TULSIRAMJI GAIKWAD-PATIL College of Engineering & Technology

Mohgaon, Wardha Road, Nagpur - 441 108

An Autonomous Institute

DEPARTMENT OF ELECTRICAL ENGINEERING

B.Tech. Electrical Engineering

Teaching Scheme

Considering

National Education Policy 2020

From

Academic Year 2026-27

Vision of Institute

To emerge as a learning Center of Excellence in the National Ethos in domains of Science, Technology and Management.

Mission of Institute

1. To strive for rearing standard and stature of the students by practicing high standards of professional ethics, transparency and accountability.
2. To provide facilities and services to meet the challenges of Industry and Society.
3. To facilitate socially responsive research, Innovation and entrepreneurship.
4. To ascertain holistic development ofthe students and staff members byinculcating knowledge and profession as work practices.

Vision of the Department

To emerge as a learning hub and center of excellence in the domain of Electrical Engineering.

Mission of the Department

1. To disseminate knowledge replete with quality education in the field of Electrical Engineering in meticulous and methodical manner.
2. Toprovideplatformtoaddresssocietalissuesaswellaschallengesfacedby industries.
3. To developer search culture and inculcate innovative and entrepreneurial skills.
4. To ensure overall development of students and staff by instilling knowledge and professional ethics as a part of lifelong learning.

Program Education Objectives (PEO)

1. Demonstrate and analyze the fundamental knowledge with respect to the various domains of Electrical Engineering.
2. Investigate and apply modern tools to develop innovativeness in different applications of Electrical Engineering domain.
3. Integrate new emerging trends and concepts in Electrical Engineering profession for sustainable development.
4. Develop professionals having managerial and administrative Qualities for Electrical Engineering related industries.
5. Promote lifelong learning, to prepare for the next challenges in the field of Electrical Engineering.

Program Outcomes(PO)

1. **Engineering Knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem Analysis:** Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **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.
4. **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.
5. **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and software tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
6. **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.
7. **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.
8. **Ethics:** Apply ethical principles and commit to professional ethics, responsibilities, and norms of the engineering practice.
9. **Individual and Team Work:** Function effectively as an individual, and as a member or laddering diverse teams, and in multidisciplinary settings.
10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. **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.
12. **Lifelong learning:** Recognize the need for, and have the preparation and ability to engage in independent and lifelong learning in the broadest context of technological change.

Program Specific Outcomes (PSO)

PSO1: Formulate the solutions to Electrical and Electronics Engineering problems using the basic concepts.

PSO2: Develop the process to interpret networks parameters in power system operation and control with their protection and driving mechanisms.

PSO3: Apply project-based learning to conduct experiments with Electrical Machines, Power Electronics to develop energy efficient system

Tulsiramji Gaikwad-Patil College of Engineering and Technolo

WardhaRoad,Nagpur-441108AccreditedwithNAACA+Grade
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SchemeofInstructionforFirstYearofB.Tech.(UG)Programme
Group-BSemester–IEE/ME/CE/AE/BT

Mandatory03-WeeksInductionProgramintheFirstSemesterforeverystudent

SN	Sem	Type	BoS/ Deptt	Sub.Code	Subject	T/P	Contact Hours L	T/L	P	Hrs	Credits	% Weightage CT/IA	CA	ESE	ESE Duration Hours
FIRSTSEMESTER(GROUP-B)															
1	1	**BSC**	**S&H**	BSH31101	AlgebraandCalculus	T	4	2	0	6	4	30	10	60	3
2	1	**BSC**	**S&H**	BSH31104	ChemicalProcessinEngineering	T	3	2	0	5	3	30	10	60	3
3	1	**BSC**	**S&H**	BSH31105	ChemicalProcessinEngineering -Lab	P	0	0	2	2	1	25	-	25	-
4	1	**ESC**	**CE/BT**	BCE31101/ BBT31101	EngineeringMechanics/ FundamentalsofBiotechnology	T	3	2	0	5	3	30	10	60	3
5	1	**ESC**	**ME**	BEE31101	EngineeringWorkshop	P	0	0	2	2	1	25	-	25	-
6	1	**BSC**	**S&H**	BSH31X08	IntroductiontoIndianKnowledgeSystem	T	2	2	0	0	2	14	6	30	2
7	1	**ESC**	**ME**	BME31X01	EngineeringandComputer GraphicsLab	P	0	0	2	2	1	25	-	25	-
8	1	**PCC**	**EE/ME /CE/AE /BT**	BEE31101/ BME31102 /BCE31102 /BAE31101 /BBT31102	Electrical Wiring and Installations/ComputerAided Design/ CAD for Civil Engineers/ CAD for Aircraft Component/Biotechnological SkillLab	P	0	0	4	4	2	25	-	25	-
9	1	**VSEC**	**CS**	BCS31102	WebDesigning	P	0	2	4	4	2	25	-	25	-
10	1	**CC**	**S&H**	BSH31X09	BusinessCommunication	P		0	4	4	2	25	-	25	-
TOTALFIRSTSEM							**12**	**10**	**18**	**34**	**21**				
SECONDSEMESTER(GROUP-B)															
1	2	**BSC**	**S&H**	BSH31201	DifferentialEquationandStatistics	T	4	2	0	6	4	30	10	60	3
2	2	**BSC**	**S&H**	BSH31208	QuantumPhysics&Optics	T	3	2	0	5	3	30	10	60	3
3	2	**BSC**	**S&H**	BSH31209	QuantumPhysics&Optics-Lab	P	0	0	2	2	1	25	-	25	-
4	2	**ESC**	**EE**	BEE31202	PrinciplesofElectricalEngineering	T	3	2	0	5	3	30	10	60	3
5	2	**ESC**	**EE**	BEE31203	PrinciplesofElectricalEng ineering-Lab	P	0	0	2	2	1	25	-	25	-
6	2	**ESC**	**IT**	BIT31103	ProgrammingforProblem Solvingusing'C'	T	3	2	0	5	3	30	10	60	3
7	2	**ESC**	**IT**	BIT31104	ProgrammingforProblem Solving using 'C'-Lab	P	0	0	2	2	1	25	-	25	-
8	2	**VSEC**	**EE/ME /CE/AE /BT**	BEE31204/ BME31201 /BCE31201 / BAE31201/ BBT31201	Power SIM / CNC Machine andProgramming/BuildingMaintenanceLab/ Basics of Aircraft Design/Environmental Biotechnology Lab	P	0	0	4	4	2	25	-	25	-
9	2	**AEC**	**S&H**	BSH31X04	Communication for PersonalityDevelopment-Lab	P	0	1	4	5	2	25	-	25	-
10	2	**CC**	**S&H**	BSH31X05	Integrated Personality DevelopmentCourse-I	P	0	0	4	4	2	25	-	25	-
TOTALSECONDSEM							**13**	**09**	**18**	**40**	**22**				

CourseCategory	BSC/ESC (BasicScienceCourse/EngineeringScienceCourse.)	PCC (Programme Corecourses	Multidisciplinary course	VSEC (Skill Course)	HumanitiesSocialScience &Management		ExperientialLearningCourses	CC(Co-CurricularCourses)
					AEC(Ability EnhancementCourse)	IKS(Indian KnowledgeSystem)		
CreditsSEM-I	08/05	02	--	02	--	02	--	02
CreditsSEM-II	08/08	--	--	02	02	--	--	02
CumulativeSum	16/13	02	--	04	02	02	--	04

PROGRESSIVETOTALCREDITS:21+22=43

Chairperson	DeanAcademics	Vice Principal	Principal	Dateof Release	Version	ApplicableforAY2023-24 Onwards
				Aug,2023	1.00	

Tulsiramji Gaikwad-Patil College of Engineering & Technology, Nagpur

(An Autonomous Institution Affiliated to RTM Nagpur University, Nagpur)

SCHEME OF INSTRUCTION & SYLLABI

Programme: Electrical Engineering (NBA Accredited)

Scheme of Instructions: Second Year B.Tech. in Electrical Engineering(As Per New NEP 2020)

Semester– III

SN	Sem	Type	BoS/ Dept	Sub Code	Subject	T/P	Contact Hours			Credits	% Weightage			ESE Duration	Total Marks
							L	P	Hrs		CT/IA	CA	ESE		
1	**III**	**PCC**	**EE**	BEE42301	Network Theory & Analysis	T	4	-	4	**4**	30	10	60	4 Hrs	100
2	**III**	**PCC**	**EE**	BEE42302	Fundamentals of Electrical Measurements	T	3	-	3	**3**	30	10	60	3 Hrs	100
3	**III**	**OEC**	**EE**	B$$423XX	Open Elective-I	T	4	-	4	**4**	30	10	60	4 Hrs	100
4	**III**	EEMC	BBA	BBA42308	Engineering Economics and Management	T	2	-	2	**2**	14	6	30	2 Hrs	50
5	**III**	**VEC**	**CE**	BCE42309	Sustainable Development and Ethics	T	2	-	2	**2**	14	6	30	2 Hrs	50
6	**III**	**MDM**	**SH**	BSH42305	Transformation and its Series	T	2	-	2	**2**	14	6	30	2 Hrs	50
7	**III**	**PCC**	**EE**	BEE42303	Network Theory & Analysis Lab	P	-	2	2	**1**	-	25	25	2 Hrs	50
8	**III**	**PCC**	**EE**	BEE42304	Fundamentals of Electrical Measurements Lab	P	-	2	2	**1**	-	25	25	2 Hrs	50
9	**III**	**CEP**	**EE**	BEE42306	Community Project	P	-	4	4	**2**	-	50	-	2 Hrs	50
10	**III**	**ACE**	**SH**	BSH423XX	Liberal Learning Module -III	P	-	2	2	**1**	-	50	-	2 Hrs	50
Total							**17**	**08**	**27**	**22**	**132**	**198**	**320**	**25 Hrs**	**650**

Course Category	BSC/ESC(Basic Science Course/ Engineering Science Course.)	PCC (Programme Core courses)	PEC (Programme Elective courses)	Multidisciplinary courses	SEC(Skill Course)	Humanities Social Science &Management	Experiential Learning Courses	CC (Liberal Learning Courses
Credits	--	09	--	06	--	04	-	--
Cumulative Sum	16/13	11	--	06	04	08	02	04

PROGRESSIVE TOTAL CREDITS :43+22=65

Tulsiramji Gaikwad-Patil College of Engineering &Technology, Nagpur

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SCHEME OF INSTRUCTION & SYLLABI

Programme: Electrical Engineering (NBA Accredited)

Scheme of Instructions: Second Year B.Tech. in Electrical Engineering (As Per New NEP 2020)

Semester– IV

SN	Sem	Type	BoS/ Dept	Sub Code	Subject	T/P	Contact Hours			Credits	% Weightage			ESE Duration	Total Marks
							L	P	Hrs		CT/IA	CA	ESE		
1	IV	PCC	EE	BEE42401	Electromagnetic Theory	T	3	-	3	3	30	10	60	3 Hrs	100
2	IV	PCC	EE	BEE42402	Electrical Machine-I	T	3	-	3	3	30	10	60	3 Hrs	100
3	IV	PCC	EE	BEE42403	Fundamentals of Power Systems	T	3	-	3	3	30	10	60	3 Hrs	100
4	IV	OEC	EE	B$$4	Open Elective-II	T	2	-	2	2	15	5	30	2 Hrs	50
5	IV	VEC	EE	BEE42404	Cultural Heritage & Values	P	-	4	4	2	-	25	25	2 Hrs	50
6	IV	VSEC	EE	BEE42406	1. PLC Programming 2. MATLAB	P	-	4	4	2	-	25	25	2 Hrs	50
7	IV	PCC	EE	BEE42407	Electrical Machine-I Lab	P	-	2	2	1	-	25	25	2 Hrs	50
8	IV	AEC	CE	BCE4	Climate Change & Sustainability	T	2	-	2	2	15	5	30	2 Hrs	50
9	IV	EEMC	BA	BBA	Basics of E-Commerce	T	2	-	4	2	15	5	30	2 Hrs	50
10	IV	MDM	CSE	BCS	Python Programming Lab	P	-	4	4	2	-	25	25	2 Hrs	50
Total							**15**	**14**	**31**	**22**	**135**	**145**	**370**	**23 Hrs**	**650**

Course Category	BSC/ESC(Basic Science Course/ Engineering Science Course.)	PCC (Programme Core courses)	PEC (Programme Elective courses)	Multidisciplinary courses	SEC(Skill Course)	Humanities Social Science &Management	Experiential Learning Courses	CC (Liberal Learning Courses
Credits	--	10	--	04	02	06	--	--
Cumulative Sum	16/13	19	--	10	06	14	02	04

PROGRESSIVE TOTAL CREDITS :63+22=85

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SCHEME OF INSTRUCTION & SYLLABI

Programme: Electrical Engineering (NBA Accredited)

Scheme of Instructions: Third Year B.Tech. in Electrical Engineering (As Per New NEP 2020)

Semester– V

SN	Sem	Type	BoS/ Dept	Sub Code	Subject	T/P	Contact Hours			Credits	% Weightage			ESE Duration	Total Marks
							L	P	Hrs		CT/IA	CA	ESE		
1	**V**	**PCC**	**EE**	BEE43501	Electrical Machines – II	T	3	-	3	**3**	30	10	60	3 Hrs	100
2	**V**	**PCC**	**EE**	BEE43502	Advanced Control Systems	T	3	-	3	**3**	30	10	60	3 Hrs	100
3	**V**	**PCC**	**EE**	BEE43503	Power Electronics & Motor Drives	T	3	-	3	**3**	30	10	60	3 Hrs	100
4	**V**	**OEC**	**EE**	B$$435XX	Open Elective–III	T	2	-	2	**2**	15	5	30	2 Hrs	50
5	**V**	**PEC**	**EE**	BEE4350 5- 07	Program Elective-I	T	4	-	4	**4**	30	10	60	3 Hrs	100
6	**V**	**PCC**	**PCC**	BEE43508	Electrical Machines – II Lab	P	-	2	2	**1**	-	25	25	2 Hrs	50
7	**V**	**PCC**	**PCC**	BEE43509	Power Electronics & Motor Drives Lab	P	-	2	2	**1**	-	25	25	2 Hrs	50
8	**V**	**MDM**	**ECE**	BEC	Fundamentals of Digital Electronics and Microcontrollers	T	3	-	3	**3**	30	10	60	3 Hrs	100
9	**V**	**MDM**	**ECE**	BEC	Fundamentals of Digital Electronics and Microcontrollers Lab	P	-	2	2	**1**	-	25	25	2 Hrs	50
Total							**18**	**6**	**24**	**21**	**165**	**130**	**405**	**23 Hrs**	**700**

Course Category	BSC/ESC(Basic Science Course/ Engineering Science Course.)	PCC (Programme Core courses)	PEC (Programme Elective courses)	Multidisciplinary courses	SEC (Skill Course)	Humanities Social Science & Management	Experiential Learning Courses	CC (Liberal Learning Courses
Credits	--	11	04	06	--	--	--	--
CumulativeSum	16/13	31	04	16	06	14	02	04

PROGRESSIVETOTALCREDITS:85+21=106

Tulsiramji Gaikwad-Patil College of Engineering &Technology, Nagpur

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SCHEME OF INSTRUCTION & SYLLABI

Programme: Electrical Engineering (NBA Accredited)

Scheme of Instructions: Third Year B.Tech. in Electrical Engineering (As Per New NEP 2020)

Semester– VI

SN	Sem	Type	BoS/ Dept	Sub Code	Subject	T/P	Contact Hours			Credits	% Weightage			ESE Duration	Total Marks
							L	P	Hrs		CT/IA	CA	ESE		
1	VI	PCC	EE	BEE43601	Power System Modelling and Analysis	T	3	-	3	3	30	10	60	3 Hrs	100
2	VI	PCC	EE	BEE43602	Advanced Protection Systems	T	3	-	3	3	30	10	60	3 Hrs	100
3	VI	VSEC	EE	BEE43603	Internet of Things Lab	P	-	4	4	2	-	50	50	2 Hrs	100
4	VI	PEC	EE	BEE43604-06	Program Elective-II	T	4	-	4	4	30	10	60	3 Hrs	100
5	VI	PEC	EE	BEE43607-09	Program Elective-III	T	4	-	4	4	30	10	60	3 Hrs	100
6	VI	PCC	EE	BEE43610	Power System Modeling and Analysis Lab	P	-	2	2	1	-	25	25	2 Hrs	50
7	VI	PCC	EE	BEE436011	Advanced Protection Systems Lab	P	-	2	2	1	-	25	25	2 Hrs	50
8	VI	MDM	ME	BME	Robotics and Industrial Automation	T	2	-	2	2	15	5	30	2 Hrs	50
Total							**16**	**8**	**24**	**20**	**135**	**120**	**345**	**20 Hrs**	**650**

Course Category	BSC/ESC(Basic Science Course/ Engineering Science Course.)	PCC (ProgrammeCore courses)	PEC (Programme Elective courses)	Multidisciplinary courses	SEC(Skill Course)	Humanities Social Science &Management	Experiential Learning Courses	CC (Liberal Learning Courses
Credits	--	08	08	02	02	--	--	--
Cumulative Sum	16/13	39	12	18	08	14	02	04

PROGRESSIVE TOTAL CREDITS :106+20=126

Tulsiramji Gaikwad-Patil College of Engineering & Technology, Nagpur

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SCHEME OF INSTRUCTION & SYLLABI

Programme: Electrical Engineering (NBA Accredited)

Scheme of Instructions: fourth Year B.Tech. in Electrical Engineering (As Per New NEP 2020)

Semester–VII

SN	Sem	Type	BoS/ Dept	Sub Code	Subject	T/P	Contact Hours			Credits	% Weightage			ESE Duration	Total Marks
							L	P	Hrs		CT/IA	CA	ESE		
1	**VII**	**PCC**	**EE**	BEE44801	High Voltage Engineering	T	4	-	4	**3**	30	10	60	3 Hrs	100
2	**VII**	**RM**	**ME**	BME	Research Methodology	T	4	-	4	**4**	30	10	60	3 Hrs	100
3	**VII**	**Project**	**EE**	BEE44803	Project	P	-	8	8	**4**	-	50	50	2 Hrs	100
4	**VII**	**PEC**	**EE**	BEE44804-06	Program Elective-IV	T	3	-	3	**4**	30	10	60	3 Hrs	100
5	**VII**	**PCC**	**EE**	BEE44810	High Voltage Engineering Lab	P	-	2	2	**1**	-	25	25	2 Hrs	50
6	**VII**	**MDM**	**MBA**	BBA	Project Management & Finance	T	4	-	4	**4**	30	10	60	3 Hrs	100
Total							**15**	**10**	**25**	**20**	**120**	**115**	**315**	**16 Hrs**	**550**

Course Category	BSC/ESC(Basic Science Course/ Engineering Science Course.)	PCC (Programme Core courses)	PEC (Programme Elective courses)	Multidisciplinary courses	SEC(Skill Course)	Humanities Social Science &Management	Experiential Learning Courses	CC (Liberal LearningCourses
Credits	--	04	04	04	--	--	04	04
Cumulative Sum	16/13	47	20	22	08	14	22	04

PROGRESSIVE TOTAL CREDITS:126+20=146

Tulsiramji Gaikwad-Patil College of Engineering &Technology, Nagpur

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SCHEME OF INSTRUCTION & SYLLABI

Programme: Electrical Engineering (NBA Accredited)

Scheme of Instructions: fourth Year B.Tech. in Electrical Engineering (As Per New NEP 2020)

Semester– VIII

SN	Sem	Type	BoS/ Dept	Sub Code	Subject	T/P	Contact Hours			Credits	% Weight age			ESE Duration	Total Marks
							L	P	Hrs		CT/IA	CA	ESE		
1	**VIII**	**PCC**	**EE**	BEE34701	Power Quality(MOOCs 12Week Course)	T	4	-	4	**4**	-	25	75	3 Hrs	100
2	**VIII**	**Internship/ OJT**	**EE**	BEE34702	Internship/On Job Training	P	-	24	24	**12**	-	50	50	2 Hrs	100
3	**VIII**	**PEC**	**EE**	BEE34703-05	Program Elective–IV (MOOCs 12 Week Course)	T	4	-	4	**4**	15	5	30	2 Hrs	50
Total							**8**	**24**	**34**	**20**	**15**	**80**	**155**	**10 Hrs**	**250**

Course Category	BSC/ESC(Basic Science Course/ Engineering Science Course.)	PCC (Programme Core courses)	PEC (Programme Elective courses)	Multidisciplinary courses	SEC(Skill Course)	Humanities Social Science &Management	Experiential Learning Courses	CC (Liberal Learning Courses
Credits	--	04	02	02	--	--	12	--
Cumulative Sum	16/13	43	14	20	08	14	14	04

PROGRESSIVE TOTAL CREDITS: 146+20=166

Program: Electrical Engineering

List of **Program Electives** offered By Electrical Engineering Department (NBA Accredited)

Program Elective-I	Program Elective-II	Program Elective-III	Program Elective-IV
Semester V	**Semester VI**	**Semester VI**	**Semester VIII**
BEE43505-Solar Power Engineering	**BEE43604-**Wind Energy Systems and Applications	**BEE43607-**Ginning Process	**BEE44804–** Advanced Ginning Process
BEE43506- Utilization of Electrical Energy	**BEE43605–**Power Plant Engineering and Technology	**BEE43608-** Modern Electrical Distribution Systems	**BEE44805-**Power System Operation & Control
BEE43507-High Voltage Technology	**BEE43606-**FlexibleAC Transmission System	**BEE43609–**Electric Vehicle Technology	**BEE44806–**Power System Deregulation

Program :Electrical Engineering

List of **Open Electives** offered By Electrical Engineering Department (NBA Accredited)

Open Elective-I	Open Elective-II	Open Elective-III
Semester-III	**Semester-IV**	**Semester-V**
BEE42307:Principles of Renewable Energy Sources	**BEE32404**:Electrical Power Generation	**BEE33504:**Energy Audit

Course Category	BSC(Basic Science Course)	ESC (Engineering Science Course.)	PCC (Programm eCore courses	PEC (Programme Elective courses)	Multidisciplinar y courses	VSEC(Skill Course)	Humanities Social Science& Management	Experiential Learning Courses	CC(Liberal Learning Courses	Semester Wise Credits
Semester-I	08	04	02	--	--	02	02	--	02	**20**
Semester-II	08	08	--	--	--	02	02	--	02	**22**
Semester-III	--	--	08	--	06	01	04	02	--	**21**
Semester-IV	--	--	10	--	04	02	06	--	--	**22**
Semester-V	--	--	11	04	06	--	--	--	--	**21**
Semester-VI	--	--	08	08	02	02	--	--	--	**20**
Semester-VII	--	--	04	02	02	--	--	12	--	**20**
Semester-VIII	--	--	04	06	02	--	--	08	--	**20**
Cumulative Sum	**16**	**13**	**47**	**20**	**22**	**08**	**14**	**22**	**04**	**166**

Tulsiramji Gaikwad-Patil College of Engineering and Technology

Wardha Road, Nagpur-441108

NAAC Accredited (A+ Grade)& NBA Accredited

An Autonomous Institute affiliated to RTMNU Nagpur

Second Year (Semester-IV)B. Tech. Electrical Engineering

BEE42401:Electromagnetic Theory

Teaching Scheme	
Lectures	3Hrs./week
Tutorial	0Hrs./week
Total Credit	3

Examination Scheme	
CT	30 Marks
CA	10 Marks
ESE	60 Marks
Total	100 Marks
Duration of ESE:03Hrs.00Min.	

Course Objective:

1	To make students able to apply different analytical tools on electrical networks
2	To analyze the behavior of the circuit's response in time domain and frequency domain.
3	To know the student show to apply the frequency analysis to circuit with different in put signals.

Course Contents		Hours
Unit I	**Vector Analysis and Electrostatic:** Review of Scalars and vector Field, 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.	**(9)**
Unit II	**Electrical field intensity and Coulombs Law** 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, Divergence:** Electric Flux density, Gauss's law and Applications of Gauss's law, the divergence theorem.	**(9)**
Unit III	**Potential of charge system, Conductors, Dielectric, Poison's** Definition of potential difference and potential, the potential field of a point charge, potential gradient. Current Density, Continuity Equation & its point form, the nature of dielectric materials, boundary conditions for perfect dielectric materials, Poisons.	**(9)**
Unit IV	**The steady Magnetic Field and Magnetic forces** Ampere's Circuital law, Biot Savart's law, Stoke's theorem, magnetic flux density, scalar and vector magnetic-potentials. Force on moving charge, force between differential current elements, nature of magnetic material.	**(9)**
Unit V	**Boundary conditions, Maxwell's equation and Poynting Vector** Faraday's law, Displacement current, Point form of Maxwell's equation, Integral form of Maxwell's equations, Wave propagation, Poynting Theorem and Poynting vector..	**(9)**

Text Books

1	Fundamentals of Electromagnetic Fields, A.U. Tinguria, Denett and Co., 3rd edition,2014

2	W.H. Hay.t, "Engineering Electromagnetics", TMH Publication, 9th edition, 2019
3	A. Pramanik, "Electromagnetism - Theory and applications", PHI Leaming Pvt. Ltd, New Delhi, 2012.
Reference Books	
1	Shevgaonkar Electromagnetic Waves,Tata Mc Graw Hill 2002
2	N.N.Rao Electromagnetic Engg. 5thEdition, Prentice Hall. 2005.
3	Krauss Electromagnetic Engg. IV Edition,Tata Mc Graw Hill.5thEdition 2017
Useful Links	
https://onlinecourses.nptel.ac.in/noc21_ee83/preview	
https://www.digimat.in/nptel/courses/video/108106073/L01.html	
https://nptel.ac.in/courses/115101005	

BEE32401	Course Outcomes	CL
BEE32401.1	**Determine** the unit vector, magnitude & angles in the specified criteria by using vector algebra.	**3**
BEE32401.2	**Evaluate** the physical quantities of electromagnetic fields by using Coulomb's law, Gauss's law and Divergence theorem.	**4**
BEE32401.3	**Calculate** the potential of charge and current density of boundary conditions for dielectric materials using Poison's and Laplace Equations.	**3**
BEE32401.4	**Find** the magnetic Field Intensity and Density of magnetic material with the help of Biot Savart's law Ampere's Circuital law and Stoke's theorem	**3**
BEE32401.5	**Discriminate** magnetic boundary conditions, Point form & Integral form of Maxwell's equation.	**4**

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Second Year (Semester-IV) B.Tech. Electrical Engineering

BEE42402: Electrical Machine -1

Teaching Scheme	
Lectures	3 Hrs/week
Tutorial	0 Hrs/week
Total Credit	3

Examination Scheme	
CT-1	15 Marks
CT-2	15 Marks
TA	10 Marks
ESE	60 Marks
Total	100 Marks
Duration of ESE: 03 Hrs 00 Min.	

Course Objectives

Students will be able to

1	**Explain** the construction, working principles, and functions of various parts of DC motors, transformers, and single-phase and three-phase induction motors.
2	**Analyz**e the performance characteristics of DC motors, transformers, and induction motors using equivalent circuits, phasor diagrams, and various testing methods.
3	**Apply** appropriate starting, speed control, and braking methods to DC and induction motors for suitable industrial applications

	Course Contents	Hours
Unit I	**Introduction to Electric Motors-** Electric Motors-Principle of operation of different Motors, construction and representation of parts with their materials, schematic diagrams, Functions of the various parts of Motors	**(6)**
Unit II	**D.C. Motors** Overview DC of Motor, Back E.M.F. and its equations, Types of DC Motors, Torque of DC Motor, Armature Reaction in DC Motor, , characteristics of DC Motors, Need of DC Motor Starter, Starting of DC Motors, Three Point and Four Point Starter, Speed control of a DC Motor, Losses in DC Machines, Plugging, dynamic and regenerative braking- and DC Motors application	**(9)**
Unit III	**Single Phase Transformer**: - Construction, principal operation of Transformer, Phasor diagram, equivalent circuit diagram, equivalent circuit parameter, calculation using O.C. & S.C. test. Polarity test and parallel operation of single-phase transformer. **3-Phase Transformer**: principle and operation of three phase transformer, O.C. & S.C. test on three phase transformers, determination of equivalent equivalent circuit parameter, Regulation, Efficiency	**(12)**

Unit IV	**Three Phase Induction Motor:** Construction, types of rotors, working principle, equivalent circuit, slip, cogging and crawling, torque-slip characteristics, maximum torque condition, losses and efficiency, load test, no-load and blocked-rotor tests, need for starting method, types of starters, DOL, Rotor resistance, Autotransformer and Star, delta starters, speed control methods, and braking methods (plugging, dynamic, and regenerative braking)	**(9)**
Unit V	**Single Phase Induction Motors** Constructional details of single phase induction motor, Double field revolving theory and operation, Equivalent circuit, Starting methods of single-phase induction motors.	**(9)**

Text Books	
1	A. E. Fitzgerald and C. Kingsley, "Electric Machinery", New York, McGraw Hill Education, 2013.
2	A. E. Clayton and N. N. Hancock, "Performance and design of DC machines", CBS Publishers, 2004.
3	M. G. Say, "Performance and design of AC machines", CBS Publishers, 2002
Reference Books	
1	P. S. Bimbhra, "Electrical Machinery", Khanna Publishers, 2011.
2	I. J. Nagrath and D. P. Kothari, "Electric Machines", McGraw Hill Education, 2010
Useful Links	
1	https://nptel.ac.in/courses/117/106/117106034/
2	https://nptel.ac.in/courses/108108076/
3	https://nptel.ac.in/courses/108105062/

BEE42402	Course Outcomes	CL
BEE42402.1	**Explain** the principle and working of Electric Motors.	3
BEE42402.2	**Understand** the torque characteristics, speed control and starting methods of DC Motors.	2
BEE42402.3	**Analyze** the performance of single-phase and three-phase transformers using equivalent circuit parameter and Tests	4
BEE42402.4	**Demonstrate** the working Principle, operating characteristics, and speed control of three phase induction motor	3
BEE42402.5	**Examine** the working principle, equivalent circuit, and starting methods of single-phase induction motors.	4

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Second Year (Semester-IV) B.Tech.

BEE42403: Fundamentals of Power System

Teaching Scheme	
Lectures	3Hrs/week
Tutorial	0 Hrs/week
Total Credit	3

Examination Scheme	
CT-1	15 Marks
CT-2	15 Marks
CA	10 Marks
ESE	60 Marks
Total	100 Marks
Duration of ESE:03Hrs 00Min.	

Course Objectives:

1	To familiarize students with the basic components of power systems, including generators, transformers, transmission lines, distribution networks, and loads
2	To provide an understanding of the principles and techniques for efficient transmission and distribution of electrical energy.
3	To introduce the fundamentals of power system control, including voltage regulation, frequency control, and reactive power management.
4	To Analyse performance of performance of short, medium and long transmission lines.
5	To equip students with methods to solve load flow problems and assess the stability and reliability of power systems.

Course Contents		CO
Unit I	**Basic Concepts:** Structure of electrical power system, brief exposure to generation, transmission and distribution aspects, elementary consideration of economic bulk power supply system, use of high voltage general system consideration, idea about substation, concept of real, reactive and complex power. Load and their characteristics, voltage and frequency dependence of loads.	**CO1**
Unit II	**Per Unit System:** Representation of power system elements, models and parameters of generator, transformer and transmission lines, per unit system representation. single line impedance diagram, advantages of per unit representation. Derivation for Inductance and a capacitance of a single-phase line, concept of self GMD and mutual GMD,GMR	**CO2**
Unit III	**Elementary distribution scheme:** Feeders and distributors. LT and HT cables, Dielectric stress in single core cables, Skin effect, Proximity effect, Corona, Grading of cables. Insulator & its types , string efficiency. Methods to improve string efficiency , Numerical on string efficiency	**CO3**
Unit IV	**Performance of Transmission line :** Classification of transmission line (short, medium (nominal T and nominal Π) and long), Numerical on transmission-line performance and ABCD parameters. Characteristics (voltage regulation and efficiency) of transmission lines, determination of generalized (A,B,C,D) constants for transmission line, Ferranti effect, Surge Impedance Loading	**CO4**

Unit V	**Load Flow Studies:** Introduction to load flow studies, Classification of buses , Formation of bus admittance matrix, Static load now equations, Gauss Seidel and Newton- Raphson method for solution (Numerical is not Introduction of frequency and voltage as system state indicators, Concept of Voltage Stability, P-V and V-Q Curves, Methods to improve voltage stability.	**CO5**
Text Books		
1	Modern Power System Analysis ,I. J. Nagrath, D. P. Kothari, 4th Edition, Tata McGraw Hill Publishing Co. Ltd., 2011	
2	Electrical Power Systems, C.L. Wadhwa, 6th Edition New Age International, 2009	
3	"Electrical Power Systems: Concepts, Theory, and Practice" Ashfaq Husain, 3rd Edition CBS Publishers & Distributors ,2014	
Reference Books		
1	"Elements of Power System Analysis" William D. Stevenson Jr., 4th Edition ,McGraw Hill	
2	"Power System Stability and Control" Prabha Kundur, McGraw Hill Education,1994	
Useful Links		
1	https://nptel.ac.in/courses/117/106/117106034/	
2	https://nptel.ac.in/courses/108108076/	
3	https://nptel.ac.in/courses/108105062/	

BEE42403	Course Outcomes	CL
BEE42403.1	**Describe** the basic concepts of electrical power system & functions of protective devices used in substation	3
BEE42403.2	**Determine** per unit values for power system components & line parameters of transmission line by using per unit system representation.	5
BEE42403.3	**Distinguish** feeders, distributors, types of insulators & HT LT cables based on their operating voltage levels.	4
BEE42403.4	**Calculate** the voltage regulation and efficiency of short, medium & Long power transmission lines by using nominal PI method and nominal T method of representation.	3
BEE42403.5	**Determine** bus admittance matrix (Y-bus) using systematic approach & **interpret** P-V and V-Q characteristics to evaluate system performance	5

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Second Year (Semester-IV) B. Tech. Electrical Engineering

BEE42404 : Cultural Heritage and Values

Teaching Scheme			Examination Scheme	
Practical	4 Hrs /Week		**CA**	25 Marks
Total Credit	2		**ESE**	25 Marks
			Duration of ESE: -	

Course Objectives (CO)

1	**Understand** the concept, significance, and various aspects of Indian cultural heritage and traditions.
2	**Identify** and appreciate the contributions of ancient Indian knowledge systems in science, technology, mathematics, and engineering**.**
3	**Understand** the importance of moral, ethical, social, and human values in personal and professional life.
4	**Recognize** the importance of cultural diversity, historical monuments, art, literature, and traditional practices in preserving national heritage**.**
5	**Develop** awareness of environmental conservation, sustainable living, and the responsible preservation of cultural and natural heritage.
6	**Apply** ethical principles, professional values, and social responsibility in engineering practice and everyday life.

SR. No.	List Of Experiment	CO
1	Study of Indian Cultural Heritage: Prepare a report on the importance and major features of Indian cultural heritage.	**CO1**
2	Study of Ancient Indian Education System: Study the Gurukul system and its contribution to education and value development.	**CO1**
3	Study of Indian Historical Monuments: Visit or study historical monuments and prepare a report on their architectural and cultural significance.	**CO2**
4	Study of Indian Constitution and Fundamental Duties: Identify and explain the fundamental duties of Indian citizens and their importance in daily life.	**CO2**
5	Study of Ethical Values in Professional Life: Prepare a report on honesty, integrity, discipline, and responsibility in engineering professions.	**CO3**
6	Study of Indian Festivals and Traditions: Study any five Indian festivals and explain their cultural, social, and ethical significance.	**CO3**
7	Case Study on Great Indian Personalities: Study the life and contributions of personalities such as Mahatma Gandhi, Dr. B. R. Ambedkar, Swami Vivekananda, or Dr. A. P. J. Abdul Kalam.	**CO4**
8	Study of Environmental Values and Sustainability: Prepare a report on traditional Indian practices related to environmental protection and sustainable development.	**CO4**
9	Study of Yoga and Meditation: Perform basic yoga and meditation activities and prepare a report on their role in physical well-being, concentration, and self-discipline.	**CO5**

10	Community Service and Social Responsibility: Participate in a cleanliness drive, tree plantation, or social awareness programme and prepare a report on the activity.	**CO5**

Text Books	
1	India's Ancient Past — R. S. Sharma, 1st edition, 2005, Oxford University Press
2	An Introduction to Indian Art, Part I — NCERT, 1st edition, September 2012; reprints include January 2025 National Council of Educational Research and Training (NCERT)
3	Introduction to the Constitution of India — D. D. Basu, 26th edition, 2021 (commonly cited edition) LexisNexis
4	The Story of My Experiments with Truth — Mahatma Gandhi, Mahatma Gandhi; English translation by Mahadev Desai ,2022 edition, Fingerprint Publishing
5	Wings of Fire — A. P. J. Abdul Kalam and Arun Tiwari, originally published in 1999; 19th edition listed in a library catalogue, Universities Press (India) Pvt. Ltd.
Reference Books	
1	The Wonder That Was India — A. L. Basham
2	A History of Ancient and Early Medieval India — Upinder Singh
3	India After Gandhi — Ramachandra Guha
Useful Links	
1	https://nptel.ac.in/courses/109106136
2	http://www.digimat.in/nptel/courses/video/124105003/L07.html

BEE42404	**Course Outcomes**	**CL**
	Students Should be able to	
BEE42404.1	Explain the significance of Indian cultural heritage, traditions, and historical monuments.	**3**
BEE42404.2	Describe the contributions of ancient Indian education systems and great Indian personalities to society.	**4**
BEE42404.3	Demonstrate ethical values, professional integrity, discipline, and social responsibility in personal and professional life.	**4**
BEE42404.4	Explain the importance of the Indian Constitution, fundamental duties, and responsible citizenship.	**3**
BEE42404.5	Apply environmental values, sustainability principles, and traditional Indian practices for environmental protection.	**3**

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Second Year (Semester-IV) B. Tech. Electrical Engineering

Open Elective-II: BEE42405 Electrical Power Generation

Teaching Scheme		Examination Scheme	
Lectures	2Hrs./week	**CT-I**	07 Marks
		CT-II	07 Marks
Tutorial	--	**CA**	06 Marks
TotalCredit	2	**ESE**	30Marks
		Total	50Marks
		Duration of ESE:02Hrs.	

Course Objective:

1	To familiarize the students to the working of power plants based on different fuels.
2	To introduce the students the working of renewable energy sources.
3	To expose the student's different types of tariffs and the terms related to economic generation.

	Course contents	Hours
Unit I	**Power Generation:** Introduction to typical layout of electrical power system, present power scenario in India, Generation of electrical power: non-renewable sources: Hydro station, Steam power plant, nuclear power plant and Gas turbine plant.	**(8)**
Unit II	**Economics of Generation:** Number and size of generator units. Base load and peak load plant. Cost of electrical energy-fixed cost, running cost.	**(8)**
Unit III	**Tariff and Economic Aspect in power generation:** Different factors connected with generating station like connected load maximum demand, demand factor, load factor, diversity factor, plant capacity and utilization factor, load curve etc. Tariff: Flat rate tariff, two-part tariff, block rate tariff, maximum demand tariff.	**(8)**

Text Books

1	Power Plant Engineering / Arora, Domkundwar,6thEdition, Dhanpatrai Publications (P) Ltd., 2013
2	Generation of Electrical Energy: Dr. B.R. Gupta, publisher S. Chand, 7thedition2017
3	Power Plant Engineering: P.C. Sharma, Publisher: Kataria, S.K. & Sons , 2004
4	Non-conventional Energy sources by G.D. Rai. 4th edition khanna publishers 2010.

Reference Books

1	Elements of Power Station Design: M.V. Deshpande, edition: Reprint, publisher: PHI Learning Pvt. Ltd., 2009.
2	Chakraborty, Sony, Power System Engineering, 15th Edition, Dhanpatrai & Sons, 2002

Useful Links

1	NPTEL: Mechanical Engineering - NOC: Power Plant Engineering
2	https://youtu.be/_HxM6DAYQ4U

BEE42405	Course Outcomes	CL
BEE42405.1	**Analyze** the working and layout of Thermal power plants and the other systems comprising the plant.	4
BEE42405.2	**Analyze** the working and layout of Hydro power plants and other systems comprising the plant.	4
BEE42405.3	**Describe** factors involved in economics of power plant operation as well as understand and apply the concept of Tariff	3

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BEE42406: MATLAB

Teaching Scheme		Examination Scheme	
Lectures	- Hrs/week	**CT-1**	-
Practical	4 Hrs/week	**CT-2**	-
Total Credit	2	**ICA**	25
		ESE	25
		Total	50
		Duration of ESE	-

Course Objectives (CO)

1. **Apply** MATLAB programming fundamentals, including variables, vectors, matrices, arithmetic operators, mathematical functions, and M-files, to solve basic engineering problems.
2. **Generate and visualize** continuous-time and discrete-time signals using MATLAB plotting commands and perform signal transformations such as amplitude scaling, time scaling, and time shifting.
3. **Implement and analyze** linear convolution, cross-correlation, autocorrelation, Fourier series, Fourier transform, and Z-transform using MATLAB.
4. **Analyze** discrete-time systems by determining impulse and step responses, computing system responses using difference equations, and plotting magnitude and phase responses.
5. **Model and simulate** basic systems and AC circuits using MATLAB/Simulink to investigate system linearity, signal amplification, three-dimensional plotting, and electrical circuit behavior

SR. No.	List Of Experiment	CO
1.	Introduction to MATLAB: To define & use variables, vectors, Matrices & its functions in MATLAB. To study various arithmetic operators and mathematical functions in MATLAB. To create & use m-files	**CO1**
2.	Basic plotting of signals: To study various MATLAB commands for creating two- and three-dimensional plots. Write a MATLAB program to plot the following continuous time and discrete time Signals. .i. Step Function ii. Impulse Function iii. Exponential Function iv. Ramp Function v. Sine Function	**CO1**
3.	Write a MATLAB program to obtain linear convolution of the given sequences.	**CO1**
4.	Write a MATLAB program to perform amplitude-scaling, time-scaling and time-shifting on a given signal.	**CO2**
5.	Write a MATLAB program to obtain Cross correlation of sequence x(n) and y(n) & autocorrelation of a sequence x (n) of the given sequences & verify the property.	**CO2**
6.	Write a MATLAB program to generate Fourier series of a Square Wave.	**CO3**
7.	Write a MATLAB program to Calculate and plot using MATLAB Fourier Transform and Z-Transform of a given signal.	**CO3**
8.	Write a MATLAB program to find the impulse response and step response of a system from its difference equation. Compute and plot the response of a given system to a given input.•	**CO4**
9.	Write a MATLAB program to plot magnitude and phase response of a given system.	**CO4**
10.	Checking linearity/non-linearity of a system using SIMULINK Build a system that amplifies a sine wave by a factor of two•	**CO5**
11.	Write a MATLAB program to draw a filled circle and view it in 3D PLOT	**CO5**
12.	To analyze a basic AC circuit using MATLAB Simulink and observe voltage, current,	**CO5**

	impedance, and phase shift**.**	
Text Books		
1	**Getting Started with MATLAB: A Quick Introduction for Scientists and Engineers**: By Rudra Pratap, published by Oxford University Press	
2	**Essentials of MATLAB Programming, 2e**: By Stephen J. Chapman, published by Cengage Learning	

BEE42406	**Course Outcomes**	**CL**
	Students Should be able to	
BEE42406.1	**Understand** the basics operation of MATLAB.	**3**
BEE42406.2	**Analyze** the time domain and frequency domain signals.	**4**
BEE42406.3	**Implemen**t the concept of Fourier series and Fourier transforms.	**4**
BEE42406.4	**Find** cross correlation, autocorrelation of sequence & impulse response, step response of a system.	**3**
BEE42406.5	**Design** frequency response of the system.	**3**

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BEE42407: Electrical Machine-I Lab

Teaching Scheme		Examination Scheme	
Practical	2 Hrs/week	**CA**	25 Marks
Total Credit	1	**ESE**	25 Marks
		Total	50 Marks
		Duration of ESE: -	

Course Objectives

1	Identify the constructional components and explain the operating principles of DC machines, starters, and single-phase transformers.
2	Perform resistance measurements, open-circuit characteristics, and load tests on DC machines to evaluate their performance characteristics.
3	Implement armature voltage control and field current control methods to regulate the speed of DC shunt motors.
4	Conduct open-circuit, short-circuit, and Sumpner's tests on single-phase transformers to determine their performance parameters and efficiency.
5	Analyze Scott connections and parallel operation of single-phase transformers to understand phase conversion, load sharing, and practical transformer applications.

Sr. No.	List of Experiment	CO
1	To study the construction, parts, materials, and working principles of different types of electric motors.	**CO1**
2	To identify the various parts of electric motors and study their functions using schematic diagrams and physical models.	**CO1**
3	To perform the load test on a DC shunt motor and determine its performance characteristics.	**CO2**
4	To study the construction and operation of three-point and four-point starters and demonstrate speed control of a DC motor.	**CO2**
5	To perform open-circuit and short-circuit tests on a single-phase transformer and determine equivalent circuit parameters, efficiency, and voltage regulation.	**CO3**
6	To perform open-circuit and short-circuit tests on a three-phase transformer and study its performance characteristics.	**CO3**
7	To perform the no-load and blocked-rotor tests on a three-phase induction motor and determine its equivalent circuit parameters.	**CO4**
8	To study different starting methods of a three-phase induction motor,	**CO4**
9	To study the construction and working principle of a single-phase induction motor and demonstrate its starting methods.	**CO5**
10	To perform a load test on a single-phase induction motor and determine its performance characteristics.	**CO5**

Text Books

1	A. E. Fitzgerald and C. Kingsley, "Electric Machinery", New York, McGraw Hill Education, 2013.

2	A. E. Clayton and N. N. Hancock, “Performance and design of DC machines”, CBS Publishers, 2004.
3	M. G. Say, “Performance and design of AC machines”, CBS Publishers, 2002
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BEE42407	**Course Outcomes**	**CL**
	Students Should be able to	
BEE42407.1	**Explain** the principle and working of DC machine.	4
BEE42407.2	**Discriminate** the principle and working of DC motor	3
BEE42407.3	**Analyze** starting methods and speed control methods of DC Machine	4
BEE42407.4	**Monitor** the different parameters of 1 Phase Transformer	3
BEE42407.5	**Visualize** the principle and to check performance of transformer.	6

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Second Year (Semester-IV)B. Tech. Electrical Engineering

BCS42409 : Python Coding Lab

Teaching Scheme		Examination Scheme	
Practical	4Hrs/week	**CA**	25Marks
Total Credit	2	**ESE**	25Marks
		Total	50Marks
		Duration of ESE: -	

Course Objective

1	Demonstrate the use of various Python data types (such as integers, strings, lists, tuples, etc.) and operators (arithmetic, logical, comparison) to build simple programs that solve real-world problems.
2	Utilize conditional statements (if, else, else if) and looping structures (for, while) to control the flow of execution in programs and solve real-life challenges through logical decision-making.
3	Differentiate between mutable (lists, dictionaries, sets) and immutable (tuples, strings) data structures in Python and apply them appropriately in problem-solving contexts.
4	Demonstrate the principles of object-oriented programming, such as classes, objects, inheritance, polymorphism, and encapsulation, to design and solve complex problems using functions and methods.
5	Develop programs that incorporate arrays and data structures, and apply file handling techniques to read from, write to, and manage external files for effective data storage and retrieval.

Sr. No.	List of Experiment	CO
1	Make of the operators in Python to execute the following: i) Python interpreter as Calculator (simple arithmetic operations) ii) Swapping of two numbers convert number in binary, octal and hexadecimal system to decimal number system	**CO1**
2	Write a Program in Python to take input from user using input method and type cast into integer value using int ( ) method to find: i) Addition of the two numbers ii) Subtraction of two numbers iii) Division of two numbers iv) Multiplication of two numbers v) Modulus of two numbers Exponential power of two numbers.	**CO1**
3	Demonstrate the use of loop control statement using while, for i) Print a multiplication table from 2 to 10 ii) Print squared value numbers ranging from 1 to 10	**CO2**
4	Use the relational operators to execute the decision making using if, if- else, if--else- if ladder: i) Print a number as Even number ii) Print a number as Even / Odd Number Number is	**CO2**

	divisible by more than two numbers	
5	Using tuples perform the following items in the data structure: i) Delete an item from a tuple ii) Assess an item in tuple iii) assess range of values in a tuple iv) reversing items in the tuple	**CO3**
6	Using list data structure performs the operations of append, insert, extend and modify the items in the data structure.	**CO3**
7	Using dictionary data structure perform the following operations on the items of the data structure: i) Accessing elements of dictionary using key name ii) Printing elements of dictionary using its name iii) Assigning a key that does not exists iv) Add a new entry Changing elements in a dictionary vi)Deleting elements from a dictionary	**CO3**
8	Find the factorial of a range of numbers input by the user using user defined function.	**CO4**
9	Use the math function in Python to find: i) maximum and minimum out of the list ii) sum and average of numbers in a list iii) calculate average using mean method in statistics library Round a number to a given precision in decimal digits	**CO4**
10	Implement a Python program to calculate the total marks and percentage from an array of student marks.	**CO5**
11	To perform data analysis using Pandas to manipulate, filter, and process CSV files in Python.	**CO5**

Text Books

1	Programming And Problem Solving with Python by Ashok Namdev Kamthane and Amit Ashok Kamthane, McGraw Hill, 2018.
2	Let Us Python, Yashwant Kanetkar and Aditya Kanetkar, 2nd Edition, bpb Press,2020
3	Python Crash Course, 2Nd Edition: A Hands-On, Project-Based Introduction to Programming, Eric Matthes, No Starch Press,20l6

Reference Books

1	Mark Lutz, Programming Python, O'Reilly, 4th Edition, 2010
2	Python Programming: Using Problem Solving Approach, Reema Thareja, Oxford HigherEducation,20l8
3	Michael Urban and Joel Murach, Python Programming, Shroff/Murach, 2016

Useful Links

1	https://onlinecourses.nptel.ac.in/noc22_cs32ipreview
2	https://nptcl.ac.in/courses/106106145

BCS42409	Course Outcomes	CL
BCS42409.1	**Demonstrate** the use of data types and operators in Python to build simple programs to solve the specified tasks by the user.	4
BCS42409.2	**Mak**e use of decision making and control statement in Python to execute the real-life problems.	3
BCS42409.3	**Demonstrate** the mutable and immutable data structures in Python Programming.	4
BCS42409.4	**Solve** the problems by using object-oriented programming concepts by using functions.	3
BCS42409.5	**Design** the programs by using arrays, data and file handling in Python.	6

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College Of Engineering
and Technology, Nagpur

Tulsiramji Gaikwad-Patil College of Engineering and Technology
Wardha Road,Nagpur-441108
NAAC Accredited (A+ Grade) & NBA Accredited
An Autonomous Institute affiliated to RTMNU Nagpur

Fourth Year (Semester-IV) B.Tech. Electrical Engineering
Honors in (Electric Vehicles)

BEE42408: Electric Vehicle and Drive Control

Teaching Scheme	
Lectures	3 Hrs/week
Tutorial	0 Hrs/week
Credit	3

Examination Scheme	
CT	30Marks
CA	10 Marks
ESE	60 Marks
Total	100 Marks
Duration of ESE: 03 Hrs 00 Min.	

Course Objective (CO)

Students will be able to

1	Study the fundamentals, architecture, and working principles of electric vehicles.
2	Understand traction motors, motor drive control techniques, and regenerative braking systems.

	Course Contents	Hours
Unit I	Classification of EVs: BEVs, HEVs, PHEVs and FCEVs, EV architecture, major powertrain components, working principles, advantages and challenges of electric mobility of electric vehicles, evolution of EV charging standards and protocols.	**(9)**
Unit II	Electric Vehicle Traction Motors Types of traction motors: DC, BLDC, PMSM, Induction Motor and SRM, torque-speed characteristics, motor selection criteria, and comparison of traction motors.	**(9)**
Unit III	Electric Vehicle Motor Drives and Control Power electronic converters, DC-DC converters, inverters, speed and torque control, BLDC motor commutation, PMSM control, Field-Oriented Control (FOC) and Direct Torque Control (DTC).	**(9)**
Unit IV	Drive Control and Regenerative Braking EV propulsion control, acceleration and speed control, torque control, traction control, regenerative braking, four-quadrant operation, and braking system coordination.	**(9)**
Unit V	EV Powertrain Integration and Performance Integration of motors, converters, batteries and Vehicle Control Units (VCUs), powertrain efficiency, thermal management, drive protection, performance evaluation, and EV drive simulation using MATLAB/Simulink.	**(9)**

Text Books

1	Modern Electric, Hybrid Electric, and Fuel Cell Vehicles - Fundamentals, Theory, and Design: M.Ehsani, Y. Gao, S.

	E. Gay and A. Emadi, CRC Press, 2004.
2	AC Motor Control & Electric Vehicle Applications by Kwang Hee Nam, CRC Press, Special Indian Edn, (Yes Dee Publishing Pvt. Ltd, Chennai) 2013.
3	Electric Vehicle Battery Systems by Sandeep Dhameja, Elsevier India Pvt. Ltd, 2013.
Reference Book	
1	Iqbal Husain, Electric and Hybrid Vehicles: Design Fundamentals, CRC Press.
2	K. T. Chau, Electric Vehicle Machines and Drives: Design, Analysis and Application, Wiley-IEEE Press, 2015.
3	NPTEL Courses
Useful Links	
1	https://onlinecourses.nptel.ac.in/noc25_ee134/preview
2	https://www.classcentral.com/course/swayam-charging-infrastructure-452073

BEE42408	Course Outcomes	CL
BEE42408.1	**Explain** the architecture and operating principles of electric vehicles.	**2**
BEE42408.2	**Identify** and compare various traction motors used in electric vehicles.	**2**
BEE42408.3	**Explain** power electronic converters and motor control techniques used in EVs.	**3**
BEE42408.4	**Analyze** electric vehicle drive control strategies and regenerative braking techniques.	**3**
BEE42408.5	**Evaluate** the performance and efficiency of electric vehicle powertrain systems.	**5**

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Second Year (Semester-IV) B. Tech. Electrical Engineering
Minors in (Renewable Energy Sources)

BEE42410: Fundamentals of Wind Energy

Teaching Scheme	
Lectures	3 Hrs./week
Tutorial	0 Hrs./week
Total Credit	3

Examination Scheme	
CT	30 Marks
CA	10 Marks
ESE	60 Marks
Total	100 Marks
Duration of ESE:03 Hrs.00Min.	

Course Objective (CO)

1	To provide students with basic knowledge of wind energy resources and utilization.
2	To enable students to understand wind turbine design and wind energy conversion systems.
3	To familiarize students with wind energy technologies, grid integration, and relevant policies in India.

Course Contents		Hours
Unit I	Wind energy fundamentals, wind characteristics, wind speed and direction, wind power equation, Betz limit, wind energy potential, and site selection for wind farms.	**(9)**
Unit II	Types of wind turbines, horizontal and vertical axis turbines, aerodynamic principles, lift and drag forces, power coefficient, tip-speed ratio, and turbine performance characteristics.	**(9)**
Unit III	Components of wind energy conversion systems (WECS), generators used in wind turbines, induction and synchronous generators, fixed-speed and variable-speed systems, and power electronic converters.	**(9)**
Unit IV	Pitch and yaw control, maximum power point tracking (MPPT), braking and protection systems, grid synchronization, power quality, and wind farm grid integration.	**(9)**
Unit V	Wind farm layout, installation and maintenance, offshore wind energy, hybrid wind-solar systems, environmental impacts, economic assessment, and emerging wind energy technologies.	**(9)**

Text Books

1	S. Rao, Dr. B.B. Parulekar “Energy Technology”, Khanna Publishers, 5th Edition
2	G.D. Rai, “ Non-Conventional Energy Sources”, Khanna Publishers, 4th Edition
3	N.S. Rathore, N.L. Panwar “Biomass Production And Efficient Utilization For Energy Generation, CRC Press, 1st Edition

Reference Books

1	John Twidell, “ Renewable Energy Soources”, Routledge, Fourth Edition.
2	Muhammad Rashed Al Mamun, “Utilization of Biomass for supply of renewable energy in rural area.”,

	Springer 1st Edition
3	Dan Bahadur Pal, Pardeep Singh, "Utilization of Waste Biomass in Energy, Environment and Catalysis", CRC Press, 1st Edition
Useful Links	
https://nptel.ac.in/103103207, https://nptel.ac.in/103103206	
Sardar Swaran Singh National Institute Of Bio-Energy (nibe.res.in)	

BEE42410	Course Outcomes	CL
BEE42410.1	**Explain** the fundamentals and potential of wind energy.	**3**
BEE42410 .2	**Describe** wind turbine types and aerodynamic principles.	**2**
BEE42410.3	**Explain** wind energy conversion systems and generators.	**3**
BEE42410.4	**Analyze** wind turbine control techniques and grid integration.	**4**
BEE42410.5	**Evaluate** wind farm planning, applications, and environmental impacts.	**5**

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