classification of transmission line (short, medium (nominal T and nominal Π) and long), Characteristics (voltage regulation and efficiency) of transmission lines, determination of generalized (A,B,C,D) constants for transmission line, Ferranti effect, Surge Impedance Loading, Series and Shunt Compensation of transmission lines (using capacitors only) .	8		4
Unit 5: Load Flow Studies			
Introduction to load flow studies, Classification of buses , Formation of bus admittance matrix, Static load flow equations, Gauss Seidel and Newton-Raphson method for solution (Numerical is not expected), Introduction of frequency and voltage as system state indicators, Concept of Voltage Stability, P-V and V-Q curves, Methods to improve voltage stability.	6		5

Text Book

1. I.J.Nagrath,D.P.Kothari,PowerSystemEngineering,TataMcGraw-Hillpublications, 2008
2. AshfaqHusain,ElectricalPowerSystem,CBSPublication,5thEdition
3. C.L.Wadhwa,ElectricalPowerSystems,NewAgeInternationalPubliser,6thEdition
4. V.K.MehtaandRohitMehta,PrinciplesofPowerSystem,S.ChandPublication, 2008

Reference Books:

1. W.D.Stevenson, Elements of power system analysis, McGraw-Hill publications,3rdEdition
2. O.I.Elgerd,ElectricEnergySystemsTheory:AnIntroduction,McGraw-Hill publications, 2ndEdition
3. Hadi Saadat, Power System Analysis,TMH, 2002
4. James A Momoh, Smart Grid:FundamentalsofDesignandAnalysis,Wiley2012
5. Janaka Ekanayake, Nick Jenkins, Kithsiri Liyanage,"Smart Grid: Technology and Applications", Wiley 2012

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FACULTY OF SCIENCE & TECHNOLOGY
B.TECH. ELECTRICAL ENGINEERING

Sem: IV	Total Hours Distribution per week	
Total Credit : 1	Practical (P): 2 Hrs	
Subject Code	BEL4P12	POWER SYSTEM LAB

Examination Scheme			
Internal Marks:	University Marks:	Minimum Passing Marks:	Examination Duration:
25 Marks	25 Marks	25 Marks	--

Course Outcomes	
After completion of syllabus, students would be able to	
1	Determine various parameters of transmission line
2	Analyze the performance insulators (Liquid insulating medium & String efficiency of disc type solid insulator)
3	Understand the effects on transmission lines
4	Understand different types of faults
5	Analyze the characteristics of different types of relay

List of Experiments	
1	To determine A, B, C, D parameters of short and medium transmission line.
2	To study and compare the performance of ring and radial distribution system
3	Determination of power angle characteristics of transmission line
4	To study search impedance loading of transmission line
5	To draw PV characteristics of transmission line
6	To study the performance of oil testing set

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7	To find out the string efficiency across the string of insulators
8	To study Ferranti effect and Corona effect on transmission line
9	To perform symmetrical fault analysis in AC network analyser.
10	To perform symmetrical fault analysis in DC network analyser & perform the experiment for Unsymmetrical fault analysis on DC network.
11	To study the characteristics of the operation of Buchholz relay.
12	To study the characteristics of the microprocessor based DMT/IDMT over current relay and determines the time current characteristics.
13	To study the characteristics of microcontroller based over current relay
14	To study microcontroller base over/ under voltage relay.
15	To study characteristics of electromechanical earth fault relay

Text Book

1. I.J.Nagrath, D.P.Kothari, Power System Engineering ,Tata Mc Graw-Hill publications, 2008
2. Ashfaq Husain, Electrical Power System,CBSPublication,5thEdition
3. C.L.Wadhwa,ElectricalPowerSystems,NewAgeInternationalPublisher,6thEdition
4. V.K.MehtaandRohitMehta,PrinciplesofPowerSystem,S.ChandPublication, 2008

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Sem: IV	Total Hours Distribution per week	
Total Credit: 2	Lecture (L): 2 Hrs	Tutorial/Activity (T/A): 0 Hr.
Subject Code	BMD4T13	Elements of Electromagnetic

Examination Scheme			
Internal Marks:	University Marks:	Minimum Passing Marks:	Examination Duration:
30 Marks	70 Marks	45 Marks	3 Hours

Course Outcomes

After completion of syllabus, students would be able to

1	Recognize and apply the knowledge of different co-ordinate systems.
2	Evaluate the physical quantities of electromagnetic fields in different media and apply Gauss law.
3	Describe static electric fields & explain steady magnetic fields
4	Understand Maxwell's equations in different forms and different media.

SYLLABUS

Details of Topic	Allotment of Hours		Mapped with CO Number
	L	T/A	CO
Unit I: Review of Vector Analysis:			
Review of Scalars and vectors, Vector Algebra, Rectangular Co-ordinate System, Cylindrical Co-ordinate System, Spherical Co-ordinate System and transformation of Cartesian to Cylindrical, Cartesian to Spherical and vice versa.	7		1
Unit II: Coulomb's law, Electrical field intensity and electric flux density, Gauss's law, Divergence:			
Coulombs Law, Electric field intensity, field due to continuous volume charge distribution, field of point charge, field of line charge, field of sheet charge, Electric Flux density, Gauss's law and Applications of Gauss's law, the divergence theorem.	5		2
Unit III: Potential of charge system, poison's and Laplace Equations & steady Magnetic Field			

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Definition of potential difference and potential, the potential field of a point charge, the potential field of a system of charges, potential gradient, Poisons and Laplace Equation. Biot Savart's law, Ampere's Circuital law, Stoke's theorem, magnetic flux density, scalar and vector magnetic potentials	6		3
Unit IV: Boundary conditions, Maxwell's equation and wave propagation			
Magnetic boundary conditions, Faraday's law, Displacement current, Point form of Maxwell's equation, Integral form of Maxwell's equations, Wave propagation, Poynting vector, skin effect.	6		4

Suggested Textbooks &Reference Books

Textbooks:

1. W.H. Hayt , "Engineering Electromagnetic" ,TMH Publication 2006

Reference books:

1. Electromagnetic Engg. N.N.Rao V Edition ,Prentice Hall. 2005
2. Applied Electromagnetics, Fawwaz T.Ulaby, Prentice Hall. 1999
3. Krauss Electromagnetic Engg. IV Edition, Tata Mc Graw Hill. 2003
4. Electromagnetic Waves,Shevgaonkar Tata Mc Graw Hill 2002
5. Elements of Electromagnetics,Matthew, N. O. Sadiku, Oxford University publication, 6th edition, 2014.

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Sem: IV	Total Hours Distribution per week	
Total Credit: 2	Lecture(L):2	Practical /Activity (T/A): NA.
Subject Code	BOE4T02	Introduction to Power Systems

Examination Scheme			
Internal Marks:	University Marks:	Minimum Passing Marks:	Examination Duration:
30 Marks	70 Marks	45 Marks	3 Hours

Course Objectives

1.	Understand basic electrical power concepts
2.	Learn about power generation methods
3.	Comprehend power transmission and distribution basics
4.	Explore renewable energy integration

Course Outcomes

After completion of syllabus, students would be able to	
1.	Explain basic electrical power concepts
2.	Describe various power generation methods
3.	Understand power transmission and distribution basics
4.	Implement basic energy conservation measures

Details of Topic	Allotment of Hours		Mapped with CO Number
	L	T/A	CO
Unit 1: Fundamentals of Electrical Power			
Basic electrical quantities (voltage, current, power), AC vs DC power systems Single-phase and three-phase systems, Power factor and its importance Simple circuit calculations, Units and conversions	6		1
Unit 2: Power Generation			
Conventional power plants: Thermal power plants, Hydroelectric power plants, Nuclear power plants (Block diagram description only) **Renewable energy sources**: Solar power, Wind power, Biomass Basic generator principles	6		2
Unit 3: Power Transmission & Distribution			
Transmission line components, Distribution system overview, Substations and transformers , Basic power loss concepts , Underground vs overhead lines Smart grid introduction	6		3
Unit 4: Energy Management			
Energy conservation principles, Power quality basics, Energy audit introduction , Load management , Energy efficiency measures , Smart metering	6		4

Textbooks

1. Power System Engineering, D.P. Kothari and I.J. Nagrath, Tata McGraw Hill Education, New Delhi
   3rd Edition, Units 1, 2, 3.
2. Generation, Distribution and Utilization of Electrical Energy, C.L. Wadhwa,New Age International Publishers ,Latest Edition, Units 2, 3, 4
3. Basic Electrical Engineering, V.K. Mehta and Rohit Mehta, S. Chand Publishing ,Latest Edition

Reference Books

1. Power System Analysis, A. Chakrabarti and S. Halder, PHI Learning, Units 1, 3
2. Non-Conventional Energy Sources, G.D. Rai,Khanna Publishers, Unit 2 (Renewable Energy)
3. Electric Power Distribution System Engineering, Turan Gonen, CRC Press.

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Sem: IV	Total Hours Distribution per week	
Total Credit : 2	Lecture (L): NA	Practical /Activity (T/A): 4 Hr.
Subject Code	BAE4P02	Technical Report Writing

Examination Scheme			
Internal Marks:	University Marks:	Minimum Passing Marks:	Examination Duration:
50 Marks	50 Marks	50 Marks	---

This guideline provide the essential components for writing technical reports in engineering. Technical reports are formal documents that describe processes, progress, or results of technical or scientific research and investigations.

Structure of a Technical Report

Preliminary Pages	Main Body	End Matter
- Title Page - Report title - Author name(s) - Institution name - Date of submission - Course details -Abstract/Executive Summary - Brief overview of the entire report (200-300 words) - Table of Contents** - List of all sections and subsections with page numbers - List of figures and tables	Introduction, Background information, Problem statement, Objectives, Scope and limitations, Methodology overview - **Literature Review** - Summary of relevant research - Analysis of existing solutions - Theoretical framework - Critical evaluation of sources - **Methodology** Detailed description of procedures , Equipment and materials used ,Experimental setup, Data collection methods Analysis techniques - **Results and Discussion** Presentation of findings, - Data analysis, Interpretation of results, Comparison with literature ,Discussion of implications - **Conclusions and Recommendations** - Summary of key findings ,Practical implications, Suggestions for future work	- References - IEEE or other specified format - All cited sources listed - Appendices - Raw data - Detailed calculations - Supporting documents

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Report Writing Process

Planning Phase	Research Phase	Writing Phase	Review Phase
-Understand the assignment requirements - Define scope and objectives - Create outline - Plan timeline	- Gather relevant literature - Collect data - Analyze findings - Document sources	- Draft main sections - Create figures and tables - Write introduction and conclusion - Prepare abstract	- Technical review - Grammar and style check - Format verification - Peer review if possible

Assessment Criteria

Reports are typically evaluated on:

1. Technical content and accuracy
2. Clarity and organization
3. Analysis and interpretation
4. Presentation and format
5. References and documentation

Practical Tips

1. Time Management
   - Start early
   - Break into manageable sections
   - Allow time for revision
   - Plan for unexpected delays

2. Documentation
   - Keep detailed notes
   - Document all sources
   - Save all raw data
   - Maintain version control

3. Professional Presentation
   - Consistent formatting
   - Clean, professional layout
   - High-quality graphics
   - Error-free content

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Sem: IV	Total Hours Distribution per week	
Total Credit : 2	Lecture (L): 2 Hrs	Tutorial/Activity (T/A): 0 Hr.
Subject Code	BHM4T02	Digital Economy

Examination Scheme			
Internal Marks:	University Marks:	Minimum Passing Marks:	Examination Duration:
15 Marks	35 Marks	23 Marks	2 Hours

Course Outcomes

After completion of syllabus, students would be able to

1	Develop knowledge of economic theories and share market.
2	Identify key trends in Digital economy
3	Acquire knowledge of business strategies.
4	Analyze the problems of Small Scale Industries.

SYLLABUS

Details of Topic	Allotment of Hours		Mapped with CO Number
	L	T/A	CO
Unit I: Concept of Economics			
Concept of Economics, Types of demand, Determinants of demand, Law of Demand, Elasticity of demand, Law of supply, Total utility and Marginal utility.	4		1
Unit II: Concept of Digital economy			
Concept of Digital economy, Components of digital economy: E-business, Infrastructure, E-commerce, Merits and Demerits of digital economy, Contribution of Digitalization in economic growth of country, Labour intensive verses Capital intensive industry.	8		2
Unit III: Concept of cost			
Concept of cost, Law of returns, Forward and Backward Integration, Merger and			3

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Acquisition, Types of merger and acquisition, hostile takeover, advantages of merger and acquisition.	6		
Unit IV: Sickness in small business			
Sickness in small business, Major problems faced by SSIs, Technical consultancy organizations, Government Policies for Small Scale Enterprises, Tax holidays, Incentives to SSIs	6		4

Suggested Text Books &Reference Books

1. Modern Economic theory by K.K. Dewett, S Chand Publication, 2006.
2. The Digital Economy, by Tim Jordan, Polity publishers, 2020
3. Industrial economics and Entrepreneurship development by A.M. Sheikh, Nawaz Khan & M.A. Tongo, S chand Publication

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Sem: IV	Total Hours Distribution per week	
Total Credit : 2	Lecture (L): 2 Hrs	Tutorial/Activity (T/A): 0 Hr.
Subject Code	BVE4T02	Universal Human Values

Examination Scheme			
Internal Marks:	University Marks:	Minimum Passing Marks:	Examination Duration:
15 Marks	35 Marks	23 Marks	2 Hours

Course Outcomes:	
After completing the course, students will be able to	
1	Understand the importance of human values and ethics for a harmonious life and society.
2	Develop clarity about relationships, happiness, and prosperity from a holistic perspective.
3	Apply universal human values in personal and professional life for ethical decision-making.
4	Evaluate the role of human values in sustainable development and social well-being.

Details of Topic	Allotment of Hours		Mapped with CO Number
	L	T/A	CO
Unit I: Introduction to Universal Human Values			
Introduction to Universal Human Values, Need for and Importance of Universal Human Values, Understanding Human Aspirations and Purpose of Life, Five Dimensions of Human Values: Individual, Family, Society, Nature, and Existence	4		1
Unit II: Understanding the Self			
Understanding the Self: "I" and the Body, Harmony of Thoughts, Behaviour, and Work ,Family as the Fundamental Unit of Society, Trust and Respect in Relationships , Ethical Values in Personal and Professional Life	8		2
Unit III: Society and Mutual Fulfilment			
Society and Mutual Fulfilment: Humanistic Education, Health, and Justice, Universal			

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Order: Role of Ethics in Social Systems, Coexistence with Nature: Environmental Ethics and Sustainability , Holistic Perspective on Economic and Technological Growth	6		3
Unit IV: Holistic Development and Professional Ethics			
Holistic Development and Professional Ethics, Role of Human Values in Education, Science, and Technology, Ethical Dilemmas in Professional Life and Their Resolution, Corporate Social Responsibility (CSR) and Ethical Leadership	6		4

Suggested Text Books &Reference Books :

1. "Human Values and Professional Ethics" – R.R. Gaur, R. Sangal, G.P. Bagaria. Publisher: Excel Books
2. "Essence of Human Values" – A.N. Tripathi Publisher: New Age International
3. "Human Values" – Prof. A. Alavudeen, R. Kalil Rahman, and M. Jayakumaran Publisher: Laxmi Publications
4. "Professional Ethics and Human Values" – M. Govindarajan, S. Natarajan, V.S. Senthilkumar. Publisher: Prentice Hall India (PHI Learning)

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Sem: IV	Total Hours Distribution per week	
Total Credit : 2	Lecture (L): NA	Practical /Activity (T/A): 4 Hr.
Subject Code	BVE4P02	Electrical Engineering Drawing

Examination Scheme			
Internal Marks:	University Marks:	Minimum Passing Marks:	Examination Duration:
50 Marks	50 Marks	50 Marks	---

Sr. No	Title of Practical	Contents
1	Basic Electrical Components	-Resistors (fixed, variable, rheostats) . Capacitors (fixed, variable, electrolytic) , Inductors and transformers ,Power sources (AC/DC) ,Ground symbols and connecting terminals
2	Protection and Switching Devices	- Circuit breakers (MCB, MCCB, ACB) , Fuses and isolators, Switches (SPST, SPDT, DPST, DPDT) , Relays and contactors Push buttons and limit switches
3	Single-Line Diagrams	- Domestic electrical installation Industrial power distribution Transformer substation layout, Motor control center, Power factor improvement setup
4	Residential Installations	- Complete house wiring layout, distribution board connections, Earthling system layout, Light and fan circuit diagram, Energy meter installation
5	Industrial Installations	- Factory floor electrical layout ,Cable tray routing, Motor installation details Panel board arrangements Emergency lighting system